# Academic Program Review for the
# Heating Ventilation Air Conditioning and Refrigeration Programs

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# Academic Program Review for HVACR AAS and HVACR BS

## Program name and history:

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HVACR Technology Program (AAS Degree):

Established in 1945, the Ferris State University, HVACR Technology program has a seventy three year history of high quality technical career- oriented educational offerings that provide the State of Michigan and the nation with prepared HVACR technicians. The mission and goal of the program is to educate students for positions in field service, design, engineering laboratories and service technology at the upper level of the technological spectrum in the HVACR industry. The program works closely with an advisory board of active industry personnel to ensure goals meet the current needs of the industry.

HVACR Engineering Technology and Energy Management (BS Degree):

Established in 1984, the Ferris State University, HVACR Engineering Technology and Energy Management program has a thirty four year history of high quality, unique technical career-oriented educational offerings. This program was developed to meet the needs of the first National Energy Act of 1978 and has continued adjusting to energy management faced by the nation. The mission of the program is to develop the professional skills and attitudes in students, necessary to measure, monitor, control and maintain HVACR systems at optimum performance.

Program History

Over the course of the last seventy three years the HVACR Technology Program has maintained a focus on the skills that HVACR industry technicians use on the job. This skill set is ever changing and regular feedback from employers is a part of curricular discussion. Whether through Advisory Board Members, Employers for Internships, Professional Group Meetings or at Career Fairs, the faculty bring the concerns of industry back for discussion amongst the group. Curricular changes are reviewed with Advisory Board members and all faculty before decisions to move forward are made. Over the past six years there have been six changes to the HVACR curriculum. These changes are reflective of changes in industry, at the University, and efforts for continuous improvement. The curriculum has two entirely new courses that are the result of feedback from industry, we have multiple new courses that represent a reorganization of learning objectives aimed at balancing workload for students and there are curricular clean up areas that reflect efforts to keep the program order and prerequisites correct and equitable for on campus and online students.

## Program Mission

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**FSU Mission:** Ferris State University prepares students for successful careers, responsible citizenship, and lifelong learning. Through its many partnerships and its career-oriented, broad-based education, Ferris serves our rapidly changing global economy and society.
**College of Engineering Technology Mission:** Our mission is to prepare graduates who have met the high academic standards of our programs for current and future industrial and business needs of the state, the nation and the global market.
**HVACR Mission:** HVACR Provides quality education and training that emphasizes practical skills and prepares the student to analyze, synthesize, and solve problems. This is accomplished in state of the art facilities with highly qualified instructors.

HVACR Technology Program (AAS Degree): The mission and goal of the program is to educate students for positions in field service, design, engineering laboratories and service technology at the upper level of the technological spectrum in the HVACR industry.

HVACR Engineering Technology and Energy Management (BS Degree): The mission of the program is to develop the professional skills and attitudes in students, necessary to measure, monitor, control and maintain HVACR systems at optimum performance

The curriculum is rigorous and under constant review. Four areas support the mission statements of HVACR, COET, and FSU.

Lecture – HVACR lectures are always changing to meet the needs of a technology based industry. The lectures support successful careers and foster lifelong learning. We strive to stay current and provide quality education that directly relates to hard and soft career skills.

Laboratory – The Granger Center HVACR Labs are diverse and representative of current and new technology in the industry. Students spend between 3 and 9 hours per week using the tools and equipment that they will see as a working professional.

Professional Development – Faculty are active with industry and maintain regular professional development opportunities in an effort to stay current in the industry. Students participate in activities with professional organizations and have numerous opportunities to interact with industry professionals on campus and off. There are multiple competition opportunities for students as they proceed through the curriculum; Skills USA tests service skills of students who participate, MSCA and ASHRAE offer design and project management based competitions that require planning and delivery of engineered projects resulting from weeks of team work.

Community Service – Students are encouraged to participate with the registered student organizations and to provide service to the community. Whether through activities like “The Big Event” or through professional service events like “Heats On”, HVACR students are learning the value of HVACR in the world and service to community.

> The Big Event: Faculty, Staff, and Students annually perform community service in the form of yard work.

Heat's On: An event sponsored by the Mechanical Service Contractors Association which the local student MSCA chapter participates in. The Heat's On event puts HVACR contractors into the community in the fall to assist with safe startup of heating systems prior to the winter season. Students work with professionals inspecting heating systems and smoke / CO2 detectors for community members in need of assistance.

Energy Audit: Each year, two classes will work on a full energy audit of a commercial or industrial facility in West Michigan. The audit results are presented to the owner at the completion of the project and would typically lead to real savings for the participating facility.

## Program Goals

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The goals for the HVACR program are related to our mission and our capacity to act as a pipeline for the HVACR industry. The quality objective for the program comes straight from both the University mission and from the program mission; we strive to provide exemplary skills for graduates entering the HVACR and Energy Management Industry. We are working toward a full capacity program with graduates prepared for both lifelong learning and day one productivity in the HVACR Industry. We believe that two measurements reflect the success in achieving these goals; enrollment and placement. Our placement numbers have been and continue to be at or near 100% for most of the past review cycle. We focus on providing as many highly skilled technicians and engineers to the industry as we are able. Enrollment has at times been a challenge for us as demand for graduates frequently outpaces supply. We examine accessibility, expense, and quality in an effort to make the degree paths fit the greatest number of students. Our online degree program for the Bachelor of Science in HVACR and Energy Management has put our unique BS degree within reach of working adults from all over the world. The program faculty and Advisory Board have worked to make over $100,000 in HVACR specific scholarships available to students annually and we continue to work to reconfigure those dollars to provide the best fit for the needs of incoming students. The quality of the education is under constant review. The Advisory Board meetings are a common vehicle for curricular review, feedback sought from summer internship employers is used to consider course effectiveness, and time spent by both faculty and students working with professional organizations like ACCA, ASHRAE, and MSCA serve to provide information on current trends and needed skills for the industry.

All of the activities mentioned above are done with an eye toward the number of students in the program and the employability of those students upon graduation. With the demand far exceeding the supply, our larger challenge has been getting word out about the HVACR industry and the opportunities that it presents. We have a dedicated full time marketing person working toward filling the available seats with well-prepared students. As we do with many of our goals, the marketing goals change from year to year based upon faculty review, market trends, and feedback from outside sources. Most recently we have changed our focus to include more visits with schools that would provide first time students in the AAS program. In years past, we have focused more (at times) on the online program and also the face to face BS program. Current market trends have made the AAS job market very attractive and the value of a BS degree has been blurred by higher demand, pay, and quality of work for AAS graduates. As a result, we have focused on increasing the number of AAS graduates specifically to address both the continuation into the BS degree but also the increased opportunities for students leaving the University with an AAS degree.

Within the overall program goals we find learning objectives (below) aimed at preparing students for HVACR specific jobs. These learning objectives translate into job types or job skills that can be regularly reviewed with the industry to fine tune learning objectives at the course level and provide the skills that make HVACR graduates productive from day one and throughout their careers.

AAS

1. Install
2. Service HVAC
3. Service Refrigeration
4. Troubleshoot Refrigeration
5. Troubleshoot HVAC
6. Design HVAC

BS

1. Select system
2. Design system
3. Select secondary equipment
4. Select primary equipment
5. Control
6. Commission
7. Energy Audit

These job types or tasks are frequently analyzed by faculty with the help of the HVACR Advisory board to determine when a change is needed and how to make the most of the short time that students have to work on their education.

Strategic Plan

The programs short term strategic plan is to fill the AAS program to capacity while maintaining the highest level of quality. This goal supports increased demand for graduates as well as the opportunity for increased numbers of continuing students in the BS program.

Our long term strategic goal is to fill both AAS and BS to capacity with further goals of growing the overall capacity of the program without loss of quality within the curriculum. The online BS degree has helped to attain that goal and many faculty have been at 100% or overloaded during the past 6 years. There is room for growth in the face to face BS program in terms of number of students, available classrooms, and labs. Faculty would be overloaded if both AAS and BS degrees were full to building capacity and scheduling would be problematic.

The measure of strategic goals starts with the department chair but falls to all faculty to make decisions on how to measure progress and adjust our response. We typically review this process fall and winter with input from the Advisory Board.

## University Curriculum

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Course check sheets and syllabi will show that the HVACR Department works on tangible learning objectives and communicates them to the students as a part of course expectations. The learning objectives are linked to assessment methods and specific assessments that favor different types of learners. As a part of our twice a year Advisory Board meeting, we review marketing, curriculum, new technologies, and students soft skills. This happens as a part of the business meeting that follows student program that we have for the first half of the day. We alternate methods of evaluating the curriculum from year to year but always have curriculum on the agenda. As time allows we will put all course level learning objectives up for display with the faculty / advisory group reviewing and discussing the merits. In some cases the groups will divide up by specialty area and at other times we review specific groups of learning objectives with everyone present and participating in the discussion. This variety allows for occasional review of very detailed and specific learning objectives that may only be within the specialty area of a small number of faculty or industry partners. It also allows for the larger group discussion that addresses the allowable time for all of the objectives; there are always more objectives than time and when reviewing what is most important it is sometimes necessary to reduce time spent on certain skills even though a small number of participants might find them important.

The form A summaries below will also outline some of the discussions that we have in regard to general education. Like any program that would accept a large number of transfer students from other schools, we struggle with the balance of minimum entrance requirements versus general education rigor. We are reluctant to reduce rigor in the curriculum but in certain cases we must allow some flexibility in the entrance requirements and then make up for the gap with course work while the students are at Ferris. One of the issues that continues to come up for discussion is our MATH 116 requirement for students continuing on for a BS degree. The students may start (or more likely transfer in to FSU) with MATH 115 and would be fine until deciding to continue on to the BS degree. The student with MATH 115 would then be required to take MATH 120 and 130 where a student starting with MATH 116 could go directly to MATH 126. We would like to level the field for all entrants but MATH 116 is not a common transfer course and transfer students end up at a credit disadvantage. We have and continue to discuss different course options that would make the math transfer issue more consistent but currently no clear solution exists without reducing math rigor. The summaries do not indicate time spent discussing these issues, but we discuss general education at length and it represents an equal share of our curricular discussions.

There are projects outside the classroom for all levels of student. Many of the projects come in the form of competitions hosted by professional organizations. In addition, BS students have opportunities for service learning in the form of HVAC 451 Energy Audit and Analysis. Each year HVAC 342 students begin an energy audit in the community and then HVAC 451 students complete the audit. The expectations are very similar to a professional audit and the student deliver real savings to customers around west Michigan.

The following section outlines the summary information from seven curriculum proposals that the HVACR Department have implemented in the past 6 years. The message that should be conveyed while reviewing this information is that the HVACR Department regularly discusses the impact of HVACR courses with employers, industry members, and advisory board members. We discuss the impact of general education curriculum as well as considering the new skills our graduates will need as they pursue careers in industry.

### 2016 HVAC 290: HVAC System Design using BIM

*Proposal A Summary*

Building Information Modeling (BIM) is a process by which buildings are designed and "built" virtually before they are built physically. The virtual building is known as the model. BIM software has revolutionized the design and construction industries to the point where all related documents are generated within the model. Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) industry professionals collaborate with other design and construction entities to integrate the delivery of a building project using software that merges models from all entities into one comprehensive model. BIM has become ubiquitous in the HVACR industry and all graduates find themselves involved in the process of building or using the model. Knowledge of BIM is thus necessary for graduates to be current in the field. Currently, the HVACR curriculum includes ARCH 110, a class that includes both AutoCAD (drafting software) and Revit (a BIM software). No on line version of ARCH 110 is available, and distance learning students earning their B.S. in HVAC Engineering Technology and Energy Management have found it impossible to find a similar course (or substitute class without several prerequisites) in their locale. As such, the HVACR faculty propose to offer an experimental on line version of the course during summer 2016 as an equivalent to ARCH 110. The course would not be an exact "duplicate" of ARCH 110, as it would include only BIM (Revit), and not AutoCAD. HVAC faculty propose this change based on feedback from stakeholders in the industry, who report that 30 (BIM) is rapidly replacing 20 design and will be the dominate platform within three to five years. Though curriculum proposals focus on pedagogical reasoning, this proposal also includes a financial advantage. Since 2003, when the first on line cohort of the BS in HVAC began, on line students have taken their AutoCAD course elsewhere and transferred the credits to Ferris. This course would bring those tuition dollars to Ferris for the first time. Because this is a brand new experimental course to be taught on line, the proposal caps enrollment at 12 students per section. Current plans include a permanent course to replace this one (proposal is in the works as of this writing). The permanent course would cap enrollment at 16, like all other HVAC online courses.

### 2016: HVAC 285: HVAC System Design using BIM

*Proposal A Summary*

This proposes to replace the campus-based ARCH 110 Computer Graphics-ARCH-HVACR with a fully online HVAC 285 HVAC System Design using BIM. (Building Information Modeling or BIM is a process by which buildings are designed and "built" virtually before they are built physically). This proposal follows a proposal that was approved 2/5/2016 to deliver a similar experimental course (HVAC 290 HVAC System Design using BIM) beginning summer 2016. ARCH 110, a service class offered exclusively to HVAC students, started as an AutoCAD class when AutoCAD was the mainstream tool used in the built environment. An introduction to BIM (using Revit software) was added to ARCH 110 several years ago in response to changing industry practices. No online version of ARCH 110 is available, and distance learning students earning their B.S. in HVAC Engineering Technology and Energy Management have found it impossible to find a similar course (or substitute class without several prerequisites) in their locale. As a new online course, the proposal offers a class that, since 2003, online students had to find elsewhere. In addition to pedagogical rational, the proposal offers a financial advantage through new tuition generated. HVAC faculty met with ARCH faculty coordinator Diane Nagelkirk early in fall 2015 to discuss the development of an online version of ARCH 110 as a collaborative effort between the architectural and HVAC faculty. Early interest by the ARCH faculty faded and HVAC faculty took up the effort, which spawned the proposal for an experimental fully online course, followed by this proposal for a permanent fully online course. Meanwhile, HVAC faculty surveyed industry employers to discover the need for graduates to gain knowledge of 20 CAD (AutoCAD) and/or 30 BIM. The unanimous response was to discontinue teaching AutoCAD and focus exclusively on BIM. During the past 10 or 15 years, BIM has transitioned from a competitive advantage used by some industry professionals to a requirement for all industry professionals. As such, graduates will find themselves working with models developed using BIM software. The models themselves are built by architects and shared with the mechanical engineers and contractors who design and coordinate the fabrication and installation of the mechanical systems. Though current software such as Navisworks and BIM 360 Glue facilitate the sharing of models between various entities (architects, engineers, contractors, owners, etc.), each discipline is responsible for their own scope of work. As such, it is necessary for HVAC students to focus on BIM functions and processes related to mechanical system. Additionally, through the efforts of HVAC faculty coordinating with industry experts, it became obvious that this new BIM class would create a platform for further integration of BIM in the existing higher level HVAC classes. This discovery, along with the history of HVAC faculty teaching in the fully online environment, supports the proposal for a new HVAC class created and taught by HVAC faculty. Finally, with the new class the HVAC program gains the ability to make fluid changes in response to future HVAC industry demands and advisory board recommendations. BIM not evolutionary, it is revolutionary. Industry uses language such as "transformational" and "paradigm shift" to describe it. We are in the midst of the most dramatic change in the design and construction of the built environment in history. And the revolution has only begun. The change is dynamic and rapid. As such, it is impossible to draft a course outline that will be as current next year as it is this year. Thus, the outline and course outcomes in this proposal are concise and have been drafted to be as broad as possible to allow flexibility without burdening the curriculum change process. Advances in the industry and software will be incorporated into HVAC 285, as will lessons learned during delivery of the experimental HVAC 290 HVAC System Design using BIM, without affecting the outline or learning outcomes. Please note that this proposal affects only the baccalaureate degree in HVAC. This degree is a 2 + 2 program and ladders from an associate degree in HVACR. As such, no documents (Forms D) for the associate degree program are included in this proposal.

### 2015: HVAC 127: Advanced HVACR Controls

*Proposal A Summary*

More advanced electric and electronic devices have become commonplace in the HVACR industry. In order to prepare students for successful employment the HVACR program has agreed that a new course focused on specific controls and devices is required. A needs assessment survey was conducted during the 2015 spring advisory committee meeting. The results of that survey were used to form the learning objectives for the proposed new course. To maintain the associate degree at the current total credit hours the faculty decided to eliminate ISYS 105. The rational for this decision was based upon students demonstrating skills outlined in the objectives for ISYS 105 as a result of their secondary education. The new course will further differentiate Ferris State University from technical schools and community colleges that offer HVAC certificates and associate degrees.

### 2015: HVACR change to math prerequisite timing

*Proposal A Summary*

MATH 116/126 have long offered advising challenges with the number of transfer students in HVACR. This proposes to delay the semester when the Math requirements are to be met, and modify the check sheets to reflect the change. As such, *this proposal affects only the timing* of *the math prerequisites.* Associate Degree: Currently, freshmen are required to complete MATH 116 by their second semester. This proposes to change this to their 200 level HVAC courses. This gives them an extra semester (and a summer) to fulfill the requirement in case they failed the course, or in case they could not fit it into their first semester schedule. Baccalaureate Degree: Transfer students typically transfer in with only MATH 115 equivalent, and fulfill their math requirements with the 1151120/130 track. This means they take MATH 120 during fall semester and 130 during winter. Current BS check sheets require students to complete MATH 126 by their second semester. This works well for continuing Ferris students who completed MATH 116 during their AAS work, but is not possible for transfers. This is a double standard that requires continuing student to reach the 1261130 level (pre-calc) by winter of their junior year, while transfer students are given until fall of their senior year. This proposes to change the MATH 126/130 completion from winter of junior year until fall of senior year (400 level classes). Similar to the associate degree rationale, this proposal grants students an extra semester (or two) to fulfill their math requirement.)

NOTE: 400 level HVAC courses already had MATH 126 listed as a prereq, so this proposal simply removes that prereq from existing 300 level courses.

### 2014: HVACR On-Line Modification and Creation of HVAC 322, HVAC323, HVAC326 & HVAC 327

*Proposal A Summary*

The HVAC Bachelor degree began in the mid 1980's when Ferris was on quarters, and during this time period the HVAC Bachelor degree had two junior level "*secondary system select-design*" courses; one was centered on air side systems and the other one was centered on water (hydronic) side systems. When Ferris moved to semester based courses, these two "*secondary system select-design*" courses were blended together to a 5 credit "*HVAC Secondary System Select-Design*" class (known as HVAC 331). Although manageable, the amount of course content within this course is beyond the normal junior level class and in some semesters it was difficult to cover all learning outcomes. In 2009, it was determined through advisory board input that another course, HVAC 350 – Contracting Issues in HVAC, should be created and to provide the needed credits for this new class it was determined that HVAC 331 should be reduced to 4 credits by reducing some of the learning outcomes (moving them to another HVAC course). It has been 4 years now and the result of this change, along with Advisory Board input, has concluded there is a strong need to return to two separate "*secondary system select-design*" courses (one air side and the other water (hydronic) side); thus, the HVAC department wants to create HVAC 321, "*HVAC Air Side System Select-Design*" and HVAC 325, "*HVAC Hydronic System Select-Design*". These new courses are being offered on campus via the traditional teaching method.

Furthermore, the HVAC program started an On-Line version of the Bachelor degree about 12 years ago and HVAC331 was split into two courses for the on-line students. The first course includes the lecture component and the computer-based lab component; while the second course includes the hands-on lab component. Thus, the on-line version was HVAC332 (3 credit lecture) and HVAC333 (1 credit lab). Following the thought process of copying the "traditional on campus" course sequence, the new On-line courses will be the following.

**HVAC322**: HVAC322 (Air Systems Select-Design) will cover the air systems segment of the old HVAC332 course and will provide the ability for enriched learning (following the direction of our Advisory Board). This course will be provided via 100% on-line learning and includes some elements of the lab learning which can be delivered via on-line lecture and assignments.

**HVAC323**: HVAC323 (Air Systems Hands-on Laboratory) will cover the "hands-on" segment and enhanced learning of HVAC322. HVAC323 will be offered when the on-line students come to Big Rapids for the laboratory learning experience during the summer after taking HVAC322.

**HVAC326**: HVAC326 (Hydronic Systems Select-Design) will cover the hydronic segment of the old HVAC332 course and will provide the ability for enriched learning (following the direction of our Advisory Board). This course will be provided via 100% on-line learning and includes some elements of the lab learning which can be delivered via on-line lecture and assignments.

**HVAC327**: HVAC327 (Hydronic Hands-on Laboratory) will cover the "hands-on" segment and enhanced learning of HVAC326. HVAC327 will be offered to the on-line students when they come to Ferris (Big Rapids) for HVAC323.

**Other Changes Reflected in Form D**: The prior curriculum modification for the HVAC Bachelor degree addressed additional changes which are also reflected in Form D of this proposal (the on-line Bachelor degree is the same degree as the traditional students on campus earn). These changes include the substitution of COMM221 with ENGL311 as this change was a direct result of our last APR along with input from our advisory board. The other change was a reduction in credit hours of the capstone class, HVAC499, from 5 credits to 4 credits (experience has shown there is no need for three lab sessions per week). Since both of these were addressed in detail on the prior curriculum modification, the only reflection here is within Form D (check sheets).

**PREREQUISITE CHANGE**: Due to the addition of new HVAC courses (HVAC 322, & HVAC 326), and deletion of HVAC 332, there is a need to change the prerequisite in HVAC313. This proposal includes this minor change within the enclosed Form F sheet for HVAC 313,

**SUMMARY:** Under this proposal:

- Overall SCH for On-Line BS students remain the same.
- HVAC 332 is replaced with HVAC 322,
- HVAC 326 is added to junior year.
- HVAC323 is the Hands-on Lab component of HVAC322
- HVAC327 is the Hands-on Lab component of HVAC326
- HVAC313 has its prerequisite modified to reflect the above changes

## 2014: HVACR Curriculum Modification and Creation of HVAC 321, HVAC325

*Proposal A Summary*

The HVAC Bachelor degree began in the mid 1980's when Ferris was on quarters, and during this time period the HVAC Bachelor degree had two junior level *"secondary system select-design"* courses; one was centered on air side systems and the other one was centered on water (hydronic) side systems. When Ferris moved to semester based courses, these two *"secondary system select-design"* courses were blended together to a 5 credit *"HVAC Secondary System Select-Design"* class (known as HVAC 331).

Although manageable, the amount of course content within this course is beyond the normal junior level class and in some semesters it was difficult to cover all learning outcomes. In 2009, it was determined through advisory board input that another course, RVAC 350 Contracting Issues in HVAC, should be created and to provide the needed credits for this new class it was determined that HVAC 331 should be reduced to 4 credits by reducing some of the learning outcomes (moving them to another HVAC course). It has been 4 years now and the result of this change, along with Advisory Board input, has concluded there is a strong need to return to two separate *"secondary system select-design"* courses (one air side and the other water (hydronic) side); thus, the RVAC department wants to create HVAC 321, *"HVAC Air Side System Select-Design" and* HVAC 325, *"HVAC Hydronic System Select-Design".*

CREATION OF HVAC 321 & HVAC 325: RVAC 321 will be in fall semester of the junior year replacing HVAC 331 (the credits remain the same - 4). HVAC 325 (4 credits) will be in the spring semester of junior year as a new course and to accommodate this creation two things will occur. The needed 4 credits will come from the elimination of our "Directed (3 credit) Elective" course which is on our current check sheet and one credit from the reduction of the HVAC Capstone Experience Class, RVAC 499 (outlined below). Thus the overall credits for graduation remain the same. The splitting of RVAC 331 into HVAC 321 and HVAC 325 will allow a deeper learning experience for students in the learning outcomes including advanced computer system design (using BIM software) per our advisory board input and to satisfy requirements our industry expects from our graduates (this was a direct outcome from our last program APR).

HVAC CAPSTONE EXPERIENCE MODIFICATION: This proposal includes the modification of HVAC 499 from a 5 credit class to a 4 credit class by eliminating one of the weekly lab sessions. Currently, this class has two lecture hours per week and nine lab

hours (three 3-hour sessions). This proposes to reduce lab to six hours per week (two 3-hour sessions).
Six hours of lab per week provides ample time for faculty to assist students. The reduction eliminates a lab session that experience has shown to be "supervised homework." The credit made available through this reduction is added to the three credits made available by eliminating the directed elective, providing four credits for HVAC 325 (shown above).
Note; this change in credit hours will be phased in to reflect some current students working from existing check sheets.
This also proposes to correct a typographical (spelling) error in the title of the course, from *Commercial* HVAC System Design, to *Commercial* HVAC System Design

CHANGE HVAC 362 to HVAC 462: This proposes to move HVAC 362 from spring semester junior year to fall semester senior year. This move reverses a move that was made when HVAC 350 was introduced into the curriculum beginning in the 2010 academic year. At that time, the class was called RVAC 462 because it was held during senior year and was changed to HVAC 362 when it was moved to spring of junior year. It is arbitrary whether the course is held spring semester junior year or fall semester senior year, so this proposal simply changes the number to reflect where it is being offered in the curriculum. This transfer of HVAC 362 back to HVAC 462 will occur over a 2-year time period as to allow students which have started on the old check sheet to continue as we have other HVAC students in the On-line format as well.

GENERAL EDUCATION MODIFICATION: The HVAC Bachelor degree contains two WIC courses (HVAC 451 & HVAC 499); thus, the degree only has one class beyond the Associate level of two English classes and one Communication class. This current class is COMM 221, and has been a requirement for graduation with the HVAC Bachelor degree for many years. However, since the HVAC program created the On-line version of this degree it has been difficult for some students to either enroll in the Ferris offering of COMM 221 or to find a transferable equal to COMM 221. Additionally, our last APR indicated that our Bachelor degree graduates could use a higher level of technical writing skills to be more successful in industry. Thus, the RVAC department determined it is in the student's best interest to take ENGL 311 (Advanced Technical Writing) instead of COMM 221. This substitution follows the guidelines of the University and will allow our students easier access for graduation and better prepare them for success.

PREREQUISITE CHANGES: Due to the addition of 2 new HVAC courses (HVAC 321 & HVAC 325), deletion of HVAC 331, and the moving of HVAC 362 to HVAC 462, there is a need for changes in many of the HVAC 300 & 400 level course prerequisites. This proposal includes these minor changes within the enclosed Form F sheet for HVAC 312, HVAC 350, HVAC 393, HVAC 415, HVAC 451, HVAC 462 & HVAC 499. Note; these changes in prerequisites will be phased in to reflect some current students working from existing check sheets.
SUMMARY: Under this proposal:
No changes are proposed for AAS students.
Overall SCH for BS students remain the same.
HVAC 499 drops from five credits to four, making one credit available.
The directed elective is eliminated, making three credits available.

HVAC 331 is replaced with HVAC 321, a four-credit course, to fall semester, junior year.
HVAC 325, a four-credit course (using the four credits available from above), is added to spring semester, junior year.
Move HVAC362 back to the senior year by changing it to HVAC462
Removal of COMM 221 from the graduation requirement by the addition of ENGL 311 in its place
Modification of prerequisites for 300 & 400 level HVAC courses to reflect the above changes

## 2012: HVAC 342 Course Name & Description Modification

### *Proposal A Summary*

This proposal is to modify an existing course HVAC 342 Load Calculation-Energy Code.
This proposal is also designed to clean up course pre-requisites for HVAC 312, HVAC 350 & HVAC 362 as these courses are in the student rotation after HVAC 342. Therefore HVAC 342 needs to be included in the prerequisite. HVAC 312, HVAC 313, HVAC 342, HVAC 350 and HVAC 362 need a math clean-up on their prerequisite. This Proposal also clarifies the potential sequence of math courses as transfer students usually do not have credit for MATH116.
Currently, HVAC 342 Load Calculation-Energy Code has two typographical errors in the course description that require correction. We propose to modify the name of the course, correct the errors in the course description and slightly modify the course description. The proposed course name modification is to rename the course HVAC 342 Load Analysis-Energy Modeling.
The purpose of adding energy modeling into the course name is to correctly identify to our students a part of the course purpose. Energy modeling has been used since the inception of our program and we are actively teaching the process in the existing HVAC 342 course and in the HVAC 451 course. It is an invaluable tool in determining building efficiency and in meeting existing LEED building rating system requirements. Created by the USBGC, the LEED rating system has been developed to classify and rate building construction and renovation projects. The rating systems are point based with a building having to reach a minimum point level (LEED Certified building) to a maximum point level of 105 (LEED Platinum). In order to accurately determine the points earned from the energy saving portion of the rating system, an energy model of the building must be performed and the percentage of energy saved due to proposed building modifications is determined. The energy modeling is located in one of the required texts, for the course, ASH RAE Standard 90.1. In this standard, appendix G clearly describes the process that our students need employ to accurately model a facility with an energy priority.
The math class, MATH126, listed in the BS check sheet for HVACR Engineering Technology has always been an issue with students which transfer to Ferris as an incoming junior due to the fact their math transfer credit is usually MATH115. This typical student usually takes MATH120 and then MATH130 or MATH126. The notes for this within the check sheet are not as clear as they could be, so a minor modification to the wording was done to clarify this typical path for a transfer student.
Finally, HVAC312 and HVAC313 are currently titled "Control Theory-Application 2" and "Control Theory-Application 1", respectively. There is no reason for the "2" and "1" in the titles, so this submittal proposes to change the name of both courses to simply "Control Theory-Application".

Note that HVAC 312 and HVAC 313 are essentially the same course, with 312 offered as the campus-based version and 313 serving as the online version. HVAC313 has one less credit than HVAC312 and requires students to visit campus during the summer to complete the requirements of that single credit through HVAC314. In total, the outcomes for HVAC312 are identical to the combined outcomes of HVAC313 and HVAC314. This arrangement is necessary due to the laboratory components of HVAC312 that cannot be completed online. It is similar to the campus based HVAC331 and its corresponding online version HVAC332 and summer lab component HVAC333. Both HVAC331 and HVAC332 are named identical in the current course catalog.

### Review of the curricular changes over the past 6 years:

The addition of HVAC 290 and then HVAC 285 both providing a Building Information Modeling (BIM) component to our drafting / design objectives have been a success. With direct feedback from industry that BIM would be a skill set that entry level engineers would need, we have put in place a course that not only introduces those skill sets but also better integrates with other design courses in the curriculum. The faculty are able to share knowledge of the projects in the BIM course with course work in other design courses allowing for increased opportunity for practical application of the skills being taught. There are certainly some small gaps in AutoCAD specific knowledge that exist now and would not have when the students were taking a straight AutoCAD course in place of BIM but the feedback has been that the BIM skillset is useful for employers and more graduates are going to need the BIM knowledge.

With the increased use of programmable control technology in light commercial and industrial HVACR equipment and systems, the addition of out HVAC 127 advanced controls course has also been well received. We do not have enough time at this point to comment on whether the graduating AAS student will be more productive or noticeably better prepared but there is no question that the curriculum addition will provide skills that more technicians need each day. We also expect that as the two year students move into the BS degree, there will be an overall increase in controls knowledge because of HVAC 127; this may allow for some advanced topics to be covered in the two successive controls courses taught at the 300 and 400 level.

One of the larger modifications that has been implemented is the creation of two new courses to replace one previous course. Through years of review and looking at proper sequence of the learning objectives it was decided to split one course covering water and air systems into two dedicated course; one each for water and air. This curriculum change also incorporated changes to the online offerings and necessitated the creation of two additional split courses for the online learners. The two additional split courses had an online component and a face to face “summer lab” component similar to HVAC 313 / 314 which combine to equal our on campus HVAC 312. This modification has allowed for additional content in each course which would have been rushed in the previous single courses as well as implementation of crossover BIM components within the two new courses. The review of this process so far is favorable.

Other modifications have covered prerequisite issues, transfer courses available to online students and communication skills of our graduates. We are working toward a curriculum that is leading the HVACR industry, is fair and equitable to all levels of student, and provides industry with well-prepared employees.

## Assessment of Student Learning

(Return to TOC)

The HVACR Faculty have worked to maintain clear objectives and stick to a "the student will" approach for both course and program objectives. The curriculum outlines the effort to maintain clear and measurable objectives as does the TracDat data collected. While there are always written assessments in the form of homework and examinations, many of the assessments are in the form of professional documents that would be used on the job and can be identified as acceptable or not for industry expectations.

Many of the assessments are laboratory skills that students repeatedly practice and demonstrate to obtain proficiency. Among these are certain baseline skill sets that all graduates must possess to be considered proficient. Due to the nature of HVACR work, safety issues will often dictate minimum expectations for program graduates. It is a minimum expectation that all graduates would be able to service and install systems that will not cause harm to people or property.

Course objectives are communicated to the student through course outlines and syllabi. Assessment techniques have been matched to the tasks that a professional in the HVACR industry would be required to perform and diverse methods are employed to allow for different strengths in learning.

### Program Level Student Learning Outcomes

*Analyze, Synthesize, Problem Solve*

The HVACR Technology and HVACR Engineering Technology and Energy Management curricula have many learning objectives that are well defined and target particular skill sets that are valuable to employers in the industry. Periodic assessment of those objectives are completed via industry connections and Advisory Board meetings. Regular curricular review is evident in Appendix three: Curriculum Proposals as well as in the learning outcomes listed in Appendix six: Course Outcomes and Learning Objectives. Throughout the coursework analysis, synthesis, and problem solving are objectives that become both the goal and the method. Students are introduced to systems and methods that may have many correct iterations and must demonstrate why one solution would be superior to others. This requires analysis of the various techniques, products, systems, or arguments. Students are asked to transfer learning from one problem to solutions in another and to demonstrate repeatable methodologies for problem solving. These methods and objectives are useful from the very first courses when students are discussing refrigerants and piping methods all the way through four years of curriculum to students analyzing complex systems for hospitals and laboratories. Whether in design, service, or installation the ability to analyze a problem, work with a team to provide a solution, and offer confident step by step problem solving methodologies is the yardstick for success in the HVACR industry. It is our continuous effort to make the coursework as much like the real work as possible that keeps graduates in constant demand.

### *Safety*

Safe work practices are part of all job related learning outcomes. Working with tools requires proper knowledge, handling, and safety equipment. HVACR Systems operate with hazardous voltages and fluid pressures; students must attain a minimum level of proficiency to continue through the curriculum safely. As the student progresses to system service, installation and design there are other considerations beyond specifically working with personal protective equipment and safe tool usage. The student will need to understand safe handling of flammable and high pressure fluids and gasses as well as system sequences that impact when a system can be serviced and when it can be left unattended. Design coursework will require knowledge of application of components and systems that provide a clean, safe environment for whatever process the student would be designing toward. Safety is pervasive in the HVACR curriculum and must be measured and assessed throughout all of our coursework. Unsafe work practices will be immediately addressed with students.

## Assessment Measures for Overall Success

Students completing coursework in HVACR Technology are tested via performance based lab projects, National examinations for refrigerant recovery and handling as well as written lab projects. As mentioned above, safety plays a large role in setting baseline expectations for students. An installer or service technician will be responsible for the lives of others when dealing with electricity, and potentially hazardous fluids and gasses. This does not lower the expectation for performance but truly increases it. A small misunderstanding in service or installation could lead to life or death situations for system operators or building occupants; as such, HVACR technicians must demonstrate the ability to design, install, start, and service many different types of systems in a safe and energy efficient manner.

Students completing coursework in HVACR Engineering Technology and Energy Management have safety concerns like the HVACR Technology graduate would have but additionally demonstrate proficiency through projects and an internship. Many of the courses in the BS curriculum have semester projects based upon tasks that would be performed by HVACR Engineers on the job. Many of the projects are based on standard engineered documents that are a part of design and construction as defined by the American Institute of Architects (AIA) and used by the Construction Management and AIA to produce commercial and industrial buildings around the world. In addition the students will participate in a 10 week internship involving at least one of the disciplines covered under the HVACR Engineering Technology and Energy Management curriculum and must pass this milestone prior to completing the final year of coursework. In the final year of coursework the students will complete an Energy Audit on commercial or industrial building in the West Michigan area and later a capstone design project involving skills learned in most of the prior HVACR Engineering Technology and Energy Management coursework. These projects both allow for students to practice the skills discussed in lecture but also to perform work that is very much like it would be in their careers after graduation; this practice allows for students to get some idea of the particular discipline that appeals to them.

### Program Level Outcomes

AAS:

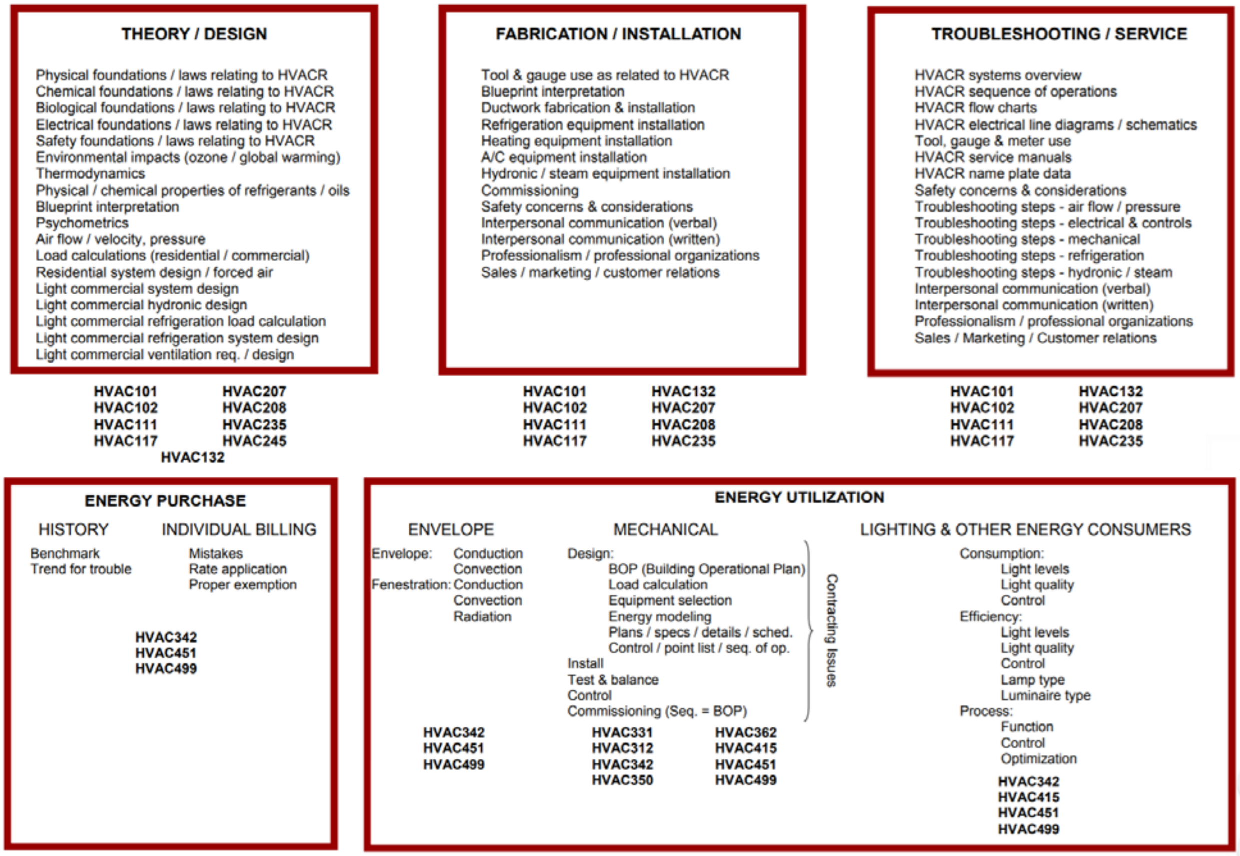
| | |
|---|---|
| 1. Install | Students will demonstrate installation techniques for residential and light commercial HVAC systems. |
| 2. Service HVAC | Students will service residential and light commercial HVAC equipment. |
| 3. Service Refrigeration | Students will service commercial refrigeration equipment. |
| 4. Troubleshoot Refrigeration | Students will systematically troubleshoot and repair commercial refrigeration equipment. |
| 5. Troubleshoot HVAC | Students will systematically troubleshoot and repair residential and light commercial HVAC equipment. |
| 6. Design HVAC | Students will design residential and light commercial HVAC systems. |

BS:

| | |
|---|---|
| 1. Select system | Students will analyze and select commercial and industrial HVAC systems for specific applications. |
| 2. Design system | Students will design commercial and industrial HVAC systems, given design parameters, building type and geographic location. |
| 3. Select secondary equipment | Students will select secondary equipment for specific commercial and industrial ducting and piping systems. |
| 4. Select primary equipment | Students will select primary equipment for specific commercial and industrial ducting and piping systems. |
| 5. Control | Students will program control sequences for specific commercial and industrial HVAC systems and equipment. |
| 6. Commission | Students will commission a commercial or industrial HVAC system. |
| 7. Energy Audit | Students will perform an energy audit of an actual facility and analyze utilities for proper application; Operation and Maintenance (O & M) and Energy Conservation Measures (ECMs) for potential energy savings; and implementation feasibility using payback calculations. |

When analyzing the TracDat report, you will see these program level outcomes as well as exercises that promote the analysis, synthesis, problem solving, and safety. While not all active courses are well reported, most are and they reflect some successes as well as some errors. Faculty have made an effort to document the corrections that would always be made when an assessment falls short. In some cases it is evident that the assessment is inadequate and needs to be addressed, others have to do with expectations of the students and still others require additional course materials to prepare students. These course corrections are a regular part of instruction much like the review of curriculum would be. We measure the performance, analyze the results, consider whether changes are necessary and in some cases, implement changes. Once that is done the process starts over.

Categorized Outcomes matched to Course Number



## Program Profile

(Return to TOC)

### Apps, Admits, and Enrolled

(Return to TOC)

**Ferris State University**
**Applied Admitted Enrolled by College, Major, DEGC and Campus**

| TERM | COLLEGE | MAJOR | MAJR_DESC | DEG CODE | CAMPUS | APPLIED | ADMITTED | ENROLLED |
|---|---|---|---|---|---|---|---|---|
| Associates Applied Science | | | | | | | | |
| 201708 | TE | HVAR | HVACR Technology | AAS | ON | 42 | 33 | 25 |
| 201608 | TE | HVAR | HVACR Technology | AAS | ON | 50 | 34 | 23 |
| 201508 | TE | HVAR | HVACR Technology | AAS | ON | 32 | 28 | 22 |
| 201408 | TE | HVAR | HVACR Technology | AAS | ON | 42 | 29 | 21 |
| 201308 | | HVEM | HVACR Technology | AAS | ON | 32 | 22 | |
| Bachelor of Science in HVACR or HVACR and EM On Campus (Code change shows overlap for Degree Name Change) | | | | | | | | |
| 201708 | TE | HVEM | HVACR Eng Tech and Enrgy Mgmt | BS | ON | 29 | 16 | 7 |
| 201608 | TE | HVEM | HVACR Eng Tech and Enrgy Mgmt | BS | ON | 31 | 25 | 21 |
| 201508 | TE | HVEM | HVACR Eng Tech and Enrgy Mgmt | BS | ON | 15 | 12 | 10 |
| 201408 | TE | HVEM | HVACR Eng Tech and Enrgy Mgmt | BS | ON | 25 | 17 | 13 |
| 201308 | | HVEM | HVACR Eng Tech and Enrgy Mgmt | BS | ON | 4 | 4 | |
| 201308 | | HVAC | HVACR Engineering Technology | BS | ON | 32 | 26 | |
| Bachelor of Science in HVACR or HVACR and EM Online (Code change shows overlap for Degree Name Change) | | | | | | | | |
| 201708 | TE | HVEM | HVACR Eng Tech and Enrgy Mgmt | BS | INT | 21 | 17 | 12 |
| 201608 | TE | HVEM | HVACR Eng Tech and Enrgy Mgmt | BS | INT | 48 | 43 | 27 |
| 201508 | TE | HVEM | HVACR Eng Tech and Enrgy Mgmt | BS | INT | 46 | 43 | 29 |
| 201408 | TE | HVAC | HVACR Engineering Technology | BS | INT | 8 | 1 | 0 |
| 201408 | TE | HVEM | HVACR Eng Tech and Enrgy Mgmt | BS | INT | 64 | 36 | 30 |
| 201308 | | HVAC | HVACR Engineering Technology | BS | INT | 60 | 31 | |

Of the three programs the AAS and BS have seen enrollment growth from 2013 through 2016. The AAS (starting with data available in 2014) saw 21, 22, 23, 25 enrolled which reflects an effort in our marketing to focus more on the associates degree with the idea that more of those students would continue for the entire 4 years. The 2017 numbers reflect a smaller transfer group and a larger continuing AAS cohort. The marketing plan has been to focus more on the freshmen than transfers with the hopes that a full AAS program would provide both plenty of grads for industry as well as increased numbers of continuing students in the BS program. It is too soon to tell if the decreased number of admits will result in a downward trend in BS graduates.

Looking specifically at applications, we see a drop from 2013/2014 for the online program of 68 and 72 down to 46 and 48 in 2015, 2016 respectively. It further drops to 21 in 2017 and becomes a trend that we need to focus on. The online program is the most flexible method of delivery and we believe that the applications should remain rather consistent. We may have economic factors interfering with these applications but nonetheless it is an area that could benefit from focused marketing. For the face to face BS degree, the applications start at 36 and then drop to 25, and 15 before rebounding to 31 and finally 29 in 2017. These numbers could also be increased with a marketing focus on transfers. There is a potential for 3 sections in the face to face BS degree although it would require additional faculty. Of the three degrees, the AAS has had the most consistent number of applications from 2013 through 2017 with 32, 42, 32, 50, and 42 respectively. This is the area where our marketing has been focused for about two years, it is not getting worse but neither is there a dramatic increase.

We have had discussions about the speed that records are processed between Applied and

Admitted and the number of students who apply from year to year and then are not admitted is of concern. We discuss this frequently and have tried to make personal contact with all applied students so that questions can be answered and we can carry more of those numbers over to the admitted column.

## Enrollment – Headcounts

(Return to TOC)

### *BS Degree Headcounts 2013 to 2017*

| Term | | On-Campus | Off-Campus | On-Line | Total |
|---|---|---|---|---|---|
| | Freshman | 1 | 0 | 11 | 12 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 25 | 0 | 7 | 32 |
| | Senior | 54 | 0 | 55 | 109 |
| | Totals | 80 | 0 | 73 | 153 |
| 201308 | | | | | |
| | Freshman | 1 | 0 | 0 | 1 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 1 | 0 | 0 | 1 |
| | Senior | 2 | 0 | 0 | 2 |
| | Totals | 4 | 0 | 0 | 4 |
| 201408 | Freshman | 1 | 0 | 9 | 10 |
| | Sophomore | 0 | 0 | 1 | 1 |
| | Junior | 9 | 0 | 15 | 24 |
| | Senior | 44 | 0 | 44 | 88 |
| | Totals | 54 | 0 | 69 | 123 |
| 201508 | Freshman | 0 | 0 | 5 | 5 |
| | Sophomore | 0 | 0 | 2 | 2 |
| | Junior | 7 | 0 | 12 | 19 |
| | Senior | 25 | 0 | 40 | 65 |
| | Totals | 32 | 0 | 59 | 91 |
| 201608 | Freshman | 0 | 0 | 0 | 0 |
| | Sophomore | 0 | 0 | 3 | 3 |
| | Junior | 12 | 0 | 17 | 29 |
| | Senior | 40 | 0 | 50 | 90 |
| | Totals | 52 | 0 | 70 | 122 |
| 201708 | Freshman | 0 | 0 | 0 | 0 |
| | Sophomore | 0 | 0 | 1 | 1 |
| | Junior | 10 | 0 | 17 | 27 |
| | Senior | 39 | 0 | 55 | 94 |
| | Totals | 49 | 0 | 73 | 122 |

On the table above, the first page indicates the change in degree name from HVACR Engineering Technology to HVACR Engineering Technology and Energy Management. The 2013 headcounts were largely the last group for the old degree name. The total number of BS degree students shows as 157 for the combination of the two degrees (summarized above) degrees then to 123, 91, 122 and 122 through 2017. The variance for 2015 does not present specifically in online versus on campus but does represent a significant decrease for one year. As a faculty group, we review these numbers several times each year and try to address the issues when a cause is known. The numbers recover during 2016 and 2017 and we believe that they are maintaining for 2018.

*AAS Degree Headcounts 2013 to 2017*

## Enrollment (Headcounts) - On-Campus, Off-Campus, On-Line and Total

| Term | | On-Campus | Off-Campus | On-Line | Total |
|---|---|---|---|---|---|
| 201308 | Freshman | 14 | 0 | 0 | 14 |
| | Sophomore | 31 | 0 | 0 | 31 |
| | Junior | 9 | 0 | 0 | 9 |
| | Senior | 6 | 0 | 0 | 6 |
| | Total | 60 | 0 | 0 | 60 |
| 201408 | Freshman | 15 | 0 | 0 | 15 |
| | Sophomore | 21 | 0 | 0 | 21 |
| | Junior | 16 | 0 | 0 | 16 |
| | Senior | 6 | 0 | 0 | 6 |
| | Total | 58 | 0 | 0 | 58 |
| 201508 | Freshman | 19 | 0 | 0 | 19 |
| | Sophomore | 17 | 0 | 0 | 17 |
| | Junior | 20 | 0 | 0 | 20 |
| | Senior | 3 | 0 | 0 | 3 |
| | Total | 59 | 0 | 0 | 59 |
| 201608 | Freshman | 22 | 0 | 0 | 22 |
| | Sophomore | 22 | 0 | 0 | 22 |
| | Junior | 13 | 0 | 0 | 13 |
| | Senior | 10 | 0 | 0 | 10 |
| | Total | 67 | 0 | 0 | 67 |
| 201708 | Freshman | 26 | 0 | 0 | 26 |
| | Sophomore | 32 | 0 | 0 | 32 |
| | Junior | 12 | 0 | 0 | 12 |
| | Senior | 5 | 0 | 0 | 5 |
| | Total | 75 | 0 | 0 | 75 |

The associates degree headcounts maintain throughout the five years with a slight increase for 2016 and 2017 which would reflect marketing efforts increased over the last several years on the AAS degree. The 2017 and 2018 headcounts put the department at or very near full capacity. The bottleneck for this group is generally the lab space which is very specific to a course and limits schedules during normal working hours. We currently offer all 200 level courses simultaneously which nearly fills a week from 8 AM to 5 PM; adding an additional section of students at the 200 level would require overlap of the lab times or teaching during evening hours. Overlap of the lab times would prevent a student from accelerating their schedule y taking two semesters of 200 level HVAC courses in one semester.

### Ideal Headcount

It is difficult to say that what the ideal number of students would be. We have seats for 32 students per lecture and planned for capacity (during the Granger construction) for 2 sections of AAS students, 2 sections of face to face BS students and online sections as allowed by faculty load beyond that. The building is an integral part of the curriculum so using classrooms in other locations does not immediately solve a problem with increased headcount. Faculty are currently overloaded and have had FTE in excess of our numbers 4 out of the last 5 years. Our FTE is typically equivalent to 1 full time person beyond our number; for example the 2017 – 2018 school year shows FTE at 10.44 with 9 full time faculty and one adjunct. Faculty could be added to increase the headcount but the building would then become the bottleneck. Our building seating capacity was planned for 128 face to face students. The 128 students comes from a plan of two sections of 32 for each of the four years; this is based on seats, lockers, labs, etc. The schedules have allowed for three sections of a particular group but when all other groups are full, the lab times make building scheduling difficult. As mentioned in other areas, we offer all 200 level courses with no scheduled overlap so that students can accelerate their schedule; this schedule feature ties up classroom and lab time in such a way that going to a third section is not possible without overlap. The BS degree can handle a third section and we have had multiple years where that group carried an additional 32 students; increased enrollment by one section would be achievable for online or face to face without any additional resources beyond the additional faculty required.

The headcounts from Institutional Testing are included below.

**Ferris State University**
**Administrative Program Review**
**Enrollment (Headcounts)**

**TE**
**HVAC HVACR Engineering Technology**
**BS**

## Enrollment (Headcounts) - On-Campus, Off-Campus, On-Line and Total

| Term | | On-Campus | Off-Campus | On-Line | Total |
|---|---|---|---|---|---|
| 201308 | Freshman | 1 | 0 | 11 | 12 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 25 | 0 | 7 | 32 |
| | Senior | 54 | 0 | 55 | 109 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201408 | Freshman | 0 | 0 | 1 | 1 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 4 | 0 | 0 | 4 |
| | Senior | 1 | 0 | 3 | 4 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201508 | Freshman | 0 | 0 | 0 | 0 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 0 | 0 | 0 | 0 |
| | Senior | 6 | 0 | 0 | 6 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201608 | Freshman | 0 | 0 | 0 | 0 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 0 | 0 | 0 | 0 |
| | Senior | 0 | 0 | 0 | 0 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201708 | Freshman | 0 | 0 | 0 | 0 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 0 | 0 | 0 | 0 |
| | Senior | 0 | 0 | 0 | 0 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |

**Ferris State University**
**Administrative Program Review**
**Enrollment (Headcounts)**

**TE**
**HVEM HVACR Eng Tech and Enrgy Mgmt**
**BS**

## Enrollment (Headcounts) - On-Campus, Off-Campus, On-Line and Total

| Term | | On-Campus | Off-Campus | On-Line | Total |
|---|---|---|---|---|---|
| 201308 | Freshman | 1 | 0 | 0 | 1 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 1 | 0 | 0 | 1 |
| | Senior | 2 | 0 | 0 | 2 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201408 | Freshman | 1 | 0 | 9 | 10 |
| | Sophomore | 0 | 0 | 1 | 1 |
| | Junior | 9 | 0 | 15 | 24 |
| | Senior | 44 | 0 | 44 | 88 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201508 | Freshman | 0 | 0 | 5 | 5 |
| | Sophomore | 0 | 0 | 2 | 2 |
| | Junior | 7 | 0 | 12 | 19 |
| | Senior | 25 | 0 | 40 | 65 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201608 | Freshman | 0 | 0 | 0 | 0 |
| | Sophomore | 0 | 0 | 3 | 3 |
| | Junior | 12 | 0 | 17 | 29 |
| | Senior | 40 | 0 | 50 | 90 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201708 | Freshman | 0 | 0 | 0 | 0 |
| | Sophomore | 0 | 0 | 1 | 1 |
| | Junior | 10 | 0 | 17 | 27 |
| | Senior | 39 | 0 | 55 | 94 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |

Ferris State University
Administrative Program Review
Enrollment (Headcounts)

TE
HVAR HVACR Technology
AAS

## Enrollment (Headcounts) - On-Campus, Off-Campus, On-Line and Total

| Term | | On-Campus | Off-Campus | On-Line | Total |
|---|---|---|---|---|---|
| 201308 | Freshman | 14 | 0 | 0 | 14 |
| | Sophomore | 31 | 0 | 0 | 31 |
| | Junior | 9 | 0 | 0 | 9 |
| | Senior | 6 | 0 | 0 | 6 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201408 | Freshman | 15 | 0 | 0 | 15 |
| | Sophomore | 21 | 0 | 0 | 21 |
| | Junior | 16 | 0 | 0 | 16 |
| | Senior | 6 | 0 | 0 | 6 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201508 | Freshman | 19 | 0 | 0 | 19 |
| | Sophomore | 17 | 0 | 0 | 17 |
| | Junior | 20 | 0 | 0 | 20 |
| | Senior | 3 | 0 | 0 | 3 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201608 | Freshman | 22 | 0 | 0 | 22 |
| | Sophomore | 22 | 0 | 0 | 22 |
| | Junior | 13 | 0 | 0 | 13 |
| | Senior | 10 | 0 | 0 | 10 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201708 | Freshman | 26 | 0 | 0 | 26 |
| | Sophomore | 32 | 0 | 0 | 32 |
| | Junior | 12 | 0 | 0 | 12 |
| | Senior | 5 | 0 | 0 | 5 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |

## Student Credit Hour Trends

(Return to TOC)

| | | Student Credit Hours | | | | Full Time Equated Faculty | | | | SCH/FTEF | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Department** | **Year** | **Summer** | **Fall** | **Spring** | **F + SP (a)** | **Summer** | **Fall** | **Spring** | **Avg F + SP (b)** | **Summer** | **Fall** | **Spring** | **F + SP (a/b)** |
| HVACR | 2012-13 | 392.00 | 1,698.00 | 1,760.00 | 3,458.00 | 2.45 | 9.37 | 10.06 | 9.71 | 160.00 | 181.22 | 174.95 | 355.94 |
| HVACR | 2013-14 | 346.00 | 1,615.00 | 1,559.00 | 3,174.00 | 3.10 | 9.69 | 9.40 | 9.54 | 111.61 | 166.75 | 165.85 | 332.62 |
| HVACR | 2014-15 | 347.00 | 1,376.00 | 1,454.00 | 2,830.00 | 2.41 | 9.39 | 9.06 | 9.22 | 143.98 | 146.56 | 160.49 | 306.79 |
| HVACR | 2015-16 | 224.00 | 1,510.00 | 1,326.00 | 2,836.00 | 1.75 | 9.21 | 8.73 | 8.97 | 128.00 | 163.87 | 151.89 | 316.08 |
| HVACR | 2016-17 | 251.00 | 1,729.00 | 1,550.00 | 3,279.00 | 2.24 | 8.66 | 9.62 | 9.14 | 112.05 | 199.67 | 161.12 | 358.77 |
| | | Summer | Fall | Spring | **F + SP (a)** | **Summer** | Fall | Spring | F + SP **(b)** | **Summer** | Fall | Spring | **F + SP (a/b)** |
| Ferris State University | 2012-13 | 35023 | 168457.00 | 157,083.00 | 325,540.00 | 237.15 | 718.26 | 689.39 | 703.83 | 147.68 | 234.53 | 227.86 | 462.53 |
| Ferris State University | 2013-14 | 34135.5 | 167183.50 | 157,302.00 | 324,485.50 | 241.65 | 701.92 | 681.49 | 691.71 | 141.26 | 238.18 | 230.82 | 469.11 |
| Ferris State University | 2014-15 | 33743.5 | 166453.00 | 157,633.50 | 324,086.50 | 234.76 | 705.24 | 703.03 | 704.13 | 143.74 | 236.02 | 224.22 | 460.26 |
| Ferris State University | 2015-16 | 36049 | 166686.00 | 154,735.50 | 321,421.50 | 246.68 | 722.50 | 685.99 | 704.25 | 146.13 | 230.71 | 225.57 | 456.41 |
| Ferris State University | 2016-17 | 34430 | 160053.00 | 149,191.00 | 309,244.00 | 245.44 | 697.70 | 671.47 | 684.58 | 140.28 | 229.40 | 222.19 | 451.73 |

Student credit hours for 2012 / 2013 were the highest in the past 5 years; this is consistent with the enrollment numbers. Overall these reflect the number of students in the program for the past year as there have been no significant changes in SCH within the curriculum during that time. Curricular discussions always include the possibility that student credit hours would be decreased in an effort to reduce student costs but learning objectives are always being added to the list and it is difficult to reduce time with the students when employers are asking for so many new skills. The upside of this trade off is that good career opportunities remain plentiful for HVACR graduates.

Examining the fall vs spring student credit hours, no clear pattern emerges. They are nearly equal (within 10%) from year to year with some years showing greater SCH in fall than spring and other years reversed. There have been curricular changes to balance the load on students that could explain these changes.

**Ferris State University**
**Administrative Program Review**
**SCH's**

**TE**
**HVAC HVACR Engineering Technology**
**BS**

**Student Credit Hours - On-Campus, Off-Campus, On-Line and Total**

| Term | | On-Campus | Off-Campus | On-Line | Total |
|---|---|---|---|---|---|
| 201308 | Freshman | 14 | 0 | 36 | 50 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 349 | 0 | 29 | 378 |
| | Senior | 697 | 0 | 241 | 938 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201408 | Freshman | 0 | 0 | 4 | 4 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 61 | 0 | 0 | 61 |
| | Senior | 17 | 0 | 11 | 28 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201508 | Freshman | 0 | 0 | 0 | 0 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 0 | 0 | 0 | 0 |
| | Senior | 93 | 0 | 0 | 93 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201608 | Freshman | 0 | 0 | 0 | 0 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 0 | 0 | 0 | 0 |
| | Senior | 0 | 0 | 0 | 0 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201708 | Freshman | 0 | 0 | 0 | 0 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 0 | 0 | 0 | 0 |
| | Senior | 0 | 0 | 0 | 0 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |

**Ferris State University**
**Administrative Program Review**
**SCH's**

**TE**
**HVAR HVACR Technology**
**AAS**

**Student Credit Hours - On-Campus, Off-Campus, On-Line and Total**

| Term | | On-Campus | Off-Campus | On-Line | Total |
|---|---|---|---|---|---|
| 201308 | Freshman | 205 | 0 | 0 | 205 |
| | Sophomore | 425 | 0 | 0 | 425 |
| | Junior | 116 | 0 | 0 | 116 |
| | Senior | 91 | 0 | 0 | 91 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201408 | Freshman | 219 | 0 | 0 | 219 |
| | Sophomore | 296 | 0 | 0 | 296 |
| | Junior | 222 | 0 | 0 | 222 |
| | Senior | 80 | 0 | 0 | 80 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201508 | Freshman | 287 | 0 | 0 | 287 |
| | Sophomore | 247 | 0 | 0 | 247 |
| | Junior | 267 | 0 | 0 | 267 |
| | Senior | 40 | 0 | 0 | 40 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201608 | Freshman | 352 | 0 | 0 | 352 |
| | Sophomore | 341 | 0 | 0 | 341 |
| | Junior | 189 | 0 | 0 | 189 |
| | Senior | 133 | 0 | 0 | 133 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201708 | Freshman | 414 | 0 | 0 | 414 |
| | Sophomore | 495 | 0 | 0 | 495 |
| | Junior | 172 | 0 | 0 | 172 |
| | Senior | 74 | 0 | 0 | 74 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |

**Ferris State University**
**Administrative Program Review**
**SCH's**

**TE**
**HVEM HVACR Eng Tech and Enrgy Mgmt**
**BS**

**Student Credit Hours - On-Campus, Off-Campus, On-Line and Total**

| Term | | On-Campus | Off-Campus | On-Line | Total |
|---|---|---|---|---|---|
| 201308 | Freshman | 13 | 0 | 0 | 13 |
| | Sophomore | 0 | 0 | 0 | 0 |
| | Junior | 16 | 0 | 0 | 16 |
| | Senior | 26 | 0 | 0 | 26 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201408 | Freshman | 13 | 0 | 36 | 49 |
| | Sophomore | 0 | 0 | 4 | 4 |
| | Junior | 132 | 0 | 60 | 192 |
| | Senior | 615 | 0 | 208 | 823 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201508 | Freshman | 0 | 0 | 30 | 30 |
| | Sophomore | 0 | 0 | 8 | 8 |
| | Junior | 99 | 0 | 58 | 157 |
| | Senior | 345 | 0 | 197 | 542 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201608 | Freshman | 0 | 0 | 0 | 0 |
| | Sophomore | 0 | 0 | 10 | 10 |
| | Junior | 185 | 0 | 74 | 259 |
| | Senior | 551 | 0 | 209 | 760 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |
| 201708 | Freshman | 0 | 0 | 0 | 0 |
| | Sophomore | 0 | 0 | 4 | 4 |
| | Junior | 147 | 0 | 81 | 228 |
| | Senior | 563 | 0 | 263 | 826 |
| | Masters | 0 | 0 | 0 | 0 |
| | 1st Professional | 0 | 0 | 0 | 0 |

## Productivity

(Return to TOC)

| | | Student Credit Hours | | | | Full Time Equated Faculty | | | | SCH/FTEF | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Department | Year | Summer | Fall | Spring | F + SP (a) | Summer | Fall | Spring | Avg F + SP (b) | Summer | Fall | Spring | F + SP (a/b) |
| HVACR | 2012-13 | 392.00 | 1,698.00 | 1,760.00 | 3,458.00 | 2.45 | 9.37 | 10.06 | 9.71 | 160.00 | 181.22 | 174.95 | 355.94 |
| HVACR | 2013-14 | 346.00 | 1,615.00 | 1,559.00 | 3,174.00 | 3.10 | 9.69 | 9.40 | 9.54 | 111.61 | 166.75 | 165.85 | 332.62 |
| HVACR | 2014-15 | 347.00 | 1,376.00 | 1,454.00 | 2,830.00 | 2.41 | 9.39 | 9.06 | 9.22 | 143.98 | 146.56 | 160.49 | 306.79 |
| HVACR | 2015-16 | 224.00 | 1,510.00 | 1,326.00 | 2,836.00 | 1.75 | 9.21 | 8.73 | 8.97 | 128.00 | 163.87 | 151.89 | 316.08 |
| HVACR | 2016-17 | 251.00 | 1,729.00 | 1,550.00 | 3,279.00 | 2.24 | 8.66 | 9.62 | 9.14 | 112.05 | 199.67 | 161.12 | 358.77 |
| | | Summer | Fall | Spring | F + SP (a) | Summer | Fall | Spring | F + SP (b) | Summer | Fall | Spring | F + SP (a/b) |
| Ferris State University | 2012-13 | 35023 | 168457.00 | 157,083.00 | 325,540.00 | 237.15 | 718.26 | 689.39 | 703.83 | 147.68 | 234.53 | 227.86 | 462.53 |
| Ferris State University | 2013-14 | 34135.5 | 167183.50 | 157,302.00 | 324,485.50 | 241.65 | 701.92 | 681.49 | 691.71 | 141.26 | 238.18 | 230.82 | 469.11 |
| Ferris State University | 2014-15 | 33743.5 | 166453.00 | 157,633.50 | 324,086.50 | 234.76 | 705.24 | 703.03 | 704.13 | 143.74 | 236.02 | 224.22 | 460.26 |
| Ferris State University | 2015-16 | 36049 | 166686.00 | 154,735.50 | 321,421.50 | 246.68 | 722.50 | 685.99 | 704.25 | 146.13 | 230.71 | 225.57 | 456.41 |
| Ferris State University | 2016-17 | 34430 | 160053.00 | 149,191.00 | 309,244.00 | 245.44 | 697.70 | 671.47 | 684.58 | 140.28 | 229.40 | 222.19 | 451.73 |

The faculty group is consistently in overload and the SCH / FTEF is running in the 300 to 360 range. In 2017 the SCH/FTEF returned to 358 which exceeds what it was in 2012/2013. There are many factors that could affect the SCH / FTEF; our 3:1 conversion of contacts to credits and the large number of high contact lab sessions in the curriculum act as a ceiling on the SCH / FTEF. Looking at similar lab (contact) heavy programs, we see that the COET numbers are slightly higher (380 – 480) over the same time period; there are numerous COET programs that display SCH / FTEF above or below the HVAC numbers. The 300 to 360 range seems to be well within the reasonable expectation for lab intensive coursework.

## Enrollment – Residency

(Return to TOC)

**HVAC HVACR Engineering Technology BS**

| | | Residency | | | Age | FSU GPA | | | ACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Term | Blan | Resident | Midwest Compact | Non-Resident | Avg. | Avg. | Min. | Max. | Avg. | Min. | Max. |
| 201308 | 0 | 126 | 7 | 20 | 31 | 3.24 | 1.52 | 4.00 | 20.03 | 11 | 29 |
| 201408 | 0 | 8 | 1 | 0 | 29 | 3.26 | 2.61 | 3.91 | 21.40 | 15 | 26 |
| 201508 | 0 | 5 | 0 | 1 | 22 | 3.30 | 2.64 | 3.82 | 21.50 | 15 | 26 |

**HVAR HVACR Technology AAS**

| | | Residency | | | Age | FSU GPA | | | ACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Term | Blan | Resident | Midwest Compact | Non-Resident | Avg. | Avg. | Min. | Max. | Avg. | Min. | Max. |
| 201308 | 0 | 57 | 2 | 1 | 22 | 2.86 | 1.20 | 4.00 | 19.61 | 13 | 27 |
| 201408 | 0 | 52 | 2 | 4 | 21 | 2.79 | 1.67 | 4.00 | 20.15 | 13 | 27 |
| 201508 | 0 | 54 | 0 | 5 | 20 | 3.01 | 1.86 | 4.00 | 19.89 | 13 | 29 |
| 201608 | 0 | 60 | 0 | 7 | 22 | 3.14 | 1.83 | 4.00 | 20.23 | 15 | 26 |
| 201708 | 0 | 68 | 0 | 7 | 21 | 3.23 | 1.76 | 4.00 | 20.90 | 15 | 32 |

**HVEM HVACR Eng Tech and Enrgy Mgmt BS**

| | | Residency | | | Age | FSU GPA | | | ACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Term | Blan | Resident | Midwest Compact | Non-Resident | Avg. | Avg. | Min. | Max. | Avg. | Min. | Max. |
| 201308 | 0 | 4 | 0 | 0 | 31 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 201408 | 0 | 105 | 6 | 12 | 32 | 3.25 | 2.16 | 4.00 | 18.97 | 11 | 29 |
| 201508 | 0 | 82 | 0 | 9 | 32 | 3.31 | 2.05 | 4.00 | 20.76 | 15 | 28 |
| 201608 | 0 | 108 | 0 | 14 | 32 | 3.40 | 2.22 | 4.00 | 20.15 | 14 | 28 |
| 201708 | 0 | 107 | 0 | 15 | 31 | 3.34 | 1.70 | 4.00 | 19.80 | 14 | 27 |

Looking at the residency numbers for the past 5 years, it is evident that the vast majority AAS students are residents, 20 to 21 years old. The BS degree offers two dimensions that cause a change in both residents and age; the 2+2 brings more transfers in to the program from around the country and the online program attracts working professionals desiring a BS in HVACR with no way to attend traditional face to face classes. The BS degree is quite unique in the nation which adds another level of desirability for out of state transfers. The HVACR marketing person is not able to travel nationally on a regular basis but does take advantage of conference opportunities when faculty are traveling nationally. We do see that between 10% and 15% of the BS degree students are from out of state. We hope to continue to access this market and bring more students in from around the country as they realize both the quality and unique nature of the degree.

## Enrollment - Gender and Ethnicity

(Return to TOC)

**HVAC HVACR Engineering Technology**

| | | Gender | | Ethnicity | | | | | | | | | Full or Part Time | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Term** | **Enrolled** | **Male** | **Female** | **Unknown** | **Black** | **Hispanic** | **Native** | **Asian** | **White** | **Hawaiian** | **Multi** | **Foreign** | **Full Time** | **Part Time** |
| 201308 | 153 | 150 | 3 | 6 | 17 | 10 | 0 | 3 | 103 | 1 | 2 | 11 | 68 | 85 |
| 201408 | 9 | 9 | 0 | 1 | 0 | 1 | 0 | 0 | 5 | 0 | 1 | 1 | 5 | 4 |
| 201508 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 1 | 0 | 6 | 0 |

**HVAR HVACR Technology AAS**

| | | Gender | | Ethnicity | | | | | | | | | Full or Part Time | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Term** | **Enrolled** | **Male** | **Female** | **Unknown** | **Black** | **Hispanic** | **Native** | **Asian** | **White** | **Hawaiian** | **Multi** | **Foreign** | **Full Time** | **Part Time** |
| 201308 | 60 | 60 | 0 | 1 | 1 | 3 | 0 | 0 | 53 | 0 | 2 | 0 | 55 | 5 |
| 201408 | 58 | 58 | 0 | 1 | 1 | 2 | 0 | 0 | 52 | 0 | 1 | 1 | 55 | 3 |
| 201508 | 59 | 59 | 0 | 1 | 1 | 3 | 0 | 1 | 53 | 0 | 0 | 0 | 55 | 4 |
| 201608 | 67 | 63 | 4 | 1 | 2 | 4 | 1 | 1 | 57 | 0 | 0 | 1 | 64 | 3 |
| 201708 | 75 | 71 | 4 | 0 | 1 | 5 | 1 | 1 | 63 | 0 | 1 | 3 | 73 | 2 |

**HVEM HVACR Eng Tech and Enrgy Mgmt**

| | | Gender | | Ethnicity | | | | | | | | | Full or Part Time | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Term** | **Enrolled** | **Male** | **Female** | **Unknown** | **Black** | **Hispanic** | **Native** | **Asian** | **White** | **Hawaiian** | **Multi** | **Foreign** | **Full Time** | **Part Time** |
| 201308 | 4 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 4 | 0 |
| 201408 | 123 | 120 | 3 | 2 | 15 | 11 | 0 | 3 | 83 | 0 | 3 | 6 | 50 | 73 |
| 201508 | 91 | 89 | 2 | 2 | 6 | 11 | 0 | 2 | 68 | 0 | 1 | 1 | 32 | 59 |
| 201608 | 122 | 120 | 2 | 2 | 10 | 11 | 0 | 3 | 88 | 1 | 1 | 6 | 49 | 73 |
| 201708 | 122 | 120 | 2 | 3 | 8 | 14 | 0 | 4 | 83 | 1 | 2 | 7 | 49 | 73 |

The majority of students in either program are white male. The AAS program reports about 90% and the BS degree comes in at about 70%. From the Michigan Department of Education 2017 – 2018 Racial Census, Montcalm County reports 93% white, Mecosta County is 87.32% white, and Osceola County 93% white. The rural districts surrounding the Big Rapids area closely match the ethnicity of students in the AAS program. The transfer and online components of the BS degree lowers that number. The AAS program is unique in the quality of laboratories and curriculum but competition is more intense with community colleges offering programs that may appear similar but come at a much lower cost. As a result we draw more of those students from the surrounding west Michigan area.

The male to female ratio is regularly below 2%, this is a regular topic for discussion in curriculum review and with industry partners. It is our belief that the industry as a whole would attract more female engineers without the service intensive curriculum from the first two years.

## Retention

(Return to TOC)

***Ferris State University***
***Retention and Graduation Rates of Full-Time FTIAC Students - By Major***
*Two-Year Degree Programs*

| | | | | Fall Term | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Enterin** | **Major** | ***N*** | | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Year 6** | **Year 7** |
| 201208 | HVAR | 8 | | | | | | | |
| | | | % Graduated By | 0 | 25 | 75 | 88 | 88 | |
| | | | % Still Enrolled In | 100 | 50 | 13 | 0 | 0 | |
| | | | % Persisters | 100 | 75 | 88 | 88 | 88 | |
| | | | % Non-Persisters | 0 | 25 | 12 | 12 | 12 | |
| 201308 | HVAR | 8 | | | | | | | |
| | | | % Graduated By | 0 | 25 | 38 | 63 | | |
| | | | % Still Enrolled In | 75 | 25 | 25 | 0 | | |
| | | | % Persisters | 75 | 50 | 63 | 63 | | |
| | | | % Non-Persisters | 25 | 50 | 37 | 37 | | |
| 201408 | HVAR | 11 | | | | | | | |
| | | | % Graduated By | 0 | 36 | 64 | | | |
| | | | % Still Enrolled In | 91 | 27 | 0 | | | |
| | | | % Persisters | 91 | 64 | 64 | | | |
| | | | % Non-Persisters | 9 | 36 | 36 | | | |
| 201508 | HVAR | 14 | % Graduated By | 0 | 57 | | | | |
| | | | % Still Enrolled In | 79 | 14 | | | | |
| | | | % Persisters | 79 | 71 | | | | |
| | | | % Non-Persisters | 21 | 29 | | | | |
| 201608 | HVAR | 15 | % Graduated By | 0 | | | | | |
| | | | % Still Enrolled In | 87 | | | | | |
| | | | % Persisters | 87 | | | | | |
| | | | % Non-Persisters | 13 | | | | | |

*Two-Year Degree Programs*

| | | | | Fall Term | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Entering Fall Term** | **Major** | ***N*** | | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Year 6** | **Year 7** |
| 201208 | PHVA | 1 | | | | | | | |
| | | | % Graduated By | 0 | 0 | 100 | 100 | 100 | |
| | | | % Still Enrolled In | 100 | 100 | 0 | 0 | 0 | |
| | | | % Persisters | 100 | 100 | 100 | 100 | 100 | |
| | | | % Non-Persisters | 0 | 0 | 0 | 0 | 0 | |
| 201308 | PHVA | 3 | | | | | | | |
| | | | % Graduated By | 0 | 0 | 33 | | 67 | |
| | | | % Still Enrolled In | 67 | 67 | 33 | | 0 | |
| | | | % Persisters | 67 | 67 | 67 | | 67 | |
| | | | % Non-Persisters | 33 | 33 | 33 | | 33 | |
| 201408 | PHVA | 1 | | | | | | | |
| | | | % Graduated By | 0 | 0 | 100 | | | |
| | | | % Still Enrolled In | 100 | 100 | 0 | | | |
| | | | % Persisters | 100 | 100 | 100 | | | |
| | | | % Non-Persisters | 0 | 0 | 0 | | | |
| 201508 | PHVA | 2 | | | | | | | |
| | | | % Graduated By | 0 | 0 | | | | |
| | | | % Still Enrolled In | 100 | 100 | | | | |
| | | | % Persisters | 100 | 100 | | | | |
| | | | % Non-Persisters | | | | | | |
| 201608 | PHVA | 2 | | | | | | | |
| | | | % Graduated By | 0 | | | | | |
| | | | % Still Enrolled In | 100 | | | | | |
| | | | % Persisters | 100 | | | | | |
| | | | % Non-Persisters | 0 | | | | | |

The first year retention is for the AAS (HVAR) is in the 75 -100% range for 2012 – 2017. The student head count for those retention numbers are in the range of 8 to 15 students. Practically speaking we lose 1 or 2 students some years while other years we lose none. The program looks at this seriously and we frequently discuss tactics that will help individual students be successful. It is uncommon for retention discussions to deal with a particular course or set of outcomes but it has happened in the past and we have modified our curriculum to allow students entering the BS degree a better chance at managing the workload.

The most common approach for our department is to address each student personally and to try and understand what the hurdle is. We feel that this is a topic that can be best handled finding out what an individual needs to be successful. Sometimes the change that is required is within the ability of a faculty member to assist, sometimes it is not. It is unfortunate but some students are not prepared to meet the responsibilities that a college career will demand.

If the retention were to decrease noticeably, the process would have to be analyzed. Would it be an individual or a curricular issue? Certainly we are prepared to deal with those types of issues but do not currently feel that the retention is outside normal expectations.

## Program Graduates

(Return to TOC)

**Ferris State University**
**Administrative Program Review**
**Graduates from 201205 Through 201701**

**TE**
**HVAR HVACR Technology**
**AAS**

**Graduate Headcount**

| Academic Year | On-Campus | Off-Campus | On-Line | Total |
|---|---|---|---|---|
| 2012-2013 | 27 | 0 | 0 | 27 |
| 2013-2014 | 20 | 0 | 0 | 20 |
| 2014-2015 | 25 | 0 | 0 | 25 |
| 2015-2016 | 24 | 0 | 0 | 24 |
| 2016-2017 | 29 | 0 | 0 | 29 |

The graduate headcount for the AAS closely mirrors the headcount for sophomores in the program each year. Most students are encouraged to apply for graduation when transitioning from the AAS to the BS degree but based upon the headcount numbers, some students wait to apply for AAS graduation until graduating with a BS also. The difference between on campus graduates of the AAS and sophomore headcount is insignificant and no further analysis is necessary.

**Ferris State University**
**Administrative Program Review**
**Graduates from 201205 Through 201701**

**TE**
**HVAC HVACR Engineering Technology**
**BS**

**Graduate Headcount**

| Academic Year | On-Campus | Off-Campus | On-Line | Total |
|---|---|---|---|---|
| 2012-2013 | 30 | 0 | 16 | 46 |
| 2013-2014 | 17 | 0 | 8 | 25 |
| 2014-2015 | 3 | 0 | 4 | 7 |
| 2015-2016 | 3 | 0 | 5 | 8 |
| 2016-2017 | 0 | 0 | 1 | 1 |

**Ferris State University**
**Administrative Program Review**
**Graduates from 201205 Through 201701**

**TE**
**HVEM HVACR Eng Tech and Enrgy Mgmt**
**BS**

**Graduate Headcount**

| Academic Year | On-Campus | Off-Campus | On-Line | Total |
|---|---|---|---|---|
| 2013-2014 | 10 | 0 | 4 | 14 |
| 2014-2015 | 31 | 0 | 6 | 37 |
| 2015-2016 | 19 | 0 | 9 | 28 |
| 2016-2017 | 24 | 0 | 6 | 30 |

The graduate headcount for the two BS degrees (Pre 2013 and 2013 forward) combined by On-

Campus and On-Line are as follows.

| | On-Campus | On-Line |
|---|---|---|
| 2012-2013 | 30 | 16 |
| 2013-2014 | 27 | 12 |
| 2014-2015 | 34 | 10 |
| 2015-2016 | 22 | 14 |
| 2016-2017 | 24 | 7 |

The decrease in online graduates is of concern but difficult to understand because of the nature of the online student. The online student is typically an older working adult with any number of reasons to delay course work. They routinely stop taking courses for a semester or more and then resume working on the degree. Many online students will complete general education coursework at a local school which may also indicate why these students do not complete at the same rate that they enter the senior semester.

The on-campus graduation rate is also a little off from the headcount for seniors. The face to face BS degree will include more transfer students who would bring additional credits to FSU, these students may reach senior status prior to graduation. We require an advisor visit each semester before any HVAC students may register for the next semester. In addition, we advise the entire senior group on the graduation application process each fall. Our advising sessions for graduating seniors in the fall are very specific and well supervised; we are not losing track of the students completing coursework with their cohort. It is far more likely that students are carrying senior credits into their junior year.

## Six Year Graduation Rate

(Return to TOC)

***Ferris State University***

***Retention and Graduation Rates of Full-Time FTIAC Students - By Major***

*Two-Year Degree Programs*

| | | | | Fall Term | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Enterin** | **Major** | ***N*** | | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Year 6** | **Year 7** |
| 201208 | HVAR | 8 | | | | | | | |
| | | | % Graduated By | 0 | 25 | 75 | 88 | 88 | |
| | | | % Still Enrolled In | 100 | 50 | 13 | 0 | 0 | |
| | | | % Persisters | 100 | 75 | 88 | 88 | 88 | |
| | | | % Non-Persisters | 0 | 25 | 12 | 12 | 12 | |
| 201308 | HVAR | 8 | | | | | | | |
| | | | % Graduated By | 0 | 25 | 38 | 63 | | |
| | | | % Still Enrolled In | 75 | 25 | 25 | 0 | | |
| | | | % Persisters | 75 | 50 | 63 | 63 | | |
| | | | % Non-Persisters | 25 | 50 | 37 | 37 | | |
| 201408 | HVAR | 11 | | | | | | | |
| | | | % Graduated By | 0 | 36 | 64 | | | |
| | | | % Still Enrolled In | 91 | 27 | 0 | | | |
| | | | % Persisters | 91 | 64 | 64 | | | |
| | | | % Non-Persisters | 9 | 36 | 36 | | | |
| 201508 | HVAR | 14 | % Graduated By | 0 | 57 | | | | |
| | | | % Still Enrolled In | 79 | 14 | | | | |
| | | | % Persisters | 79 | 71 | | | | |
| | | | % Non-Persisters | 21 | 29 | | | | |
| 201608 | HVAR | 15 | % Graduated By | 0 | | | | | |
| | | | % Still Enrolled In | 87 | | | | | |
| | | | % Persisters | 87 | | | | | |
| | | | % Non-Persisters | 13 | | | | | |

*Two-Year Degree Programs*

| Entering Fall Term | Major | *N* | | Fall Term Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 |
|---|---|---|---|---|---|---|---|---|---|
| 201208 | PHVA | 1 | | | | | | | |
| | | | % Graduated By | 0 | 0 | 100 | 100 | 100 | |
| | | | % Still Enrolled In | 100 | 100 | 0 | 0 | 0 | |
| | | | % Persisters | 100 | 100 | 100 | 100 | 100 | |
| | | | % Non-Persisters | 0 | 0 | 0 | 0 | 0 | |
| 201308 | PHVA | 3 | | | | | | | |
| | | | % Graduated By | 0 | 0 | 33 | | 67 | |
| | | | % Still Enrolled In | 67 | 67 | 33 | | 0 | |
| | | | % Persisters | 67 | 67 | 67 | | 67 | |
| | | | % Non-Persisters | 33 | 33 | 33 | | 33 | |
| 201408 | PHVA | 1 | | | | | | | |
| | | | % Graduated By | 0 | 0 | 100 | | | |
| | | | % Still Enrolled In | 100 | 100 | 0 | | | |
| | | | % Persisters | 100 | 100 | 100 | | | |
| | | | % Non-Persisters | 0 | 0 | 0 | | | |
| 201508 | PHVA | 2 | | | | | | | |
| | | | % Graduated By | 0 | 0 | | | | |
| | | | % Still Enrolled In | 100 | 100 | | | | |
| | | | % Persisters | 100 | 100 | | | | |
| | | | % Non-Persisters | | | | | | |
| 201608 | PHVA | 2 | | | | | | | |
| | | | % Graduated By | 0 | | | | | |
| | | | % Still Enrolled In | 100 | | | | | |
| | | | % Persisters | 100 | | | | | |
| | | | % Non-Persisters | 0 | | | | | |

The data presented here is reflective of just the AAS program since the 2 + 2 nature of the BS degree prevents tracking student is a single program through 4 years. The AAS graduates are 88% complete by year 6 and we have no “year 7” data. The PHVA is a short term condition for pre-HVAC students; this category no longer exists but the data would indicate the all pre students were completing and moving into the AAS degree. To be clear; the university “retention4yrbymajor” provided by institutional testing has no data for the BS degree.

## Graduate Average GPA

(Return to TOC)

**Ferris State University**
**APR Graduated 201205 Through 201701**
**Average GPA**

**TE**
**HVACR Eng Tech and Enrgy Mgmt HVEM**
**BS**

**FSU GPA**

| Year | Average GPA | Min. GPA | Max. GPA |
|---|---|---|---|
| 2013-2014 | 3.28 | 2.47 | 3.89 |
| 2014-2015 | 3.19 | 2.54 | 3.97 |
| 2015-2016 | 3.46 | 2.37 | 4.00 |
| 2016-2017 | 3.47 | 2.86 | 3.92 |

**Ferris State University**
**APR Graduated 201205 Through 201701**
**Average GPA**

**TE**
**HVACR Engineering Technology HVAC**
**BS**

**FSU GPA**

| Year | Average GPA | Min. GPA | Max. GPA |
|---|---|---|---|
| 2012-2013 | 3.41 | 2.32 | 3.97 |
| 2013-2014 | 3.42 | 2.49 | 3.96 |
| 2014-2015 | 3.17 | 2.38 | 3.94 |
| 2015-2016 | 3.35 | 2.61 | 3.91 |
| 2016-2017 | .00 | .00 | .00 |

**Ferris State University**
**APR Graduated 201205 Through 201701**
**Average GPA**

**TE**
**HVACR Technology HVAR**
**AAS**

**FSU GPA**

| Year | Average GPA | Min. GPA | Max. GPA |
|---|---|---|---|
| 2012-2013 | 3.00 | 1.99 | 3.92 |
| 2013-2014 | 3.45 | 2.64 | 4.00 |
| 2014-2015 | 3.00 | 2.02 | 3.72 |
| 2015-2016 | 2.95 | 2.07 | 4.00 |
| 2016-2017 | 3.35 | 2.09 | 4.00 |

The average GPA for the program runs from a 5 year average of 3.15 for AAS students to 3.34 for all BS degrees over the same period. The website prep-scholar reports that the average GPA at Ferris is 3.24. The average GPA for an AAS student is expected to be below the university average and as the students become more engaged in their careers, mature, and learn how to manage college life the 3.34 average 5 year GPA for BS students is appropriate.

Graduate Average ACT
(Return to TOC)

**HVAC HVACR Engineering Technology BS**

| | | Residency | | | Age | FSU GPA | | | ACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Term | Blan | Resident | Midwest Compact | Non-Resident | Avg. | Avg. | Min. | Max. | Avg. | Min. | Max. |
| 201308 | 0 | 126 | 7 | 20 | 31 | 3.24 | 1.52 | 4.00 | 20.03 | 11 | 29 |
| 201408 | 0 | 8 | 1 | 0 | 29 | 3.26 | 2.61 | 3.91 | 21.40 | 15 | 26 |
| 201508 | 0 | 5 | 0 | 1 | 22 | 3.30 | 2.64 | 3.82 | 21.50 | 15 | 26 |

**HVAR HVACR Technology AAS**

| | | Residency | | | Age | FSU GPA | | | ACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Term | Blan | Resident | Midwest Compact | Non-Resident | Avg. | Avg. | Min. | Max. | Avg. | Min. | Max. |
| 201308 | 0 | 57 | 2 | 1 | 22 | 2.86 | 1.20 | 4.00 | 19.61 | 13 | 27 |
| 201408 | 0 | 52 | 2 | 4 | 21 | 2.79 | 1.67 | 4.00 | 20.15 | 13 | 27 |
| 201508 | 0 | 54 | 0 | 5 | 20 | 3.01 | 1.86 | 4.00 | 19.89 | 13 | 29 |
| 201608 | 0 | 60 | 0 | 7 | 22 | 3.14 | 1.83 | 4.00 | 20.23 | 15 | 26 |
| 201708 | 0 | 68 | 0 | 7 | 21 | 3.23 | 1.76 | 4.00 | 20.90 | 15 | 32 |

**HVEM HVACR Eng Tech and Enrgy Mgmt BS**

| | | Residency | | | Age | FSU GPA | | | ACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Term | Blan | Resident | Midwest Compact | Non-Resident | Avg. | Avg. | Min. | Max. | Avg. | Min. | Max. |
| 201308 | 0 | 4 | 0 | 0 | 31 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 201408 | 0 | 105 | 6 | 12 | 32 | 3.25 | 2.16 | 4.00 | 18.97 | 11 | 29 |
| 201508 | 0 | 82 | 0 | 9 | 32 | 3.31 | 2.05 | 4.00 | 20.76 | 15 | 28 |
| 201608 | 0 | 108 | 0 | 14 | 32 | 3.40 | 2.22 | 4.00 | 20.15 | 14 | 28 |
| 201708 | 0 | 107 | 0 | 15 | 31 | 3.34 | 1.70 | 4.00 | 19.80 | 14 | 27 |

The average ACT of students entering the AAS program over the last 5 years is 20.156; the average ACT for BS students over the last 5 years is 20.37.

### State and National Examinations

The HVACR Industry does not have required national examinations. We encourage students to complete EPA 608 testing while they are on campus because it adds a level of employability but we do not track the numbers.

## Program Value beyond Productivity and Enrollment Numbers

(Return to TOC)

### The Granger Center for Construction and HVACR

The HVACR labs are considered to be some of the best equipped labs in the country and between the hands on opportunities that the AAS labs provide, the experience of the faculty, and the quality of the curriculum, the quality of education provided is unrivaled.

The HVACR Engineering Technology and Energy Management degree is one of only a few bachelor's degree programs available in the country. Over the years we have had one main competitor in the program at Pennsylvania College of Technology. The vast majority of professionals in the HVACR industry have been without a Bachelor's Degree or have been graduates of mechanical engineering programs. Lewis-Clark State College of Idaho offers a BS in HVACR and a few other schools allow student with an AAS in HVACR to ladder in to a business or facility management degree BS. Despite this the HVACR program at Ferris State University remains the example for students wishing to specialize in HVACR Engineering.

Faculty provide additional value to the program through interactions in community education, participation with professional organizations, and participating in professional development activities with students. The HVACR Industry has many professional organizations to participate with; the HVACR faculty and students are involved primarily with ACCA, ASHRAE, and MSCA. We have student chapters of each group and participate locally as Registered Student Organizations as well as joining in with Michigan area functions and national events.

### ACCA

Air Conditioning Contractors of America
Student Chapter

The Air Conditioning Contractors of America (ACCA) is one of the largest and oldest HVAC contractor organizations in the USA. Its headquarters is located at 2800 Shirlington Road, Suite 300, Arlington, VA 22206. ACCA is a non-profit association whose membership includes more than 60,000 professionals and 4,000 businesses in the indoor environment and energy services community. The association is made up of mostly residential and light commercial contractors that employ a non-union workforce.

As a national trade association, ACCA's mission is to collaborate with its membership board on furthering the interests of HVACR contracting businesses and the broader HVACR industry by lobbying to the U.S Congress on behave of the members of ACCA. This action aids ACCA's members and the HVAC industry by providing an environment that will create a professional effective industry or trade that complies with the codes and regulations to better serve their customers by allowing members to run successful and profitable businesses.

ACCA focuses on training and sharing information with its members. It is a great venue for Ferris State University students to come and interact with contractors and vendors from all over the entire nation. This interaction brings the employer's perspective to industry issues, not available in the usual classroom setting. The students hear first-hand, what it is that the employer will be looking for in his or her future workforce. Students will learn about advancement possibilities within contractor's operations. A number of the students from the local Ferris State University student chapter attend the annual national conference where they get the direct exposure the HVAC industry and have the opportunity to meet manufacture representatives, HVAC subject matter experts, and a host of HVAC contractors.

Students that join the ACCA student chapter gain access to resources and tools that are helpful in learning the skills needed to be a successful employee. The student ACCA membership will give the student access to ACCA and MIACCA websites (including member only areas).
Also, the student membership allows the student to pursue all of the ACCA or MIACCA publications at "member" rates and attend conventions and other meetings at a reduced "student" rate. Some of the ACCA training materials are used in classes the student take while attaining the Ferris HVAC program degree. The chapter has been involved with community service, such as, Habitat for Humanity and Heat the Country. Ferris State University students have found jobs through this Chapter, so it is an important organization for our HVAC program students to be associated with.

ACCA offers a scholarship to a student each year as well.

## ASHRAE

With more than 56,000 members from over 132 nations, ASHRAE is a diverse organization representing building system design and industrial processes professionals around the world.
Mission:
To advance the arts and sciences of heating, ventilating, air conditioning and refrigerating to serve humanity and promote a sustainable world.

Vision
ASHRAE will be the global leader, the foremost source of technical and educational information, and the primary provider of opportunity for professional growth in the arts and sciences of heating, ventilating, air conditioning and refrigerating.

FSU ASHRAE Chapter
The Ferris State University ASHRAE Student Chapter has historically been one of the most active and well attended chapters within the organization. For many years Ferris HVACR students used ASHRAE Engineering Manuals for textbooks and became student members in the process. The student chapter attends monthly chapter meetings with the West Michigan ASHRAE Chapter and uses the opportunity to network with HVACR Professionals from the West Michigan area. Many of the students attend the annual HVACR Expo and ASHRAE winter

meeting which is the world's largest gathering of HVACR professionals annually. The monthly meeting and annual winter conference/expo provide numerous opportunities for technical training outside of the University. West Michigan ASHRAE provides an annual scholarship for the HVACR Students.

### MSCA

Greater Michigan Student Chapter of the Mechanical Service Contractors of America
The Greater Michigan Student Chapter is a registered student organization (RSO) at Ferris State University. This RSO is associated with the Mechanical Service Contractors of America (MSCA) and Mechanical Contractors Association of America (MCAA).

**This RSO supports the HVACR program and Ferris State University missions, goals and objectives by providing the following benefits:**

- Multiple student scholarships totaling $18,000 per year.
- The goals and objectives of the HVACR program include preparing students to be successful in the HVACR industry. There are two annual conference events that support the HVACR program by keeping the faculty serving as the RSO advisor current with the latest teaching methods, technology and products in the HVACR industry. Student success is also dependent on personal characteristics, these events provide unique opportunities to gain the employers perspective on the current challenges and concerns contractors have with this generation of graduating students.
- Equipment donation opportunities. The faculty advisor has multiple opportunities to meet with industry representatives that can provide donations. Example: Spring of 2018; a donation of a state of the art unit was obtained for the commercial air conditioning lab. This unit will assist with keeping the program lab equipment up to date. Purchase of this unit with program funds would not occur, thus making the benefit of attending the conference very clear.
- The conference educational activities provide information and resources to modify curriculum as needed to enable faculty to effectively train the next generation of skilled workers in the HVACR industry. This information is used to align the course curriculum with current industry trends and developments.
- Networking and career opportunities for students. Students meet MSCA and MCAA members and learn about internship and full-time employment opportunities.
- Student events designed to introduce them to the mechanical contracting industry. Students also obtain advice about moving from the classroom to a career.
- Annual HVACR program picnic. The Greater Michigan MSCA and ASHRAE student chapters work together to host a picnic in September for all HVACR program students. This allows new students the opportunity to socialize and form friendships thus supporting a sense of community.
- Students can gain leadership skills by serving as a student chapter officer.

**This registered student organization provides the following benefits to communities:**

- Annual Big Rapids, Heats On event. Students work with HVACR technicians to provide residential heating system inspections and maintenance for qualified low-income individuals.
- Ann Arbor, Heats On event. This is another Heats On event that takes place in Ann Arbor, Michigan. Ann Arbor contractor association sponsors students' travel and food expenses for attending.

### Community Education

Faculty have taught multi day training sessions for employees of AK Steel in Detroit, MI. Three, five day courses are offered annually at the Washtenaw Community College for the United Association of Plumbers and Steamfitters annual Instructor Training and Apprentice Competition. We have worked with Spectrum Health to provide employee training and offer a summer camp for high school students exploring career choices.

## Program Flexibility and Access

(Return to TOC)

There are no offsite locations for either the AAS or the BS degree. The BS degree is offered in "fully on-line" version which would require students with appropriate AAS degrees completing all but 7 days of BS course work in a fully online environment. The students are required to come to campus for one full week of hands on lab work that supports 3 courses completed online.

## Visibility and Distinctiveness

(Return to TOC)

There are many BS degrees listed around the country that will accept an AAS in HVACR and then progress to a BS degree in something other than HVACR. Degrees in facility management, business management, or applied management are available but a BS in HVACR is quite unique.

The HVACR Industry employs entry level technicians and installers with no higher education, trained technicians and installers who may have completed an AAS degree or perhaps an apprenticeship, a small number of HVACR BS degree graduates and mechanical engineers. The Ferris State University AAS degree has to compete with all other 2 and 4 year colleges. We believe that the strength of the curriculum, the labs, and the diversity of the faculty make the AAS degree from FSU a good value. The hands on labs make a difference for a student entering the workforce and a FSU AAS graduate will be the best prepared for first day productivity.

The BS degree provides a different value because there are very few BS degrees in HVACR. As mentioned above, most engineering positions are filled by mechanical engineers. The education is less specific for mechanical engineering and although it can in many ways be more rigorous, we believe that it does not spend enough time with the HVAC specific coursework required to perform the various jobs that Ferris graduates occupy. A graduate of the HVACR E/M BS at

FSU will have spent far more time with HVACR tasks and engineering projects than a mechanical engineering graduate. This is not to dismiss engineering graduates who will have higher math skills and increased opportunity to become professional engineers. It is a different approach and it fits a wide variety of HVACR careers. The Bachelors of Science in HVACR Engineering Technology and Energy Management at Ferris State University is the preeminent program in the nation. There are many BS degrees listed but you will find (Like the examples below) that they are "applied science" which may not have any specific curricular direction in the core courses or that the programs are actually mechanical engineering degrees with a focus in HVACR. The program at Pennsylvania College of Technology remains the closest comparison that we are able to find nationally. It is well respected but has a different focus than the program at Ferris does; the program at Pennsylvania College of Technology is aimed at making technicians (typically we would think of this as an AAS Graduate) into business people. It advances the two year curriculum where our own program enters into the commercial and industrial design and engineering of the industry; they have different objectives.

Sienna Heights University - Bachelor of Applied Science with the last two years of curriculum containing 29 credits that are elective. The directed curriculum leans more toward mechanical service work.

Lewis-Clark State College – Bachelor of Applied Science with the last two years of curriculum containing 29 credits that are elective. The directed curriculum leans more toward mechanical service work.

Pennsylvania College of Technology – Bachelor of Science - addresses industry needs for educated technicians with business management, supervision, and design skills.

## Demand

(Return to TOC)

From student surveys sent out by the department.

### Why do students enrolled in the HVACR program choose FSU?

---

*"I was attracted to the Ferris program for a few reasons:*

*1) The specific focus on the HVAC industry (versus a generic Mechanical Engineering) program.*

*2) Ferris was willing to review my file and offer credit for my prior education at another college."*

---

*Only online 4 year degree availability*

*I had friends who in the past went through the program and told me this is the best program to go through. I was told I would find a job very easy and no other programs around the state could compare to Ferris.*

*It's the best.*

*Ferris has the best hands on learning experiences.*

*Students enrolled in the HVACR program choose FSU because it's the best HVACR programs in the state!*

*It's the best Program in the country for HVAC/R. The professors are very educated and love passing their knowledge on to the students.*

*There are very few colleges worldwide that have a dedicated bachelor degree program for HVACR. Ferris's website provides good insights about the program and its structure. The university is also recognized by delegated from ASHRAE.*

*Online accessibility and it being highly recognized within the HVACR field.*

*Heard its the best around.*

*I can't speak for the AAS degree students, but as a BS HVACR major, it's great that I can pursue a bachelors without having to start over from scratch. --- I know there isn't a question that prompts this next response, but the only downside I do see to the program in the lack of ABET certification. It seems that a few additional courses could fix that. If the AAS Welding program at Ferris is ABET Accredited, why can't the HVACR BS degree be? Most engineering students are completing their coursework in 4.5 years+ anyway. I think this opportunity would benefit the University as much as the students and professionals in the HVACR industry.*

*Its ranked #1in the country*

*simple, Its the best program in the country*

*Ferris State University is among the best to provide a good HVACR program online and on campus with outstanding faculty*

*Ferris is known to produce students that are ready to go into industry and perform well.  This is because the course materials prepare the student for employment and the Faculty staff ensure that the course materials are well structured for understanding and the fact that our Faculty staff have industrial experience, they have both theory and the practical aspect of the program*

*I chose FSU after talking to a couple of  former students who had chose the program.  I looked at a couple of other HVAC/R bachelors programs and I felt the program was a good fit for me.*

*It's the best HVAC program in the country*

*Hands on, great program and even greater people*

*I heard it was the best place in the country to go for HVAC so I thought that if I was going to go to school then this would be the place*

*The quality of education you receive*

*A Bachelor degree in technology taught fully online*

*It has the reputation of being the best*

*One of the only online program available in the country, and an HVACR Batchelors programs available.  I am not interested in mechanical engineering, just HVACR.*

*Only University with a well established Bachelors Degree in HVAC/R*

*FSU is a widely known program with an excellent reputation, which makes a big difference when searching for jobs.*

*I chose FSU because it was close to home, affordable and I heard that the skilled trade center here was amazing.*

*Not many reputable online HVAC programs available.*

*I heard it was the best HVACR program near me and I decided to enroll for that reason*

*Because its the only one with a 4 year degree*

*Because FSU is one of the only universities in State offers HVACR online program.*

*Top school for the HVAC industry. Offer flexible learning/ online program.*

*Ferris has the best HVAC program in the nation.*

*Because its high quality and close to home.*

*Their program credibility with the HVAC industry. Instructors are well versed in industry organizations such as ASHRAE and AHR expo. They are also practical field experience to share with students.*

*FSU is one of the few universities that have a 4-year program for HVACR.*

**Would students enrolled in the program choose the HVACR program at FSU if they had to do it over again?**

| | | |
|---|---|---|
| Yes | **44** | **100.00%** |
| No | 0 | 0.00% |
| **Total** | **44** | |

| | |
|---|---|
| Mean | 1.00 |
| Standard Dev. | 0.00 |
| Variance | 0.00 |

### Would students enrolled in the program recommend the HVACR program at FSU to others?

| | | |
|---|---|---|
| Yes | **42** | **95.45%** |
| No | 2 | 4.55% |
| **Total** | **44** | |
| | | |
| Mean | 1.05 | |
| Standard Dev. | 0.21 | |
| Variance | 0.04 | |

### Report the average number of hours a typical student in the program is engaged in paid employment per week.

| | | |
|---|---|---|
| 1-10 hours | 11 | 25.58% |
| 11-20 hours | 12 | 27.91% |
| 21-30 hours | 4 | 9.30% |
| 31-40 hours | 3 | 6.98% |
| over 40 hours | **13** | **30.23%** |
| **Total** | **43** | |
| | | |
| Mean | 2.88 | |
| Standard Dev. | 1.62 | |
| Variance | 2.63 | |

From Advisory Board surveys sent out by the department.

### What do faculty teaching within the program say about the continued demand for program graduates?

*The faculty continues to be aware of the need for more what the HVACR students have to offer employers. I am hearing the all that the graduates are positioned for employment*

*Based on what I have heard from the faculty members of the HVAC/R program, they are telling students that there is a large demand nationally for HVAC/R technicians and technologists. I believe this is the right message to continue to push within the program. My experience is that many employers are struggling to fill their open positions and be staffed at the level that they would like to be to meet customer demands.*

### What do potential employers say about the continued demand for program graduates?

*There is an increasing demand & shortage of HVACR Technicians & Engineers in general. Much opportunity exists for AAS & BS graduates interested in working in a Lab & Engineering environment at Refrigeration & Air Conditioning OEM's & their suppliers.*

*The demand for HVACR graduates is high and employers (for the most part) are looking to add staff or re-fill positions from retiring staff members. FSU students are well trained and employers either know this or can see it during an interview.*

*The current economic situation should drive demand for graduates for at least 5 years.*

*My belief is that there is and will continue to be a demand for the graduates for many years. The biggest hurdle may be meeting the larger regional and national demand with students that do not want to leave Michigan or if they are willing to leave, they would like to come back in a few years. This could create a saturated market locally.*

From faculty survey sent out by the department

### What do faculty teaching within the program say about the continued demand for program graduates?

*"Our need for graduates is still very high. Almost every graduate has several offers to choose from*

*"*

*We see demand directly from industry, which is currently very high and was even sustained throughout the recession. Though jobs were not as plentiful during the height of the recession, all students seeking employment found a good job. Graduates of the HVACR programs have always been in high demand.*

*Faculty within the program say that the demand for program graduates continues to be very strong.*

*If our graduates show prospective employers any competency in HVAC skills and people skills at all, The HVAC industry will hire as many students that we can graduate from the program for many years into the future.*

*In the HVACR service industry there are more jobs available than can be filled by our graduating students. The demand for qualified service technicians coupled with the retirement rates from the industry have and continue to cause a labor market shortage in the HVACR industry. Research into the issue shows the labor market shortage to continue to worsen in the foreseeable future.*

*Demand is steady, we have more employers looking for interns and graduates than we have interns & graduates available*

*The faculty agree with the Bureau of Labor Statistics that the need for qualified and educated HVACR professionals will continue to grow at twice the average growth for all other occupations.*

---

**What do potential employers say about the continued demand for program graduates?**

---

*Employers are worried about worker shortage and is a frequent discussion at advisory. Employers come to campus earlier and earlier each year to get the few graduates we have.*

*Potential employers always want to know what they need to do to land a graduate. Those that are familiar with the HVACR programs begin recruiting immediately after fall semester begins. Those that wait until spring semester regret their delay. Employers are actually asking students to come to work before they complete their studies, and a number of student secure full time employment as a result of their internship, often working part time throughout their senior year for the company with which they interned. As has always been the case, the demand for graduates outpaces our ability to produce them.*

*With the construction industry booming in west Michigan, employers are saying demand is very high for program graduates.*

---

*Employers are struggling to find enough skilled HVAC technicians and Technical engineers to be able to satisfy the demand for the opportunities presented to them to grow their business, thus the growth of company is hindered.*

*We see far more employers looking for students than we have available. Many local and national employers want our students, there just are not enough students available to fill the current market of jobs available.*

*Future demand is steady, most employers I spoke with are expiring a deficit in available workforce.*

*The opinions of both business owners and employment representatives which I have spoken with through networking and advisory board events unanimously support the need for more skilled and educated professionals in our industry. Many of them express nervousness about the notion that they will simply not be able to fill the open positions.*

## Student Achievement

(Return to TOC)

**Registered Student Organizations (RSO)**

The HVACR Program students have three RSO's that are student chapters of National professional organizations that are affiliated with HVACR Industry. These Organizations are Air Conditioning Contractors of America (ACCA), American Society of Heating and Air-Conditioning Engineers (ASHAE), and Mechanical Service Contractors of America (MSCA). All three RSO's have active student participation. The average percent of students from the program that participate in the RSO's on an annual basis is 33% (30 students of average enrollment of freshman to senior is 90 is students). All of the RSO's send a group of students to represent their student chapters to a National conference during the school year. This gives the Ferris State University HVACR program and its student an opportunity and network with prospective employers and see the tremendous opportunities afforded then in the Industry.

<u>ASHRAE student design competition</u>

The Capstone class (HVAC 499 Commercial HVAC System Design) of the Bachelor's Degree program is one major opportunities for the students in the program that has a positive impact. ASHRAE sponsors these competitions to encourage students to become involved in a profession that is crucial to insuring a sustainable future for our Earth – the design of energy-efficient HVAC systems. System Selection and Design for the proposed building shall address the following major design goals:

Low Life Cycle Cost
Low Environmental Impact
Comfort and Health

Creative High Performance Green Design
Synergy (with architecture)
**Average number of hours a typical student in the program is engaged in paid employment**
The HVACR Program students are required to find a summer internship between their junior and senior year with an employer where the student will work a paid internship for the employer for a minimum of 10 weeks (400 hours). The positive impact of the summer internship is remarkable. The faculty see a large increase in the confidence of the students and their attitude that they will have many opportunities for career employment. Also, they gain confidence that they can work in the HVAC field and be an asset to their employer.
Here is an example of how employers feel about the HVAC program students. This student is an average student in terms of academics, but it will give the APR committee an idea of how the internship helps the typical HVAC student realize that they are employable and capable helping their future employer be successful.
**Dear Ladies & Gentlemen,**

**In a nutshell, we feel that the summer has been awesome with Nathan as our first "FSU intern".**
**We are certain that he will continue to do FSU and his family proud.**
**Frankly, we look forward to working with him down the road after he graduates.**
**Please find our notes attached, for your review.**
**We trust that you had a good summer and are busy with school starting again soon.**
**If we may assist other interns or help FSU in any way, please let us know.**
**We are grateful for every opportunity to assist with the Skilled Trades, Work Force Development.**

**Thank You!**

**Respectfully,**

**Michael L. Cain**
**President**
**Michigan Engineered Comfort Corporation (MECC)**
**Facility Engineers, Contractors & Consultants**

**MIACCA, Board Member & Chairman Work Force Development**
**SEMIACCA, Board Member & Chairman Work Force Development**
**MCAA & Metro Detroit ACCA, Past President & Chairman of Labor Negotiations**
**SMACNA, Past Director, Pension Trustee & Chairman, Apprentice Training Program**

An unofficial poll of the freshman and sophomores find that approximately 40 % of the students in the Associates program. The HVACR program gets inquiries form companies in the industry regularly and those inquiries are put on a job board that is available to all the student on Google docs.
**Awards and Honors**
1st place National USA Skills 2016
1st place State USA Skills2012, 2013, 2014, 2015, 2016

3rd Place - ASHRAE International Student Design Competition, ASHRAE. (2016).
2nd Place - ASHRAE International Student Design Competition, ASHRAE. (2014).
2nd Place - ASHRAE International Student Design Competition, ASHRAE. (2013).
2nd Place - ASHRAE International Student Design Competition, ASHRAE. (2012).

## Employability of Graduates

(Return to TOC)

| | | Degrees Placement Information | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CERT | AAS | BS | TOTAL | # Responded | % Responded | # Employed / CE | Placement Rate | Ave Salary |
| 2016/2017 | HVACR Eng Tech & Energy Mgmt | | | 30 | 30 | 3 | 10% | 3 | 100% | $ 44,333.00 |
| | HVACR Engineering Technology | | | 1 | 1 | | 0% | | | |
| | HVACR Technology | | 27 | | 27 | 2 | 7% | 2 | 100% | |
| 2015/2016 | HVACR Eng Tech & Energy Mgmt | | | 28 | 28 | 12 | 43% | 12 | 100% | $ 66,717.00 |
| | HVACR Engineering Technology | | | 8 | 8 | 2 | 25% | 2 | 100% | na |
| | HVACR Technology | | 24 | | 24 | 3 | 13% | 3 | 100% | $ 48,000.00 |
| 2014/2015 | HVACR Eng Tech & Energy Mgmt | | | 37 | 37 | 15 | 41% | 15 | 100% | $ 65,917.00 |
| | HVACR Engineering Technology | | | 7 | 7 | 3 | 43% | 3 | 100% | $ 75,830.00 |
| | HVACR Technology | | 25 | | 25 | 1 | 4% | 1 | 100% | NA |
| 2013/2014 | HVACR Eng Tech & Energy Mgmt | | | 14 | 14 | 7 | 50% | 7 | 100% | $ 57,357.00 |
| | HVACR Engineering Technology | | | 25 | 25 | 6 | 24% | 6 | 100% | $ 62,109.00 |
| | HVACR Technology | | 20 | | 20 | 2 | 10% | 2 | 100% | $ 42,500.00 |
| 2012 / 2013 | HVACR Engineering Technology | | | 46 | 46 | 14 | 30% | 12 | 86% | $ 59,667.00 |
| | HVACR Technology | | 27 | | 27 | 4 | 15% | 3 | 75% | $ 45,682.00 |
| 2011 / 2012 | HVACR Engineering Technology | | | 45 | 45 | 7 | 16% | 7 | 100% | $ 67,286.00 |
| | HVACR Technology | | 19 | | 19 | 4 | 21% | 3 | 75% | $ 27,500.00 |

**J Eric Quillitsch:**
Curriculum Change: Change to Degree Name add Energy Management. Several years to show both new and old name as existing students move through the program.

## Employment Post Graduation

Virtually 100%, as with many of the College of Engineering Technology, of the HVAC program graduates pursuing employment are able to find a willing employer. This is true whether the students graduate form the Associate's Degree program or the Bachelor's Degree program. The percentage of the graduates that gain employment in the HVAC field is also very high, again virtually 100%. The reason for such a high percentage of students gaining employment in the HVAC field is because the employment opportunities are very board. There is a saying in the program "The 150 billion dollar hidden industry" indicating that number different types of jobs available in the industry is vast.

There are very few indicators that the HVAC alumni are leaving the industry because job opportunities are not available.

The job market gives the student many areas to pursue many employment opportunities:

Examples of jobs:

Building Controls, Technicians, HVAC System design, System commissioning, Building energy audits, Material cost Estimating, System balancing Project manager, Cad, Building maintenance supervisor, Boiler specialist, Refrigeration specialist, and Stationary engineer to name some job opportunities. This happen in any type of building and almost any location.

The HVAC program is finding the HVAC field is as recession proof as any other career path that can be pursued. The buildings still exist if the owner leaves and probably will be repurposed for some other function.

| | | Degrees Placement Information | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CERT | AAS | BS | TOTAL | # Responded | % Responded | # Employed / CE | Placement Rate | Ave Salary |
| 2016/2017 | HVACR Eng Tech & Energy Mgmt | | | 30 | 30 | 3 | 10% | 3 | 100% | $ 44,333.00 |
| | HVACR Engineering Technology | | | 1 | 1 | | 0% | | | |
| | HVACR Technology | | 27 | | 27 | 2 | 7% | 2 | 100% | |
| | | | | | | | | | | |
| 2015/2016 | HVACR Eng Tech & Energy Mgmt | | | 28 | 28 | 12 | 43% | 12 | 100% | $ 66,717.00 |
| | HVACR Engineering Technology | | | 8 | 8 | 2 | 25% | 2 | 100% | na |
| | HVACR Technology | | 24 | | 24 | 3 | 13% | 3 | 100% | $ 48,000.00 |
| | | | | | | | | | | |
| 2014/2015 | HVACR Eng Tech & Energy Mgmt | | | 37 | 37 | 15 | 41% | 15 | 100% | $ 65,917.00 |
| | HVACR Engineering Technology | | | 7 | 7 | 3 | 43% | 3 | 100% | $ 75,830.00 |
| | HVACR Technology | | 25 | | 25 | 1 | 4% | 1 | 100% | NA |
| | | | | | | | | | | |
| 2013/2014 | HVACR Eng Tech & Energy Mgmt | | | 14 | 14 | 7 | 50% | 7 | 100% | $ 57,357.00 |
| | HVACR Engineering Technology | | | 25 | 25 | 6 | 24% | 6 | 100% | $ 62,109.00 |
| | HVACR Technology | | 20 | | 20 | 2 | 10% | 2 | 100% | $ 42,500.00 |
| | | | | | | | | | | |
| 2012 / 2013 | HVACR Engineering Technology | | | 46 | 46 | 14 | 30% | 12 | 86% | $ 59,667.00 |
| | HVACR Technology | | 27 | | 27 | 4 | 15% | 3 | 75% | $ 45,682.00 |
| | | | | | | | | | | |
| 2011 / 2012 | HVACR Engineering Technology | | | 45 | 45 | 7 | 16% | 7 | 100% | $ 67,286.00 |
| | HVACR Technology | | 19 | | 19 | 4 | 21% | 3 | 75% | $ 27,500.00 |

**J Eric Quilitzsch:**
Curriculum Change: Change to Degree Name add Energy Management. Several years to show both new and old name as existing students move through the program.

The Bureau of Labor Statistics projects that by 2022 the field will experience a 21% increase in job growth. HVAC techs will be busier than ever before and remain in high demand throughout the next decade. HVAC jobs can never be outsourced and will always be on site, which affords technicians and other professional’s long-term job security. The goal of the Associates degree student with the knowledge base the student obtains from our 2 year program should put our two year students in the top 10% HVAC earners and their salaries should top out at around $70K to $100K annually.
Data from a separate source shows that in 2014 only about 33 percent of people fresh out of college didn't have jobs that required college educations and after age 22 their career paths were much improved. The latest figures were released by Stephen Rose of the Urban Institute, who analyzed the American Consumer Survey of 2014. A poll by the Pew Research Center in 2014 found significant optimism. About 86 percent of college grads between 25 and 32 said they were either in a "career job" or in "a stepping stone to a career job." The average % of the HVAC program attaining jobs in the industry is much higher than the typical college degree.
Average Salary: $56,600 to $85,400
Mechanical engineering technicians help mechanical engineers design, develop, test, and manufacture mechanical devices, including tools, engines, and machines. They may make sketches and rough layouts, record and analyze data, make calculations and estimates, and report their findings. The HVAC program graduates salary opportunities is very competitive with similar jobs for from other types of Technology engineering degree

Stakeholder Perceptions of Employability of Graduates

In discussions with the HVAC program Alumni, the perception of that the program prepares students for a career is strong. This is evident from the number of graduates that recommend to others and family members that they attain a degree in the HVAC field.

The most feedback that the HVAC program receives is from the Advisory board. The HVAC advisory board has consistently given the HVAC faculty positive reviews that the program is preparing the students well to be successful in their careers. The Advisory Board does give the faculty advice on what is new in the HVAC industry and the HVAC program as added and removed classes to adapt to the needed changes to keep the program current to keep the students well prepared when entering the workforce.

The employer perception of the program is very strong. This is apparent because the same Companies keep coming back to the Ferris State University HAVC program to interview and hire students. These same Companies want to serve on the HVAC Advisory board to help guide the program curriculum to best fit their company and have the best opportunity to hire the program graduates.

Here is an example of an email for an employer that hired a typical student from the HVAC program:

Thank you for sending Eric Opland our way. We hired him as a tech and he is working out very well for us. Keione Hargrow is working as a Building Automation Controls Engineer who is also a Ferris grad. Your university does a fine job preparing people for our industry.
We are currently looking for another Controls Engineer in our Engineering department. If you know of anyone who might fit this role, please give them my contact information.
Thank you,

**Rick Freund**
**Vice President, Engineering**

Office: 773-299-1903 ext 104
Cell: 312-735-6546

**Intelli-Building Control & Solutions, LLC**

**Chicago Office-** 2545 W. Diversey Ave. Suite 219, Chicago, IL 60647
**Indianapolis Office**: 7330 East 90th Street, Suite 1, Indianapolis, IN 46256
**Lakemoor Engineering Office:** 27992 IL Route 120 #21 Lakemoor, IL 60051
**Billing/Accounting**: 817 S. Kildare Ave. Chicago, IL 60624

The Ferris State University HVAC program Faculty perception of the program's the ability to prepare the HVAC graduates it also strong. This is obvious for several factors. The strong relationships the program has made with Companies in the industry, the Advisory board strong support of the program and willingness to help with donations that help aid the program, the positive reviews that the program receives when companies take internship students form the program and that these come back asking for more students after having had interns or having hired students.

The trends are evaluated by working with the advisory board because they are meeting the students twice a year and have an intimate relationship with the student in the HVAC program and are able to recognize the needed changes that will help the students be prepared to enter the workforce. These trends are addressed by making the appropriate changes in the HVAC curriculum to provide the students in the program the necessary skills and knowledge needed to be a successful employee and give the employers the needed staff to keep their companies sustainable and competitive.

## Faculty Composition and Engagement

(Return to TOC)

### Organization

There are nine full time tenured / tenure track faculty teaching on the Big Rapids campus. Of the nine faculty, five faculty are also teaching fully online courses. The faculty teaching fully online courses it would not likely have an online load exceeding the face to face load for classes taught in Big Rapids. Of the five faculty teaching both face to face and online, four faculty would regularly have approximately 50% of their load from online courses. There is currently one adjunct faculty teaching one course face to face fall and winter. There are no off campus locations and currently no full time temporary faculty. The mix of fully online and face to face teaching for four full time faculty adds flexibility to the building schedule and allows for student block schedules to align favorably with general education coursework.

## Curriculum Vitae for Faculty

**Mr. Joseph C. Compton**
MBA, Ferris State University, 2007
Major: Business Administration

**Dr. Michael Feutz Ph.D**
PhD, Western Michigan University, 2010.
Major: Educational Leadership
Supporting Areas of Emphasis: Career and Technical Education

**Mr. Eric D. Fradette**
MS, Ferris State University, 2016.
Major: Career and Technical Education Instructor

**Mr. Brian Holton**
MS, Ferris State University
Masters of Education Career and Technical Education

**Mr. Michael J. Korcal CEM, MT (ASCP)**
MS, Ferris State University, 2000.
Major: Career and Technical Education

**Mr. Gerry J. Lucas**
MS, Ferris State University, 2017.
Major: Career and Technical Education

**Mr. Joseph Pacella**
MS, Ferris State University
Major: Information Systems Management

**Mr. John E. Quilitzsch**
MS, Ferris State University, 2006.
Major: Information Systems Management

**Mr. Douglas Ford Zentz**
MS, Ferris State University, 2007
Major: Career and Technical Education

## Average Semester Load for All Faculty

School Year of fall 2013 & spring 2014

| Name | FALL 2013 | SPRING 2014 | AY Total |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| Mike Feutz | 14/24 | 10/12 | 24/36 |
| Bob Persons | 11/21 | 10/18 | 21/39 |
| Mike Korcal | 8/12 | 14/32 | 22/44 |
| Eric Quilitzsch | 13/21 | 15/21 | 28/42 |
| John Tomczyk | 12/18 | 9/15 | 21/33 |
| Doug Zentz | 12/15 | 15/24 | 27/39 |
| Joe Compton | 10/18 | 14/24 | 24/42 |
| Joe Pacella | 17/26 | 17/26 | 34/52 |
| Brian Holton | 11/19 | 13/21 | 24/40 |
| TOTALS | | | 225/367 |
| FTE | | | 9.38/10.19 |
| Full time faculty | | | 8 |
| Full time temporary | | | 1 |
| Total actual faculty | | | 9 |

School Year of fall 2014 & spring 2015

| Name | FALL | SPRING | YEAR |
|---|---|---|---|
| | 2014 | 2015 | TOTAL |
| | | | |
| | | | |
| | | | |
| Mike Feutz | 15/21 | 11/15 | 26/36 |
| Gerry Lucas | 11/17 | 11/21 | 22/38 |
| Eric Fradette | 14/24 | 9/15 | 23/39 |
| Mike Korcal | 12/18 | 0/0 | 12/18 |
| Eric Quilitzsch | 16/27 | 11/15 | 27/42 |
| John Tomczyk | 9/15 | 10/18 | 19/33 |
| Doug Zentz | 12/15 | 14/25 | 26/40 |
| Joe Compton | 10/18 | 10/18 | 20/36 |
| Joe Pacella | 13/21 | 9/15 | 22/36 |
| Brian Holton | 9/13 | 10/22 | 19/35 |
| TOTALS | | | 216/353 |
| FTE | | | 9/9.81 |
| Full time faculty | | | 10 |
| Full time temporary | | | 0 |
| Total actual faculty | | | 10 |

School Year of fall 2015 & spring 2016

| **Name** | **FALL** | **SPRING** | **YEAR** |
|---|---|---|---|
| | **2016** | **2017** | **TOTAL** |
| | | | |
| | | | |
| | | | |
| Mike Feutz | 15/27 | 10/16 | 25/43 |
| Gerry Lucas | 14/24 | 11/21 | 25/45 |
| Eric Fradette | 18/30 | 13/21 | 31/51 |
| Mike Korcal | 13/21 | 12/20 | 25/41 |
| Eric Quilitzsch | 16/24 | 11/15 | 27/39 |
| Doug Zentz | 15/18 | 14/21 | 29/39 |
| Joe Compton | 13/21 | 14/24 | 27/45 |
| Joe Pacella | 17/27 | 13/21 | 30/48 |
| Brian Holton | 10/18 | 9/17 | 19/35 |
| TOTALS | | | 238/386 |
| FTE | | | 9.92/10.72 |
| Full time faculty | | | 9 |
| Full time temporary | | | 0 |
| Total actual faculty | | | 9 |

School Year of fall 2016 & spring 2017

| Name | FALL | SPRING | YEAR |
|---|---|---|---|
| | 2016 | 2017 | TOTAL |
| | | | |
| | | | |
| | | | |
| Mike Feutz | 15/27 | 10/16 | 25/43 |
| Gerry Lucas | 14/24 | 11/21 | 25/45 |
| Eric Fradette | 18/30 | 13/21 | 31/51 |
| Mike Korcal | 13/21 | 12/20 | 25/41 |
| Eric Quilitzsch | 16/24 | 11/15 | 27/39 |
| Doug Zentz | 15/18 | 14/21 | 29/39 |
| Joe Compton | 13/21 | 14/24 | 27/45 |
| Joe Pacella | 17/27 | 13/21 | 30/48 |
| Brian Holton | 10/18 | 9/17 | 19/35 |
| TOTALS | | | 238/386 |
| FTE | | | 9.92/10.72 |
| Full time faculty | | | 9 |
| Full time temporary | | | 0 |
| Total actual faculty | | | 9 |

School Year of fall 2017 & spring 2018

| Name | FALL 2017 | SPRING 2018 | YEAR TOTAL |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| Mike Feutz | 11/21 | 10/16 | 21/37 |
| Gerry Lucas | 14/24 | 11/21 | 25/45 |
| Eric Fradette | 10/18 | 15/27 | 25/45 |
| Mike Korcal | 22/30 | 12/20 | 34/50 |
| Eric Quilitzsch | 16/24 | 11/15 | 27/39 |
| Doug Zentz | 15/18 | 13/21 | 28/39 |
| Joe Compton | 9/15 | 11/18 | 20/33 |
| Joe Pacella | 13/21 | 13/21 | 26/42 |
| Brian Holton | 13/23 | 11/23 | 24/46 |
| TOTALS | | | 230/376 |
| FTE | | | 9.58/10.44 |
| Full time faculty | | | 9 |
| Full time temporary | | | 0 |
| Total actual faculty | | | 9 |

**Service**

Habitat for Humanity – Compton, Holton
Heat's On – Feutz, Holton

Korcal:
Committee Member, Jennifer Miller's Tenure Committee. (August 2017 - Present).
Committee Chair, Eric Fradette's Tenure Committee. (August 2014 - Present).
Committee Member, HVACR Programs Advisory Board. (August 2005 - Present).
Committee Member, CET Promotion Committee. (August 2014 - May 2015).
Committee Member, HVACR Programs Faculty Search Committee. (August 2013 - May 2014).
Committee Member, CET Restructuring Committee. (August 2012 - May 2013).
Committee Member, Stategic Planning Committee for School of Built Environment. (August 2011 - May 2013).
Committee Member, Academic Program Review Committee. (August 2011 - October 2012).
Committee Chair, Brian Holton's Tenure Committee. (August 2007 - November 2011).
Committee Member, Michigan Energy Conference Committee. (August 2008 - April 2011).
Committee Member, Joe Pacella's Tenure Committee. (August 2005 - November 2010).
Committee Member, Director of Built Environment Search Committee. (January 2010 - May 2010).
Committee Member, CET Dean's Advisory Committee. (August 2008 - May 2010).
Committee Member, CET Sabbatical Committee. (August 2007 - May 2010).
Committee Member, CET Accrditation & Assessment Committee. (August 2007 - May 2009).
Committee Member, Joe Compton's Tenure Committee. (August 2005 - November 2008).
Committee Member, Doug Zentz's Tenure Committee. (August 2005 - November 2007).
Committee Member, Eric Quilitzsch's Tenure Committee. (August 2005 - November 2006).

Committee Chair, HVACR Programs Academic Program Review Committee. (January 2005 - October 2006).
Committee Member, President's TAC Review Committee. (August 2005 - May 2006).
Committee Member, HVACR Programs Advisory Board. (August 1996 - May 2001).
Chairperson, HVACR Programs Academic Program Review Committee. (January 1999 - October 2000).

Quilitzsch:
Learning Technologies Advisory Board ( ?? – 2013)
Curriculum Committee (2014 – Present)
Tenure Committees – (Brian Holton, Ferrel Clark)
HVACR Dept. Hiring Committee – All
HVACR Dept. Scholarship Committee
HVACR Summer Camp – 2014, 2017
Advisor ASHRAE Student Chapter (2002- 2018)

Fradette:
Committee Member, HVAC Marketing Committee. (August 23, 2017 - Present).
Develop and maintain "Tool Sign Out" system. (August 2014 - Present).
Attendee, Graduation. (May 5, 2018).
State of Michigan High School Skills USA Contest Organizer / Judge, Skills USA. (April 21, 2018).
Attendee, Award Ceremony, Women in Engineering Technology. (April 19, 2018).
Student/Industry Connection, ASHRAE AHR Expo. (January 23, 2018).
Attendee, Meeting, Mecosta-Osceola Intermediate School District. (November 17, 2017).
Judge for Campus Wide Public Speaking Contest. (October 23, 2017).
Served as Marshal at Spring 2017 Commencement - College of Engineering Technology. (May 6, 2017).
Student Recruiter, Ferris State University HVACR Dawg Days Event. (April 22, 2017).
Attendee, Award Ceremony, Women in Engineering Technology. (April 18, 2017).
State of Michigan High School Skills USA Contest Organizer / Judge, Skills USA. (April 8, 2017).
Student Recruiter, Southern Technical College in Orlando Florida. (February 16, 2017).
Student Recruiter, United Association Pipe Trades Training & Technology Conference. (February 15, 2017 - February 16, 2017).
Judge for Campus Wide Public Speaking Contest. (November 2, 2016).
Served as Marshal at Spring 2016 Commencement - College of Engineering Technology. (May 7, 2016).
Student Recruiter, Ferris State University HVACR Dawg Days Event. (April 16, 2016).
State of Michigan High School Skills USA Contest Organizer / Judge, Skills USA. (April 9, 2016).
Judge for Campus Wide Public Speaking Contest. (November 2, 2015).
Served as Marshal at Spring 2015 Commencement - College of Engineering Technology. (May 9, 2015).

State of Michigan "Post-Secondary" Skills USA Contest Organizer / Judge, Skills USA. (April 18, 2015).
State of Michigan High School Skills USA Contest Organizer / Judge, Skills USA. (April 18, 2015).
Regional "Post-Secondary" Skills USA Contest Organizer / Judge, Skills USA. (April 11, 2015).
Student/Industry Connection, ASHRAE AHR Expo. (January 26, 2015).
Judge for Campus Wide Public Speaking Contest. (November 17, 2014).

Lucas:
Committee Member, Academic Senate Professional Development Committee. (September 22, 2017 - Present).
Committee Member, CET Diversity Committee. (October 6, 2014 - Present).

Holton:
UCC 2014-2017.
College- Promotion and merit committee
School: Curriculum committee
**Department:**

- Advisor for the registered Student Organization: Greater Michigan chapter of Mechanical Contractor of America Association
- Completed curriculum proposal and developed the new HVAC 127course

## Research

The faculty are not currently involved in any research.

## Continuing Education

The HVACR Industry has many areas of focus for career focus. The faculty have experience in many different areas of the industry and stay active with professional development within their areas of interest and / or within the content areas covered by course that they are teaching. Faculty have participated the following continuing education

Residential Energy Auditing (RESNET)
Webinar, "Building Control," ASHRAE. (November 16, 2017).
Webinar, "Energy Conservation," ASHRAE. (November 16, 2017).
Seminar, "Advancements in Energy Modeling," ASHRAE, Orlando, Florida, USA. (January 27, 2016).
Seminar, "The Science, Application and Art of Load Calculations," ASHRAE, Orlando, Florida, USA. (January 25, 2016).
Seminar, "Commercial Building Energy Audits," ASHRAE, Orlando, Florida, USA. (January 23, 2016).
Webinar, "ASHRAE 90.1 - Building Envelope - Trade Off Option," ASHRAE. (November 21, 2014).
Webinar, "ASHRAE 90.1 - HVAC Prescriptive Req. 2," ASHRAE. (November 21, 2014).
Webinar, "ASHRAE 90.1 - Lighting - General & Mandatory Provisions," ASHRAE. (November 17, 2014).
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Webinar, "ASHRAE 90.1 - Lighting - Interior Power," ASHRAE. (November 17, 2014).
Webinar, "ASHRAE 90.1 - Power and Other Equipment," ASHRAE. (November 17, 2014).

Webinar, "ASHRAE 90.1 - Service Water Heating," ASHRAE. (November 17, 2014).
Webinar, "ASHRAE 90.1 - HVAC Prescriptive Req. 1," ASHRAE. (November 16, 2014).
Webinar, "ASHRAE 90.1 - Mandatory Provisions I." (November 16, 2014).
Webinar, "ASHRAE 90.1 - Mandatory Provisions II," ASHRAE. (November 16, 2014).
Webinar, "ASHRAE 90.1 - Building Envelope - General and Mandatory Provisions," ASHRAE. (November 15, 2014).
Webinar, "ASHRAE 90.1 - General Information and Simple Approach." (November 15, 2014).

MS, Ferris State University, 2016.
Major: Career and Technical Education Instructor

Manufacturer Training, "LG Air Conditioning Systems Multi V IV Installation Essentials," Comfort Engineering Solutions, Farmington, Michigan, United States. (May 9, 2018 - May 10, 2018).
Conference Attendance, "AHR Expo," ASHRAE, Chicago, Illinois, United States. (January 23, 2018).
Workshop, "Digital Signage Training," Ferris State University, Big Rapids, Michigan, United States. (September 12, 2017).
Conference Attendance / Exhibitor, "United Association Pipe Trades Training and Technology Conference," United Association, Orlando, Florida, United States. (February 15, 2017 - February 16, 2017).
Workshop, "2016 HVACR Instructors Workshop," Ferris State University - HVACR Department, Big Rapids, Michigan, United States. (August 1, 2016 - August 3, 2016).
Industry Training, "Focus on Refrigerants," Young Supply Company / Emerson Corporation, Grand Rapids, Michigan, United States. (April 28, 2016).
Industry Training, "Introduction to Industrial Ammonia Refrigeration Operations," Wagner-Meinert LLC, Holland, Michigan, United States. (October 15, 2015).
Conference Attendance, "40th Anniversary Trades Expo," Johnstone Supply, Grand Rapids, Michigan, United States. (September 10, 2015).
Conference Attendance, "National HVACR Educators and Trainers Conference," HVAC Excellence, Las Vegas, Nevada, United States. (March 20, 2015 - March 24, 2015).
Conference Attendance, "AHR Expo," ASHRAE, Chicago, Illinois, United States. (January 26, 2015).
Manufacturer Training, "Instructor Training for Baxi Boiler Installation and Service," Marathon International, Big Rapids, Michigan, United States. (December 15, 2014 - December 16, 2014).
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Workshop, "FerrisConnect Training," Ferris State University - Faculty Center for Teaching and Learning, Big Rapids, Michigan, United States. (December 10, 2014).
New Product Training, "iManifold," Johnstone Supply, Big Rapids, Michigan, United States. (December 4, 2014).
Continuing Education Program, "United Association Instructor Training Program," United Association, Ann Arbor, Michigan, United States. (August 10, 2013 - August 16, 2013).
Factory Training, "WME Magnetic Bearing Centrifugal Chillers," Daikin McQuay, McLean, Virginia, United States. (May 21, 2013 - May 23, 2013).

MS, Ferris State University, 2017.
Major: Career and Technical Education
Supporting Areas of Emphasis: Instructor

Webinar, "10 Things you Should Know about the WELL Building Standard," Green Building Research Institute. (May 18, 2018).
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Webinar, "Sustainable Olympics: A Gold Medal Winner," Green Building Research Institute. (May 16, 2018).
Webinar, "Understanding LEED v4 ID+C Inside and Out," Green Building Research Institute. (May 16, 2018).
Webinar, "Wanderlust: Taking the Sustainable Route," Green Building Research Institute. (May 16, 2018).
Webinar, "LEED v4 Project Implementation," Green Building Research Institute. (May 7, 2018 -

May 16, 2018).
Webinar, "AIA COTE Top 10: Step Inside the 10 Best Green Buildings of 2015," Green Building Research Institute. (May 15, 2018).
Webinar, "Building Better Medicine: LEED v4 & Healthcare," Green Building Research Institute. (May 15, 2018).
Webinar, "I am Doing WELL! Are You?." (May 15, 2018).
Webinar, "Nature's Marvels: Innovation in Natural Building Design," Green Building Research Institute. (May 15, 2018).
Continuing Education Program, "21 Things You Should Know About LEED v4," Green Building Research Institute. (May 14, 2018).
Webinar, "A Ripple Effect Sustainable Supply Chain & LEED v4," Green Building Research Institute. (May 14, 2018).
Webinar, "LEED v4 BD+C Rating System Review - Water Efficiency," Green Building Education Services. (May 27, 2016).
Webinar, "LEED v4 Case Study HKS Headquarters," Green Building Education Services. (May 27, 2016).
Webinar, "Passive Hybrid Downdraught Cooling," Green Building Education Services. (May 27, 2016).
Webinar, "The Pros and Cons of Building Reuse," Green Building Education Services. (May 27, 2016).
Webinar, "LEED v4 BD+C Rating System Review - Location and Transportation," Green Building Education Services. (May 25, 2016).
Webinar, "LEED v4 BD+C Rating System Review - Materials and Resources," Green Building Education Services. (May 25, 2016).
Webinar, "LEED v4 BD+C Rating System Review - Sustainable Sites," Green Building Education Services. (May 25, 2016).
Webinar, "LEED v4 BD+C Rating System Review - Innovation and Integrative Process," Green Building Education Services. (April 6, 2016).
Webinar, "LEED v4 BD+C Rating System Review - Indoor Environmental Quality," Green Building Education Services. (April 5, 2016).
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Webinar, "LEED v4 BD+C Rating System Review - Energy and Atmosphere," Green Building Education Services. (April 4, 2016).
Webinar, "Implementing Ergonomics - a LEED Pilot Credit," Green Building Education Services. (March 15, 2016).
Webinar, "LEED Pilot Credit Bird Collision Deterrence," Green Building Education Services. (March 15, 2016).
Webinar, "Forest Sequestration and Carbon Offsets," Green Building Education Services. (March 14, 2016).
Webinar, "Fast Savings: Sustainable Design Choices With a Payback of 8 Years or Less," Green Building Education Services. (March 9, 2016).
Webinar, "Blue Roofs: Cutting Edge Stormwater Management," Green Building Education Services. (March 7, 2016).
Webinar, "Demand Response: Getting Paid to Reduce Electricity," Green Building Education Services. (March 7, 2016).
Webinar, "20 Things You Must Know about LEED v4," Green Building Education Services. (December 28, 2015).
Webinar, "Best Practices in Architectural Acoustics," Green Building Education Services. (December 28, 2015).
Waterfurnace Series 7 and Series 5 ground source heat pump Service course 2014

Attended Annual Summer Meetings for ASHRAE in Long Beach, CA and attended seminars on site verses source energy efficiency and centralized chilled water systems, June 2017
Attended Winter ASHRAE/AHR Expo in Las Vegas, NV and attended seminars on Building Energy Performance and integration of smart devices within building HVAC automation systems, January

2017
Attended Annual Summer Meetings for ASHRAE in St. Louis, MO and attended seminars on BIM (Building Information Modeling) to BEM (Building Energy Modeling), June 2016
Attended Winter ASHRAE/AHR Expo in Orlando, FL and attended seminars on BIM to BEM and Solar Energy for High Performance Buildings, January 2016
Attended Annual Summer Meetings for ASHRAE in Atlanta, GA and attended seminars on HVAC Aps and Building Energy Modeling, June 2015
Attended Winter ASHRAE/AHR Expo in Chicago, IL and attended seminars on High Performance Buildings, January 2015
Attended Annual Summer Meetings for ASHRAE in Seattle, WA and attended seminars on HVAC Aps for smart devices and Building Energy Policies Around the World, June 2014
Attended Winter ASHRAE/AHR Expo in New York, NY and attended seminars on High Performance Buildings, January 2014
Attended Annual Summer Meetings for ASHRAE in Denver, CO and attended seminars on Net Zero Energy Buildings, June 2013
Attended Winter ASHRAE/AHR Expo in Dallas, TX and attended seminars on Building Efficiency and Renewable Energy, January 2013

The Commissioning Process in New and Existing Buildings ASHRAE 2018
Humidification in Commercial and Industrial Facilities ASHRAE 2013

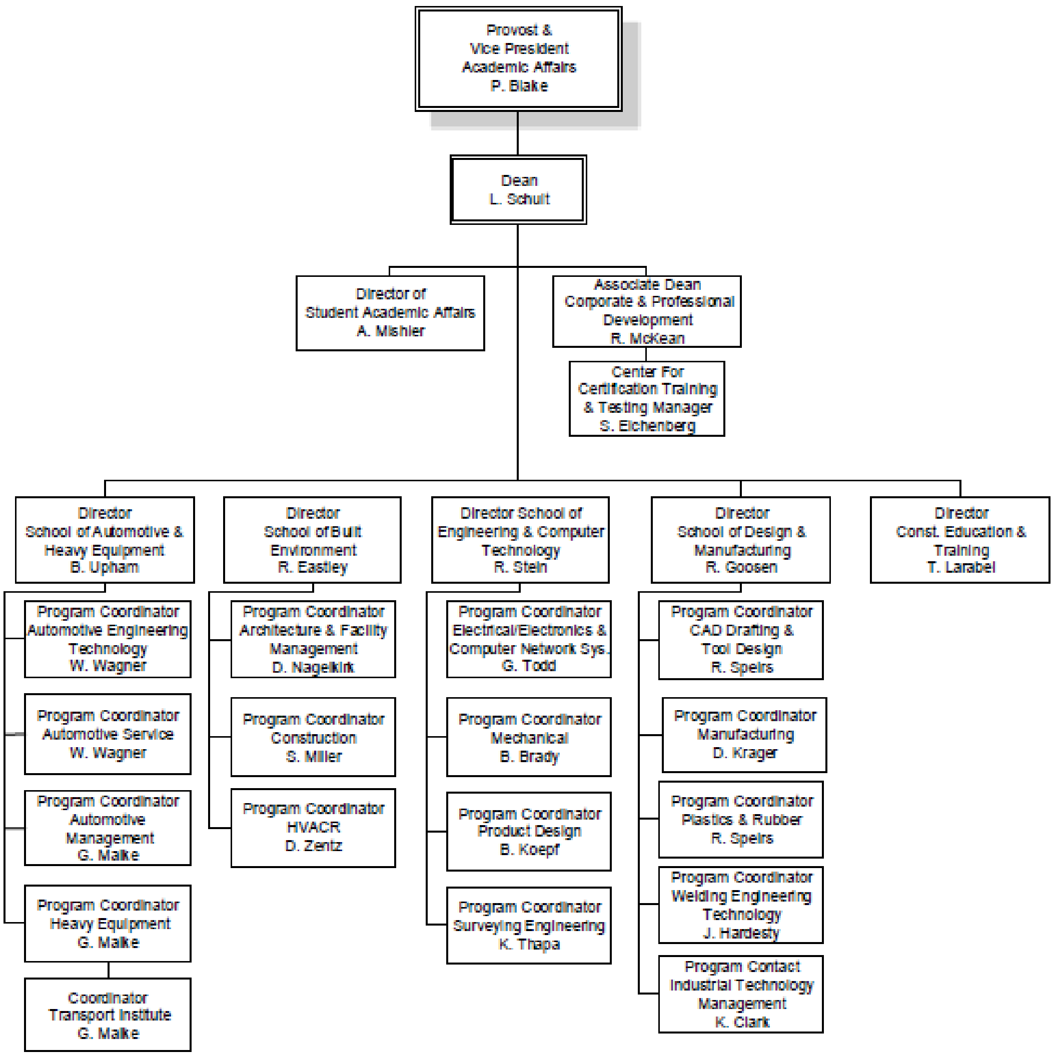
## Program Administration and Support

(Return to TOC)

**FERRIS STATE UNIVERSITY**

*ACADEMIC AFFAIRS DIVISION*

COLLEGE OF ENGINEERING TECHNOLOGY




The HVACR Faculty have been fortunate to have a great deal of oversight within the department. The department coordinator is responsible to the school director who reports to the Dean of the College of Technology. In recent years the relationship has been supportive and the department has been encouraged to create new programs and expand marketing initiatives. Faculty take the responsibility seriously and regularly review budgets, effectiveness of marketing initiatives and scholarship impacts.

### *Staff*

There are currently three staff supporting the HVACR programs; one full time secretary is shared with the Construction Management program within the Granger Center. There is one full time staff member staffing the tool crib area; this position is responsible for building deliveries, material handling, tool loans, and lab management for the building. This has been a good fit and the workload is appropriate for one person. There is also a full time marketing person supported by the HVACR Endowment. This person reports to the director of the School of the Built Environment but is funded and generally takes direction from the HVACR Department. The secretarial duties have been reduced from two positions to one position and the workload is excessive for the shared secretary.

## Support Services

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The faculty and staff make regular use of services provided by FLITE, TAC, Career Center, and UA&M. The materials made available to students both via FLITE are providing a financial break for students who in the past would have needed to purchase multiple engineering manuals. This benefit is more pronounced for the fully on-line students who would not have had access to the local engineering manuals housed in the Granger center; all of these resources are now available on demand through FLITE. As mentioned below, the Granger Center computer labs have a variety of specialized software packages and interfaces to mechanical equipment. TAC provides support for the problems that arise from conflicts with hardware and software within the labs. Faculty would appreciate a greater level of expertise with the specifics but it is a challenge given the variety of specialties within the College of Engineering Technology and our TAC support is currently flexible and willing to work collaboratively on solutions. We regularly interface with the Career Center as the employers come in from all over the country to interview HVAC students for employment; the HVACR marketing person regularly works with University Advancement and Marketing in collaborative efforts to recruit students for the program and the College of Engineering Technology.

## Facilities and Equipment

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### Instructional Environment

The HVACR Programs have been housed in the Granger Center for Construction and HVACR since the winter of 2004. Having been designed with the teaching of HVACR and Construction Management in mind, it remains one of the premier teaching facilities in the country and perhaps the world.

The classrooms within the Granger Center are well equipped and in fair shape for a 15 year old facility. There are maintenance items as would be expected and some audio visual equipment has been upgraded to stay current with digital media. The laboratories are constantly changing as equipment and technology move in and out of lab stations as required by changes in industry. As is true with the classrooms; the condition of the labs is typical of a 15 year old facility needing periodic maintenance.

The technology available to students of the HVACR programs is second to none, faculty and staff are continually working internally and externally to make the most current technology available to students; this is true of computers as well as HVACR specific equipment.

The Granger Center fills multiple roles impacting program delivery. First it is a marketing tool which is used to get prospective students excited about an education in HVACR. Next it is a home to students in the HVACR and CM programs; they have access, materials, technology, comfortable surroundings; all these things lead to a feeling of ownership and the Granger Center becomes a gathering place for all types of activities. Finally the facility is a living laboratory; it has amazing labs with specific examples of new and old technology but even more examples can be found throughout the building systems. There are many opportunities to step out of the classroom or lab and see real world examples of “The Built Environment” just down the hall.

The projected needs of the program with regard to the facilities will be dependent upon enrollment. The program is currently below capacity and has the room for a significant increase in enrollment in the last two years. AAS Enrollment is up and we are near the limits of classrooms and labs when considering two years schedules.

The only changes to current facilities would be due to improved technology in the future as it relates to student learning. Most of our students are “left brain” and this demands a more hands-on approach to learning. Therefore, if future advances in technology lead to enhanced learning there may be a need for facility modifications.

### Computer Access and Availability

1. The hardware that is available to the program includes eighteen computer workstations located in Granger 270 and sixteen workstations located in Granger 260 plus one computer each in the main lecture rooms, Granger 117 & 119. The computers were replaced in the 2015 and are acceptable for the next few years. Due to compatibility issues, software varies in the two main computer labs. The students are required to use the following software for degree completion. The software included on the computers in lab is the Microsoft Office bundle of programs for word processing, database and spreadsheet creation and manipulation. In addition Microsoft Project and Visio and Revit are used regularly. Other program specific software packages that are used include the following:

1. Carrier HAP (Building load and simulation software)
2. Johnson Controls application programs
3. Revit (Building Informational Modeling)
4. Trane Trace (Building load and simulation software)
5. Trane TOPPS (HVAC equipment selection software)
6. Trane System Analyzer (Building HVAC simulation software)
7. Trane Piping and ductwork design software

Most of the software has an annual cost incurred to the HVACR department on a yearly or semester basis. The labs are available to our on-campus student's for use during lab times and available to use on the weekends or other times when no classes are scheduled. In addition the online student must have access to the same program specific software packages. Many of these applications have been made available to the fully online student to use on their own computers; other packages have been made available to the students through cloud services like Skytap.

Adjacent to both computer labs is a printing room with a plotter and a printer, the printer has been replaced within the last 5 years.  Outside of the computer labs are 13 workstations for general use in the public area of the building. The resources are used for both HVACR AAS and BS degrees. The courses in the BS program and one course in the AAS program employ the use of the above computers with a minimum of 1 lab per section to 3 labs per section on a weekly basis. The AAS degree has other courses that use these labs as they are available for instruction. These rooms are in use virtually all day between and after scheduled class times as the much software available on the machines is not available on other computers across campus.

Industry partners have donated and updated many systems to insure student development. The Granger Center remains an excellent facility in which to teach of students in both the AAS & BS HVACR programs for the on campus student during scheduled class times. Continued availability of cloud resources are crucial to success in the fully online program. In previous reviews the issue of resources available to online students has been at the forefront. We currently have options in place using services like Tegrity, Kivuto and Skytap that make delivery of online content possible. If the online degree is to continue to be successful, support of these virtual services is imperative.

The on campus student is using Ferris Connect for most of the courses in the AAS and the BS programs. The effect is positive for both students and instructors. It acts as a medium to share information to students and provide a vehicle for various self-assessments for students, a vehicle for submission of work in electronic fashion and an active grade book for students. The on line student uses Ferris Connect for all HVACR classes.

Computer support has been an issue with our on campus students. Numerous issues have been experienced in computer labs in Granger 260 & 270. Most of the issues have been related to software compatibility between HVACR specific programs and the challenge to complete the installation of the software.

### Other Instructional Technology

The HVACR curriculum lends itself to exercises built on real world examples. The HVACR Industry is an industry immersed in changing technologies. Combine these two ideas and we find that the courses within the HVACR program require a wide variety of technologies to serve as examples for lecture and laboratory exercises. Many of the instructional technology components exist within the construct of the Granger Center. The classrooms and computer labs have audio visual stations that allow the instructor to share computer images, DVD, audio, and hi-res camera sources with the students via a projector.

Additionally some of these rooms have the ability to capture handwritten annotations on the images projected. Changes in computer technology will necessitate the upgrade of the building equipment as we use different types of media.

The individual labs will also have a continuing need for instructional technology in the form of simulator panels or actual lab equipment. In some cases this equipment will need to be updated frequently so that students learn on current technology; temperature controls is such an area and through industry support we have installed 16 student stations plus 2 real world example systems with current temperature control technology. Other subjects may require both current and older technologies so that students can learn to function in a service industry where not everything is new. Each faculty member is active in soliciting donations for equipment to be used as instructional tools within the areas they teach and try to maintain a relevant mix of examples so the students will be well prepared. These lab equipment donations are continually sought and should be expected to remain an area of flux.

The Granger Center mechanical and electrical systems also serve as a great source for instructional technology. The facility was built as a teaching tool and most systems that would be hidden from view in a typical building are exposed and available to occupants of Granger. These types of examples are not in a state of constant change like the lab equipment and test panels but they provide a true example of HVACR, construction and maintenance in a commercial facility.

When examining an application in the HVACR industry, students will be shown examples of equipment, calculations, charts, and etcetera. These examples may be real objects or audio visual materials. Many times the application will have such a large number of variables and possible outcomes that the student will need to move on to a practical exercise using the actual object, or a test panel. This practice provides an assurance from firsthand knowledge and builds confidence. All of the HVACR courses follow a "hands on"approach and require continuous support in the form of HVACR specific instructional technology as well as standard computer and audio visual technology.

Overall the facility resources are still in good shape; the building is approximately 15 years old. Computers have been replaced, projectors have been maintained and in some cases replaced, lab equipment is constantly changing. The HVACR programs will often identify a need from industry and go in search of a donor. That process in most cases has proven very effective; it is the facility equipment that is more difficult to upgrade and keep current.

### Library Resources

The library resources available through FLITE support the HVACR programs very well. Students in both traditional setting as well as distance learning students have access to HVACR and Engineering specific documents and data via the FLITE database. Publications from professional organizations in HVACR, Mechanical and Electrical Code, all relevant standards can be accessed locally or on-line. We have periodic contact with our FLITE liaison and have opportunity to discuss materials and subscriptions that will be available to students and faculty alike.

The FLITE staff have been able to accommodate faculty teaching FSUS 100 courses as well as holding special HVACR program training so that faculty know how to properly use resources that are available. There are no known issues with support.

The budget allocated to HVACR specific resources has been adequate and we have had opportunity to discuss cost versus value for the subscriptions that are provided.

## Perceptions of Overall Quality
(Return to TOC)

| | Mission | | | | | | Graduates | | | Composition and |
|---|---|---|---|---|---|---|---|---|---|---|
| | University | College | Department | Visibility | Distinctiveness | Enrollment | Characteristics | Quality | Employability | Quality of Faculty |
| 10 | | | | | | | X | X | | |
| 9 | X | X | X | | X | | | | X | X |
| 8 | | | | | | | | | | |
| 7 | | | | X | | | | | | |
| 6 | | | | | | | | | | |
| 5 | | | | | | X | | | | |
| 4 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 1 | | | | | | | | | | |

Overall we rate the program at 86 out of 100

### *Support:*

#### Mission:
**University** - Ferris State University prepares students for successful careers, responsible citizenship, and lifelong learning. Through its many partnerships and its career-oriented, broad-based education, Ferris serves our rapidly changing global economy and society.
College of Engineering Technology Mission: Our mission is to prepare graduates who have met the high academic standards of our programs for current and future industrial and business needs of the state, the nation and the global market.

The HVACR Department program with AAS, BS, and Fully Online BS prepare students for very successful careers in the HVACR industry. The career choices are many and with nearly 100% placement for as long as we have been keeping track, the security of the industry is highly desirable. The students are held to high standards and encouraged to consider the world with an open mind. We have international students, vendors, and sometimes internships and encourage life long learning.

**College of Engineering Technology Mission:** Our mission is to prepare graduates who have met the high academic standards of our programs for current and future industrial and business needs of the state, the nation and the global market.

The HVACR Department is supplying a much need resource to industry; graduates who are well prepared on day one. The proof of this is in our relationships with companies from all over the nation that travel to Big Rapids once or twice each year to recruit HVAC Grads. Many of these industry partners have only one or two locations for recruitment; Ferris is unique and meets the needs of industry.

**HVACR Mission:** HVACR Provides quality education and training that emphasizes practical skills and prepares the student to analyze, synthesize, and solve problems. This is accomplished in state of the art facilities with highly qualified instructors.

This is measurable in our assessment; we match these goals to our objectives and track them.

### Visibility

The visibility of the program is good. We are well known in a large industry and see transfer students from all over the nation; occasionally international students as well. The visibility is reduced by the size of the University and the location. It is a challenge for a student from southern California to see moving to the Midwest for 4 years without ever having heard of the school or Big Rapids, Michigan. It does happen and we get excellent referrals through the graduates that are in the field but maintaining nationwide visibility is a challenge.

### Distinctiveness

The unique labs and diverse experience of faculty make the AAS degree a definite value for students seeking the best education. There are many similarities in the content found at other good schools though and that lowers the distinctiveness of the overall program. The BS degree is almost entirely unique and the course content that is so directly aligned with the jobs that HVAC engineers do cannot be found anywhere else.

### Enrollment

We are struggling with enrollment right now. It feels as though we have held our own in a market that has been shrinking over the past 6 years. Staying at current levels is not the goal but when many other programs are losing students, we have been pleased to maintain current levels. Nonetheless, we would like to see these numbers improve.

## *Graduates*

### Characteristics, Quality, Employability

The quality of FSU HVAC Graduates is what keeps us going. The companies that return to hire “another” graduate or to find another engineer like “Mike” testify to the work ethic that they develop, the tasks they are ready to perform and the value they provide as employees. They make us look good.

### Composition and Quality of Faculty

The faculty group is self-motivated, highly diverse, and incredibly talented. I find this to be true throughout the College of Engineering Technology; we have faculty who were responsible for big things in their home industry. There are so many that were very well respected and successful before coming (often back) to FSU to give back. The HVACR group is no exception.

## Implementation of Findings
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It is evident that we are using this process to identify improvements, check our mission and our goals. We see that some of the items identified from the previous APR have found solutions and that we have record of those improvements. The opportunity to review curriculum and the process for tracking those changes is also valuable.

From the previous APR we found a new administrative structure in place; the objective was to work well within that new structure and this document supports that. There is now a new administrative process being put in place and we will work to find clearly defined roles and responsibilities within that structure once the new Dean is appointed. We continue to work with our in house recruiting person in an effort to align our efforts with those of the College and the University.

## Signature Page

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Zentz, Douglas Associate Professor HVACR Program Faculty

Korcal, Michael Associate Professor HVACR Program Faculty

Feutz, Michael Professor HVACR Program Faculty

Quilitzsch, J. Eric Associate Professor HVACR Program Faculty

Pacella, Joseph Associate Professor HVACR Program Faculty

Compton, Joseph Associate Professor HVACR Program Faculty

Holton, Brian Associate Professor HVACR Program Faculty

Robert Eastley Director School of Built Environment

Shari Wessels Program Secretary School of Built Environment

Trinklein, Jill PR/Marketing & Pre-Admissions Officer HVACR Programs

Nancy Cammenga, Tool Room Clerk HVACR Program

## Appendices

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# Appendix one: Summary of Graduate Follow Up Survey 2012 through 2017

| | | Degrees Placement Information | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CERT | AAS | BS | TOTAL | # Responded | % Responded | # Employed / CE | Placement Rate | Ave Salary |
| 2016/2017 | HVACR Eng Tech & Energy Mgmt | | | 30 | 30 | 3 | 10% | 3 | 100% | $ 44,333.00 |
| | HVACR Engineering Technology | | | 1 | 1 | | 0% | | | |
| | HVACR Technology | | 27 | | 27 | 2 | 7% | 2 | 100% | |
| 2015/2016 | HVACR Eng Tech & Energy Mgmt | | | 28 | 28 | 12 | 43% | 12 | 100% | $ 66,717.00 |
| | HVACR Engineering Technology | | | 8 | 8 | 2 | 25% | 2 | 100% | na |
| | HVACR Technology | | 24 | | 24 | 3 | 13% | 3 | 100% | $ 48,000.00 |
| 2014/2015 | HVACR Eng Tech & Energy Mgmt | | | 37 | 37 | 15 | 41% | 15 | 100% | $ 65,917.00 |
| | HVACR Engineering Technology | | | 7 | 7 | 3 | 43% | 3 | 100% | $ 75,830.00 |
| | HVACR Technology | | 25 | | 25 | 1 | 4% | 1 | 100% | NA |
| 2013/2014 | HVACR Eng Tech & Energy Mgmt | | | 14 | 14 | 7 | 50% | 7 | 100% | $ 57,357.00 |
| | HVACR Engineering Technology | | | 25 | 25 | 6 | 24% | 6 | 100% | $ 62,109.00 |
| | HVACR Technology | | 20 | | 20 | 2 | 10% | 2 | 100% | $ 42,500.00 |
| 2012 / 2013 | HVACR Engineering Technology | | | 46 | 46 | 14 | 30% | 12 | 86% | $ 59,667.00 |
| | HVACR Technology | | 27 | | 27 | 4 | 15% | 3 | 75% | $ 45,682.00 |
| 2011 / 2012 | HVACR Engineering Technology | | | 45 | 45 | 7 | 16% | 7 | 100% | $ 67,286.00 |
| | HVACR Technology | | 19 | | 19 | 4 | 21% | 3 | 75% | $ 27,500.00 |

**J Eric Quillitzsch:**
Curriculum Change: Change to Degree Name add Energy Management. Several years to show both new and old name as existing students move through the program.

**Appendix two: Graduate Follow Up Surveys 2012 through 2017 (click to open embedded file)**

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2015/2016 Graduate Follow Up Survey Summary
College: Engineering Technology

| ENGINEERING TECHNOLOGY | DEGREES | | | | PLACEMENT INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Program | CERT | AAS | BAS/BS | TOTAL | # Responded | % Responded | # Employed/CE | Placement Rate | Avg Salary |
| **ARCHITECURAL TECHNOLOGY & FACILITIES MANAGEMENT** | | | | | | | | | |
| Architectural Technology | | 19 | | 19 | 3 | 16% | 3 | 100% | $3,000 |
| Architecture Sustainability | | | 14 | 14 | 7 | 50% | 7 | 100% | $40,833 |
| Facility Management | | | 13 | 13 | 3 | 23% | 3 | 100% | $59,388 |
| Facility Management | 7 | | | 7 | 1 | 14% | 1 | 100% | NA |
| **AUTOMOTIVE** | | | | | | | | | |
| Automotive Engineering Technology | | | 44 | 44 | 11 | 25% | 10 | 91% | $56,686 |
| Automotive Management | | | 15 | 15 | 1 | 7% | 1 | 100% | NA |
| Automotive Service Technology | | 14 | | 14 | 2 | 14% | 2 | 100% | NA |
| Performance Motorsports | 7 | | | 7 | 1 | 14% | 1 | 100% | NA |
| **CONSTRUCTION TECHNOLOGY & MANAGEMENT** | | | | | | | | | |
| Building Construction Technology | | 18 | | 18 | 1 | 6% | 1 | 100% | NA |
| Civil Engineering Technology | | 6 | | 6 | 1 | 17% | 1 | 100% | NA |
| Construction Management | | | 44 | 44 | 6 | 14% | 6 | 100% | $59,280 |
| **ELECTRONICS/COMPUTER NETWORKS AND SYSTEMS** | | | | | | | | | |
| Computers Networks and Systems | | | 8 | 8 | 5 | 63% | 5 | 100% | $46,760 |
| Electrical/Electronic Engineering Technology | | | 20 | 20 | 4 | 20% | 4 | 100% | $61,000 |
| Industrial Electronics Technology | | 7 | | 7 | 1 | 14% | 1 | 100% | NA |
| **HEAVY EQUIPMENT** | | | | | | | | | |
| Heavy Equipment Service Engineering Tech | | | 13 | 13 | 5 | 38% | 5 | 100% | $55,010 |
| Heavy Equipment Technology | | 28 | | 28 | 2 | 7% | 2 | 100% | NA |
| **HVACR** | | | | | | | | | |
| HVACR Engineering Tech & Energy Mgmt | | | 28 | 28 | 12 | 43% | 12 | 100% | $66,717 |
| HVACR Engineering Technology | | | 8 | 8 | 2 | 25% | 2 | 100% | NA |
| HVACR Technology | | 24 | | 24 | 3 | 13% | 3 | 100% | $48,000 |

# GRADUATE FOLLOW-UP SURVEY REPORT

2014-2015

INSTITUTIONAL RESEARCH & TESTING
FERRIS STATE UNIVERSITY

# GRADUATE FOLLOW-UP SURVEY REPORT

2013-2014

INSTITUTIONAL RESEARCH & TESTING
FERRIS STATE UNIVERSITY

# Graduate Follow-Up

Survey Report

2012-2013

INSTITUTIONAL RESEARCH & TESTING
FERRIS STATE UNIVERSITY

## Appendix three: Curriculum Proposals

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*2016: HVAC 285: HVAC System Design using BIM*

(Double click to open embedded Adobe Acrobat document.)

Form A

### PROPOSAL SUMMARY AND ROUTING FORM

Proposal Title: HVAC 285: HVAC System Design using BIM

Initiating Individual: Mike Feutz Initiating Department or Unit: HVAC

Contact Person's Name: Mike Feutz Email: feutzm@ferris.edu Phone: x2351

☐ Group I-A – New Degree, major, concentration, minor, or redirection of a current offering

☐ Group I-B – Deletion of a degree, major, concentration, or minor

☒ Group II-A – New Course, modification of a course, deletion of a course

☐ Group II-B – Minor Curriculum Clean-up

☐ Group III – Certificate (☐ College Credit ☐ Non-credit ☐ New Certificate)

☐ Group IV – Other site location (☐ College Credit ☐ Non-credit)

| | PLEASE PRINT AND SIGN YOUR NAME | DATE | VOTE/ACTION * Number Count |
|---|---|---|---|
| Program Representative ** | Mike Feutz | 4-28-16 | 1 Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| Department/School/Faculty Representative Vote ** | DOUGLAS FERTZ<br>D.F. Fz | 4-28-16 | 9 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| Department/School/Administrator<br>School of Built Environment | JOHN R. SCHMIDT<br>DIRECTOR, SBE<br>John Schmidt | 10/4/2016 | 7 Support (6 committee + director)<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| College Curriculum Committee/Faculty | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| UCC Representative | | | __ Support<br>__ Hold<br>__ Not Support |
| Dean | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| University Curriculum Committee ** | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| Senate ** | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| Academic Affairs | | | __ Support<br>__ Hold<br>__ Not Support |

* Support with Concerns or Not Support must include identification of specific concern with appropriate rationale

** Number Count must be given for all members present and/or voting.

To be completed by Academic Affairs Date of Implementation: Click here to enter text.

President (Date Approved) Board of Trustees (Date Approved) Academic Officers of MI (Date Approved)

1

## *2015: HVAC 127: Advanced HVACR Controls*

(Return to TOC)

(Double click to open embedded Adobe Acrobat document.)

#16-046

**Form A**

Revised Jan. 2015

**PROPOSAL SUMMARY AND ROUTING FORM**

**Proposal Title:** HVAC 127, Advanced HVACR Controls

**Initiating Individual:** Brian Holton **Initiating Department or Unit:** HVACR Program

**Contact Person's Name:** Brian Holton **Email:** holt8@ferris.edu **Phone:** 591-2322

☐ **Group I-A** – New Degree, major, concentration, minor, or redirection of a current offering

☐ **Group I-B** – Deletion of a degree, major, concentration, or minor

☒ **Group II-A** – New Course, modification of a course, deletion of a course

☐ **Group II-B** – Minor Curriculum Clean-up

☐ **Group III** – Certificate (☐ College Credit ☐ Non-credit ☐ New Certificate)

☐ **Group IV** – Other site location (☐ College Credit ☐ Non-credit)

| | PLEASE PRINT AND SIGN YOUR NAME | DATE | VOTE/ACTION * Number Count |
|---|---|---|---|
| Program Representative ** | Brian Holton / Brian Holton | 11/16/15 | 1 Support, 0 Support with Concerns, 0 Not Support, 0 Abstain — 1 voting |
| Department/School/Faculty Representative Vote ** | DOUGLAS ZENTZ / [signature] | 11/16/15 | 9 Support, 0 Support with Concerns, 0 Not Support, 0 Abstain — 9 voting |
| Department/School Administrator | JOHN R. SCHMIDT / [signature] | 12/2/2015 | 6 Support (School + Director = 7), 0 Support with Concerns, 0 Not Support, 0 Abstain |
| College Curriculum Committee/Faculty | Chuck Drake / [signature] | 12-14-15 | 8 Support, 0 Support with Concerns, 0 Not Support, 0 Abstain |
| UCC Representative | Brian Holton / Brian Holton | 12-14-15 | X Support, 0 Hold, 0 Not Support |
| Dean | [signature] | 12/15/15 | 2 Support, __ Support with Concerns, __ Not Support, __ Abstain |
| University Curriculum Committee ** | [signature] | 1/11/16 | ✓ Support 10 – 0, __ Support with Concerns, __ Not Support, __ Abstain |
| Senate ** | K Thompson | 1/21/16 | ✓ Support, __ Support with Concerns, __ Not Support, __ Abstain |
| Academic Affairs | [signature] | 1/13/16 | ✓ Support, __ Hold, __ Not Support |

* Support with Concerns or Not Support must include identification of specific concern with appropriate rationale.

** Number Count must be given for all members present and/or voting.

To be completed by Academic Affairs Date of Implementation: Fall 2016

VPAA JAN 11 2016

Date Approved Board of Trustees (Date Approved) Academic Officers of MI (Date Approved)

## *2015: HVACR change to math prerequisite timing*

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(Double click to open embedded Adobe Acrobat document.)

15-079

**FORM A**

Revised September 2014

### PROPOSAL SUMMARY AND ROUTING FORM

**Proposal Title:** HVACR change to math prerequisite timing

**Initiating Individual:** Mike Feutz **Initiating Department or Unit:** HVAC
**Contact Person's Name:** Mike Feutz **e-mail:** feutzm@ferris.edu **phone:** 2351

- ☐ Group I - A – New degree, major, concentration, minor, or redirection of a current offering
- ☐ Group I - B – Deletion of a degree, major, concentration, or minor
- ☐ Group II - A – New Course, modification of a course, deletion of a course
- ☒ Group II - B – Minor curriculum clean-up
- ☐ Group III – Certificates (☐ College Credit ☐ Non-Credit) ☐ New Certificate
- ☐ Group IV – Other Site Locations (☐ College Credit ☐ Non-Credit)

| | Signature<br>Print and sign your name. | Date | Vote/Action *<br>Number count ** |
|---|---|---|---|
| Program Representative ** | DOUGLAS F. ZENTZ | 3/3/15 | 9 Support<br>0 Support with Concerns<br>0 Not Support<br>1 Abstain (SABBATICAL) |
| Department/School/Faculty Representative Vote ** | John Schmidt | 3/19/15 | 5 Support<br>0 Support with Concerns<br>0 Not Support<br>1 Abstain (on travel) |
| Department/School Administrator | John Schmidt | 3/19/15 | X Support<br>Support with Concerns<br>Not Support |
| College Curriculum Committee/Faculty | CHUCK DRAKE | 4/2/15 | 9 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| Dean | LARRY SCHULTZ | 4/6/15 | ✓ Support<br>Support with Concerns<br>Not Support |
| University Curriculum Committee ** | | 9-10-15 | ✓ Support 6-0<br>Support with Concerns<br>Not Support<br>Abstain |
| Senate ** | K. Thorp | 9-15-15 | ✓ Support<br>Support with Concerns<br>Not Support<br>Abstain |
| Academic Affairs | | 9/28/15 | ✓ Support<br>Hold<br>Not Support |

* Support with Concerns or Not Support must include identification of specific concerns with appropriate rationale.
** Number count must be given for all members present and/or voting.

| | | |
|---|---|---|
| To be completed by Academic Affairs | Date/Term of Implementation: SPRING 2016 | |
| President (Date Approved) | Board of Trustees (Date Approved) | Academic Officers of MI (Date Approved) |

VPAA
SEP 16 2015
PROVOST

*2014: HVACR On-Line Modification and Creation of HVAC 322, HVAC323, HVAC326 & HVAC 327*

(Return to TOC)

(Double click to open embedded Adobe Acrobat document.)

**FORM A**

Revised September 2012

## PROPOSAL SUMMARY AND ROUTING FORM

**Proposal Title: HVACR On-Line Modification and Creation of HVAC 322, HVAC323, HVAC326 & HVAC 327**

**Initiating Individual:** Doug Zentz **Initiating Department or Unit:** HVACR

**Contact Person's Name:** Doug Zentz **e-mail:** zentzd@ferris.edu **phone:** 3083

☐ Group I - A – New degree, major, concentration, minor, or redirection of a current offering

☐ Group I - B – Deletion of a degree, major, concentration, or minor

☒ Group II - A – New Course, modification of a course, deletion of a course

☒ Group II - B – Minor curriculum clean-up

☐ Group III – Certificates (☐ College Credit ☐ Non-Credit)

☐ Group IV – Other Site Locations (☐ College Credit ☐ Non-Credit)

| | Signature | Date | Vote/Action * Number count ** |
|---|---|---|---|
| Program Representative ** | | | ___Support<br>___Support with Concerns<br>___Not Support<br>___Abstain |
| Department/School/Faculty Representative Vote ** | | | ___Support<br>___Support with Concerns<br>___Not Support<br>___Abstain |
| Department/School Administrator | | | ___Support<br>___Support with Concerns<br>___Not Support |
| College Curriculum Committee/Faculty | | | ___Support<br>___Support with Concerns<br>___Not Support<br>___Abstain |
| Dean | | | ___Support<br>___Support with Concerns<br>___Not Support |
| University Curriculum Committee ** | | | ___Support<br>___Support with Concerns<br>___Not Support<br>___Abstain |
| Senate ** | | | ___Support<br>___Support with Concerns<br>___Not Support<br>___Abstain |
| Academic Affairs | | | ___Support<br>___Hold<br>___Not Support |

* Support with Concerns or Not Support must include identification of specific concerns with appropriate rationale.
** Number count must be given for all members present and/or voting.

| | | |
|---|---|---|
| To be completed by Academic Affairs | Date/Term of Implementation: ___________ | |
| President (Date Approved) | Board of Trustees (Date Approved) | Academic Officers of MI (Date Approved) |

*2014: HVACR Curriculum Modification and Creation of HVAC 321, HVAC325*
(Return to TOC)
(Double click to open embedded Adobe Acrobat document.)

**FORM A**

Revised September 2012

## PROPOSAL SUMMARY AND ROUTING FORM

**Proposal Title: HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325**

**Initiating Individual:** Doug Zentz **Initiating Department or Unit:** HVACR
**Contact Person's Name:** Doug Zentz **e-mail:** zentzd@ferris.edu **phone:** 3083

- ☐ Group I - A – New degree, major, concentration, minor, or redirection of a current offering
- ☐ Group I - B – Deletion of a degree, major, concentration, or minor
- ☒ Group II - A – New Course, modification of a course, deletion of a course
- ☒ Group II - B – Minor curriculum clean-up
- ☐ Group III – Certificates (☐ College Credit ☐ Non-Credit)
- ☐ Group IV – Other Site Locations (☐ College Credit ☐ Non-Credit)

| | Signature | Date | Vote/Action * Number count ** |
|---|---|---|---|
| Program Representative ** | | 11/19/13 | 8 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| Department/School/Faculty Representative Vote ** School Curriculum Comm | | 01/02/14 | 6 Support<br>– Support with Concerns<br>– Not Support<br>– Abstain |
| Department/School Administrator Director, SBE | | 01/02/14 | 1 Support<br>– Support with Concerns<br>– Not Support |
| College Curriculum Committee/Faculty | | 2/20/14 | 10 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| Dean | | 2/27/14 | 1 Support<br>0 Support with Concerns<br>0 Not Support |
| University Curriculum Committee ** | | 3/24/14 | ✓ Support 15-0<br>Support with Concerns<br>Not Support<br>Abstain |
| Senate ** | | 3/24/14 | 1 Support<br>Support with Concerns<br>Not Support<br>Abstain |
| Academic Affairs | Paul Blake | 4/1/14 | ✓ Support<br>Hold<br>Not Support |

* Support with Concerns or Not Support **must** include identification of specific concerns with appropriate rationale.
** Number count **must** be given for all members present and/or voting.

| To be completed by Academic Affairs | Date/Term of Implementation: Fall 2014 | |
|---|---|---|
| President (Date Approved) | Board of Trustees (Date Approved) | Academic Officers of MI (Date Approved) |

VPAA
MAR 31 2014
PROVOST

## *2012: HVAC 342 Course Name & Description Modification*

(Return to TOC)

(Double click to open embedded Adobe Acrobat document.)

**FORM A**
**College of Engineering Technology**

Revised 05/08/2009

**PROPOSAL SUMMARY AND ROUTING FORM**

**Proposal Title:** HVAC342 Course name & description modification

**Initiating Unit or Individual:** Joseph Pacella
**Contact Person's Name:** Joseph Pacella **e-mail:** pacellj@ferris.edu **phone:** 3586
**Date or Term of Proposal Implementation:** 201205

☐ Group I - A – New degree/major or major, redirection of a current offering, or elimination of a degree, major or minor
☐ Group I - B – New minors or concentrations
X Group II - A - Minor curriculum clean-up and course changes
☐ Group II - B – New Course
☐ Group III - Certificates
☐ Group IV – Off-Campus Programs

| Group/Individual | Signature | Date | Vote/Action * |
|---|---|---|---|
| Program Faculty/Committee | [signature] | 12/5/11 | 7 Support<br>___ Support with Concerns<br>___ Not Support |
| School Committee | [signature] | 12/9/11 | 6 Support<br>0 Support with Concerns<br>0 Not Support |
| College Curriculum Committee | [signature] | 12/14/11 | ✓ Support<br>✓ Support with Concerns<br>✓ Not Support |
| Dean | [signature] | 1/31/12 | ✓ Support<br>___ Support with Concerns<br>___ Not Support |
| University Curriculum Committee | | | ___ Support<br>___ Support with Concerns<br>___ Not Support |
| Senate | | | ___ Support<br>___ Support with Concerns<br>___ Not Support |
| Academic Affairs | | | ___ Support<br>___ Support with Concerns<br>___ Not Support |

* Support with Concerns or Not Support must include a list of specific concerns. Votes must be shown for faculty groups. Administrators check appropriate action taken.

To be completed by Academic Affairs

President (Date Approved) ______ Board of Trustees (Date Approved) ______ President's Council (Date Approved) ______

# Appendix four: Syllabi

## HVAC 101

(Return to TOC)

FERRIS STATE UNIVERSITY

**Course Syllabus**
**HVAC 101 Introduction to Refrigeration an A/C Systems**
**Spring 2018 – Section 211**

Instructor: ..............................Eric Fradette
Office Hours: .........................Mondays: 4:00 – 5:00 PM, Tuesdays: 4:15 – 5:15 PM, Wednesdays: 3:00 – 4:00 PM, Thursdays: 4:15 – 5:15 PM,
Office: ....................................GRN 204
Phone: ....................................x 3763
E-mail: ...................................ericfradette@ferris.edu
Credits: ..................................4 Hours: 3 lecture hours and 3 lab hours per week

Course Description: ..............An introductory course covering the physical and chemical laws governing the principles of refrigeration. The basic refrigeration cycle and components will be covered. Objectives include temperature and pressure conversion, evacuation, charging, transferring refrigerant, and basic system troubleshooting.

Course Co requisite: ..............MATH 116

Final Exam: ...........................The final exam for this course is scheduled by the University to prevent conflict with other courses. The scheduled time is as follows:

**Thursday, May 3rd, 8:00 – 9:40 AM.**

**Student Learning Outcomes**

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding of physical and chemicals laws and equations that are the foundation of the HVAC field.
2. Describe component and system operations for typical Refrigeration equipment.
3. Performing various refrigeration charging and recovery operations with different refrigerants in a safe and proper manner.
4. Utilizing equipment name plate data, knowledge of vapor compression cycle, electrical schematics, and equipment sequences to troubleshoot refrigeration equipment.

1

## HVAC 102

(Return to TOC)

(Double click to open embedded Adobe Acrobat document.)

2016 Spring
Semester Course Syllabus (HVACR 102)

**Instructor:** Joe Compton

**Office Location:** GRN 202

**Office Phone: 591-3062** Cell: 231-349-1294

**Office Hours:** **Wednesday: 11:00 AM – 2:00 PM**
**Thursday: 3:00 PM – 4:00 PM**

**E- Mail:** comptonj@ferris.edu

**Course Requirements**

**Attendance:** Regular attendance of each class session is expected, since it is proven that students who attend class on a regular basis are much more likely to excel in learning and mastering the given topic, and that is what you are here for. You will be allowed 2 absences without penalty (Includes Lecture and Lab). For each absence beyond two, the final numerical grade will be reduced by one point. Two points will be added to the final numerical grade if you attended all classes. One point will be added if you have only 1 absence. ***EXCUSED ABSENCES MUST BE IN WRITING.***

**Exceptions to the Attendance Policy:** Absences for the following reasons will be viewed as beyond the control of the students and will not cause a person's grade to be lowered or cause them to withdraw or fail the class.

a. death of a family member/or significant person
b. illness as long as accompanied by a physician's note or extended hospitalization
c. University sponsored events (permission from the Academic Vice President's Office is required).
d. Jury duty / or being subpoenaed for court testimony.

**Note:** All other exceptions must be discussed with the instructor prior to the time they occur to be considered as an excused absence **(There will be no exceptions)**.

**Tardiness:** Three times late for class will equal one absence.

**Assignments:** Assignments handed must be your own work. Collaboration with fellow students is encouraged to help better understand concepts and ideas, but the assignment handed in cannot be a duplication of others work.

**Late Assignments:** Assignments that have a due date are subject to a grade reduction if turned in late.

**Handouts:** Students are responsible to obtain any hand out passed out in class when absent.

**Cell Phones:** No use of cell phones in lecture or lab without permission. There will be a cell phone grade on final grade calculation. Excessive cell phone use will be penalized

***Note:** I reserve the right to make any changes in the content or the point system of this class that I may see necessary as the class progresses through the semester.

Tests: 2 or 3 tests plus final exam
**Homework:** Numerous assignments
**Lab and Lab performance test:** Numerous assignments

FERRIS STATE UNIVERSITY

**Course Syllabus**
**HVAC 117 Advanced HVACR Electricity & Circuits**
**Spring 2018 – Section 211**

Instructor:...............................Eric Fradette
Office Hours: ........................Mondays: 4:00 – 5:00 PM, Tuesdays: 4:15 – 5:15 PM, Wednesdays: 3:00 – 4:00 PM, Thursdays: 4:15 – 5:15 PM,
Office: ...................................GRN 204
Phone: ...................................x 3763
E-mail: ..................................ericfradette@ferris.edu
Credits:..................................4 Hours: 3 lecture hours and 3 lab hours per week

Course Description: AC electrical theory and application, concentrating on the operation, installation and analysis of HVACR components and control circuits. The components include single and polyphase transformer and motors, heating and air conditioning controls, commercial defrost timers, motor starters, contactors, relays and other control devices. Lab exercises focus on developing wiring diagrams; wiring, troubleshooting and analyzing circuits based on lecture material.

Course Co requisite:..............MATH 116

Final Exam:...........................Final Exam: The final exam for this course is scheduled by the University to prevent conflict with other courses. The scheduled time is as follows:

**Monday, April 30th, 10:00 – 11:40 AM.**

## Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

1. Alternating current and electrical circuit characteristics.
2. Single and three phase transformers.
3. All forms of motors.
4. Wiring diagrams and schematics.
5. Low voltage devices.
6. Control devices.

HVAC 127

*(Return to TOC)*

(Double click to open embedded Adobe Acrobat document.)

***FERRIS STATE UNIVERSITY***

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

HVAC 127 SYLLABUS

**Course: HVAC 127** **Advanced HVACR Controls**

**Credit hours:** Three
**Contact hours** Two lecture hours and three lab hours

**Course description:** The study of advanced controls related to residential and commercial applications. The course focuses on control components, wiring, and control sequences used in direct digital control systems. Lab exercises concentrate on control system wiring, configuration, operations, and troubleshooting.

**Prerequisites: HVAC 101, HVAC 111, HVAC 117, all with a grade of C- or better.**

**Required Textbooks:** *Refrigeration & Air Conditioning Technology*, Whitman, Johnson, Tomczyk, and Silberstein, 7th or 8th edition.

**Faculty:** Brian Holton
**Office location:** Grainger 212
**Office phone:** 591-2322
**Home phone**
**E mail:** brianholton@ferris.edu

**Office hours:**

Assistance in this course is available to help you with academic or personal problems.
Students are encouraged to seek help as needed.
**Sources for assistance:**

1. Office hours: I am available during regular scheduled office hours or by appointment.
2. Academic advisor: meet with your advisor for assistance with registration.
3. Education counselor
4. Academic Support Services Center: this center provides free tutoring and assistance with test anxiety, study skills, writing skills, exam preparation, content reading, personal growth, and classroom skills.

**Disabilities Services:**
Any student registered with Disabilities Services should contact the instructor as soon as possible for assistance with classroom accommodations.

**Student Learning Outcomes**

Students satisfactorily completing this course will achieve proficiency in:

1. HVACR control terminology and Direct digital controls (DDC) basics
2. Valve and damper actuators
3. Pneumatic control basics
4. Advanced residential and light commercial thermostats
5. Variable frequency drives (VFD)
6. Air-side economizer controls
7. Change-over bypass (VVT) control systems
8. Variable Air Volume Systems and Controls

*HVAC 102*

(Return to TOC)

**FERRIS STATE UNIVERSITY**

COLLEGE OF TECHNOLOGY

HVACR DEPARTMENT

**HVAC 132**

**Course Syllabus**

| | |
|---|---|
| **Course:** | HVAC 132: Fundamentals of Heating and Mechanical Systems |
| **Semester Hours:** | 5 Hours per Week |
| **Contact Hours:** | Lecture: 3 Hours a Week, Lab: 6 Hours per Week |
| **Course Description:** | A study of combustion in conventional and high-efficiency units. The study of residential and commercial gas fired equipment. Topics include mechanical and electrical components, operations, testing, and Troubleshooting. |
| **Prerequisites:** | HVAC 111 and Math 116, both with a grade of C– or better or a minimum score of 24 on ACT or 560 on SAT |
| **Textbooks Required:** | Refrigeration & Air Conditioning Technology, 8th Edition, Whitman, Johnson, Tomczyk, and Silberstein. |
| **Course Website:** | Gradebook and other information is provided through Blackboard for this course. |
| **Contact Information:** | Name: Professor Gerard Lucas<br>Office Location: Granger 218<br>Office Phone: 231-591-3764<br>Home Phone: 253-459-4071<br>E-mail: GerryLucas@ferris.edu |
| **Office Hours:** | Tuesday and Thursday 1:00 to 2:50, or by appointment. |

## *HVAC 207*

(Return to TOC)

(Double click to open embedded Adobe Acrobat document.)

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

Spring 2018 SYLLABUS

**Course: HVAC 207** **Commercial Refrigeration Systems**

**Credit hours:** Five
**Contact hours** Three lecture hours and six lab hours
**Course description:** A study of commercial and industrial refrigeration systems associated with supermarkets, restaurants and storage facilities. Topics include electrical & mechanical refrigeration systems found in today's applications. Laboratory periods will cover testing, adjusting and troubleshooting electrical and mechanical systems.

**Prerequisites: HVAC 102, HVAC 117, both with a grade of C- or better.**

**Required Textbooks:** *Refrigeration & Air Conditioning Technology*, Whitman, Johnson, Tomczyk, and Silberstein.

**Faculty:** Brian Holton
**Office location:** Grainger
**Office phone:** 591-2322
**E mail:** brianholton@ferris.edu

**Office hours:**

Assistance in this course is available to help you with academic or personal problems.
**Sources for assistance:**

1. Office hours: I am available during regular scheduled office hours or by appointment.
2. Academic advisor: meet with your advisor for assistance with registration.
3. Education counselor
4. Academic Support Services Center: this center provides free tutoring and assistance with test anxiety, study skills, writing skills, exam preparation, content reading, personal growth, and classroom skills.

**Disabilities Services:**
A student registered with Disabilities Services shall contact the instructor as soon as possible for assistance with classroom accommodations.

**Student Learning Outcomes**

Students satisfactorily completing this course will achieve proficiency in:

1. Commercial ice machines.
2. Water cooled condensers.
3. Single phase compressor starting devices
4. Commercial refrigeration components
5. Commercial refrigeration control systems – temperature, pump-down, and defrost
6. Food preservation issues and effect of coil TD on humidity
7. Troubleshooting commercial refrigeration systems.
8. Low ambient controls, valves, and operation
9. Compressor failures and corrections
10. Specialty refrigeration valves.
11. Refrigeration system lubrication issues and safety controls
12. Parallel compressors and supermarket systems
13. Applicable ammonia and carbon dioxide systems (time permitting)

## HVAC 208

(Return to TOC)

(Double click to open embedded Adobe Acrobat document.)

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

Fall 2017 SYLLABUS

**Course: HVAC 208** **Air-Conditioning Applications**

**Credit hours:** Five
**Contact hours** Three lecture hours and six lab hours
**Course description:** A study of mechanical air conditioning equipment including heat pump, chiller, absorption refrigeration, cooling tower and evaporative cooling applications. Compressor types and capacity control systems are included. Hands on laboratories cover electrical systems, capacity testing and troubleshooting of residential and light commercial mechanical and electrical systems.

**Prerequisites: HVAC 102, HVAC 117, both with a grade of C- or better.**
**Required Textbooks:** Refrigeration & Air Conditioning Technology, 7th Edition, Whitman, Johnson, Tomczyk, and Silberstein.

**Faculty:** Brian Holton
**Office location:** Grainger
**Office phone:** 591-2322
**Home phone**
**E mail:**

**Office hours:**

Assistance in this course is available to help you with academic or personal problems.
Students are encouraged to seek help as needed.
**Sources for assistance:**

1. Office hours: I am available during regular scheduled office hours or by appointment.
2. Academic advisor: meet with your advisor for assistance with registration.
3. Education counselor
4. Academic Support Services Center: this center provides free tutoring and assistance with test anxiety, study skills, writing skills, exam preparation, content reading, personal growth, and classroom skills

**Disabilities Services:**
Any student registered with Disabilities Services should contact the instructor as soon as possible for assistance with classroom accommodations.

**Student Learning Outcomes**

Students satisfactorily completing this course will achieve proficiency in:

1. System classifications
2. Psychrometrics for air conditioning
3. Refrigerants and refrigerant charging for air conditioning
4. Maintenance, testing and troubleshooting for air conditioning systems
5. Installation and replacement considerations for air conditioning systems
6. Economizers
7. Heat pump system types and operation
8. Cooling tower system types and operation
9. Chiller system types and operation
10. Capacity control methods

HVAC 312

(Return to TOC)

(Double click to open embedded Adobe Acrobat document.)

Ferris State University

**Syllabus – Winter 201X**
**HVAC 312**
**HVACR Department**

| | |
|---|---|
| **COURSE TITLE:** | HVAC 312 Control Theory and Application |
| **COURSE DESCRIPTION:** | The study of control loop theory related to commercial and industrial comfort, process and safety applications. The course focuses on analog electronic and pneumatic control components and their systems used in new and existing applications. Lab exercises concentrate on control system operation and analysis. |
| **CREDIT HOURS:** | 4 Semester Credit Hours |
| **PREREQUISITE:** | A grade of C- or better in HVAC 321, HVAC 342 and MATH 126 |
| **REQUIRED TEXT:** | Information sheets provided within BlackBoard |

Instructor: Eric Quilitzsch
Phone 231-591-2747
GRN 219
E:Mail: quilitzj@ferris.edu

## GRADING POLICY

| | |
|---|---|
| A | 94 - 100 |
| A- | 90 - 93 |
| B+ | 87 - 89 |
| B | 84 - 86 |
| B- | 81 - 83 |
| C+ | 78 - 80 |
| C | 75 - 77 |
| C- | 73 - 74 |
| D+ | 71 – 72 |
| D | 69 - 70 |
| D- | 66 - 68 |
| F | Below 66 |

Classroom Policies:

Late entry may result in being marked absent.

2 Days absence will be excused automatically.

Attendance shall be based on 5 days for the 50 Pts Attendance grade.

Late work will may be reduced by 10% / day

Students are responsible for adhering to University policies as set forth in the Student Handbook. In particular I would invite you to read the section III.A. Academic Misconduct and understand that the minimum penalty for Academic Misconduct is outlined in the Student Handbook. Students caught cheating, falsifying, plagiarizing, or interfering as defined in the Student Handbook will receive a failing grade for the course.

**Office Hours**
M,W,F 10-10:50
W 9-9:50

**Approximate Course Points**
Quizzes (5 @ 10 pts) 50
Online Assessments (10 @ 10 pts ea.) 100
Labs (13@ 30 pts ea.) 390
Exams (4 @ 100) 400
Attendance (5 missed or late days @ 10pts ea.) 50

Ferris State University
College of Engineering Technology
School of Built Environment
HVACR Department

**HVAC-342 Course Syllabus Fall 2018**

## Course Name: HVAC 342

### HVAC Load Calculations and Energy Codes

## Course Description:

Complete heat loss and gain calculations for commercial and industrial buildings will be performed manually and utilizing currently available computer software packages. Student will perform load calculations with the expectations to understand minimum required and maximum energy efficiency.

Energy estimating methods will be studied and an analysis of a building using the Performance Rating Method as described in ASHRAE Standard 90.1 appendix G. Current federal, state and local codes and standards will be examined as they apply to HVAC systems.

## Semester Hours:

4

## Contact Hours:

Lectures M-W-F 08:00-08:50 AM

Labs: Section 211 8:00-10:50 Monday, Section 212: 8:00-10:50 Wednesday

## Prerequisites:

Admission to HVACR Engineering Technology Program

## Textbook and Required Materials:

**2009 ASHRAE Handbook of Fundamentals**

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. 2009 & CD, be sure to order the correct version (I/P (inch pounds) vs. S/I)

Course Pack Will be available at the on campus bookstore

**Safety glasses** please bring them to lectures and labs when asked so that we can be more expedient with the class.

## Reference Materials: (Not Required to Purchase)

**Principles of Heating Ventilating and Air Conditioning (not required)**

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. 2005 &CD

**HVAC Systems and Equipment (not required to purchase)**

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. Current
Typically required in other HVAC courses

# HVAC Engineering Technology & Energy Management
## Syllabus HVAC 350

**COURSE DESCRIPTION:**

HVAC-350 is the study of contracting issues as related to the HVACR industry. The course will focus on plans and specifications, estimating, budget issues, project management, economic cost analysis and codes and standards, all from the perspective of an HVACR professional. Assignments and Laboratory exercises focus on application of contracting issues.

**SEMESTER HOURS:** 4

**CONTACT HOURS:**

Spring 2018
Sec.211: Lectures. Tuesday & Thursday: 9:30-10:45, Lab Tuesday: 12:00-2:50
Sec.212: Lectures. Tuesday & Thursday: 9:30-10:45, Lab Thursday: 12:00-2:50

**PREREQUISITES:** HVAC 290, HVAC 325 & HVAC 342

**TEXTBOOK & REQUIRED MATERIAL:** RSMEANS Mechanical Cost Data 2018

ISBN 978-1-946872-13-5Edition: 41st (Amazon.com ~ $200.00)
Microsoft Office various programs, Excel & Word plus Microsoft Project (Provided in Lab for on-campus students)
On Center Takeoff Software (Provided in Lab and remote access codes for on-campus students)

**REFERENCES:**

***Referenced Materials*** **(Not required to purchase as they will be provided)**
On Center Takeoff Software, Free Download, requires access code from Professor
The Project Resource Manual, A CSI Manual of Practice 5th Edition 2005
ASHRAE, Standards 15, 55, 62.1 & 90.1
International Code Council (ICC), International Mechanical Code 2012 -2018
RS Means, Building Construction Cost Data 66th Annual Edition, 2008
MCAA Project Manager's Manual, Mechanical Contractors Association of America & Plumbing Contractors of America,

## HVAC 415

(Return to TOC)

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Ferris State University

## HVAC 451

(Return to TOC)

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**FERRIS STATE UNIVERSITY**
COLLEGE OF TECHNOLOGY
CONSTRUCTION DEPARTMENT
HVACR PROGRAMS

**SYLLABUS**

### COURSE TITLE:

HVAC 451, Energy Analysis and Audit

### COURSE DESCRIPTION:

The survey of utility rate structures, billing energy consumption and energy profiling of commercial and industrial buildings. On-site audit projects will report on recommendations to building envelopes, HVACR systems and control systems with regard to payback. Oral and written presentations are a requirement of this senior project.

### SEMESTER HOURS:

4

### CONTACT HOURS:

| | | | |
|---|---|---|---|
| Lecture: | 3 Hours / Week | Fall 2018: | Sec. 211 & 212; T, R; 9:30am - 10:45am |
| Lab: | 3 Hours / Week | Fall 2018: | Sec. 212; T; 12:00pm - 2:50pm |
| | | | Sec. 211; R; 12:00pm - 2:50pm |

### PREREQUISITES:

Math 126 or Math 130, HVAC 393 or Waiver, all HVAC courses with grade of C– or better.

### TEXTBOOK REQUIRED:

None

### REFERENCES & Course Pack:

*Capehart, Turner and Kennedy, ***Guide to Energy Management,*** The Fairmont Press, 8th Edition.
*Doty and Turner, ***Energy Management Handbook***, The Fairmont Press, 8th Edition.
*Thumann and Mehta, ***Handbook of Energy Engineering***, The Fairmont Press, 7th Edition.

Reiter, Sydney, ***The Financial Evaluation of Energy Costs and Projects,*** Van Nostrand Reinhold, 1985.

There is a required course pack at the campus bookstore.

* Suggested reference books to study for the CEM (Certified Energy Manager) exam.

## *HVAC 462*

(Return to TOC)

(Double click to open embedded Adobe Acrobat document.)

**FERRIS STATE UNIVERSITY**
College of Engineering Technology
School of Built Environment
HVACR PROGRAMS

# SYLLABUS

## COURSE TITLE:

HVAC 462, HVAC Primary Equipment Selection

## COURSE DESCRIPTION:

The selection, application and layout of state-of-the-art equipment and systems for commercial and industrial buildings. Emphasis will be placed upon the energy efficiency, integration of equipment into a complete system, and sequence of operation.

## SEMESTER HOURS:

4

## CONTACT HOURS:

Fall 2017
Sec. 211: Lec. T, R - 9:30am - 10:45am, Lab R - 2:00pm - 4:50pm
Sec. 212: Lec. T, R - 9:30am - 10:45am, Lab T - 2:00pm - 4:50pm

## PREREQUISITES:

HVAC 393 and MATH 126 with C- or better in both.

## TEXTBOOK REQUIRED:

<u>**2013 or 2017 ASHRAE Fundamentals Handbook**</u> - See library

<u>**2012 or 2016 ASHRAE Handbook - HVAC Systems & Equipment**</u> - See library

Suggested Reference: ACCA Manual CS "Commercial Applications, Systems and Equipment"

## Units of Instruction - (Time / Weight):

| | Areas of Instruction | Time |
|---|---|---|
| I | Introduction | 1 |
| II | Air Handling Units | 8 |
| III | Heat Exchangers | 3 |
| IV | Boiler Systems | 6 |
| V | Chiller Systems | 8 |
| VI | Cooling Towers | 5 |
| VII | Heat Pumps | 3 |

| | Areas of Instruction | Time |
|---|---|---|
| VIII | Thermal Storage | 2 |
| IX | Piping Layouts | 2 |
| X | Variable Refrigerant Flow Systems | 3 |
| XI | Semester Project | 1 |
| XII | Exams | 3 |
| | Total Hours | 45 |
| | | |

## *HVAC 499*

(Return to TOC)

(Double click to open embedded Adobe Acrobat document.)

**FERRIS STATE UNIVERSITY**
College of Engineering Technology
School of Built Environment
HVACR Programs

**SYLLABUS**

### COURSE TITLE:

HVAC 499, Commercial HVAC System Design

### COURSE DESCRIPTION:

Given building architectural plans, appropriate software, codes and standards, and owner's requirements, students will select appropriate HVAC systems, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation.

### SEMESTER HOURS:

4

### PROFESSOR:

Michael J. Korcal, C.E.M., MT(ASCP)

### CONTACT & OFFICE HOURS:

**Spring Semester 2018**

Office Hours:
Mon: 11:00am - 11:50am & 1:00pm - 1:50pm
Wed: 11:00am - 11:50am, 1:00pm - 1:50pm

Office:
GRN 203

Phone:
231-591-2626

e-mail:
korcalm@ferris.edu (But use the Blackboard communications!)

## Appendix five: Course Check Sheets.

(Return to TOC)

*Check sheet: HVACR Technology (HVAR)*

HVAR_AAS_TE_2018-2019.pdf

*Check Sheet: HVACR Engineering Technology and Energy Management (HVEM)*

HVEM_BS_TE_2018-2019.pdf

## Appendix six: Course Level Outcomes and Learning Objectives

(Return to TOC)

Course Level Outcomes.pdf

## Appendix seven: Trac Dat Assessment Report

(Return to TOC)

Assessment_ Course Planning Final .pdf

## Appendix eight: Curriculum Vitae

(Return to TOC)


- **Joseph Charles Compton**

College of Technology/HVACR Department
605 S Warren Ave – Granger Building
Ferris State University
Big Rapids, MI 49307
Phone: 231-591-3062

911 Cherry Ave
Big Rapids, MI 49307
Phone: 231-796-3673
Cell: 231-250-2926
comptonj@ferris.edu


### Education

- **Master of Business Administration**, Ferris State University, Big Rapids, MI, received December, 2007 ***Highest Honors***.
- **Bachelor of Science, HVACR Engineering Technology**, Ferris State University, Big Rapids, MI, received May, 2003 ***Highest Honors***.
- **Bachelor of Science, Machine Tool Engineering Technology**, Ferris State University, Big Rapids, MI, received February, 1992 ***Honors***.
- **Associate in Applied Science, HVACR Technology,** Ferris State University, Big Rapids, MI, received December, 1997 ***Honors***.
- **Associate in Applied Science, Machine Tool Technology,** Ferris State University, Big Rapids, MI, received May, 1988.
- **Associate in Ornamental Horticulture Technology**, Ferris State University, Big Rapids, MI, received September 1978 ***Highest Honors.***

### Honors and Awards

- 2006 Jeff Forker Award for Excellence in Training by the National Air Conditioning Contractors of America – Student Chapter Advisor
- 2008,2010,2012,2013 USA Skills Competition State Winner in HVAC – Student Chapter Advisor

### Professional Development

- Waterfurnace Series 7 and Series 5 ground source heat pump Service course 2014
- Designed, installed and commissioned 5-ton commercial mini-split heat pump Summer 2013
- Co-designed, installed and commissioned heating system in Energy Star version 3 and control system Spring 2013
- Performed CSD1 check on commercial boiler systems Fall 2012 & 13
- Renovated Hydronic Boiler system to accept new high efficiency boiler Winter 2012
- Designed and installed split system hybrid furnace heat pump heat/cool system Summer 2011
- Designed and installed mini 3-ton split heat pump system Summer 2010
- Designed and installed hydronic radiant floor heating system Fall 2009
- Mr. Slim Service Course, Mitsubishi Electric, June, 2008
- RTHC Rotary Chiller Service Training, Trane, June 2008
- CITY MULTI Service Course, Mitsubishi Electric, May, 2008
- Comfort College Training School, Arzel, March, 2008
- ACCA (Air Conditioning Contractors of America) National Conference, Winter 2008
- FerrisConnect Course Management System Training, Ferris State University, January, 2008

- ARI (Air Conditioning and Refrigeration Institute) Teacher Workshop, Ferris State University, July, 2007
- ACCA National Conference, Winter, 2007
- Winter ASHRAE (American Society of Heating Refrigeration and Air-Conditioning Engineers)/AHR (Air-Conditioning, Heating and Refrigeration) Expo, 2007
- Variable Refrigerant Flow and Distributed Capacity Systems Training, Mitsubishi Electric & Electronics USA, Inc., HVAC Advanced Products division, November, 2006
- Introduction to Pneumatic Controls, Siemens, August, 2006
- Geothermal Heatpumps, Hydro Heat, July, 2006
- ACCA National Conference, Winter, 2006
- Winter ASHRAE/AHR Expo, 2006
- Variable Frequency Drives, Trane, December, 2005
- ACCA National Conference, Winter, 2005
- Winter ASHRAE/AHR Expo, 2005
- Hot Water Boiler Schematics, Behler-Young Grand Rapids Training Center, February, 2005
- Rooftop Unit Troubleshooting, Behler-Young Grand Rapids Training Center, February, 2005
- Steam Utilization and Energy Management, Merlo Steam, Armstrong Steam University, January, 2005

**Teaching Experience**

- **Spring 2018** **HVAC 235 Advanced Heating – Mechanical Systems**
- **Fall 2017** **FSUS 100 Ferris State University Seminar**
- **Fall 2017** **HVAC 102 HVAC 102 Advanced Refrigeration & AC**
- **Fall 2017** **HVAC 235 Advanced Heating – Mechanical Systems**
- **Summer 2017** **HVAC 393 Internship Coordinator**
- **Spring 2017** **HVAC 102 HVAC 102 Advanced Refrigeration & AC**
- **Spring 2017** **HVAC 235 Advanced Heating – Mechanical Systems**
- **Spring 2017** **HVAC 245 HVAC 245 HVAC Unitary System Design**
- **Fall 2016** **HVAC 102 HVAC 102 Advanced Refrigeration & AC**
- **Fall 2016** **HVAC 235 Advanced Heating – Mechanical Systems**
- **Fall 2016** **HVAC 245 HVAC 245 HVAC Unitary System Design**
- **Spring 2016** **HVAC 102 HVAC 102 Advanced Refrigeration & AC**
- **Spring 2016** **HVAC 235 Advanced Heating – Mechanical Systems**
- **Fall 2015** **HVAC 102 HVAC 102 Advanced Refrigeration & AC**
- **Fall 2015** **HVAC 235 Advanced Heating – Mechanical Systems**
- **Summer 2015** **HVAC 393 Internship Coordinator**
- **Spring 2015** **HVAC 208 Air Conditioning Applications**
- **Spring 2015** **HVAC 235 Advanced Heating – Mechanical Systems**
- **Fall 2014** **HVAC 208 Air Conditioning Applications**
- **Fall 2014** **HVAC 235 Advanced Heating – Mechanical Systems**
- **Spring 2014** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Spring 2014** **HVAC 208 Air Conditioning Applications**
- **Spring 2014** **HVAC 235 Advanced Heating – Mechanical Systems**
- **Fall 2013** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Fall 2013** **HVAC 208 Air Conditioning Applications**
- **Spring 2013** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Spring 2013** **HVAC 208 Air Conditioning Applications**
- **Fall 2012** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**

- **Fall 2012** **HVAC 208 Air Conditioning Applications**
- **Spring 2011** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Spring 2011** **HVAC 208 Air Conditioning Applications**
- **Fall 2010** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Fall 2010** **HVAC 102 Thermodynamics of Refrigeration**
- **Fall 2010** **HVAC 208 Air Conditioning Applications**
- **Spring 2009** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Spring 2009** **HVAC 208 Air Conditioning Applications**
- **Fall 2009** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Fall 2009** **HVAC 208 Air Conditioning Applications**
- **Fall 2008** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Fall 2008** **HVAC 208 Air Conditioning Applications**
- **Spring 2008** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Spring 2008** **HVAC 208 Air Conditioning Applications**
- **Fall 2007** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Fall 2007** **HVAC 208 Air Conditioning Applications**
- **Spring 2007** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Spring 2007** **HVAC 208 Air Conditioning Applications**
- **Spring 2007** **HVAC 245 Design of Heating, Ventilation and Air Conditioning Systems**
- **Fall 2006** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Fall 2006** **HVAC 208 Air Conditioning Applications**
- **Winter 2006** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Winter 2006** **HVAC 208 Air Conditioning Applications**
- **Winter 2006** **HVAC 245 Design of Heating, Ventilation and Air Conditioning Systems**
- **Fall 2005** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Fall 2005** **HVAC 208 Air Conditioning Applications**
- **Winter 2005** **HVAC 208 Air Conditioning Applications**
- **Winter 2005** **HVAC 245 Design of Heating, Ventilation and Air Conditioning Systems**
- **Fall 2004** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Fall 2004** **HVAC 208 Air Conditioning Applications**
- **Winter 2004*** **HVAC 101 Introduction to Refrigeration and Air Conditioning Systems**
- **Fall 2003*** **HVAC 102 Thermodynamics of Refrigeration**

*Adjunct Faculty

**Consulting and/or HVACR Work Experience**

- 5/14 – 11/16 Habitat for Humanity Houses
- Summer 2014 High school students recruiting one week Summer camp
- Summer 2009 (5) Three week training sessions to Hobart refrigeration training
- Summer 2008 HVACR Technician, Seaman's Heating & Refrigeration
- 1/94 – 8/04 HVACR Technician, Ferris State University

**Other Experience**

- 9/93 – 1/94 Groundskeeper, Ferris State University
- 7/91 – 2/92 Quality Control Engineer, International Furniture Technology
- 6/90 – 2/91 Process Engineer, FitzSimons Manufacturing Company
- 10/85 – 8/93 Custodian, Ferris State University
- 2/85 – 10/85 Insurance Agent, Combined Insurance of America
- 10/84 – 2/85 District Manager, Detroit Free Press
- 4/81 – 9/84 Greens Superintendent, Ludington Hills Golf Club
- 5/78 – 4/81 Assistant Greens Superintendent, Katke Golf Course, FSU

**Professional Affiliations & Certifications/Licenses**

- Energy Star Version 3 Contractor
- Member - Air Conditioning Contractors of America (ACCA)
- Faculty Advisor – West Michigan Student Chapter of ACCA
- Boiler Installer's License, State of Michigan
- Mechanical Contractor License, State of Michigan

**Committee Work**

- ACCA Professional Development Committee (National Committee)

**Community Service**

- Habitat for Humanity
- Faculty Advisor – Heat's On Community Service Project
- Cub Scouts – Instructed troop in sheet metal project
- Chair, Board of Trustees, First United Methodist Church
- Member, Board of Trustees, First United Methodist Church
- Member, Endowment Committee, First United Methodist Church
- Member, Administrative Council, First United Methodist Church
- Member, Education Committee, First United Methodist Church

(Return to TOC)

**Michael J. Feutz**

Ferris State University
CET - School of Built Environment
(231) 591-2351
Email: MikeFeutz@ferris.edu

**Education**

PhD, Western Michigan University, 2010.
Major: Educational Leadership
Supporting Areas of Emphasis: Career and Technical Education
MS, Ferris State University, 2001.
Major: Career and Technical Education
Supporting Areas of Emphasis: Administration
BS, Ferris State University, 1997.
Major: HVACR Engineering Technology
Certificate, Ohio State University, 1996.
Major: Sheet Metal Apprentice Instructor
Certificate, American Welding Society, 1995.
Major: Certified Welding Educator
Certificate, American Welding Society, 1994.
Major: Certified Welding Instructor
Certificate, Sheet Metal Workers Apprentice Program, 1981.
Major: Journeyman Sheet Metal Worker
AAS, Grand Rapids Junior College, 1976.
Major: Heating, Refrigeration and Air Conditioning

**Professional Positions**

**Academic - Post-Secondary**

Professor, Ferris State University. (2009 - Present).
HVACR Department Chair, Ferris State University. (1998 - 2009).
Instructor, Ohio State University. (1983 - 1989).

**Professional**

Coordinator, Instructor, Certified Welding Educator and Inspector (American Welding Society),
Western Michigan Sheet Metal Joint Apprenticeship Training Committee (J.A.T.C.). (1989 -
1998).
Sheet Metal Worker, Enterprise Construction Services, J. Klanderman Company, Franklin
Holwerda Company, Heights Sheet Metal. (1977 - 1989).

**Teaching Experience**

**Ferris State University**

HVAC 285, HVAC System Design using BIM, 5 courses.
HVAC 321, HVAC Air System Select-Design, 2 courses.
HVAC 325, HVAC Hydronic System Slct-Dsgn, 2 courses.
HVAC 483, HVACR Building Systems, 1 course.

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**Eric D. Fradette**

Ferris State University
CET - School of Built Environment
(231) 591-3763
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**Education**

MS, Ferris State University, 2016.
Major: Career and Technical Education Instructor
BS, Ferris State University, 2006.
Major: HVACR Engineering Technology
AAS, Ferris State University, 2001.
Major: HVACR Technology

**Professional Positions**

**Professional**

Mid-state Service Instructor, United Association, Mid-Michigan. (August 2013 - August 2014).
Journeyman Service Technician, Hurst Mechanical. (May 2007 - August 2013).
Project Manager - Equipment, Trane West Michigan. (May 2006 - May 2007).
Intern, Johnson Controls. (May 2005 - August 2005).
Service Technician, Werner Plumbing and Heating. (October 2001 - August 2004).
Service Technician, Refrigeration Engineering, Inc. (May 2001 - October 2001).

**Licensures and Certifications**

Completion of Apprenticeship - Mechanical Equipment Service Journeyman, United Association - Plumbers, Pipe Fitters, and HVACR Service Technicians. (August 22, 2009 - Present).
CSD-1 Certification, Boiler Risk Control. (January 15, 2009 - Present).
OSHA 10 Certification, Occupational Safety and Health Administration. (October 10, 2008 - Present).
UA STAR HVACR Mastery Certification, United Association - Plumbers, Pipe Fitters, and HVACR Service Technicians. (August 23, 2008 - Present).
HVAC Excellence Green Mechanical Certification, HVAC Excellence. (August 1, 2008 - Present).
HVAC Excellence Carbon Monoxide Inspector Certification, HVAC Excellence. (May 23, 2008 - Present).
R410A Safe Handling Certification, Air Conditioning & Refrigeration Safety Coalition. (May 21, 2008 - Present).
HVAC Excellence Combustion Analysis Certification, HVAC Excellence. (March 27, 2008 - Present).
Mechanical Contractors License, State of Michigan. (August 2006 - Present).
EPA 608 - Universal, Environmental Protection Agency. (November 8, 2000 - Present).

**Professional Memberships**

American Society of Refrigeration and Air Conditioning Engineers. (June 10, 2018 - Present).

American Society of Refrigeration and Air Conditioning Engineers - West Michigan Chapter. (June 10, 2018 - Present).
Refrigeration Service Engineers Society. (May 16, 2018 - Present).
United Association. (August 7, 2007 - Present).

**Development Activities Attended**

Manufacturer Training, "LG Air Conditioning Systems Multi V IV Installation Essentials," Comfort Engineering Solutions, Farmington, Michigan, United States. (May 9, 2018 - May 10, 2018).
Conference Attendance, "AHR Expo," ASHRAE, Chicago, Illinois, United States. (January 23, 2018).
Workshop, "Digital Signage Training," Ferris State University, Big Rapids, Michigan, United States. (September 12, 2017).
Conference Attendance / Exhibitor, "United Association Pipe Trades Training and Technology Conference," United Association, Orlando, Florida, United States. (February 15, 2017 - February 16, 2017).
Workshop, "2016 HVACR Instructors Workshop," Ferris State University - HVACR Department, Big Rapids, Michigan, United States. (August 1, 2016 - August 3, 2016).
Industry Training, "Focus on Refrigerants," Young Supply Company / Emerson Corporation, Grand Rapids, Michigan, United States. (April 28, 2016).
Industry Training, "Introduction to Industrial Ammonia Refrigeration Operations," Wagner-Meinert LLC, Holland, Michigan, United States. (October 15, 2015).
Conference Attendance, "40th Anniversary Trades Expo," Johnstone Supply, Grand Rapids, Michigan, United States. (September 10, 2015).
Conference Attendance, "National HVACR Educators and Trainers Conference," HVAC Excellence, Las Vegas, Nevada, United States. (March 20, 2015 - March 24, 2015).
Conference Attendance, "AHR Expo," ASHRAE, Chicago, Illinois, United States. (January 26, 2015).
Manufacturer Training, "Instructor Training for Baxi Boiler Installation and Service," Marathon International, Big Rapids, Michigan, United States. (December 15, 2014 - December 16, 2014).
Workshop, "FerrisConnect Training," Ferris State University - Faculty Center for Teaching and Learning, Big Rapids, Michigan, United States. (December 10, 2014).
New Product Training, "iManifold," Johnstone Supply, Big Rapids, Michigan, United States. (December 4, 2014).
Continuing Education Program, "United Association Instructor Training Program," United Association, Ann Arbor, Michigan, United States. (August 10, 2013 - August 16, 2013).
Factory Training, "WME Magnetic Bearing Centrifugal Chillers," Daikin McQuay, McLean, Virginia, United States. (May 21, 2013 - May 23, 2013).
Factory Training, "Lochinvar Boiler Service Training," Lochinvar, Lebanon, Tennessee, United States. (October 6, 2011 - October 7, 2011).
Factory Training, "AAON Air Conditioning Equipment - Factory Trained Technician Course," AAON, Tulsa, Oklahoma, United States. (September 27, 2010 - September 28, 2010).
Manufacturer Training, "Watt Master Controls - Orion Control Systems," Watt Master Controls / Airtech, Grand Rapids, Michigan. (December 2, 2008 - December 3, 2008).

Industry / Manufacturer Training, "Armstrong Steam University," Armstrong International, Three Rivers, Michigan, United States. (April 9, 2008).

**TEACHING**

**Teaching Experience**

**Ferris State University**

HVAC 101, Intro to Refrig and AC Systems, 13 courses.
HVAC 111, Electricity, Blueprints, and Fabrication, 5 courses.
HVAC 117, Advanced Electricity-Circuits, 12 courses.
HVAC 208, Air Conditioning Applications, 3 courses.

**Non-Credit Instruction**

HVACR Summer Camp, Ferris State University HVACR Department, 16 participants. (June 4, 2018 - June 5, 2018).

HVACR Summer Camp, Ferris State University HVACR Department, 16 participants. (July 9, 2017 - July 14, 2017).

"Fundamentals of Electrical Measurements, Diagram Reading and Troubleshooting", Spectrum Health Hospital, 6 participants. (May 24, 2017 - May 25, 2017).

"Fundamentals of Refrigeration Systems", Spectrum Health Hospital, 6 participants. (May 17, 2017 - May 18, 2017).

HVACR Summer Camp, Ferris State University HVACR Department, 16 participants. (July 12, 2015 - July 17, 2015).

**SCHOLARSHIP AND RESEARCH**

**Awards and Honors**

Outstanding Student - Master of Science (Career & Technical Education) program for 2016-17, Ferris State University, College of Education and Human Services. (April 29, 2017).

**SERVICE**

**University Service**

Committee Member, HVAC Marketing Committee. (August 23, 2017 - Present).
Develop and maintain "Tool Sign Out" system. (August 2014 - Present).
Attendee, Graduation. (May 5, 2018).
State of Michigan High School Skills USA Contest Organizer / Judge, Skills USA. (April 21, 2018).
Attendee, Award Ceremony, Women in Engineering Technology. (April 19, 2018).
Student/Industry Connection, ASHRAE AHR Expo. (January 23, 2018).
Attendee, Meeting, Mecosta-Osceola Intermediate School District. (November 17, 2017).
Judge for Campus Wide Public Speaking Contest. (October 23, 2017).
Served as Marshal at Spring 2017 Commencement - College of Engineering Technology. (May 6, 2017).
Student Recruiter, Ferris State University HVACR Dawg Days Event. (April 22, 2017).
Attendee, Award Ceremony, Women in Engineering Technology. (April 18, 2017).
State of Michigan High School Skills USA Contest Organizer / Judge, Skills USA. (April 8, 2017).
Student Recruiter, Southern Technical College in Orlando Florida. (February 16, 2017).
Student Recruiter, United Association Pipe Trades Training & Technology Conference. (February 15, 2017 - February 16, 2017).
Judge for Campus Wide Public Speaking Contest. (November 2, 2016).
Served as Marshal at Spring 2016 Commencement - College of Engineering Technology. (May 7, 2016).
Student Recruiter, Ferris State University HVACR Dawg Days Event. (April 16, 2016).
State of Michigan High School Skills USA Contest Organizer / Judge, Skills USA. (April 9, 2016).
Judge for Campus Wide Public Speaking Contest. (November 2, 2015).
Served as Marshal at Spring 2015 Commencement - College of Engineering Technology. (May 9, 2015).

State of Michigan "Post-Secondary" Skills USA Contest Organizer / Judge, Skills USA. (April 18, 2015).
State of Michigan High School Skills USA Contest Organizer / Judge, Skills USA. (April 18, 2015).
Regional "Post-Secondary" Skills USA Contest Organizer / Judge, Skills USA. (April 11, 2015).
Student/Industry Connection, ASHRAE AHR Expo. (January 26, 2015).
Judge for Campus Wide Public Speaking Contest. (November 17, 2014).

**Public Service**

Coach, Big Rapids Little League, Big Rapids, Michigan. (May 1, 2017 - June 23, 2017).
Coach, Big Rapids Flag/Rocket Football & Cheerleading, Big Rapids, Michigan. (July 25, 2016 - August 19, 2016).
Assistant Coach, Big Rapids Little League, Big Rapids, Michigan. (April 25, 2016 - June 24, 2016).
Coach, Big Rapids Little League, Big Rapids, Michigan. (April 25, 2016 - June 24, 2016).
Coach, Big Rapids Flag/Rocket Football & Cheerleading, Big Rapids, Michigan. (July 27, 2015 - August 21, 2015).
Assistant Coach, Big Rapids Little League, Big Rapids, Michigan. (April 27, 2015 - June 26, 2015).
Coach, Big Rapids Little League, Big Rapids, Michigan. (April 27, 2015 - June 26, 2015).

**Awards and Honors**

**Service, University**

Received nomination for 2018 Nontraditional Student Advocate Award, Ferris State University. (April 18, 2018).

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**Brian Holton**

2572 Van Dyke Street
Conklin, MI 49403
616-899-5431

**Education:**
All three degrees from Ferris State University:
Masters of Education Career and Technical Education
Bachelor of Science HVACR Engineering Technology
Associate in Applied Science HVACR Technology

**Industry Experience:**
Ferris State University, HVACR Program Associate Professor, 11 years.
HVACR Service Technician, total of 21 years.
Employment in HVACR Industry, total of approximately 28 years **prior** to employment at Ferris.
Most recent employment prior to Ferris State University: B & V Mechanical, service, service manager, project management; sales and design, 17 Years total.
**Other Accomplishments and Professional Organization Membership**
Completed certification for Residential Energy Auditing (RESNET organization)
Member in ASHRAE, American Society of Heating, Refrigerating, Air Conditioning Engineers.
Received first place in the 2000 ASHRAE student design award as part of a six member team.
Performed research for the Department of Energy and National Renewable Energy Laboratory (NREL Build America Program). This was a multi-year contract with the Department of Energy.

**Michael J. Korcal CEM, MT (ASCP)**

Ferris State University
CET - School of Built Environment
(231) 591-2626
Email: MichaelKorcal@ferris.edu

**Education**
MS, Ferris State University, 2000.
Major: Career and Technical Education
Supporting Areas of Emphasis: Administration
BS, Ferris State University, 1991.
Major: HVACR Engineering Technology
AAS, Ferris State University, 1990.
Major: Refrigeration Heating and Air Conditioning
BS, Michigan State University, 1979.
Major: Medical Technology
**Professional Positions**
**Academic - Post-Secondary**
Associate Professor, Ferris State University. (August 2005 - Present).

Assistant Professor, Ferris State University. (1996 - 2001).
**Professional**
Senior Technical Instructor, Johnson Controls. (2001 - 2005).
IAQ/Control/Energy/Consultant/Instructor, Air-N-Energy Consulting. (1994 - 2001).
Project Manager/Designer, Technical Energy Solutions. (November 1992 - May 1994).
HVAC Designer - PR & D Division, The Upjohn Company. (October 1991 - November 1992).
HVAC Designer, The WBDC Group. (May 1990 - October 1991).
Assistant Laboratory Manager, East Paris Medical Laboratory. (October 1984 - November 1987).
**Licensures and Certifications**
Certified Energy Manager, Association of Energy Engineers. (June 2011 - Present).
Certified Metasys System Extended Architecture for Building Engineers Instructor, Johnson
Controls Learning Institute. (December 2003 - Present).
Certified Energy Management Fundamentals Instructor, Johnson Controls Learning Institute.
(September 2003 - Present).
Certified Metasys GPL Engineering Instructor, Johnson Controls Learning Institute. (July 19,
2002 - Present).
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Certified Metasys Hardware Troubleshooting Instructor, Johnson Controls Learning Institute.
(April 19, 2002 - Present).
Certified Metasys DX-9100 Engineering Instructor, Johnson Controls Learning Institute. (January
25, 2002 - Present).
Certified Metasys DX-9100 Operations & Troubleshooting Instructor, Johnson Controls Learning
Institute. (January 25, 2002 - Present).
Certified Metasys Operations: The Basics Instructor, Johnson Controls Learning Institute.
(January 2002 - Present).
Certified Metasys PMI Facility Operator Instructor, Johnson Controls Learning Institute. (January
2002 - Present).
Certified Medical Technologist, American Society of Clinical Pathologists. (August 15, 1980 -
Present).
**Professional Memberships**
Association of Energy Engineers. (2011 - 2018).
American Society of Heating, Refrigerating and Air Conditioning Engineers. (September 1990 -
2017).
Regional Vice Chair for Student Activities - Region 5, American Society of Heating, Refrigerating and Air Conditioning Engineers. (August 1999 - May 2001).

Student Coordinator, American Society of Heating, Refrigerating and Air Conditioning Engineers.
(September 1996 - May 2001).

**Development Activities Attended**

Webinar, "Building Control," ASHRAE. (November 16, 2017).
Webinar, "Energy Conservation," ASHRAE. (November 16, 2017).
Seminar, "Advancements in Energy Modeling," ASHRAE, Orlando, Florida, USA. (January 27,
2016).
Seminar, "The Science, Application and Art of Load Calculations," ASHRAE, Orlando, Florida,
USA. (January 25, 2016).
Seminar, "Commercial Building Energy Audits," ASHRAE, Orlando, Florida, USA. (January 23,
2016).
Webinar, "ASHRAE 90.1 - Building Envelope - Trade Off Option," ASHRAE. (November 21,
2014).
Webinar, "ASHRAE 90.1 - HVAC Prescriptive Req. 2," ASHRAE. (November 21, 2014).
Webinar, "ASHRAE 90.1 - Lighting - General & Mandatory Provisions," ASHRAE. (November 17,
2014).

Webinar, "ASHRAE 90.1 - Lighting - Interior Power," ASHRAE. (November 17, 2014).
Webinar, "ASHRAE 90.1 - Power and Other Equipment," ASHRAE. (November 17, 2014).
Webinar, "ASHRAE 90.1 - Service Water Heating," ASHRAE. (November 17, 2014).
Webinar, "ASHRAE 90.1 - HVAC Prescriptive Req. 1," ASHRAE. (November 16, 2014).
Webinar, "ASHRAE 90.1 - Mandatory Provisions I." (November 16, 2014).
Webinar, "ASHRAE 90.1 - Mandatory Provisions II," ASHRAE. (November 16, 2014).
Webinar, "ASHRAE 90.1 - Building Envelope - General and Mandatory Provisions," ASHRAE.
(November 15, 2014).
Webinar, "ASHRAE 90.1 - General Information and Simple Approach." (November 15, 2014).
Webinar, "CEM Course Preparation," AEE. (June 4, 2011 - June 11, 2011).
Conference Attendance, "Model Energy Curriculum," Ferris State University, Big Rapids, MI,
USA. (April 2011).
Conference Attendance, "Building Science Basics," Ferris State University, Big Rapids, MI, USA.
(April 2010).
Conference Attendance, "Cost Effective Efficiency," Ferris State University, Big Rapids, MI, USA.

(April 2010).
Conference Attendance, "Energy Optimum Programs by Consumers Energy," Ferris State
University, Big Rapids, MI, USA. (April 2010).
Conference Attendance, "Michigan Saves - The Pilot Program," Ferris State University, Big
Rapids, MI, USA. (April 2010).
Conference Attendance, "New Energy Code," Ferris State University, Big Rapids, MI, USA. (April
2010).
Conference Attendance, "The New Energy Economy," Ferris State University, Big Rapids, MI,
USA. (April 2010).
Conference Attendance, "Michigan Sales & State Energy Efficiency Program," Multiple, Grand
Rapids, MI, USA. (July 2009).
Conference Attendance, "New Energy Efficiency Technology & Services Program for Business,"
Multiple, Grand Rapids, MI, USA. (July 2009).
Conference Attendance, "Performance Contracting," Multiple, Grand Rapids, MI, USA. (July
2009).
Conference Attendance, "Reducing Energy Heating Water for Industrial Hot Water Applications,"
Multiple, Grand Rapids, MI, USA. (July 2009).
Conference Attendance, "Steam System Optimization," Multiple, Grand Rapids, MI, USA. (July
2009).
Conference Attendance, "Detroit Edison & MichCon Energy Optimization Overview," Ferris State
*Report Generated on August 23, 2018 Page 4 of 10*
University, Big Rapids, MI, USA. (April 2009).
Conference Attendance, "ITP Save Energy Now Assessment Program," Ferris State University,
Big Rapids, MI, USA. (April 2009).
Conference Attendance, "Reducing Carbon Footprint-Transition to a Low Carbon Society," Ferris
State University, Big Rapids, MI, USA. (April 2009).
Conference Attendance, "ACCA Winter Convention," Air Conditioning Contractors of America,
Orlando, Florida, USA. (March 2007).
Conference Attendance, "ASHRAE International Winter Convention & AHR Expo," ASHRAE &
Others, Chicago, Illinois, USA. (February 2006).
Conference Attendance, "ASHRAE International Summer Convention," ASHRAE, Cincinnati,

Ohio, USA. (June 2001).
Special Meeting, "ASHRAE Region V - New Office Holder Meeting," Fort Wayne, Indiana, USA.
(May 2001).
Seminar, "Metasys Hardware Troubleshooting," Johnson Controls, Orlando, Florida, USA.
(March 5, 2001 - March 9, 2001).
Conference Attendance, "ASHRAE International Winter Convention & AHR Expo," ASHRAE &
Others, Atlanta, Georgia, USA. (January 2001).
Seminar, "Metasys Database Management & Generation," Johnson Controls, Orlando, Florida,
USA. (November 6, 2000 - November 10, 2000).
Seminar, "Economic Analysis of Engineering Projects: Life Cycle Costing," ASHRAE, Ft.
Lauderdale, Florida, USA. (May 17, 2000).
Seminar, "System Selection and Report," ASHRAE, Ft. Lauderdale, Florida, USA. (May 16,
2000).
Seminar, "Building Retrofit for Energy Efficiency," ASHRAE, Ft. Lauderdale, Florida, USA. (May
15, 2000).
Conference Attendance, "ASHRAE International Winter Convention & AHR Expo," ASHRAE &
Others, Dallas, Texas, USA. (February 2000).
Conference Attendance, "Asynchronous Learning Network Conference," University of Maryland,
Washington DC, District of Columbia, USA. (September 1999).
Seminar, "DX9100 Engineering Seminar," Johnson Controls, Detroit, MI, USA. (August 19, 1999 -
August 25, 1999).
Conference Attendance, "Annual Association of Higher Education Conference," Association of
Higher Education, San Diego, California, USA. (January 1999).
Seminar, "Stand Alone Field Panel Programming," Landis & Staefa, Chicago, Illinois, USA.
(March 16, 1998 - March 20, 1998).

**Awards and Honors**

3rd Place - ASHRAE International Student Design Competition, ASHRAE. (2016).
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2nd Place - ASHRAE International Student Design Competition, ASHRAE. (2013).
2nd Place - ASHRAE International Student Design Competition, ASHRAE. (2012).
2nd Place - ASHRAE International Student Design Competition, ASHRAE. (2010).
1st Place - ASHRAE International Student Design Competition, ASHRAE. (2001).
2nd Place - ASHRAE International Student Design Competition, ASHRAE. (1999).
1st Place - ASHRAE International Student Design Competition, ASHRAE. (1998).

**TEACHING**

**Teaching Experience**

**Ferris State University**

HVAC 132, Fundamentals of Heating & Mechanical Systems, 2 courses.
HVAC 234, Residential Gas Heating, 4 courses.
HVAC 245, HVAC Unitary System Design, 1 course.
HVAC 312, Control Theory & Application, 10 courses.
HVAC 337, Mech-Elec Systems for Building, 16 courses.
HVAC 342, Load Analysis & Energy Modeling, 19 courses.
HVAC 362, HVAC Primary Equipment Selection, 3 courses.
HVAC 415, Direct Digital Control, 10 courses.
HVAC 451, Energy Audit and Analysis, 48 courses.
HVAC 462, Primary HVAC Equip Selection, 8 courses.
HVAC 497, Special Studies in HVACR, 2 courses.
HVAC 499, Commercial HVAC System Design, 30 courses.

**Non-Credit Instruction**

Seminar, Mechanical Service Contractors of America (MSCA), 31 participants. (May 17, 2010 -
May 19, 2010).
Seminar, Mechanical Service Contractors of America (MSCA), 40 participants. (August 24, 2009 -
August 26, 2009).
Seminar, Mechanical Service Contractors of America (MSCA), 47 participants. (May 18, 2009 -
May 20, 2009).
Continuing Education, UA & HVAC Excellence, 20 participants. (November 4, 2007 - November
6, 2007).

**Directed Student Learning**

Master's Thesis Committee Member, "ACCA Manual J On-Line Delivery." (August 2016 -
September 2017).
Advised: Gerald Lucas

**SCHOLARSHIP AND RESEARCH**

**Published Intellectual Contributions**



**Books**

Korcal, M. J. (2008). *Enhancing Energy Efficiency for High Performance Buildings*. Mechanical
Service Contractors of America.
Korcal, M. J., Pacella, J. (2007). *Green Awareness*.

**Other**

Korcal, M. J. (2015). *Development of On-Line Certification Course in "Building Operational Plan
Creation and Sustainment"*. Big Rapids, MI: Ferris State University.

Korcal, M. J., LeClaire, M., Lafferty, M., Stevens, R. (1998). *Electrical Troubleshooting of an HVAC System*.

**Presentations Given**

Korcal, M. J. (Author & Presenter), Same as presentation title, "Utility Bill Analysis and Tax
Exemptions," W.J. O'Neil Company, Livonia, MI. (May 2012).

Korcal, M. J. (Presenter), 4th Annual Michigan Energy Conference, "Report on DOE Building
Science Curriculum," Ferris State University, Big Rapids, MI. (April 2011).

Korcal, M. J. (Author & Presenter), 3rd Annual Michigan Energy Conference, "Commercial
Mechanical Systems," Ferris State University, Ferris State University. (April 2010).

Korcal, M. J. (Author & Presenter), Grand Rapids Energy Expo, "Commercial Energy Audits,"
GRCC, Grand Rapids, MI. (July 2009).

Korcal, M. J. (Author & Presenter), Spring Learning Institute, "Energy Audit Basics," Ferris State
University, Big Rapids, MI. (April 2009).

Korcal, M. J. (Author & Presenter), 2nd Annual Michigan Energy Conference, "Energy Audits for
Business Owners," Ferris State University, Big Rapids, MI. (April 2009).

Korcal, M. J. (Author & Presenter), MSCA Educational Conference, "Retro-commissioning,"
MSCA, San Antonio, Texas. (October 2008).

Korcal, M. J. (Author & Presenter), The Basics of Retro-Commissioning, "The Basics of Retro-Commissioning," MSCA. (October 2008).

Korcal, M. J. (Author & Presenter), Monthly Meeting, "Energy Efficiency and the Commercial
Building Owner," West Michigan Print and Graphic Society, Grand Rapids, MI. (September
2008).

Korcal, M. J. (Presenter), West Michigan ASHRAE, "ASHRAE Energy Audits," West Michigan
ASHRAE, Grand Rapids, MI. (October 2007).

Korcal, M. J. (Author & Presenter), ARI - HVAC Instructors Conference, "Applied Digital Control,"
Ferris State University - HVACR Programs, Big Rapids, MI. (July 10, 2007).

**Awards and Honors**

Sigma Lambda Chi Construction Honor Society, FSU Construction Department. (April 29, 2010).



**SERVICE**

**University Service**

Committee Member, Jennifer Miller's Tenure Committee. (August 2017 - Present).
Committee Chair, Eric Fradette's Tenure Committee. (August 2014 - Present).
Committee Member, HVACR Programs Advisory Board. (August 2005 - Present).

Committee Member, CET Promotion Committee. (August 2014 - May 2015).
Committee Member, HVACR Programs Faculty Search Committee. (August 2013 - May 2014).
Committee Member, CET Restructuring Committee. (August 2012 - May 2013).
Committee Member, Strategic Planning Committee for School of Built Environment. (August 2011- May 2013).
Committee Member, Academic Program Review Committee. (August 2011 - October 2012).
Committee Chair, Brian Holton's Tenure Committee. (August 2007 - November 2011).
Committee Member, Michigan Energy Conference Committee. (August 2008 - April 2011).
Committee Member, Joe Pacella's Tenure Committee. (August 2005 - November 2010).
Committee Member, Director of Built Environment Search Committee. (January 2010 - May 2010).
Committee Member, CET Dean's Advisory Committee. (August 2008 - May 2010).
Committee Member, CET Sabbatical Committee. (August 2007 - May 2010).
Committee Member, CET Accreditation & Assessment Committee. (August 2007 - May 2009).
Committee Member, Joe Compton's Tenure Committee. (August 2005 - November 2008).
Committee Member, Doug Zentz's Tenure Committee. (August 2005 - November 2007).
Committee Member, Eric Quilitzsch's Tenure Committee. (August 2005 - November 2006).
Committee Chair, HVACR Programs Academic Program Review Committee. (January 2005 - October 2006).
Committee Member, President's TAC Review Committee. (August 2005 - May 2006).
Committee Member, HVACR Programs Advisory Board. (August 1996 - May 2001).
Chairperson, HVACR Programs Academic Program Review Committee. (January 1999 - October 2000).

**Professional Service**



Judge, Skills USA, Big Rapids, Michigan. (April 2018).
Judge, Skills USA, Big Rapids, Michigan. (April 2017).
Judge, Skills USA, Big Rapids, Michigan. (April 2016).
Judge, Skills USA, Big Rapids, Michigan. (April 2015).
Judge, Skills USA, Big Rapids, Michigan. (April 2014).

**Public Service**

Instructor, FSU-HVACR-ASL-Energy Audit - Trinity Fellowship Church, Big Rapids, Michigan. (August 2017 - December 2017).
Instructor, FSU-HVACR-ASL-Energy Audit - St Mary's Parish Center, Big Rapids, Michigan. (August 2016 - December 2016).

Instructor, FSU-HVACR-ASL-Energy Audit - Artworks, Big Rapids, Michigan. (August 2015 -
December 2015).
Instructor, FSU-HVACR-ASL-Energy Audit - Riverhouse, Grand Rapids, Michigan. (August 2014 -
December 2014).
Instructor, FSU-HVACR-ASL-Energy Audit - Rexair, Cadillac, Michigan. (August 2013 -
December 2013).
Instructor, FSU-HVACR-ASL-Energy Audit - HR Screw, Reed City, Michigan. (August 2012 -
December 2012).
Instructor, FSU-HVACR-ASL-Energy Audit - Big Rapids Products, Big Rapids, Michigan. (August
2011 - December 2011).
Instructor, FSU-HVACR-ASL-Energy Audit - Chemical Bank, Big Rapids, Michigan. (August 2011
- December 2011).
Instructor, FSU-HVACR-ASL-Energy Audit - St. Peter's Lutheran Church, Big Rapids, Michigan.
(August 2011 - December 2011).
Instructor, FSU-HVACR-ASL-Energy Audit - Big Rapids City Hall, Big Rapids, Michigan. (August
2010 - December 2010).
Instructor, FSU-HVACR-ASL-Energy Audit - Pioneer Group, Big Rapids, Michigan. (August 2010
- December 2010).
Instructor, FSU-HVACR-ASL-Energy Audit - Pioneer Press, Big Rapids, Michigan. (August 2010 -
December 2010).
Instructor, FSU-HVACR-ASL-Energy Audit - FSU Racquet Facility, Big Rapids, Michigan.
(August 2009 - December 2009).
Instructor, FSU-HVACR-ASL-Energy Audit - Mecosta / Osceola Career Center, Big Rapids,
Michigan. (August 2009 - December 2009).
Instructor, FSU-HVACR-ASL-Energy Audit - United Methodist Church, Big Rapids, Michigan.
(August 2009 - December 2009).

Instructor, FSU-HVACR-ASL-Energy Audit - Frauenthal Performing Art Center, Muskegon,
Michigan. (August 2008 - December 2008).
Instructor, FSU-HVACR-ASL-Energy Audit - St. Peter's Lutheran Church, Big Rapids, Michigan.
(August 2008 - December 2008).

Instructor, FSU-HVACR-ASL-Energy Audit - Alticor Fulfillment Center, Ada, Michigan. (August
2007 - December 2007).
Instructor, FSU-HVACR-ASL-Energy Audit - Alticor Research & Development, Ada, Michigan.
(August 2007 - December 2007).
Instructor, FSU-HVACR-ASL-Energy Audit - Grand Rapids Public Museum, Grand Rapids,
Michigan. (August 2006 - December 2006).
Instructor, FSU-HVACR-ASL-Energy Audit - Structural Concepts, Muskegon, Michigan. (August
2001 - December 2001).
Instructor, FSU-HVACR-ASL-Energy Audit - Greenville Public Schools, Greenville, Michigan.
(August 1999 - December 1999).
Instructor, FSU-HVACR-ASL-Energy Audit - Oliver Machine, Grand Rapids, Michigan. (August
1998 - December 1998).
Instructor, FSU-HVACR-ASL-Energy Audit - Blodgett Kentwood Medical Office Building,
Kentwood, Michigan. (August 1997 - December 1997).
Instructor, FSU-HVACR-ASL-Energy Audit - Northeast Professional Building, Grand Rapids,
Michigan. (August 1997 - December 1997).
Instructor, FSU-HVACR-ASL-Energy Audit - The Charlevoix Club, Grand Rapids, Michigan.
(August 1997 - December 1997).
Instructor, FSU-HVACR-ASL-Energy Audit - Assumption of the Blessed Virgin Mary Catholic
School, Belmont, Michigan. (August 1996 - December 1996).
Instructor, FSU-HVACR-ASL-Energy Audit - Helen Ferris Hall (FSU), Big Rapids, Michigan.
(August 1996 - December 1996).
Instructor, FSU-HVACR-ASL-Energy Audit - Wolverine World Wide, Big Rapids, Michigan.
(August 1996 - December 1996).
Instructor, FSU-HVACR-ASL-Energy Audit - Calvary Church, Grand Rapids, Michigan. (August
1995 - December 1995).

**Consulting**

Government, State of Michigan, Mecosta County, Michigan. (September 2009 - August 2010).
Government, State of Michigan, Mecosta County, Michigan. (September 2008 - August 2009).
For Profit Organization, Stryker Medical, Kalamazoo, Michigan. (November 2008 - December

2008).
For Profit Organization, Orange County Convention Center, Orlando, Michigan. (January 2005 -
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March 2005).
For Profit Organization, Celebration Hospital, Celebration, Florida. (March 2004 - April 2004).
For Profit Organization, Gaylord Palm Resort and Convention Center, Orlando, Michigan.
(October 2003).
For Profit Organization, Walt Disney World, Orlando, Michigan. (August 2003 - September 2003).
For Profit Organization, Universal Studios - Islands of Adventure, Orlando, Michigan. (March
2002).
For Profit Organization, WZZM13, Grand Rapids, Michigan. (June 2001 - July 2001).
Academic, Applied Technical Center, Grand Rapids, Michigan. (June 2000).
Public School, Alma Public Schools, Alma, Michigan. (May 2000).
For Profit Organization, Frigidaire Home Products, Greenville, Michigan. (May 1999 - August
1999).
For Profit Organization, Valley Ridge Bank, Kent City, Michigan. (June 1998 - August 1998).
For Profit Organization, Tree Tops Resorts, Gaylord, Michigan. (June 1997 - July 1997).
For Profit Organization, The Upjohn Company, Kalamazoo, Michigan. (June 1996 - August 1996).

For Profit Organization, The Upjohn Company, Kalamazoo, Michigan. (June 1996 - July 1996).

**Mr. Gerry J. Lucas**

Ferris State University
CET - School of Built Environment
(231) 591-3764
Email: GerryLucas@ferris.edu

**Education**

MS, Ferris State University, 2017.
Major: Career and Technical Education
Supporting Areas of Emphasis: Instructor
BS, Ferris State University, 2008.
Major: HVACR Engineering Technology
AAS, Ferris State University, 2006.
Major: HVACR Technology

**Professional Positions**

**Professional**

Service Technician, Air Systems Engineering, Inc. (May 2012 - August 2014).
Project Designer, Air Systems Engineering, Inc. (May 2008 - May 2012).

Project Design Intern, Air Systems Engineering, Inc. (May 2007 - August 2007).
Service Tech. Intern, Air Systems Engineering, Inc. (May 2006 - August 2006).

**Licensures and Certifications**

OSHA 10-Hour Occupational Safety and Health, U.S. Department of Labor. (March 2, 2007 -
Present).
EPA 608: Universal, HVACR Institute, Ferris State University. (April 12, 2006 - Present).
LEED Accredited Professional BD+C, Green Building Certification Institute. (June 10, 2010 -
June 8, 2020).

**Professional Memberships**

Omicron Delta Kappa. (April 2006 - Present).
American Society of Heating, Refrigeration, and Air-Conditioning Engineers. (May 23, 2018 -
June 1, 2019).
American Society of Heating, Refrigeration, and Air-Conditioning Engineers. (September 17,
2014 - September 30, 2015).

**Development Activities Attended**

Webinar, "10 Things you Should Know about the WELL Building Standard," Green Building Research Institute. (May 18, 2018).

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Webinar, "Sustainable Olympics: A Gold Medal Winner," Green Building Research Institute. (May
16, 2018).
Webinar, "Understanding LEED v4 ID+C Inside and Out," Green Building Research Institute. (May 16, 2018).
Webinar, "Wanderlust: Taking the Sustainable Route," Green Building Research Institute. (May16, 2018).
Webinar, "LEED v4 Project Implementation," Green Building Research Institute. (May 7, 2018 - May 16, 2018).
Webinar, "AIA COTE Top 10: Step Inside the 10 Best Green Buildings of 2015," Green Building
Research Institute. (May 15, 2018).
Webinar, "Building Better Medicine: LEED v4 & Healthcare," Green Building Research Institute. (May 15, 2018).
Webinar, "I am Doing WELL! Are You?." (May 15, 2018).
Webinar, "Nature's Marvels: Innovation in Natural Building Design," Green Building Research
Institute. (May 15, 2018).
Continuing Education Program, "21 Things You Should Know About LEED v4," Green Building
Research Institute. (May 14, 2018).
Webinar, "A Ripple Effect Sustainable Supply Chain & LEED v4," Green Building Research

Institute. (May 14, 2018).
Webinar, "LEED v4 BD+C Rating System Review - Water Efficiency," Green Building Education Services. (May 27, 2016).
Webinar, "LEED v4 Case Study HKS Headquarters," Green Building Education Services. (May 27, 2016).
Webinar, "Passive Hybrid Downdraught Cooling," Green Building Education Services. (May 27, 2016).
Webinar, "The Pros and Cons of Building Reuse," Green Building Education Services. (May 27, 2016).
Webinar, "LEED v4 BD+C Rating System Review - Location and Transportation," Green Building Education Services. (May 25, 2016).
Webinar, "LEED v4 BD+C Rating System Review - Materials and Resources," Green Building Education Services. (May 25, 2016).
Webinar, "LEED v4 BD+C Rating System Review - Sustainable Sites," Green Building Education Services. (May 25, 2016).
Webinar, "LEED v4 BD+C Rating System Review - Innovation and Integrative Process," Green Building Education Services. (April 6, 2016).
Webinar, "LEED v4 BD+C Rating System Review - Indoor Environmental Quality," Green Building Education Services. (April 5, 2016).
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Webinar, "LEED v4 BD+C Rating System Review - Energy and Atmosphere," Green Building Education Services. (April 4, 2016).
Webinar, "Implementing Ergonomics - a LEED Pilot Credit," Green Building Education Services. (March 15, 2016).
Webinar, "LEED Pilot Credit Bird Collision Deterrence," Green Building Education Services. (March 15, 2016).
Webinar, "Forest Sequestration and Carbon Offsets," Green Building Education Services. (March 14, 2016).
Webinar, "Fast Savings: Sustainable Design Choices With a Payback of 8 Years or Less," Green
Building Education Services. (March 9, 2016).
Webinar, "Blue Roofs: Cutting Edge Stormwater Management," Green Building Education
Services. (March 7, 2016).
Webinar, "Demand Response: Getting Paid to Reduce Electricity," Green Building Education
Services. (March 7, 2016).
Webinar, "20 Things You Must Know about LEED v4," Green Building Education Services.
(December 28, 2015).
Webinar, "Best Practices in Architectural Acoustics," Green Building Education Services.
(December 28, 2015).
**Awards and Honors**
Outstanding Student, Ferris State University: College of Education and Human Services. (April

28, 2018).

**TEACHING**

**Teaching Experience**

**Ferris State University**

HVAC 111, Electricity-Blueprints-Fab, 3 courses.
HVAC 132, Fund of Heating-Mech Systems, 3 courses.
HVAC 245, HVAC Unitary System Design, 1 course.

**SERVICE**

**University Service**

Committee Member, Academic Senate Professional Development Committee. (September 22, 2017 - Present).
Committee Member, CET Diversity Committee. (October 6, 2014 - Present).

**Mr. John E. Quilitzsch**

Ferris State University
CET - School of Built Environment
(231) 591-2747
Email: EricQuilitzsch@ferris.edu

**Education**

Certificate, Ferris State University, 2006.
Major: Network Security
MISM, Ferris State University, 2006.
Major: Information Systems Management
BS, Ferris State University, 2002.
Major: HVACR Engineering Technology
AAS, Ferris State University, 1992.
Major: HVACR Technology

**Professional Positions**

**Academic - Post-Secondary**

Associate Professor, Ferris State University. (August 2007 - Present).

**Licensures and Certifications**

Journeyman Steamfitter, The United States Department of Labor. (July 18, 1996 - Present).

**TEACHING**

**Teaching Experience**

**Ferris State University**

451, Energy Audit and Analysis, 1 course.
HVAC 312, Control Theory - Application, 12 courses.
HVAC 313, Control Theory - Application 1, 2 courses.
HVAC 314, Control Laboratory, 1 course.
HVAC 415, Direct Digital Control, 13 courses.
HVAC 451, Energy Audit and Analysis, 2 courses.
HVAC 499, Commercial HVAC System Design, 2 courses.

**SCHOLARSHIP AND RESEARCH**

**Awards and Honors**

ASHRAE 10 Year Appreciation, American Society of Heating Refrigeration and Air Conditioning
Engineers. (November 1, 2012).

**Awards and Honors**
**Service, University**
Outstanding Advisor Appreciation, FSU / American Society of Heating, Refrigeration, Air Conditioning Engineers. (November 7, 2016).

Douglas Ford Zentz

College of Technology/HVACR Department
605 S. Warren Ave – Granger Building
Ferris State University
Big Rapids, MI 49307
Email: Zentzd@ferris.edu
http://www.ferris.edu/hvacr

Education

Master of Career and Technical Education, Instructor Option, Ferris State University, Big Rapids, MI, August 2007.

Bachelor of Science Mechanical Engineering Technology, Purdue University, West Lafayette, IN, December 1980.

Presentations

Zentz, D. (May, 2017), "Doing More with Less, Low Flow and High Delta Hydronic Systems", Northern Indiana Chapter ASHRAE South Bend and Calumet, IN

Zentz, D. (April, 2017), "Doing More with Less, Low Flow and High Delta Hydronic Systems" & "What's Your EUI? Commercial Building Energy Efficiency", Birmingham Chapter ASHRAE Birmingham, AL

Zentz, D. (April, 2017), "Doing More with Less, Low Flow and High Delta Hydronic Systems", Fort Wayne Chapter ASHRAE Fort Wayne, IN

Zentz, D. (February, 2017), "Doing More with Less, Low Flow and High Delta Hydronic Systems" & "What's Your EUI? Commercial Building Energy Efficiency", West Virginia Chapter ASHRAE Huntington, WV

Zentz, D. (February, 2017), "Doing More with Less, Low Flow and High Delta Hydronic Systems" & "Applied Psychrometrics", Blue Grass Chapter ASHRAE Lexington, KY

Zentz, D. (January, 2017). "How to Communicate Technically in a Professional World with Technical Information", Chapters Technology Transfer Committee of ASHRAE in Las Vegas, NV

Zentz, D. (November, 2016), "ASHRAE Society Standard 189.1, Standard for High Performance Green Buildings Except Low Rise Residential", Big Sky ASHRAE Billings & Bozeman, MT

Zentz, D. (September, 2016), "Doing More with Less, Low Flow and High Delta Hydronic Systems", Central Indiana Chapter ASHRAE Indianapolis, IN

Zentz, D. (May, 2016), "Doing More with Less, Low Flow and High Delta Hydronic Systems" & "What's Your EUI? Commercial Building Energy Efficiency", Black Hills Chapter ASHRAE Rapid City, SD

Zentz, D. (May, 2016), "What's Your EUI? Commercial Building Energy Efficiency", Oregon Chapter ASHRAE in Portland, OR

Zentz, D. (April, 2016), "What's Your EUI? Commercial Building Energy Efficiency", Granite State Chapter ASHRAE in Manchester, NH

Zentz, D. (February, 2016), "ASHRAE Society Standard 189.1, Standard for High Performance Green Buildings Except Low Rise Residential", West Michigan USGBC Grand Rapids, MI

Zentz, D. (January, 2016). "Hydronic Systems: Doing More With Less", ASHRAE 2016 Winter Conference in Orlando, FL

Zentz, D. (January, 2016), "Doing More with Less, Low Flow and High Delta Hydronic Systems", West Michigan ASHRAE Grand Rapids, MI & Kalamazoo, MI & Traverse City, MI

Zentz, D. (November, 2015), "Applied Psychrometrics", Evansville ASHRAE, Evansville, IN

Zentz, D. (November, 2015), "Michigan Energy Standards for Commercial Buildings – ASHRAE Standard 90.1", West Michigan AIA in Grand Rapids, MI

Zentz, D. (October, 2015), "Sustaining ASHRAE Though Leadership, Mentoring our Future", London Ontario ASHRAE, London, ON

Zentz, D. (September, 2015), "Applied Psychrometrics", Montreal ASHRAE, Montreal, QC

Zentz, D. (May, 2015), "Applied Psychrometrics", Cleveland ASHRAE, Cleveland, OH

Zentz, D. (April, 2015), "HVAC and Energy Efficiency" – Efficiency United Conference for Commercial and Industrial Buildings, Battle Creek and Harris, MI

Zentz, D. (March, 2015), "ASHRAE Society Standard 189.1, Standard for High Performance Green Buildings Except Low Rise Residential", Northern Indiana ASHRAE South Bend, IN

Zentz, D. (February, 2015), "What's Your EUI? Commercial Building Energy Efficiency", West Michigan AIA in Grand Rapids, MI

Zentz, D. (February, 2015), "ASHRAE Society Standard 189.1, Standard for High Performance Green Buildings Except Low Rise Residential", Southern Nevada ASHRAE Las Vegas, NV

Zentz, D. (January, 2015), "ASHRAE Society Standard 189.1, Standard for High Performance Green Buildings Except Low Rise Residential", West Michigan ASHRAE Grand Rapids, MI

Zentz, D. (May, 2014), "ASHRAE Society Standard 189.1, Standard for High Performance Green Buildings Except Low Rise Residential", Qatar Oryx ASHRAE in Doha, Qatar

Zentz, D. (May, 2014), "Sustaining ASHRAE Though Leadership, Mentoring our Future", Connecticut ASHRAE meeting in Cromwell, CT

Zentz, D. (February, 2014), "What's Your EUI? Commercial Building Energy Efficiency", South Piedmont ASHRAE in Charlotte, NC

Zentz, D. (January, 2014). "Commercial Building Energy Efficiency and High Performance HVAC", ASHRAE 2014 Winter Conference in New York, NY

Zentz, D. (January, 2014), "What's Your EUI? Commercial Building Energy Efficiency", Louisville ASHRAE in Louisville, KY

Zentz, D. (January, 2014), "What's Your EUI? Commercial Building Energy Efficiency", Kentucky Blue Grass ASHRAE in Lexington, KY

Zentz, D. (October, 2013), "What's Your EUI? Commercial Building Energy Efficiency", North Piedmont ASHRAE in Greensboro, NC

Zentz, D. (October, 2013), "What's Your EUI? Commercial Building Energy Efficiency", Detroit ASHRAE in Detroit, MI

Zentz, D. (September, 2013). "How to Communicate Technically in a Professional World with Technical Information", Kansas City ASHRAE in Kansas City, KS

Zentz, D. (March, 2013), "ASHRAE Society Standard 189.1, Standard for High Performance Green Buildings Except Low Rise Residential", North Eastern Wisconsin ASHRAE Symposium on Green Buildings in Breen Bay, WI

Zentz, D. (February, 2013). "How to Communicate Technically in a Professional World with Technical Information", San Jose ASHRAE in San Jose, CA

Zentz, D. (January, 2013). "Decoupling the Latent Load through Psychrometrics", ASHRAE 2013 Winter Conference in Dallas, TX

Zentz, D. (December, 2012), "What's Your EUI? Commercial Building Energy Efficiency", Toledo ASHRAE in Toledo, OH

Zentz, D. (May, 2012), "HVAC and Energy" – Efficiency United Conference for Commercial and Industrial Buildings, Battle Creek and Harris, MI

Zentz, D. (April, 2012), “ASHRAE Society Standard 189.1, Standard for High Performance Green Buildings Except Low Rise Residential”, Ferris State University’s Michigan Energy Conference in Grand Rapids, MI

Zentz, D. (March, 2012), “What’s Your EUI? Commercial Building Energy Efficiency”, Evansville ASHRAE in Evansville, IN

Zentz, D. (January, 2012). “How to Communicate Technically in a Professional World with Technical Information”, ASHRAE 2012 Winter Conference in Chicago, IL

Zentz, D. (December, 2011), “What’s Your EUI? Commercial Building Energy Efficiency”, Fort Wayne ASHRAE in Fort Wayne, IN

Zentz, D. (October, 2011), “ASHRAE Society Standard 189.1, Standard for High Performance Green Buildings Except Low Rise Residential”, USBGC Educational Conference in Grand Rapids, MI

Zentz, D. (October, 2011), “What’s Your EUI? Commercial Building Energy Efficiency”, Northern Indiana ASHRAE in South Bend, IN & Calumet, IN

Zentz, D. (September, 2011), “Sustaining ASHRAE Though Leadership, Mentoring our Future”, West Michigan ASHRAE meeting in Grand Rapids, MI

Zentz, D. (April, 2011), “What’s Your EUI? Commercial Building Energy Efficiency”, Ferris State University’s Michigan Energy Conference in Big Rapids, MI

Zentz, D. (January, 2011), “What’s Your EUI? Commercial Building Energy Efficiency”, West Michigan ASHRAE meeting in Grand Rapids, MI

Zentz, D. (July, 2010), “Zero Energy Structures”, 4 hour workshop for Ferris State University’s Summer Energy Camp in Big Rapids, MI

Zentz, D. (July, 2010), “Carbon Footprint”, 4 hour workshop for Ferris State University’s Summer Energy Camp in Big Rapids, MI

Zentz, D. (April, 2010), “ASHRAE Society Standard 189.1, Standard for High Performance Green Buildings Except Low Rise Residential”, Plain Green Conference in Sioux Falls, SD

Zentz, D. (April, 2010), “ASHRAE Society Standard 189.1, Standard for High Performance Green Buildings Except Low Rise Residential”, Ferris State University’s Michigan Energy Conference in Big Rapids, MI

Zentz, D. (March, 2010), “ASHRAE Society Standard 189.1, Standard for High Performance Green Buildings Except Low Rise Residential”, Detroit ASHRAE meeting in Troy, MI

Zentz, D. (November, 2009), “ASHRAE Society Standard 189.1P, Standard for High Performance Green Buildings except Low Rise Residential”, West Michigan ASHRAE meeting in Traverse City, MI

Zentz, D. (September, 2009), “ASHRAE Society Standard 189.1P, Standard for High Performance Green Buildings except Low Rise Residential”, West Michigan ASHRAE meeting in Grand Rapids, MI

Zentz, D. (December, 2008), “What is GREEN?”, West Michigan ACCA meeting in Grand Rapids, MI

Zentz, D. (September, 2008), “ASHRAE Society Update and Report from Salt Lake City – Carbon Footprint, Life Cycle Assessment, Exergy and Energy Efficiency”, West Michigan ASHRAE meeting in Grand Rapids, MI

Zentz, D. (November, 2007), “Michigan Energy Conference”, Exceptional Merit Grant Award at The Ferris Foundation For Excellence Benefit in Grand Rapids, MI

Zentz, D. (September, 2007), “ASHRAE’s Call for Greater Efficiency – How Does This Effect Michigan”, West Michigan ASHRAE meeting in Grand Rapids, MI

Zentz, D. (July, 2007), “Applied Psychrometrics”, ARI Teacher Workshop at Ferris State University in Big Rapids, MI

Zentz, D. (April, 2007), “Delivering Analytical Problem Solving Curricula via a Web-Based Format to Support Critical Thinking and Integration of World Events to Technical Discussion”, Workshop session at Lily West Conference in Pomona, CA

Zentz, D. (April, 2006), “Mechanical Properties”, Presenter at an educational workshop for the Mechanical Electrical Education Council of the Mechanical Contractors of America, Workshop in Fort Collins, CO

Zentz, D. (April, 2006), “Fans and Air Distribution”, Presenter at an educational workshop for the Mechanical Electrical Education Council of the Mechanical Contractors of America, Workshop in Fort Collins, CO

Zentz, D. (July, 2005), “HVAC Systems –Introducing Students to Large Mechanical Systems”, ARI Teacher Workshop at Ferris State University in Big Rapids, MI

Zentz, D. (April, 2005), “Mechanical Properties”, Presenter at an educational workshop for the Mechanical Electrical Education Council of the Mechanical Contractors of America, Workshop in Cincinnati, OH

Honors and Awards

Appointed as member of the Ferris State University Communication Committee of General Education July 2017 to June 2018
Continued Appointment as Distinguished Lecturer for ASHRAE – July 2017 to June 2018
Continued as Region V RMCR for ASHRAE for the year of July 2017 to June 2018
Continued as Coordinator of Ferris State University HVACR program for fall 2017 semester
Appointed Coordinator of Ferris State University HVACR Program for School Year September 2016 to August 2017
Appointed as member of College of Engineering Technology Merit-Promotion committee for 2016-2017
Continued as a member of the Professional Development Committee for Ferris State University – July 2016 to June 2017
Continued Appointment as Distinguished Lecturer for ASHRAE – July 2016 to June 2017
Appointed RMCR (Regional Member's Council Representative) in June 2016 for Region V of ASHRAE, this is a three year service representing Ohio, Indiana and Michigan ASHRAE Chapters
Appointed Coordinator of Ferris State University HVACR Program for School Year September 2015 to August 2016
Continued as a member of the Professional Development Committee for Ferris State University – July 2015 to June 2016
Continued Appointment as Distinguished Lecturer for ASHRAE – July 2015 to June 2016
Received the Distinguished Service Award from ASHRAE in June 2015
Topic of "Doing More with Less – Low Flow and High Delta Hydronic Systems" is added to the list of speaking topics as a Distinguished Lecturer for ASHRAE
Appointed Coordinator of Ferris State University HVACR Program for School Year September 2014 to August 2015
Appointed to the Professional Development Committee for Ferris State University – July 2014 to June 2015
Continued Appointment as Distinguished Lecturer for ASHRAE – July 2014 to June 2015
Appointed Coordinator of Ferris State University HVACR Program for School Year September 2013 to August 2014
Appointed to the School of Built Environment Leadership Committee Fall of 2013
Continued as a member of Ferris State University Curriculum Committee for School year of September 2013 to May 2014
Continued Appointment as Distinguished Lecturer for ASHRAE – July 2013 to June 2014
Member of ASHRAE Society Board of Governors from July 2013 to June 2014 and member of ASHRAE Society Sub-committee on Presidential Awards of Excellence

Appointed Chair to ASHRAE Society Student Activities Committee for the term of July 2013 to June 2014 – includes participation in 4 subcommittees
Appointed Coordinator of Ferris State University HVACR Program for School Year September 2012 to August 2013
Appointed to the School of Built Environment Leadership Committee Fall of 2012
Continued as a member of Ferris State University Curriculum Committee for School year of September 2012 to May 2013
Appointed Distinguished Lecturer for ASHRAE July 2012, topics to include 1) What's Your EUI?, 2) ASHRAE Standard 189.1 – Standards for High Performance Green Buildings, 3) How to Communicate Technically in a Professional World with Technical

Information, 4) Sustaining ASHRAE through Leadership, Mentoring our Future, 5) Applied Psychrometrics, 6) HVAC and Energy Efficiency
Member of ASHRAE Society Board of Governors from July 2012 to June 2013 and member of ASHRAE Society Sub-committee on Presidential Awards of Excellence
Appointed Vice-Chair to ASHRAE Society Student Activities Committee for the term of July 2012 to June 2013 – includes participation in 4 subcommittees
Appointed Coordinator of Ferris State University HVACR Program for School Year September 2011 to August 2012
Appointed to the Ferris State University Curriculum Committee for School year of September 2011 to May 2012
Appointed to the School of Built Environment Leadership Committee Fall of 2011
Elected to President of West Michigan ASHRAE to serve July 2011 to June 2012
Appointed as Subcommittee Chair of ASHRAE Society Student Activities Post High Committee for July 2011 to June 2012
Appointed member of Subcommittee of ASHRAE Society Student Activities Student Design Competition for July 2011 to June 2012
Appointed to serve as Region V Regional Vice Chair for ASHRAE Student Activities for July 2011 to June 2012
Appointed to the Ferris State University Curriculum Committee Summer of 2011
Appointed Coordinator of Ferris State University HVACR Program for School Year September 2010 to August 2011
Elected to President-Elect of West Michigan ASHRAE to serve July 2010 to June 2011
Appointed as Subcommittee Chair of ASHRAE Society Student Activities Post High Committee for July 2010 to June 2011
Appointed member of Subcommittee of ASHRAE Society Student Activities Student Design Competition for July 2010 to June 2011
Appointed to serve as Region V Regional Vice Chair for ASHRAE Student Activities for July 2010 to June 2011
Appointed to the School of Built Environment Leadership Committee Fall of 2010
Appointed Coordinator of Ferris State University HVACR Program for School Year September 2009 to August 2010
Elected to Vice-President of West Michigan ASHRAE to serve July 2009 to June 2010
Appointed as Subcommittee Chair of ASHRAE Society Student Activities Post High Committee for July 2009 to June 2010
Appointed member of Subcommittee of ASHRAE Society Student Activities Student Design Competition for July 2009 to June 2010
Appointed to serve as Region V Regional Vice Chair for ASHRAE Student Activities for July 2009 to June 2010
Faculty Advisor for 2nd place Student HVAC System Selection ASHRAE International competition, 2009
Chair of Steering Committee for Ferris State University's 2nd Annual Michigan Energy Conference to be held in April of 2009
Elected to Treasurer of West Michigan ASHRAE to serve July 2008 to June 2009
Appointed member of Subcommittee of ASHRAE Society Student Activities K-12 Committee for July 2008 to June 2009

Appointed member of Subcommittee of ASHRAE Society Student Activities Grants Award committee for July 2008 to June 2009
Appointed to serve as Region V Regional Vice Chair for ASHRAE Student Activities for July 2008 to June 2009
Faculty Advisor for 3rd place Student HVAC System Selection ASHRAE International competition, 2008
Promoted to Associate Professor, Spring 2008
Tenured Faculty HVACR department of College of Engineering Technology, Spring 2008
Chair of Steering Committee for Ferris State University's 1st Annual Michigan Energy Conference to be held in April of 2008
Appointed Chair of Research and Promotion for West Michigan ASHRAE to serve July 2007 to June 2008
Elected to Secretary of West Michigan ASHRAE to serve July 2007 to June 2008
Faculty Advisor for 1st place Student HVAC Design ASHRAE International competition, 2007
Faculty Advisor for 2nd place Student HVAC System Selection ASHRAE International competition, 2007
Exceptional Merit Faculty/Staff Award – Plan and host an Energy Conference in 2007-2008
Award for Academic Excellence, Outstanding Achievement for a Cumulative 4.0 Grade Point Average, Academic Year 2006-2007
Appointed for 2-term on the Distinguished Teacher Award Committee in 2006
Faculty Advisor for 2nd place Student HVAC Design ASHRAE International competition, 2006
Faculty Advisor for 3rd place Student HVAC System Selection ASHRAE International competition, 2006
Appointed Member to Ferris State University Certification for Online Instructor Retreat, November 2005
Faculty Advisor for 3rd place Student HVAC System Selection ASHRAE International competition, 2005
Appointed to Fluke Instrument's IAQ Advisory Board, 2004
Faculty Advisor for 1st place Student HVAC Design ASHRAE International competition, 2004
Faculty Advisor for 2nd place Student HVAC System Selection ASHRAE International competition, 2004

Professional Development

Attended Annual Summer Meetings for ASHRAE in Long Beach, CA and attended seminars on site verses source energy efficiency and centralized chilled water systems, June 2017
Attended Winter ASHRAE/AHR Expo in Las Vegas, NV and attended seminars on Building Energy Performance and integration of smart devices within building HVAC automation systems, January 2017

Attended Annual Summer Meetings for ASHRAE in St. Louis, MO and attended seminars on BIM (Building Information Modeling) to BEM (Building Energy Modeling), June 2016

Attended Winter ASHRAE/AHR Expo in Orlando, FL and attended seminars on BIM to BEM and Solar Energy for High Performance Buildings, January 2016

Attended Annual Summer Meetings for ASHRAE in Atlanta, GA and attended seminars on HVAC Aps and Building Energy Modeling, June 2015

Attended Winter ASHRAE/AHR Expo in Chicago, IL and attended seminars on High Performance Buildings, January 2015

Attended Annual Summer Meetings for ASHRAE in Seattle, WA and attended seminars on HVAC Aps for smart devices and Building Energy Policies Around the World, June 2014

Attended Winter ASHRAE/AHR Expo in New York, NY and attended seminars on High Performance Buildings, January 2014

Attended Annual Summer Meetings for ASHRAE in Denver, CO and attended seminars on Net Zero Energy Buildings, June 2013

Attended Winter ASHRAE/AHR Expo in Dallas, TX and attended seminars on Building Efficiency and Renewable Energy, January 2013

Attended Annual Summer Meetings for ASHRAE in San Antonio, TX and attended seminars on Building Energy Quotient, Mentoring Young Professionals, and Building Thermal Modeling, June 2012

Attended Blackboard Training Sessions I & II, May 2012

Attended Winter ASHRAE/AHR Expo in Chicago, IL and attended seminars on High Performance Buildings, January 2012

Attended Annual Summer Meetings for ASHRAE in Montreal, QC and attended seminars on Professional Communication, Mentoring and Building Energy Footprint, June 2011

Attended Winter ASHRAE/AHR Expo in Las Vegas, NV and attended seminars on High Performance Buildings, January 2011

Attended Annual Summer Meetings for ASHRAE in Albuquerque, NM and attended seminars on Ethics, "American Building Energy Labeling" program, and Exergy, June 2010

Attended Winter ASHRAE/AHR Expo in Orlando, FL and attended Workshop on High Performance GREEN Building Standards (ASHRAE Standard 189), January 2010

Participated in curriculum committee for the development of new Energy Engineering degree within the College of Engineering Technology, multiple months of 2009

Attended Annual Summer Meetings for ASHRAE in Louisville, KY and attended seminars on Exergy, Climate Change, and High Performance Buildings, June 2009

Attended ASHRAE Net-Zero Energy Building Seminar in San Francisco, March 2009

Attended Winter ASHRAE/AHR Expo and Technical Meetings on Energy, Environmental Challenges, Net-Zero Buildings, and Renewable Energy, January 2009

Ferris Connect Training, August 2008

Attended Annual Summer Meetings for ASHRAE in Salt Lake City and attended Technical Seminars on Exergy, Site-to-Source Energy, Clinton Climate Initiative, and Energy, 2008

Co-Development of On-line Orientation for HVAC Students, Summer 2008
Attended Winter ASHRAE/AHR Expo and Technical Meetings on Energy and Indoor Air Quality, January 2008
Ferris Connect Training, October 2007
Attended Advisory Board Meeting with Fluke Instrumentation on Indoor Air Quality, July 2007
Great Lakes Renewable Energy Fair, June 2007
Attended Lily West Conference, April 2007
Attended Winter ASHRAE/AHR Expo and Technical Meetings, January 2007
Attended Advisory Board Meeting with Fluke Instrumentation on Indoor Air Quality, January 2007
Attended 21st Century Energy Plan with Michigan Public Service Commission, Summer 2006
Attended Advisory Board Meeting with Fluke Instrumentation on Indoor Air Quality, July 2006
Attended Dead Men Steam Night School, May 2006
Attended Winter ASHRAE/AHR Expo and Technical Meetings, January 2006
Attended Advisory Board Meeting with Fluke Instrumentation on Indoor Air Quality, January 2006
Developed HVAC 499 for Online delivery via Web CT, Fall 2005
Developed HVAC 342 for Online delivery via Web CT, Summer 2005
Attended Advisory Board Meeting with Fluke Instrumentation on Indoor Air Quality, July 2005
LEED Training Regional Workshop (West Michigan), Spring 2005
Developed HVAC 462 for Online delivery via Web CT, Winter 2005
Attended Winter ASHRAE/AHR Expo and Technical Meetings, January 2005
Attended Advisory Board Meeting with Fluke Instrumentation on Indoor Air Quality, January 2005
Attended Advisory Board Meeting with Fluke Instrumentation on Indoor Air Quality, Summer 2004
Attended Lily West Conference, April 2004
Attended Winter ASHRAE/AHR Expo and Technical Meetings, January 2004
Completed Tegrity Training for On-line Curriculum Development, Fall 2003
Completed Web CT Training for On-line Curriculum Delivery, Fall 2003

Teaching Experience

| | |
|---|---|
| Fall 2017 | HVAC 326 Water Side System Selection/Design (online), Ferris State U |
| Summer 2017 | HVAC 322 Air Side System Selection/Design (online), Ferris State U |
| Spring 2017 | HVAC 499 Capstone Experience (on-line), Ferris State U |
| Fall 2016 | HVAC 326 Water Side System Selection/Design (online), Ferris State U |
| Fall 2016 | HVAC 337 Mechanical-Electrical Systems, Ferris State U |

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|---|---|
| Summer 2016 U | HVAC 322 Air Side System Selection/Design (online), Ferris State |
| Spring 2016 | HVAC 499 Capstone Experience (on-line), Ferris State U |
| Fall 2015 State U | HVAC 326 Water Side System Selection/Design (online), Ferris |
| Summer 2015 U | HVAC 322 Air Side System Selection/Design (online), Ferris State |
| Spring 2015 | HVAC 499 Capstone Experience (on-line), Ferris State University |
| Fall 2014 | HVAC 362 Primary Equipment Selection (on-line), Ferris State U |
| Summer 2014 | HVAC 333 Lab Experience for online learners, Ferris State U |
| Spring 2014 | HVAC 362 Primary Equipment Selection, Ferris State U |
| Fall 2013 | HVAC 332 Secondary System Design (online), Ferris State U |
| Summer 2013 | HVAC 333 Lab Experience for online learners, Ferris State U |
| Spring 2013 | HVAC 362 Primary Equipment Selection, Ferris State University |
| Fall 2012 | HVAC 332 Secondary System Design (online), Ferris State U |
| Summer 2012 | HVAC 393 Internship, Ferris State University |
| Summer 2012 | HVAC 333 Lab Experience for online learners, Ferris State U |
| Spring 2012 | HVAC 499 Capstone Experience, Ferris State University |
| Fall 2011 | HVAC 332 Secondary System Design (online), Ferris State U |
| Summer 2011 | HVAC 333 Lab Experience for online learners, Ferris State U |
| Spring 2011 | HVAC 362 Primary Equipment Selection, Ferris State U |
| Fall 2010 | HVAC 331 Secondary System Design, Ferris State U |
| Fall 2010 | HVAC 332 Secondary System Design (online), Ferris State U |
| Summer 2010 | HVAC 333 Lab Experience for online learners, Ferris State U |
| Spring 2010 | HVAC 362 Primary Equipment Selection, Ferris State U |
| Fall 2009 | HVAC 331 Secondary System Design, Ferris State U |
| Fall 2009 | HVAC 332 Secondary System Design (online), Ferris State U |
| Summer 2009 | HVAC 393 Internship, Ferris State U |
| Summer 2009 | HVAC Orientation Class for Online Learners |
| Summer 2009 | HVAC 333 Lab Experience for online learners, Ferris State U |
| Spring 2009 | HVAC 499 Capstone Experience, Ferris State U |
| Fall 2008 | HVAC 331 Secondary System Design, Ferris State U |
| Fall 2008 | HVAC 332 Secondary System Design (online), Ferris State U |
| Summer 2008 | HVAC 393 Internship, Ferris State U |
| Summer 2008 | HVAC Orientation Class for Online Learners |
| Summer 2008 | HVAC 333 Lab Experience for online learners, Ferris State U |
| Spring 2008 | HVAC 499 Capstone Experience, Ferris State U |
| Fall 2007 | HVAC 331 Secondary System Design, Ferris State U |
| Fall 2007 | HVAC 332 Secondary System Design (online), Ferris State U |
| Summer 2007 | HVAC 393 Internship, Ferris State U |
| Summer 2007 | HVAC 333 Lab Experience for online learners, Ferris State U |
| Spring 2007 | HVAC 499 Capstone Experience, Ferris State U |
| Fall 2006 | HVAC 331 Secondary System Design, Ferris State U |
| Fall 2006 | HVAC 332 Secondary System Design (online), Ferris State U |
| Summer 2006 | HVAC 393 Internship, Ferris State U |
| Summer 2006 | HVAC 333 Lab Experience for online learners, Ferris State U |

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|---|---|
| Winter 2006 | HVAC 499 Capstone Experience, Ferris State U |
| Fall 2005 | HVAC 331 Secondary System Design, Ferris State U |
| Fall 2005 | HVAC 332 Secondary System Design (online), Ferris State U |
| Summer 2005 | HVAC 393 Internship, Ferris State U |
| Summer 2005 | HVAC 333 Lab Experience for online learners, Ferris State U |
| Winter 2005 | HVAC 499 Capstone Experience, Ferris State U |
| Winter 2005 | HVAC 462 Primary Equipment, Ferris State U |
| Fall 2004 | HVAC 331 Secondary System Design, Ferris State U |
| Fall 2004 | HVAC 332 Secondary System Design (online), Ferris State U |
| Summer 2004 | HVAC 393 Internship, Ferris State U |
| Summer 2004 | HVAC 333 Lab Experience for online learners, Ferris State U |
| Winter 2004 | HVAC 499 Capstone Experience, Ferris State U |
| Fall 2003 | HVAC 331 Secondary System Design, Ferris State U |
| Fall 2003 | HVAC 332 Secondary System Design (online), Ferris State U |
| Fall 2003 | HVAC 337 Mechanical-Electrical Systems, Ferris State U |

Previous Experience

Professional Technical Sales Engineer with Trane Commercial/Industrial Sales in Detroit Michigan, handled industrial clients with HVAC and heat transfer applications – projects included total renovation of old GM corporate headquarters and numerous industrial heat transfer applications. Projects ranged from Michigan (many locations) to Monterrey, Mexico.

Co-owner of ZENCAR Engineering, provided engineering services to industrial clients including GM & Ford. Projects included industrial production and human comfort mechanical systems.

1994-1995 Vice President of Engineering and Manufacturing for EPPA Industries (custom air handling manufacturer), provided custom air handling equipment for complex industrial applications throughout the United States with GM, Ford, Navistar, Chrysler and many others.

Manager of Design-Build Engineering for O'Neil Mechanical Contracting, primary clients included industrials (Ford & Chrysler) and scope of projects varied from production, to research and human comfort. Example project was "Hot-Form" stamping of crash impact protection where high strength steel was stamped and cooled from 1600 F to 275 F during the stamping process.

1981-1992 Professional Technical Sales Engineer for Trane Detroit Commercial Systems, clients included architects, engineers, contractors, building owners, and hospitals – provided design assistance and education of HVAC systems to clients including energy analysis of buildings.

Notables

Co-advisor for Student ASHRAE organization at Ferris State University
Recipient of the ASHRAE Distinguished Service Award
Past Chair of ASHRAE Society Student Activities Committee and Society Board of Governors
Past Region V (Ohio, Indiana & Michigan) Representative for Student Activities in ASHRAE
Past presenter to Michigan ASHRAE conferences
Past presenter for Trane in HVAC training classes
Alum of Phi Kappa Sigma Fraternity from Purdue University
Finalist for nomination to the Air Force Academy in 1975 from the State of Indiana
Past member of National Honor Society

# Professor Joseph Pacella

Ferris State University
CET - School of Built Environment
(231) 591-3586
Email: JosephPacella@ferris.edu

Education

Masters in Information Systems Management, Ferris State University, 2008.
Major: Computer Information Systems Management
Supporting Areas of Emphasis: System hardening using Linux

BS, Ferris State University, 1987.
Major: HVAC and Energy Management

AAS, Ferris State College, 1982.
Major: HVAC

Professional Positions

Academic - Post-Secondary

Associate Professor, Ferris State University. (August 2011 - Present).

Professional

Owner, Advantage Heating & Air, LLC. (August 2002 - Present).

Licensures and Certifications

LEED AP, USGBC. (June 2010 - June 2099).

Professional Memberships

None, United States Green Building Council. (July 1, 2009 - Present).

Manual N, Manual P & standards Task Team Member, Air Conditioning Contracors of America. (January 1, 2006 - Present).

None, American Society of Heating , Refrigeration and Air Conditioning Engineers. (January 2006 - Present).

Teaching

Teaching Experience

Ferris State University
HVAC 350, Contracting Issues in HVACR, 4 courses.
HVAC 451, Energy Audit and Analysis, 1 course.

SCHOLARSHIP AND Research

Presentations Given

Pacella, J. R. (Leader), MCTA Annual Conference, "Residential HVAC Systems," Michigan Construction Teachers Association, Michigan. (February 8, 2018).

# Assessment: Course Planning

## Z - HVAC Courses

### HVAC 101: Intro to Refrig and AC Systems

### Course Outcome: Safety

Students will a hieve proficiency in sá tey.

**Course Outcome Status:** Active

#### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post** - Exa 1: Fa ulty will test student in cla sroom setting. Exa will a sess student understa ding of sá ety, history, ma ifold ga ges, refrigera ts, pressures, hea , ma ter a d tempera ure. The exa will a so a sess the students a ility to a ply their understa ding. (Active)

**Criterion for Success:** 80% test score average.

#### *Results*

**Reporting Period:** 2017 - 2018 — 03/01/2018
**Classification:** Criterion Met
Class Average was 83.13%

**Reporting Period:** 2017 - 2018 — 10/11/2017
**Classification:** Criterion Met
Cla s a erg e wa 86%

**Reporting Period:** 2016 - 2017 — 03/01/2017
**Classification:** Criterion Met
Class average was 88.91%.

**Reporting Period:** 2016 - 2017 — 10/12/2016
**Classification:** Criterion Met
Class average was 86.80%

**Reporting Period:** 2015 - 2016 — 03/02/2016
**Classification:** Criterion Met
Class average was 88.87%

**Reporting Period:** 2015 - 2016 — 10/21/2015
**Classification:** Criterion Met
Class average was 80.97%

**Reporting Period:** 2014 - 2015 — 03/04/2015
**Classification:** Criterion Not Met
Class average was 77.32%

#### *Actions*

**Action:** 08/31/2015 Added several "practice" homework assignments on BlackBoard related to areas of exam which needed improvement.
**Follow-Up:** 10/21/2015 Criterion met: 80.97% class average on exam.

**Reporting Period:**
**Classification:**

### *Actions*

**Action:**

**Follow-Up:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

## Course Outcome: History & Development of Refrigeration

**Course Outcome Status:**

# Z - HVAC Courses

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]

[illegible]

[illegible]

**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]
[illegible]

# Course Outcome: Heat / Matter / Temperature

[illegible]

**Course Outcome Status:** [illegible]

# Z - HVAC Courses

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*
**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Pressures

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]

# Z - HVAC Courses

**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*
**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*
**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*
**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Refrigeration Systems

[illegible]
[illegible]
**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]

# Z - HVAC Courses

**Follow-Up:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

## Results

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

## Actions

**Action:**
**Follow-Up:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

## Results

**Reporting Period:**

**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Refrigerants

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### Actions

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]
[illegible]

## Course Outcome: Manifold Gauges / Service Valves / Name Plate Data

[illegible]

**Course Outcome Status:** [illegible]

### Assessment Methods

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
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[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### Actions

**Action:** [illegible]

Follow-Up:

Reporting Period:
Classification:

### *Actions*

Action:

Follow-Up:

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

## *Results*

Reporting Period:
Classification:

Reporting Period:
Classification:

Reporting Period:
Classification:

Reporting Period:
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Reporting Period:
Classification:

Reporting Period:
Classification:

Reporting Period:
Classification:

Reporting Period:
Classification:

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

## *Results*

# Z - HVAC Courses

Reporting Period:
Classification:

Reporting Period:
Classification:

Reporting Period:
Classification:

Reporting Period:
Classification:

Reporting Period:
Classification:

Reporting Period:
Classification:

Reporting Period:
Classification:

### *Actions*

**Action:**

**Follow-Up:**

Reporting Period:
Classification:

## Course Outcome: Vacuum Pumps, Recovery/Reclaim/Recycle Equipment

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

Reporting Period:
Classification:

Reporting Period:

**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

### Actions

**Action:**

**Follow-Up:**

**Reporting Period:**
**Classification:**

## Course Outcome: Charging Cylinders

**Course Outcome Status:**

### Assessment Methods

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### Results

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]

# Z - HVAC Courses

**Classification:**

## Course Outcome: Ammeter / Cap Tube Systems

**Course Outcome Status:**

### *Assessment Methods*

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

#### *Results*

**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

#### *Results*

# Z - HVAC Courses

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

### *Actions*

**Action:**
**Follow-Up:**

**Reporting Period:**
**Classification:**

## Course Outcome: Charging Procedure

**Course Outcome Status:**

### *Assessment Methods*

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**

**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
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[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]%

## *Results*

**Reporting Period:** [illegible] [illegible]
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[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]

# Z - HVAC Courses

**Classification:**

### Actions

**Action:**

**Follow-Up:**

**Reporting Period:**
**Classification:**

## Course Outcome: System Components & Application

**Course Outcome Status:**

### Assessment Methods

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

### Results

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
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**Reporting Period:**
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**Reporting Period:**
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**Reporting Period:**
**Classification:**

**Reporting Period:**

**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### Results

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

#### Actions

**Action:**

**Follow-Up:**

**Reporting Period:**
**Classification:**

## Course Outcome: Leak Checking / Dehydration / Charging / Setup Procedures for TXV

**Course Outcome Status:**

### Assessment Methods

**Written Product (essay, research paper, journal, newsletter, etc.) -**

# Z - HVAC Courses

[illegible]
[illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
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[illegible]
**Criterion for Success:** [illegible]

## *Results*

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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]

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**Reporting Period:** [illegible] [illegible]
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[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## HVAC 102: Advanced Refrigeration and AC

## Course Outcome: Introduction, orientation, and safety

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

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**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Pressure-heat diagram

[illegible]
[illegible]
[illegible]
**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

#### *Results*

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[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Physical and chemical properties of refrigerants and refrigerant blends

[illegible]
[illegible]
[illegible]
**Course Outcome Status:** [illegible]

# Z - HVAC Courses

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Course Outcome: Refrigerant oils

[illegible]
[illegible]
**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Theoretical and actual refrigeration capacities with power requirements

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]
[illegible]

## Course Outcome: Pressure drop due to frictional line loss in low side of system

[illegible]
[illegible]
**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

#### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Automated metering devices

[illegible]
[illegible]
**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
[illegible]

# Z - HVAC Courses

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Course Outcome: Compressors

[illegible]
[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Determination, cause and cleanup of compressor burnout

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: System analysis and system troubleshooting

[illegible]
[illegible]

# Z - HVAC Courses

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Course Outcome: EPA Section 608 Certification

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - External - Post or Pre/Post -** [illegible]
[illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## HVAC 111: Electricity-Blueprints-Fabrication

## Course Outcome: Electrical

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

[illegible]
**Criterion for Success:** [illegible]
[illegible]
[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Circuits and Ohms Law

[illegible]

**Course Outcome Status:** [illegible]

## Course Outcome: Electric Generation and Principles

# Z - HVAC Courses

[illegible]

**Course Outcome Status:** [illegible]

## Course Outcome: AC Characteristics

[illegible]

**Course Outcome Status:** [illegible]

## Course Outcome: Duct Fabrication

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

[illegible]

**Criterion for Success:** [illegible]

[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

[illegible]

**Criterion for Success:** [illegible]

[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

# Course Outcome: Piping Systems

**Course Outcome Status:**

## *Assessment Methods*

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

#### *Actions*

**Action:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

[illegible]
**Criterion for Success:** [illegible]
[illegible]

### Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Blueprints and Schematics

[illegible]

**Course Outcome Status:** [illegible]

### Assessment Methods

[illegible]
**Criterion for Success:** [illegible]
[illegible]

### Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### Actions

**Action:** [illegible]
**Follow-Up:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

### *Actions*

**Action:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## HVAC 117: Advanced Electricity-Circuits

## Course Outcome: Power & Transformers

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]
**Assessment Schedule:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### Actions

**Action:**

**Follow-Up:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### Results

**Reporting Period:**

**Classification:**

### Actions

**Action:**

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**Reporting Period:**

**Classification:**

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**Reporting Period:**

**Classification:**

### Actions

**Action:**

**Follow-Up:**

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**Reporting Period:**

**Classification:**

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**Reporting Period:**

**Classification:**

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**Reporting Period:**

**Classification:**

---

**Reporting Period:**

**Classification:**

### Actions

**Action:**

**Follow-Up:**

## Course Outcome: Alternating current, series and parallel circuits, and ohms and watts laws.

# Z - HVAC Courses

[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]
**Assessment Schedule:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

# Course Outcome: Motors

[illegible]

**Course Outcome Status:** [illegible]

# Z - HVAC Courses

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

#### *Actions*

**Action:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
**Follow-Up:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
**Follow-Up:** [illegible]

# Course Outcome: Wiring Diagrams / Conductor Sizing

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Project/Model/Invention -** [illegible]
[illegible]

# Z - HVAC Courses

[illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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### *Actions*

**Action:** [illegible]
**Follow-Up:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Test - Internally Developed - Pre/Post or Post -** [illegible]
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[illegible]
**Criterion for Success:** [illegible]
**Assessment Schedule:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

# Z - HVAC Courses

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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### *Actions*
**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*
**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*
**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

### *Actions*
**Action:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*
**Action:** [illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

**Reporting Period:**
**Classification:**

### *Actions*

**Action:**
**Follow-Up:**

## Course Outcome: Low Voltage Thermostats

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**
**Assessment Schedule:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

### *Actions*

**Action:**
**Follow-Up:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

# Z - HVAC Courses

### Actions
**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

## Course Outcome: Relays, Contactors, and Motor Starters.

[illegible]
[illegible]
**Course Outcome Status:** [illegible]

### Assessment Methods

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]
**Assessment Schedule:** [illegible]

### Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### Actions
**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### Actions
**Action:** [illegible]
[illegible]

**Follow-Up:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

### Actions

**Action:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

### Actions

**Action:** [illegible]
**Follow-Up:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

### Actions

**Action:** [illegible]
**Follow-Up:** [illegible]

# Course Outcome: Compressor start devices and commercial defrost control.

[illegible]

**Course Outcome Status:** [illegible]

## Assessment Methods

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]

[illegible]
**Criterion for Success:** [illegible]

## Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

### Actions

**Action:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### Actions

**Action:** [illegible]
**Follow-Up:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### Actions

**Action:** [illegible]
**Follow-Up:** [illegible]

# HVAC 127: Advanced HVACR Controls

## Course Outcome: Control terms and application

[illegible]

**Course Outcome Status:** [illegible]
**Planned Semester(s) of Assessment:** [illegible]
**Start Date:** [illegible]
**End Date:** [illegible]

### Assessment Methods

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

# Z - HVAC Courses

**Assessment Schedule:**

## Results

**Reporting Period:**
**Classification:**

### Actions

**Action:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Change Assessment Strategy:**

**Curriculum Change:**

### Actions

**Action:**

**Reporting Period:**
**Classification:**

# Course Outcome: HVACR Control installation

**Course Outcome Status:**
**Planned Semester(s) of Assessment:**
**Start Date:**
**End Date:**

## Assessment Methods

**Observations (e.g. Clinical or Field) -**

**Criterion for Success:**

**Assessment Schedule:**

## Results

# Z - HVAC Courses

**Reporting Period:**
**Classification:**

### *Actions*

**Action:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

## Course Outcome: Troubleshoot and repair HVACR controls

**Course Outcome Status:**
**Planned Semester(s) of Assessment:**
**Start Date:**
**End Date:**

### *Assessment Methods*

**Observations (e.g. Clinical or Field) -**
**Criterion for Success:**
**Assessment Schedule:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**
**Criterion for Success:**
**Assessment Schedule:**

### *Results*

**Reporting Period:**
**Classification:**

### *Actions*

**Action:**

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## HVAC 132: Fund of Heating-Mech Systems

## Course Outcome: Combustion

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Gas Fired Systems

[illegible]

**Course Outcome Status:** [illegible]

# Z - HVAC Courses

## Assessment Methods

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

### Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### Actions

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Forced-Air Furnaces

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

#### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

#### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]%

**Reporting Period:** [illegible] [illegible]

# Z - HVAC Courses

**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Performance (e.g. Music, Theatre) -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Air pressures and air flow

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Make-Up Air

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

# Z - HVAC Courses

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

# Course Outcome: Gas Train Assemblies and Flame Safeguard Controls

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]

# Z - HVAC Courses

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Performance (e.g. Music, Theatre) -** [illegible]
[illegible]
**Criterion for Success:** [illegible]
**Assessment Schedule:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Customer Relations

[illegible]

**Course Outcome Status:** [illegible]
**Start Date:** [illegible]

### *Assessment Methods*

**Presentation (Oral) -** [illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Curriculum Change:** [illegible]

#### *Actions*

**Action:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## HVAC 207: Commercial Refrigeration Syst

## Course Outcome: Food

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Troubleshooting Commercial Refrigeration Systems

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Compressor Components and causes of failures

[illegible]

**Course Outcome Status:** [illegible]

# Z - HVAC Courses

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Electrical Systems for Commercial Refrigeration Systems

[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Observations (e.g. Clinical or Field) -** [illegible]
**Criterion for Success:** [illegible]

### *Results*

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Water Cooled Condensers

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

#### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Observations (e.g. Clinical or Field) -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

#### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Commercial Ice Machines

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

#### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]

**Classification:**

**Reporting Period:**
**Classification:**

**Change Assessment Strategy:**
**Curriculum Change:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

## Course Outcome: Specialty Refrigeration Valves

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

#### *Actions*

**Action:**

**Reporting Period:**
**Classification:**

**Observations (e.g. Clinical or Field) -**
**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

#### *Actions*

**Action:**

**Reporting Period:**

# Z - HVAC Courses

**Classification:** [illegible]
[illegible]

## HVAC 208: Air Conditioning Applications

## Course Outcome: Safety

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: System Classifications

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Psychrometrics

# Z - HVAC Courses

[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

# Course Outcome: Air Conditioning Systems

[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

# Z - HVAC Courses

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Heat Pump Systems

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]

# Z - HVAC Courses

**Criterion for Success:** [illegible]

## Course Outcome: Chillers

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

#### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

#### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Cooling Towers and Evaporative Condensers

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

# Z - HVAC Courses

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

# Course Outcome: Capacity Control Systems

[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

## HVAC 235: Advanced Heating-Mechnical Systems

## Course Outcome: Introduction, Orientation, and Safety

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Operation of high pressure gun type oil burner

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

## Course Outcome: Fuel pumps

[illegible]
[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Nozzles

[illegible]
[illegible]
[illegible]

# Z - HVAC Courses

**Course Outcome Status:**

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

# Course Outcome: Primary controls

**Course Outcome Status:**

## *Assessment Methods*

# Z - HVAC Courses

## Results

**Reporting Period:**
**Classification:**

# Course Outcome: Operation and troubleshooting complete unit

**Course Outcome Status:**

## Assessment Methods

**Test - Internally Developed - Pre/Post or Post -**
**Criterion for Success:**

## Results

**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

### Actions

**Action:**

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**Reporting Period:**
**Classification:**

# Z - HVAC Courses

[illegible]

## Course Outcome: Combustion chambers

[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

## Course Outcome: Combustion testing and efficiency

[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

**Directly related to Course Outcome**

### *Results*

**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

### *Results*

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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

# Z - HVAC Courses

[illegible]

## Course Outcome: Hydronics

[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

### *Results*

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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Steam

[illegible]
[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## HVAC 245: HVAC Unitary System Design

## Course Outcome: Psychrometrics

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

#### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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[illegible]

#### *Actions*

**Action:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]
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### *Actions*

**Action:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Residential load calculation

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Project/Model/Invention -** [illegible]
**Criterion for Success:** [illegible]
[illegible]
[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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[illegible]
[illegible]
**Curriculum Change:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
**Change Assessment Strategy:** [illegible]
**Curriculum Change:** [illegible]

## *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

## Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### Actions

**Action:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### Actions

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Course Outcome: Residential equipment selection

[illegible]

**Course Outcome Status:** [illegible]

## Assessment Methods

**Project/Model/Invention -** [illegible]
**Criterion for Success:** [illegible]
[illegible]
[illegible]

# Z - HVAC Courses

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Residential air distribution system design

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Project/Model/Invention -** [illegible]
**Criterion for Success:** [illegible]
[illegible]
[illegible]
[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]

**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

## Course Outcome: Commercial System Identification and Operation

**Course Outcome Status:**

### *Assessment Methods*

**Project/Model/Invention -**
**Criterion for Success:**

#### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**
**Criterion for Success:**

#### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
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**Reporting Period:**
**Classification:**

## Course Outcome: Residential hydronic design

**Course Outcome Status:**

### *Assessment Methods*

**Project/Model/Invention -**
**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**

**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
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### *Results*

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## HVAC 312: HVAC Control Theory-Applicat

## Course Outcome: Control Terminology

# Z - HVAC Courses

[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Visual Displays (e.g. webpage, film, Concept maps, graphics, etc.) -** [illegible]
[illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]
[illegible]
[illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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# Z - HVAC Courses

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**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

# Z - HVAC Courses

[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible]
**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible]
**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible]
**Classification:** [illegible]

[illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible]

**Classification:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible]

**Classification:** [illegible]

# Z - HVAC Courses

**Change Assessment Strategy:** [illegible]

## *Actions*

**Action:** [illegible]

**Reporting Period:** [illegible]

**Classification:** [illegible]

**Reporting Period:** [illegible]

**Classification:** [illegible]

# Z - HVAC Courses

## *Related Goals*

[illegible]

**Learning -** [illegible]

[illegible]

# Course Outcome: Loop Components

[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]

**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

## *Results*

**Reporting Period:**

**Classification:**

**Reporting Period:**

**Classification:**

# Z - HVAC Courses

**Reporting Period:** [illegible]

**Classification:** [illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible]
**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]
[illegible]

## *Related Goals*

[illegible]

**Learning -** [illegible]
[illegible]

# Course Outcome: Transfer Function Basics

[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Written Product (essay, research paper, journal, newsletter, etc.) -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

### *Results*

**Reporting Period:** [illegible]
**Classification:** [illegible]
[illegible]

[illegible]

**Reporting Period:** [illegible]

# Z - HVAC Courses

**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

# Z - HVAC Courses

**Reporting Period:**
**Classification:**

## *Related Goals*

**Learning -**

# Course Outcome: Transfer Function Application

**Course Outcome Status:**

## *Assessment Methods*

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## *Results*

**Reporting Period:**
**Classification:**

# Z - HVAC Courses

[illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

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**Reporting Period:** [illegible]
**Classification:** [illegible]

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# Z - HVAC Courses

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

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**Test - Internally Developed - Pre/Post or Post -** [illegible]

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**Criterion for Success:** [illegible]

## *Results*

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**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

# Z - HVAC Courses

## Related Goals

**Learning -**

# Course Outcome: Sensors

**Course Outcome Status:**

## Assessment Methods

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Results

**Reporting Period:**

**Classification:**

**Reporting Period:**

**Classification:**

# Z - HVAC Courses

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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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# Z - HVAC Courses

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**Test - Internally Developed - Pre/Post or Post -** [illegible]
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**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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# Z - HVAC Courses

## *Related Goals*

| [illegible] |
|---|
| **Learning -** [illegible]<br>[illegible] |

# Course Outcome: Controllers

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Case Studies/Problem-based Assignments -** [illegible]
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**Criterion for Success:** [illegible]

## *Results*

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# Z - HVAC Courses

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

# Z - HVAC Courses

**Test - Internally Developed - Pre/Post or Post -** [illegible]
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**Criterion for Success:** [illegible]

## *Results*

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### *Actions*

**Action:** [illegible]

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**Reporting Period:** [illegible] [illegible]
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**Change Assessment Strategy:** [illegible]

### *Actions*

**Action:** [illegible]
[illegible]

# Z - HVAC Courses

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

## *Related Goals*

**Learning -**

## Course Outcome: Process Characterisitics

**Course Outcome Status:**

# Z - HVAC Courses

## *Assessment Methods*

**Case Studies/Problem-based Assignments -** [illegible]

[illegible]

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible]

**Classification:** [illegible]

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**Reporting Period:** [illegible]

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**Reporting Period:** [illegible]

**Classification:** [illegible]

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# Z - HVAC Courses

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**Reporting Period:** [illegible]
**Classification:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible]
**Classification:** [illegible]

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**Reporting Period:** [illegible]

**Classification:** [illegible]

[illegible]

## *Related Goals*

| [illegible] |
|---|
| **Learning -** [illegible] [illegible] |

## Course Outcome: Modulating Final Control Devices

[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Project/Model/Invention -** [illegible]

# Z - HVAC Courses

**Criterion for Success:** [illegible]
**Assessment Schedule:** [illegible]

## Results

**Reporting Period:** [illegible]
**Classification:** [illegible]

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**Reporting Period:** [illegible]
**Classification:** [illegible]

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**Reporting Period:** [illegible]
**Classification:** [illegible]

# Z - HVAC Courses

Test - Internally Developed - Pre/Post or Post -

Criterion for Success:

## *Results*

Reporting Period:
Classification:

Reporting Period:
Classification:

# Z - HVAC Courses

## Related Goals

**Learning -** [illegible]

# Course Outcome: Documentation

**Course Outcome Status:** [illegible]

**Planned Semester(s) of Assessment:** [illegible]

## Assessment Methods

**Project/Model/Invention -** [illegible]

**Criterion for Success:** [illegible]

**Assessment Schedule:** [illegible]

### Results

**Reporting Period:** [illegible]

**Classification:** [illegible]

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**Change Assessment Strategy:** [illegible]

## *Actions*

**Action:** [illegible]

**Reporting Period:** [illegible]

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**Reporting Period:** [illegible]

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**Reporting Period:** [illegible]

**Classification:** [illegible]

# Z - HVAC Courses

Test - Internally Developed - Pre/Post or Post -

Criterion for Success:

## *Results*

Reporting Period:

Classification:

Reporting Period:

Classification:

# Z - HVAC Courses

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

## *Related Goals*

# Z - HVAC Courses

| |
|---|
| Collaboration - |
| Learning - |

## HVAC 313: HVAC Control Theory-Applicat

## Course Outcome: Control Terminology

**Course Outcome Status:**
**Planned Semester(s) of Assessment:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**

# Z - HVAC Courses

**Classification:** [illegible]

**Reporting Period:** [illegible]

**Classification:** [illegible]

**Reporting Period:** [illegible]

**Classification:** [illegible]

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**Case Studies/Problem-based Assignments -** [illegible]

[illegible]

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible] [illegible]
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# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Test - Internally Developed - Pre/Post or Post -** [illegible]

[illegible]

**Criterion for Success:** [illegible]

## *Results*

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# Z - HVAC Courses

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**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

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**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Loop Components

[illegible]

**Course Outcome Status:** [illegible]
**Planned Semester(s) of Assessment:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
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**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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# Z - HVAC Courses

[illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
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[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

# Z - HVAC Courses

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## *Results*

**Reporting Period:**

**Classification:**

**Reporting Period:**

**Classification:**

# Z - HVAC Courses

[illegible]

**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

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# Z - HVAC Courses

[illegible]

### Actions

**Action:** [illegible]

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**Test - Internally Developed - Pre/Post or Post -** [illegible]

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**Criterion for Success:** [illegible]

## Results

**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

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**Reporting Period:** [illegible] [illegible]
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# Z - HVAC Courses

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**Reporting Period:** [illegible]
**Classification:** [illegible]

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**Reporting Period:** [illegible]
**Classification:** [illegible]

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# Z - HVAC Courses

## Course Outcome: Transfer Function Basics

[illegible]

**Course Outcome Status:** [illegible]
**Planned Semester(s) of Assessment:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]

**Criterion for Success:** [illegible]

### *Results*

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**Reporting Period:** [illegible]
**Classification:** [illegible]

# Z - HVAC Courses

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

# Z - HVAC Courses

## *Results*

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**Classification:** [illegible]

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**Reporting Period:** [illegible]

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**Reporting Period:** [illegible]

**Classification:** [illegible]

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**Reporting Period:** [illegible]

**Classification:** [illegible]

# Z - HVAC Courses

Reporting Period: [illegible]
Classification: [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]

**Criterion for Success:** [illegible]

## Course Outcome: Sensors

**Course Outcome Status:** [illegible]
**Planned Semester(s) of Assessment:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]

**Criterion for Success:** [illegible]

### *Results*

# Z - HVAC Courses

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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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# Z - HVAC Courses

**Reporting Period:**

**Classification:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## *Results*

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# Z - HVAC Courses

**Test - Internally Developed - Pre/Post or Post -** [illegible]

**Criterion for Success:** [illegible]

## *Results*

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# Z - HVAC Courses

**Reporting Period:** [illegible]

**Classification:** [illegible]

**Reporting Period:** [illegible]

**Classification:** [illegible]

# Z - HVAC Courses

## Course Outcome: Controllers

[illegible]
[illegible]

**Course Outcome Status:** [illegible]
**Planned Semester(s) of Assessment:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
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**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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# Z - HVAC Courses

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**Case Studies/Problem-based Assignments -** [illegible]
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**Criterion for Success:** [illegible]

## Results

# Z - HVAC Courses

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# Z - HVAC Courses

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

## *Results*

**Reporting Period:**
**Classification:**

# Z - HVAC Courses

## Course Outcome: Process Characterisitics

**Course Outcome Status:**
**Planned Semester(s) of Assessment:**

### Assessment Methods

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### Results

**Reporting Period:**
**Classification:**

# Z - HVAC Courses

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

## *Results*

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**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
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# Z - HVAC Courses

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**Reporting Period:** [illegible]
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**Reporting Period:** [illegible]
**Classification:** [illegible]

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**Reporting Period:** [illegible]
**Classification:** [illegible]

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# Z - HVAC Courses

## Course Outcome: Modulating Final Control Devices

**Course Outcome Status:**
**Planned Semester(s) of Assessment:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**

# Z - HVAC Courses

**Classification:** [illegible]

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**Reporting Period:** [illegible]

**Classification:** [illegible]

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**Reporting Period:** [illegible]

**Classification:** [illegible]

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**Reporting Period:** [illegible]

**Classification:** [illegible]

# Z - HVAC Courses

**Reporting Period:**
**Classification:**

**Case Studies/Problem-based Assignments -**

# Z - HVAC Courses

[illegible]
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**Criterion for Success:** [illegible]

## Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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### Actions

**Action:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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### Actions

**Action:** [illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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# Z - HVAC Courses

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**Reporting Period:** [illegible]

**Classification:** [illegible]

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**Test - Internally Developed - Pre/Post or Post -** [illegible]

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**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible]

**Classification:** [illegible]

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# Z - HVAC Courses

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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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# Z - HVAC Courses

[illegible]

## Course Outcome: Documentation

[illegible]

**Course Outcome Status:** [illegible]
**Planned Semester(s) of Assessment:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]

[illegible]

**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible]
**Classification:** [illegible]

[illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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**Reporting Period:** [illegible] [illegible]
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[illegible]

# Z - HVAC Courses

[illegible]

**Case Studies/Problem-based Assignments -** [illegible]

**Criterion for Success:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible]

**Classification:** [illegible]

[illegible]

# Z - HVAC Courses

## HVAC 314: HVAC Control Laboratory

## Course Outcome: Transfer Function Application

**Course Outcome Status:**
**Planned Semester(s) of Assessment:**

### *Assessment Methods*

**Observations (e.g. Clinical or Field) -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

## Course Outcome: Controllers

**Course Outcome Status:**
**Planned Semester(s) of Assessment:**

### *Assessment Methods*

**Observations (e.g. Clinical or Field) -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

# Z - HVAC Courses

## Course Outcome: Documentation

**Course Outcome Status:**

**Planned Semester(s) of Assessment:**

### *Assessment Methods*

**Observations (e.g. Clinical or Field) -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

# HVAC 321: HVAC Air System Select-Design

## Course Outcome: Applied Psychrometrics

**Course Outcome Status:**

## Course Outcome: Air Diffusion

**Course Outcome Status:**

## Course Outcome: Ductwork

**Course Outcome Status:**

## Course Outcome: Air System Pressure Loss Calculations

**Course Outcome Status:**

# Z - HVAC Courses

## Course Outcome: Air System Configuration

[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## Course Outcome: Fan Selection and Performance

[illegible]
[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## Course Outcome: Duct System Design Procedure

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## Course Outcome: Air System Testing and Balancing

[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

# HVAC 325: HVAV Hydronic System Slct-Dsgn

## Course Outcome: Hydronic System Definition and Classification

[illegible]
[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## Course Outcome: Terminal Devices

[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## Course Outcome: Hydronic System Design Procedure

[illegible]
[illegible]
[illegible]

# Z - HVAC Courses

**Course Outcome Status:**

## Course Outcome: Flow Control Devices

**Course Outcome Status:**

## Course Outcome: Pumps

**Course Outcome Status:**

## Course Outcome: Balancing Hydronic Systems

**Course Outcome Status:**

# HVAC 331: HVAC Sec Equip Selec-Design

## Course Outcome: Hydronic System Classification

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**

**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

## Course Outcome: Pumps

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**

**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Terminal Devices

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Flow Devices

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Hydronic System Design Procedure

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Balancing Hydronic Systems

# Z - HVAC Courses

[illegible]
[illegible]
**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Written Product (essay, research paper, journal, newsletter, etc.) -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

# Course Outcome: Air System Configurations

[illegible]
[illegible]
**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Written Product (essay, research paper, journal, newsletter, etc.) -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

# Z - HVAC Courses

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## Course Outcome: Fan Selection and Performance

[illegible]
[illegible]
[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Written Product (essay, research paper, journal, newsletter, etc.) -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

# Z - HVAC Courses

## Course Outcome: Ductwork

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**

**Classification:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Duct System Design Procedure

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**

**Classification:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: System Pressure Loss Calculation

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**

**Classification:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Air Diffusion

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Testing & Balancing

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

# Z - HVAC Courses

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

## Course Outcome: Final Exam

**Course Outcome Status:**
**Start Date:**

**Directly related to Course Outcome**

*Results*

**Reporting Period:**
**Classification:**

*Actions*

**Action:**

*Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

# HVAC 332: HVAC Sec Equip Selec-Design

## Course Outcome: Hydronic System Classification (Copy)

**Course Outcome Status:**

## Course Outcome: Pumps (Copy)

**Course Outcome Status:**

## Course Outcome: Terminal Devices (Copy)

# Z - HVAC Courses

**Course Outcome Status:**

## Course Outcome: Flow Devices (Copy)

**Course Outcome Status:**

## Course Outcome: Hydronic System Design Procedure (Copy)

**Course Outcome Status:**

## Course Outcome: Balancing Hydronic Systems (Copy)

**Course Outcome Status:**

## Course Outcome: Air System Configurations (Copy)

**Course Outcome Status:**

## Course Outcome: Fan Selection and Performance (Copy)

**Course Outcome Status:**

## Course Outcome: Ductwork (Copy)

**Course Outcome Status:**

## Course Outcome: Duct System Design Procedure (Copy)

**Course Outcome Status:**

## Course Outcome: System Pressure Loss Calculation (Copy)

# Z - HVAC Courses

**Course Outcome Status:**

## Course Outcome: Air Diffusion (Copy)

**Course Outcome Status:**

## Course Outcome: Testing & Balancing (Copy)

**Course Outcome Status:**

## HVAC 342: HVAC Load Calc and Energy Code

## Course Outcome: Building Heat Transfer

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

## Course Outcome: Heat Loss Load Calculation

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

---

**Reporting Period:**
**Classification:**

[illegible]

**Project/Model/Invention -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Heat Gain Load Calculation

[illegible]
[illegible]
**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Project/Model/Invention -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: Psychrometrics and Equipment Selection

[illegible]
[illegible]
**Course Outcome Status:** [illegible]

# Z - HVAC Courses

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Project/Model/Invention -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Course Outcome: HVAC System Design

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Project/Model/Invention -** [illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

**Reporting Period:**
**Classification:**

## Course Outcome: Energy Estimating Methods

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**
**Criterion for Success:**

#### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Project/Model/Invention -**
**Criterion for Success:**

#### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

# HVAC 350: Contracting Issues in HVAC

## Course Outcome: Plans & Specifications

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**
**Criterion for Success:**

#### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Codes and Standards

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

Criterion for Success:

## Course Outcome: Estimating

Course Outcome Status:

### Assessment Methods

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### Results

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Project Management / Post Award of Bid

**Course Outcome Status:**

### Assessment Methods

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

# Z - HVAC Courses

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Economic Analysis

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

## Course Outcome: Final Examination

**Course Outcome Status:**

# Z - HVAC Courses

**Start Date:** [illegible]
**End Date:** [illegible]

**Directly related to Course Outcome**

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## HVAC 362: Primary HVAC Equiptment Selection

## Course Outcome: Heat Exchangers

[illegible]
[illegible]
**Course Outcome Status:** [illegible]
**Start Date:** [illegible]
**End Date:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

**Project/Model/Invention -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

# Z - HVAC Courses

## Course Outcome: Cooling Towers

[illegible]
[illegible]
**Course Outcome Status:** [illegible]
**Start Date:** [illegible]
**End Date:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

#### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

#### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

#### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

#### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]

**Project/Model/Invention -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## Course Outcome: Air Handlers

[illegible]
[illegible]
**Course Outcome Status:** [illegible]
**Start Date:** [illegible]

# Z - HVAC Courses

**End Date:**

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

---

**Reporting Period:**
**Classification:**

**Project/Model/Invention -**

**Criterion for Success:**

# Course Outcome: Chillers

**Course Outcome Status:**
**Start Date:**
**End Date:**

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

# Z - HVAC Courses

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

## Course Outcome: Boilers

**Course Outcome Status:**
**Start Date:**
**End Date:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

# Z - HVAC Courses

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

## Course Outcome: Geothermal Systems

**Course Outcome Status:**
**Start Date:**
**End Date:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

## Course Outcome: Thermal Storage

**Course Outcome Status:**
**Start Date:**
**End Date:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**

**Classification:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

## Course Outcome: Combined heat and Power Systems

**Course Outcome Status:**
**Start Date:**
**End Date:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

## Course Outcome: Dehumidification Units

**Course Outcome Status:**
**Start Date:**
**End Date:**

# Z - HVAC Courses

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

**Project/Model/Invention -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## Course Outcome: Solar Thermal Energy

[illegible]
[illegible]
**Course Outcome Status:** [illegible]
**Start Date:** [illegible]
**End Date:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

**Project/Model/Invention -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

# HVAC 415: HVAC Digital Control Systems

## Course Outcome: Compare Systems

# Z - HVAC Courses

[illegible]

**Course Outcome Status:** [illegible]
**Planned Semester(s) of Assessment:** [illegible]

## *Assessment Methods*

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

# Z - HVAC Courses

# Course Outcome: Numbering Systems

**Course Outcome Status:** [illegible]

**Planned Semester(s) of Assessment:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible]

**Classification:** [illegible]

**Reporting Period:** [illegible]

**Classification:** [illegible]

**Reporting Period:** [illegible]

**Classification:** [illegible]

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

## Course Outcome: Binary Logic

**Course Outcome Status:**
**Planned Semester(s) of Assessment:**

### *Assessment Methods*

**Case Studies/Problem-based Assignments -**

# Z - HVAC Courses

[illegible]
[illegible]
[illegible]
[illegible]

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

### Results

**Reporting Period:** [illegible]
**Classification:** [illegible]

## Course Outcome: Microcomputers / DDC Systems

a [illegible]
b [illegible]
c [illegible]
d [illegible]
e [illegible]

**Course Outcome Status:** [illegible]
**Planned Semester(s) of Assessment:** [illegible]

### Assessment Methods

**Case Studies/Problem-based Assignments -** [illegible]

# Z - HVAC Courses

[illegible]

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

[illegible]

**Reporting Period:** [illegible]

**Classification:** [illegible]

[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]

[illegible]

**Criterion for Success:** [illegible]

## Results

**Reporting Period:** [illegible]

**Classification:** [illegible]

[illegible]

### Actions

**Action:** [illegible]

**Reporting Period:** [illegible]

**Classification:** [illegible]

[illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

## Course Outcome: Specifications and Hardware

a [illegible]
b [illegible]
c [illegible]
d [illegible]
e [illegible]

**Course Outcome Status:** [illegible]

# Z - HVAC Courses

**Planned Semester(s) of Assessment:** [illegible]

## *Assessment Methods*

**Case Studies/Problem-based Assignments -** [illegible]

[illegible]

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible]

**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible]

**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible]

**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible]

**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

# Course Outcome: DDC Database

[illegible]

A [illegible]

B [illegible]

C [illegible]

**Course Outcome Status:** [illegible]

**Planned Semester(s) of Assessment:** [illegible]

## *Assessment Methods*

**Case Studies/Problem-based Assignments -** [illegible]

[illegible]

**Criterion for Success:** [illegible]

# Z - HVAC Courses

### *Results*

**Reporting Period:**

**Classification:**

## Course Outcome: Program Statements

A

B

**Course Outcome Status:**

**Planned Semester(s) of Assessment:**

### *Assessment Methods*

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

### *Results*

**Reporting Period:**

**Classification:**

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**Reporting Period:**

**Classification:**

# Z - HVAC Courses

Reporting Period: [illegible]
Classification: [illegible]

Reporting Period: [illegible]
Classification: [illegible]

Reporting Period: [illegible]
Classification: [illegible]

Reporting Period: [illegible]
Classification: [illegible]

# Z - HVAC Courses

**Test - Internally Developed - Pre/Post or Post -** [illegible]

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible]
**Classification:** [illegible]

# Course Outcome: Writing DDC Programs

A [illegible]
B [illegible]

**Course Outcome Status:** [illegible]
**Planned Semester(s) of Assessment:** [illegible]

## *Assessment Methods*

**Case Studies/Problem-based Assignments -** [illegible]

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible]
**Classification:** [illegible]

# Z - HVAC Courses

Reporting Period: [illegible]

Classification: [illegible]

Reporting Period: [illegible]

Classification: [illegible]

# Z - HVAC Courses

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

# Z - HVAC Courses

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

*Results*

**Reporting Period:**
**Classification:**

## Course Outcome: Load Management Functions

A

B

C

**Course Outcome Status:**

# Z - HVAC Courses

**Planned Semester(s) of Assessment:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]

[illegible]

[illegible]

**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

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**Reporting Period:** [illegible] [illegible]

**Classification:** [illegible]

[illegible]

# Z - HVAC Courses

[illegible]

## HVAC 451: Energy Analysis and Audit

## Course Outcome: Units of Energy

[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

**Reporting Period:** [illegible]
**Classification:** [illegible]

# Z - HVAC Courses

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## *Related Goals*

[illegible]

**Learning -** [illegible]
[illegible]

# Course Outcome: Energy Code and Standards

[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]
[illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## *Related Goals*

[illegible]

**Learning -** [illegible]
[illegible]

## Course Outcome: Energy History

[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]
[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]

# Z - HVAC Courses

**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
**Follow-Up:** [illegible]

## *Related Goals*

[illegible]

**Learning -** [illegible]
[illegible]

# Course Outcome: Energy Audit Types

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]
[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Related Goals*

[illegible]

**Learning -** [illegible]
[illegible]

## Course Outcome: Utility Bill Analysis

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]
[illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

# Z - HVAC Courses

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Project/Model/Invention -** [illegible]
**Criterion for Success:** [illegible]
[illegible]
[illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
**Change Assessment Strategy:** [illegible]

### *Actions*

**Action:** [illegible]
[illegible]
[illegible]
**Follow-Up:** [illegible]
[illegible]

**Presentation (Oral) -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

**Data Analysis -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### Results

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### Results

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

### Related Goals

**Excellence -**

**Learning -**

## Course Outcome: Energy Estimating Methods

**Course Outcome Status:**

### Assessment Methods

**Test - Internally Developed - Pre/Post or Post -**
**Criterion for Success:**

### Results

**Reporting Period:**

# Z - HVAC Courses

**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
**Change Assessment Strategy:** [illegible]
**Curriculum Change:** [illegible]

### *Actions*
**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]
[illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Project/Model/Invention - [illegible]**
**Criterion for Success:** [illegible]
[illegible]
[illegible]

**Presentation (Oral) - [illegible]**
**Criterion for Success:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post - [illegible]**
[illegible]
**Criterion for Success:** [illegible]

### *Results*
**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### Actions

**Action:** [illegible]
**Follow-Up:** [illegible]

## Related Goals

| |
|---|
| [illegible] |
| **Excellence -** [illegible] |
| **Learning -** [illegible]<br>[illegible] |

# Course Outcome: Building Improvements

[illegible]
[illegible]
**Course Outcome Status:** [illegible]

## Assessment Methods

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]
[illegible]
[illegible]

### Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
**Change Assessment Strategy:** [illegible]
**Curriculum Change:** [illegible]

# Z - HVAC Courses

## *Actions*

**Action:**

**Follow-Up:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**
**Criterion for Success:**

## *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Project/Model/Invention -**
**Criterion for Success:**

**Presentation (Oral) -**
**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**
**Criterion for Success:**

## *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

# Z - HVAC Courses

### *Actions*
**Action:** [redacted]
**Follow-Up:** [redacted]

**Test - Internally Developed - Pre/Post or Post -** [redacted]
[redacted]
**Criterion for Success:** [redacted]

## *Results*
**Reporting Period:** [redacted] [redacted]
**Classification:** [redacted]
[redacted]

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**Reporting Period:** [redacted] [redacted]
**Classification:** [redacted]
[redacted]

### *Actions*
**Action:** [redacted]
**Follow-Up:** [redacted]

**Test - Internally Developed - Pre/Post or Post -** [redacted]
[redacted]
**Criterion for Success:** [redacted]

## *Results*
**Reporting Period:** [redacted] [redacted]
**Classification:** [redacted]
[redacted]

### *Actions*
**Action:** [redacted]

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**Reporting Period:** [redacted] [redacted]
**Classification:** [redacted]
[redacted]

### *Actions*
**Action:** [redacted]
**Follow-Up:** [redacted]
[redacted]

**Test - Internally Developed - Pre/Post or Post -** [redacted]
[redacted]
**Criterion for Success:** [redacted]

## *Results*
**Reporting Period:** [redacted] [redacted]
**Classification:** [redacted]
[redacted]

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**Reporting Period:** [redacted] [redacted]
**Classification:** [redacted]
[redacted]

**Test - Internally Developed - Pre/Post or Post -** [redacted]
[redacted]
**Criterion for Success:** [redacted]

# Z - HVAC Courses

## Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### Actions

**Action:** [illegible]
**Follow-Up:** [illegible]

## Related Goals

| [illegible] |
|---|
| **Excellence -** [illegible] |
| **Learning -** [illegible] [illegible] |

# Course Outcome: Steam Systems

[illegible]
[illegible]

**Course Outcome Status:** [illegible]

## Assessment Methods

**Test - Internally Developed - Pre/Post or Post -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

## Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Project/Model/Invention -**
**Criterion for Success:**

**Presentation (Oral) -**
**Criterion for Success:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

*Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

## *Related Goals*

**Learning -**

## Course Outcome: Technical Assistance Audit

**Course Outcome Status:**

## *Assessment Methods*

**Project/Model/Invention -**
**Criterion for Success:**

*Results*

**Reporting Period:**
**Classification:**

# Z - HVAC Courses

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
**Follow-Up:** [illegible]

**Presentation (Oral) -** [illegible]
**Criterion for Success:** [illegible]
[illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Observations (e.g. Clinical or Field) -**

**Criterion for Success:**
**Assessment Schedule:**

## Results

**Reporting Period:**
**Classification:**

**Project/Model/Invention -**

**Criterion for Success:**
**Assessment Schedule:**

## Results

**Reporting Period:**
**Classification:**

**Written Product (essay, research paper, journal, newsletter, etc.) -**

**Criterion for Success:**

**Assessment Schedule:**

## *Results*

**Reporting Period:**

**Classification:**

## *Related Goals*

| |
|---|
| **Collaboration -** |
| **Diversity -** |
| **Ethical Community -** |
| **Excellence -** |
| **Learning -** |

# Z - HVAC Courses

## HVAC 462: Primary HVAC Equip Selection

## Course Outcome: Heat Exchangers

**Course Outcome Status:**
**Start Date:**
**End Date:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

#### *Results*

**Reporting Period:**
**Classification:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

#### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

#### *Results*

**Reporting Period:**
**Classification:**

[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Related Goals*

[illegible]

**Excellence -** [illegible]

**Learning -** [illegible]
[illegible]

## Course Outcome: Cooling Towers

[illegible]
[illegible]

**Course Outcome Status:** [illegible]
**Start Date:** [illegible]
**End Date:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]

Reporting Period:
Classification:

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

## *Related Goals*

**Excellence -**

**Learning -**

# Course Outcome: Air Handlers

**Course Outcome Status:**
**Start Date:**
**End Date:**

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**

# Z - HVAC Courses

**Classification:** [illegible]
[illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
[illegible]
**Follow-Up:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Actions*

**Action:** [illegible]
[illegible]

**Follow-Up:** [illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

**Project/Model/Invention -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

### *Related Goals*

[illegible]

**Excellence -** [illegible]

**Learning -** [illegible]
[illegible]

## Course Outcome: Chillers

[illegible]
[illegible]

**Course Outcome Status:** [illegible]
**Start Date:** [illegible]
**End Date:** [illegible]

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

# Z - HVAC Courses

## *Results*

**Reporting Period:**
**Classification:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## *Results*

**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

## *Results*

**Reporting Period:**
**Classification:**

---

**Reporting Period:**
**Classification:**

---

**Reporting Period:**
**Classification:**

# Z - HVAC Courses

## *Related Goals*

| |
|---|
| **Excellence -** |
| **Learning -** |

# Course Outcome: Boilers

**Course Outcome Status:**
**Start Date:**
**End Date:**

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Project/Model/Invention -**

# Z - HVAC Courses

**Criterion for Success:**

## *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

## *Related Goals*

**Excellence -**

**Learning -**

# Course Outcome: Geothermal Systems

**Course Outcome Status:**
**Start Date:**
**End Date:**

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

## *Results*

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

# Z - HVAC Courses

## *Related Goals*

| |
|---|
| **Excellence -** |
| **Learning -** |

# Course Outcome: Thermal Storage

**Course Outcome Status:**
**Start Date:**
**End Date:**

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

## *Related Goals*

| |
|---|
| **Excellence -** |
| **Learning -** |

# Course Outcome: Combined heat and Power Systems

**Course Outcome Status:**

# Z - HVAC Courses

**Start Date:**
**End Date:**

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

## *Related Goals*

**Excellence -**

**Learning -**

# Course Outcome: Dehumidification Units

**Course Outcome Status:**
**Start Date:**
**End Date:**

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

# Z - HVAC Courses

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

## *Related Goals*

| |
|---|
| **Excellence -** |
| **Learning -** |

## Course Outcome: Solar Thermal Energy

**Course Outcome Status:**
**Start Date:**
**End Date:**

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Project/Model/Invention -**

**Criterion for Success:**

## *Related Goals*

| |
|---|
| **Excellence -** |
| **Learning -** |

# Z - HVAC Courses

## HVAC 483: HVACR Building Systems

## Course Outcome: Energy Sources

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Utility Billing

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Energy Sources and Economic Analysis

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Co-Generation Systems

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Human Comfort

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Indoor Air Quality

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Energy Costs of Building Applications

# Z - HVAC Courses

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: HVAC System Components

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Piping Systems

**Course Outcome Status:**

### *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Controls / Loops / Sequence of Operations

**Course Outcome Status:**

# Z - HVAC Courses

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Energy Conservation & Management

**Course Outcome Status:**

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Preventative Maintenance

**Course Outcome Status:**

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -**

**Criterion for Success:**

**Case Studies/Problem-based Assignments -**

**Criterion for Success:**

## Course Outcome: Codes / Ordinances / Regulations

**Course Outcome Status:**

# Z - HVAC Courses

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

## Course Outcome: Licensure / Certification / Insurance

[illegible]

**Course Outcome Status:** [illegible]

## *Assessment Methods*

**Test - Internally Developed - Pre/Post or Post -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

**Case Studies/Problem-based Assignments -** [illegible]
[illegible]
[illegible]
**Criterion for Success:** [illegible]

# HVAC 499: Commerical HVAC System Design

## Course Outcome: Design Procedure & BOP

[illegible]
[illegible]
**Course Outcome Status:** [illegible]
**Start Date:** [illegible]
**End Date:** [illegible]

## *Assessment Methods*

**Project/Model/Invention -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

# Z - HVAC Courses

| | |
|---|---|
| **Reporting Period:**<br>**Classification:** | |
| **Reporting Period:**<br>**Classification:** | |
| **Reporting Period:**<br>**Classification:** | |
| **Reporting Period:**<br>**Classification:** | |
| **Reporting Period:**<br>**Classification:** | |
| **Reporting Period:**<br>**Classification:** | |
| **Reporting Period:**<br>**Classification:** | |

## *Related Goals*

| |
|---|
| **Collaboration -** |
| **Diversity -** |
| **Ethical Community -** |
| **Excellence -** |
| **Learning -** |

# Course Outcome: HVAC System Review

**Course Outcome Status:**
**Start Date:**
**End Date:**

# Z - HVAC Courses

## *Assessment Methods*

**Project/Model/Invention -** [illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Survey - Students -** [illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

**Survey - Faculty -** [illegible]
**Criterion for Success:** [illegible]

### *Results*

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## *Related Goals*

[illegible]

**Learning -** [illegible]
[illegible]

# Course Outcome: Load Calculation

[illegible]
[illegible]

**Course Outcome Status:** [illegible]
**Start Date:** [illegible]
**End Date:** [illegible]

## *Assessment Methods*

**Project/Model/Invention -** [illegible]
[illegible]
**Criterion for Success:** [illegible]

# Z - HVAC Courses

## Results

**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]
[illegible]

### Actions

**Action:** [illegible]
[illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

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**Reporting Period:** [illegible] [illegible]
**Classification:** [illegible]
[illegible]

## Related Goals

| [illegible] |
|---|
| **Collaboration -** [illegible]<br>[illegible] |
| **Diversity -** [illegible]<br>[illegible] |
| **Ethical Community -** [illegible]<br>[illegible] |
| **Excellence -** [illegible] |

**Learning -**

## Course Outcome: Equipment Selection

**Course Outcome Status:**
**Start Date:**
**End Date:**

### *Assessment Methods*

**Project/Model/Invention -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
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**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

### *Related Goals*

# Z - HVAC Courses

| |
|---|
| **Collaboration -** |
| **Diversity -** |
| **Ethical Community -** |
| **Excellence -** |
| **Learning -** |

## Course Outcome: System Layout & Sizing

**Course Outcome Status:**
**Start Date:**
**End Date:**

### *Assessment Methods*

**Project/Model/Invention -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

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**Reporting Period:**
**Classification:**

# Z - HVAC Courses

Reporting Period:
Classification:

Reporting Period:
Classification:

Reporting Period:
Classification:

## *Related Goals*

**Collaboration -**

**Diversity -**

**Ethical Community -**

**Excellence -**

**Learning -**

# Course Outcome: Controls

**Course Outcome Status:**
**Start Date:**
**End Date:**

## *Assessment Methods*

**Project/Model/Invention -**

**Criterion for Success:**

### *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**

# Z - HVAC Courses

**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

## *Related Goals*

**Collaboration -**

**Diversity -**

**Ethical Community -**

**Excellence -**

**Learning -**

# Course Outcome: Executive Summary

**Course Outcome Status:**

## *Assessment Methods*

**Written Product (essay, research paper, journal, newsletter, etc.) -**

# Z - HVAC Courses

Criterion for Success:

## *Results*

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

**Reporting Period:**
**Classification:**

## *Related Goals*

**Collaboration -**

**Diversity -**

**Ethical Community -**

**Excellence -**

**Learning -**

**FORM A**

Revised September 2012

# PROPOSAL SUMMARY AND ROUTING FORM

## Proposal Title: HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325

**Initiating Individual:** Doug Zentz **Initiating Department or Unit:** HVACR
**Contact Person's Name:** Doug Zentz **e-mail:** zentzd@ferris.edu **phone:** 3083

- ☐ Group I - A – New degree, major, concentration, minor, or redirection of a current offering
- ☐ Group I - B – Deletion of a degree, major, concentration, or minor
- ☒ Group II - A – New Course, modification of a course, deletion of a course
- ☒ Group II - B – Minor curriculum clean-up
- ☐ Group III – Certificates (☐ College Credit ☐ Non-Credit)
- ☐ Group IV – Other Site Locations (☐ College Credit ☐ Non-Credit)

| | Signature | Date | Vote/Action * Number count ** |
|---|---|---|---|
| Program Representative ** | [signature] | 11/19/13 | 8 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| Department/School/Faculty Representative Vote **<br>School Curriculum Comm | [signature] | 01/02/14 | 6 Support<br>– Support with Concerns<br>– Not Support<br>– Abstain |
| Department/School Administrator<br>Director, SBE | [signature] | 01/02/14 | 1 Support<br>– Support with Concerns<br>– Not Support |
| College Curriculum Committee/Faculty | [signature] | 2/20/14 | 10 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| Dean | [signature] | 2/27/14 | 1 Support<br>0 Support with Concerns<br>0 Not Support |
| University Curriculum Committee ** | Sandy Alspach | 3/24/14 | ✓ Support 9-0<br>Support with Concerns<br>Not Support<br>Abstain |
| Senate ** | [signature] | 3/24/14 | ✓ Support<br>Support with Concerns<br>Not Support<br>Abstain |
| Academic Affairs | Paul Blake | 4/1/14 | ✓ Support<br>Hold<br>Not Support |

* Support with Concerns or Not Support must include identification of specific concerns with appropriate rationale.
** Number count must be given for all members present and/or voting.

| To be completed by Academic Affairs | | Date/Term of Implementation: Fall 2014 |
|---|---|---|
| President (Date Approved) | Board of Trustees (Date Approved) | Academic Officers of MI (Date Approved) |

VPAA
MAR 3 1 2014
PROVOST

# FORM A CONT.

## 1. Proposal Summary

(Summary is generally less than one page. Briefly: state what is proposed with a summary of rationale and highlights.)

**BACKGROUND**

The HVAC Bachelor degree began in the mid 1980's when Ferris was on quarters, and during this time period the HVAC Bachelor degree had two junior level "*secondary system select-design*" courses; one was centered on air side systems and the other one was centered on water (hydronic) side systems. When Ferris moved to semester based courses, these two "*secondary system select-design*" courses were blended together to a 5 credit "*HVAC Secondary System Select-Design*" class (known as HVAC 331). Although manageable, the amount of course content within this course is beyond the normal junior level class and in some semesters it was difficult to cover all learning outcomes. In 2009, it was determined through advisory board input that another course, HVAC 350 – Contracting Issues in HVAC, should be created and to provide the needed credits for this new class it was determined that HVAC 331 should be reduced to 4 credits by reducing some of the learning outcomes (moving them to another HVAC course). It has been 4 years now and the result of this change, along with Advisory Board input, has concluded there is a strong need to return to two separate "*secondary system select-design*" courses (one air side and the other water (hydronic) side); thus, the HVAC department wants to create HVAC 321, "*HVAC Air Side System Select-Design*" and HVAC 325, "*HVAC Hydronic System Select-Design*".

**CREATION OF HVAC 321 & HVAC 325**: HVAC 321 will be in fall semester of the junior year replacing HVAC 331 (the credits remain the same - 4). HVAC 325 (4 credits) will be in the spring semester of junior year as a new course and to accommodate this creation two things will occur. The needed 4 credits will come from the elimination of our "Directed (3 credit) Elective" course which is on our current check sheet and one credit from the reduction of the HVAC Capstone Experience Class, HVAC 499 (outlined below). Thus the overall credits for graduation remain the same. The splitting of HVAC 331 into HVAC 321 and HVAC 325 will allow a deeper learning experience for students in the learning outcomes including advanced computer system design (using BIM software) per our advisory board input and to satisfy requirements our industry expects from our graduates (this was a direct outcome from our last program APR).

**HVAC CAPSTONE EXPERIENCE MODIFICATION**: This proposal includes the modification of HVAC 499 from a 5 credit class to a 4 credit class by eliminating one of the weekly lab sessions. Currently, this class has two lecture hours per week and nine lab hours (three 3-hour sessions). This proposes to reduce lab to six hours per week (two 3-hour sessions).

Six hours of lab per week provides ample time for faculty to assist students. The reduction eliminates a lab session that experience has shown to be "supervised homework." The credit made available through this reduction is added to the three credits made available by eliminating the directed elective, providing four credits for HVAC 325 (shown above). Note; this change in credit hours will be phased in to reflect some current students working from existing check sheets.

This also proposes to correct a typographical (spelling) error in the title of the course, from *Commerical* HVAC System Design, to *Commercial* HVAC System Design

**CHANGE HVAC 362 to HVAC 462**: This proposes to move HVAC 362 from spring semester junior year to fall semester senior year. This move reverses a move that was made when HVAC 350 was introduced into the curriculum beginning in the 2010 academic year. At that time, the class was called HVAC 462 because it was held during senior year and was changed to HVAC 362 when it was moved to spring of junior year. It is arbitrary whether the course is held spring semester junior year or fall semester senior year, so this proposal simply changes the number to reflect where it is being offered in the curriculum. This transfer of HVAC 362 back to HVAC 462 will occur over a 2-year time period as to allow students which have started on the old check sheet to continue as we have other HVAC students in the On-line format as well.

**GENERAL EDUCATION MODIFICATION**: The HVAC Bachelor degree contains two WIC courses (HVAC 451 & HVAC 499); thus, the degree only has one class beyond the Associate level of two English classes and one Communication class. This current class is COMM 221, and has been a requirement for graduation with the HVAC Bachelor degree for many years. However, since the HVAC program created the On-line version of this degree it has been difficult for some students to either enroll in the Ferris offering of COMM 221 or to find a transferable equal to COMM 221. Additionally, our last APR indicated that our Bachelor degree graduates could use a higher level of technical writing skills to be more successful in industry. Thus, the HVAC department determined it is in the student's best interest to take ENGL 311 (Advanced Technical Writing) instead of COMM 221. This substitution follows the guidelines of the University and will allow our students easier access for graduation and better prepare them for success.

**PREREQUISITE CHANGES**: Due to the addition of 2 new HVAC courses (HVAC 321 & HVAC 325), deletion of HVAC 331, and the moving of HVAC 362 to HVAC 462, there is a need for changes in many of the HVAC 300 & 400 level course prerequisites. This proposal includes these minor changes within the enclosed Form F sheet for HVAC 312, HVAC 350, HVAC 393, HVAC 415, HVAC 451, HVAC 462 & HVAC 499. Note; these changes in prerequisites will be phased in to reflect some current students working from existing check sheets.

**SUMMARY:** Under this proposal:

- No changes are proposed for AAS students.
- Overall SCH for BS students remain the same.
- HVAC 499 drops from five credits to four, making one credit available.
- The directed elective is eliminated, making three credits available.
- HVAC 331 is replaced with HVAC 321, a four-credit course, to fall semester, junior year.
- HVAC 325, a four-credit course (using the four credits available from above), is added to spring semester, junior year.
- Move HVAC362 back to the senior year by changing it to HVAC462
- Removal of COMM 221 from the graduation requirement by the addition of ENGL 311 in its place
- Modification of prerequisites for 300 & 400 level HVAC courses to reflect the above changes

## 2. Summary of Curricular Action (check all that apply to this proposal)

☐ Degree ☒ Major ☐ Minor ☐ Concentration ☐ Certificate ☒ Course

☒ New ☒ Modification ☒ Deletion

**Name of Degree, Major, etc. :** <u>HVACR Engineering Technology and Energy Management</u>

## 3. Summary of All Course Action Required **Contact Senate Secretary or UCC Chair if additional spaces are required.**

**a. Newly Created Courses to be Added to FSU Catalog:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 321 | HVAC Air Side System Select-Design |
| HVAC | 325 | HVAC Hydronic System Select-Design |
| HVAC | 462 | HVAC Primary Equipment Selection |

**b. Courses to be Deleted from FSU Catalog:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 331 | HVAC Secondary System Select-Design |

**c. Existing Course(s) to be Modified:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 312 | Control Theory & Application |
| HVAC | 350 | Contracting Issues in HVACR |
| HVAC | 393 | Summer Internship |
| HVAC | 415 | Direct Digital Control |
| HVAC | 451 | Energy Audit and Analysis |
| HVAC | 499 | Commercial HVAC System Design |

**d. Addition of existing FSU courses to program**

| Prefix | Number | Title |
|---|---|---|
| ENGL | 311 | Advanced Technical Writing |

**e. Removal of existing FSU courses from program**

| Prefix | Number | Title |
|---|---|---|
| COMM | 221 | Small Group Decision Making |

## 4. Summary of All Consultations

| Form Sent (B or C) | Date Sent | Responding Dept. | Date Received & by Whom |
|---|---|---|---|
| Form B | 2/7/14 | Humanities | |
| Form B | 2/7/14 | Language and Literature | |
| Form C | 2/7/14 | FLITE | |

## 5. Will External Accreditation be sought? (For new programs or certificates only)

☐ **Yes** ☒ **No**

**If yes, name the organization involved with accreditation for this program.**

**6. Program Checksheets affected by this proposal (check all that apply to this proposal)**

☒ Add Course ☒ Delete Course ☒ Modify Course ☐ Change Prerequisite ☐ Move from required to elective
☐ Move from elective to required ☐ Change Outcomes and Assessment Plan ☒ Change credit hours

List all Checksheets affected by this proposal:

| College | Department | Program |
| --- | --- | --- |
| CET | HVACR | HVACR Engineering Technology and Energy Management |

**FORM B**
Rev. September 2012

# CURRICULUM CONSULTATION FORM

To be completed by each department affected by the proposed change, addition, or deletion. Potential duplication of coursework is reason for consultation.

1. This completed form must be forwarded with the proposal to the administrator of the department to be consulted.

2. The department must respond within 10 business days of receipt of this form to insure inclusion in the final proposal. The completed original is returned to the Academic Senate office to be inserted into the proposal and a copy is returned to the initiator.

   The department must acknowledge receipt of this form and the proposal in writing to the initiator.

   **Failure to respond by 10 business days of receipt of this form is interpreted as support for the proposal.**

3. The Proposing Department must address any concerns raised by the consulted department. This response must be in writing and will be included in the proposal following the original consultation form.

**RE: Proposal Title** HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325

**Initiator(s):** Doug Zentz

**Proposal Contact**: Doug Zentz **Date Sent**: ~~2/11/14~~ 2/11/14

**Department:** HVAC Engineering Technology **Campus Address:** GRN-227
(Please type)

**Responding Department: Humanities – JOH-117**

Administrator: Trinidy Williams Date Received: 2/11/14 Date Returned: 2/25/14

Based upon department faculty review on 2/21/14 (date), we

- ☐ Support the above proposal.
- ☒ Support the above proposal with the modifications and concerns listed below.
- ☐ Do not support the proposal for the reasons listed below.

Comment regarding the impact this proposal has on current curriculum including prerequisites, scheduling, room assignments, and/or faculty load for your department. Use additional pages, if necessary.

Humanities Department Communications area: Our response is a support with recommendations that students who have not taken their communication general education requirement be steered to take COMM 221.

**FORM B**
Rev. September 2012

# CURRICULUM CONSULTATION FORM

To be completed by each department affected by the proposed change, addition, or deletion. Potential duplication of coursework is reason for consultation.

1. This completed form must be forwarded with the proposal to the administrator of the department to be consulted.

2. The department must respond within 10 business days of receipt of this form to insure inclusion in the final proposal. The completed original is returned to the Academic Senate office to be inserted into the proposal and a copy is returned to the initiator.

   The department must acknowledge receipt of this form and the proposal in writing to the initiator.

   **Failure to respond by 10 business days of receipt of this form is interpreted as support for the proposal.**

3. The Proposing Department must address any concerns raised by the consulted department. This response must be in writing and will be included in the proposal following the original consultation form.

**RE: Proposal Title** HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325

**Initiator(s):**Doug Zentz

**Proposal Contact**: Doug Zentz **Date Sent**: 2/7/14

**Department:** HVAC Engineering Technology **Campus Address:** GRN-227
(Please type)

**Responding Department: Languages & Literature – ASC-3080**

Administrator: Andy Karafa Date Received: _____ Date Returned: _____

Based upon department faculty review on _____(date), we

- ☐ Support the above proposal.
- ☐ Support the above proposal with the modifications and concerns listed below.
- ☐ Do not support the proposal for the reasons listed below.

Comment regarding the impact this proposal has on current curriculum including prerequisites, scheduling, room assignments, and/or faculty load for your department. Use additional pages, if necessary.

**FORM C**
Rev. September 2012

# FLITE SERVICES CONSULTATION FORM

To be completed by the liaison librarian and approved by the Dean of FLITE. FLITE must return the original form to the Academic Senate office to be inserted in the proposal and a copy to the initiator. FLITE must respond within 10 business days of receipt of this form to insure that the form is included in the final proposal.

**Failure to respond by 10 business days of receipt of this form is interpreted as support for the proposal.**

## RE: Proposal Title: HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325

**Projected number of students per year affected by proposed change: 75**

**Initiator(s):** Doug Zentz
**Proposal Contact**: Doug Zentz Date Sent: **2/7/14**

**Department:** HVAC Engineering Technology **Address:** GRN-227
(Please type)

**Liaison Librarian Signature:** Fran Rosen **Date Received:** 2/11/14
**Dean of FLITE Signature:** [signature] **Date Returned:** 2/12/14

Based upon our review on 2/12/14 (date), FLITE concludes that:

☒ Library resources to support the proposed curriculum change are currently available.

☐ Additional Library resources are needed but can be obtained from current funds.

☐ Support, but significant additional Library funds/resources are required in the amount of $____________.

☐ Does not support the proposal for reasons listed below.

**Comment regarding the impact this proposal will have on library resources, collection development, or other FLITE programs. Use additional pages if necessary.**

**FORM D – Current**

Ferris State University
Imagine More

Associate in Applied Science

# HVACR Technology

## Program Academic Requirements

| Student: | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|
| email: | | ID: | | | Ferris | |
| Advisor: | | Ph: | | 1 | Transfer | |

| | | MAJOR | Cr | Gr | Pts | S | Yr | Code | Notes |
|---|---|---|---|---|---|---|---|---|---|
| HVAC | 101 | Intro to Refrig & A/C Systems (co-req MATH 116) | 4 | | | | | | |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | | | | | | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | | | | | | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111, MATH 116) | 4 | | | | | | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | | | | | | |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | | | | | | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102,117) | 5 | | | | | | |
| HVAC | 235 | Advanced Heating-Mech System (C- or better in HVAC 117, 132) | 5 | | | | | | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | |
| ISYS | 105 | Microcomputer Applications | 3 | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | |
| ENGL | 150 | English 1 | 3 | | | | | | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | | | | | | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | |
| MATH | 116 | Interm. Algebra & Numerical Trig (ACT 19 or MATH 110) | 4 | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, BIOL 111. Course must have a lab) | 4 | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | |
| | | **FRESHMEN SEMINAR** | | | | | | | |
| FSUS | 100 | FSU Seminar | 1 | | | | | | |
| | | **Unofficial Statistics** | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 67 | | | | | | |
| | | GPA Major: | - | | | | | | |
| | | GPA Degree: | - | | | | | | |

AAS Minimum General Education Requirements:
Cultural Enrichment (CE) – 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3/4 credits
Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Ferris State University
Imagine More

Associate in Applied Science

# HVACR Technology

## Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 1 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 101 | Introduction to Refrigeration & A/C Systems (co-req MATH 116) | 4 | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | |
| MATH | 116 | Intermediate Algebra & Numerical Trigonometry (C- in MATH 110 or 19 ACT) | 4 | |
| ENGL | 150 | English 1 | 3 | |
| FSUS | 100 | FSU Seminar | 1 | |
| | | Total | 16 | |
| **YEAR 1 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111 and MATH 116) | 4 | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, or BIOL 111. Must Include a Lab Section) | 4 | |
| | | Total | 17 | |
| **YEAR 2 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 235 | Advanced Heating-Mechanical Systems (C- or better in HVAC 117, 132) | 5 | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | |
| ISYS | 105 | Microcomputer Applications | 3 | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Total | 18 | |
| **YEAR 2 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117) | 5 | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | |
| | | Social Awareness Elective | 3 | |
| | | Total | 16 | |

AAS Minimum General Education Requirements

Cultural Enrichment (CE) - 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3-4 credits

Reference: gttp://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Ferris State University
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Program Academic Requirements

| Student: | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|
| email: | | ID: | | | Ferris | |
| Advisor: | | Ph: | | 1 | Transfer | |

| | | MAJOR | Cr | Gr | Pts | S | Yr | Code | Notes |
|---|---|---|---|---|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 331, HVAC342, and MATH 116 or 120) | 4 | | | | | | |
| HVAC | 331 | Secondary System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | | | | | | |
| HVAC | 362 | Primary HVAC Equipment Selection (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | | | | | | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 350 & 362) | 4 | | | | | | |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 or 130, and HVAC 393) | 4 | | | | | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 or 130, and HVAC 393) | 4 | | | | | | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, and 451) | 5 | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | |
| ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | 2 | | | | | | |
| | | Directed Elective (See Your Advisor) | 3 | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | |
| COMM | 221 | Small Group Decision Making | 3 | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | |
| | | Scientific Understanding Elective | 4 | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | |
| ECON | 221 | Principles of Economics 1 | 3 | | | | | | |
| | | Unofficial Statistics | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 37 | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 65 | | | | | | |
| | | GPA Major: | - | | | | | | |
| | | GPA Degree: | - | | | | | | |

Bachelor of Science General Education Requirements:
One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr)
Multiple requirements may be satisfied by a single course.
Cultural Enrichment – 9 credits (3 credits in course > 200 level), Social Awareness - 9credits (3 credits in course > 200 level)
Students must complete 40 credits at or above the 300 level. [Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

Ferris State University
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 3 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 331 | Secondary System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | |
| HVAC | 342 | Load Analysis & Energy Modeling (Admission to BS in HVACR Engineering Technology) | 4 | |
| ARCH | 110 | Intro to Computer Graphics in ARCH for HVACR Students | 2 | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116)- (Students who took MATH115 shall take MATH120) | 4 | |
| | | Social Awareness Elective | 3 | |
| | | Total | 17 | |

| YEAR 3 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | |
| HVAC | 362 | Primary Equipment Selection (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | |
| | | Scientific Understanding Elective | 4 | |
| MATH | | Students who took MATH 115 and MATH 120 shall take MATH 130 | | |
| | | Total | 16 | |

| YEAR 3 - SUMMER SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 350 & 362) | 4 | |
| | | Total | 4 | |

Submit Application for Graduation.

| YEAR 4 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 415 | Direct Digital Control (C- in MATH 126 or 130, and HVAC 393) | 4 | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- in MATH 126 or 130, and HVAC 393) | 4 | |
| COMM | 221 | Small Group Decision Making | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Total | 14 | |

| YEAR 4 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415 and 451) | 5 | |
| ECON | 221 | Principles of Economics 1 | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Directed Elective | 3 | |
| | | Total | 14 | |

Students must complete 40 credits at or above the 300 level in the bachelor program. Three credits of 300 level coursework must be taken in the social awareness and/or cultural enrichment courses to meet this requirement. From among the cultural enrichment and social awareness coursework, at least one global consciousness course and one REG course must be taken.

**FORM D – Proposed**

Ferris State University
Imagine More

Associate in Applied Science

# HVACR Technology

**Program Academic Requirements**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Student: | | | | | | | | | Code | Location | Crs |
| email: | | | ID: | | | | | | | Ferris | |
| Advisor: | | | Ph: | | | | | | 1 | Transfer | |
| | | **MAJOR** | Cr | Gr | Pts | S | Yr | Code | | Notes | |
| HVAC | 101 | Intro to Refrig & A/C Systems (co-req MATH 116) | 4 | | | | | | | | |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | | | | | | | | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | | | | | | | | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111, MATH 116) | 4 | | | | | | | | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | | | | | | | | |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | | | | | | | | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102,117) | 5 | | | | | | | | |
| HVAC | 235 | Advanced Heating-Mech System (C- or better in HVAC 117, 132) | 5 | | | | | | | | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | | | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | | | |
| ISYS | 105 | Microcomputer Applications | 3 | | | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | | | |
| ENGL | 150 | English 1 | 3 | | | | | | | | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | | | | | | | | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | | | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | | | |
| MATH | 116 | Interm. Algebra & Numerical Trig (ACT 19 or MATH 110) | 4 | | | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | | | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, BIOL 111. Course must have a lab) | 4 | | | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | | | |
| | | **FRESHMEN SEMINAR** | | | | | | | | | |
| FSUS | 100 | FSU Seminar | 1 | | | | | | | | |
| | | **Unofficial Statistics** | | | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | | | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 67 | | | | | | | | |
| | | GPA Major: | - | | | | | | | | |
| | | GPA Degree: | - | | | | | | | | |

AAS Minimum General Education Requirements:
Cultural Enrichment (CE) – 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3/4 credits
Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Ferris State University
Imagine More

Associate in Applied Science

# HVACR Technology

## Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 1 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 101 | Introduction to Refrigeration & A/C Systems (co-req MATH 116) | 4 | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | |
| MATH | 116 | Intermediate Algebra & Numerical Trigonometry (C- in MATH 110 or 19 ACT) | 4 | |
| ENGL | 150 | English 1 | 3 | |
| FSUS | 100 | FSU Seminar | 1 | |
| | | **Total** | **16** | |

| YEAR 1 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111 and MATH 116) | 4 | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, or BIOL 111. Must Include a Lab Section) | 4 | |
| | | **Total** | **17** | |

| YEAR 2 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 235 | Advanced Heating-Mechanical Systems (C- or better in HVAC 117, 132) | 5 | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | |
| ISYS | 105 | Microcomputer Applications | 3 | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | **Total** | **18** | |

| YEAR 2 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117) | 5 | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | |
| | | Social Awareness Elective | 3 | |
| | | **Total** | **16** | |

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential/light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems.

Ferris State University
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Program Academic Requirements

| Student: | | | | | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|---|---|---|---|
| email: | | | ID: | | | | | | Ferris | |
| Advisor: | | | Ph: | | | | | 1 | Transfer | |

| | | MAJOR | Cr | Gr | Pts | S | Yr | Code | Notes | |
|---|---|---|---|---|---|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 321, HVAC342, and MATH 126) | 4 | | | | | | | |
| HVAC | 321 | HVAC Air Side System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | | |
| HVAC | 325 | HVAC Hydronic System Select-Design (C- or better in HVAC 321, HVAC342, and MATH 126) | 4 | | | | | | | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321, HVAC 342, and MATH 126) | 4 | | | | | | | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 325 & 350) | 4 | | | | | | | |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 and HVAC 393) | 4 | | | | | | | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in HVAC 393 and MATH 126) | 4 | | | | | | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 and HVAC 393) | 4 | | | | | | | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, HVAC 451 and HVAC 462) | 4 | | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | | |
| ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | 2 | | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | | |
| ENGL | 311 | Advanced Technical Writing | 3 | | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | | |
| | | Scientific Understanding Elective | 4 | | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | | |
| ECON | 221 | Principles of Economics 1 | 3 | | | | | | | |
| | | Unofficial Statistics | | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 65 | | | | | | | |
| | | GPA Major: | - | | | | | | | |
| | | GPA Degree: | - | | | | | | | |

Bachelor of Science General Education Requirements:
One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr)
Multiple requirements may be satisfied by a single course.
Cultural Enrichment – 9 credits (3 credits in course > 200 level), Social Awareness - 9credits (3 credits in course > 200 level)
[Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

Ferris State University
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Course Sequence Guide

| Student: | | ID: | |
|---|---|---|---|

| YEAR 3 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 321 | HVAC Air Side System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | |
| HVAC | 342 | Load Analysis & Energy Modeling (Admission to BS in HVACR Engineering Technology) | 4 | |
| ARCH | 110 | Intro to Computer Graphics in ARCH for HVACR Students | 2 | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116)- (Students who took MATH115 shall take MATH120) | 4 | |
| ENGL | 311 | Advanced Technical Writing | 3 | |
| | | Total | 17 | |
| **YEAR 3 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 321, HVAC342, and MATH 126) | 4 | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321, HVAC 342, and MATH 126) | 4 | |
| HVAC | 325 | HVAC Hydronic System Select-Design (C- or better in HVAC 321, HVAC342, and MATH 126) | 4 | |
| | | Scientific Understanding Elective | 4 | |
| MATH | | Students who took MATH 115 and MATH 120 shall take MATH 130 | | |
| | | Total | 16 | |
| **YEAR 3 - SUMMER SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 325 & 350) | 4 | |
| | | Total | 4 | |
| **YEAR 4 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 and HVAC 393) | 4 | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 and HVAC 393) | 4 | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in HVAC 393 and MATH 126) | 4 | |
| | | Cultural Enrichment Elective | 3 | #REF! |
| | | Total | 15 | |
| **YEAR 4 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, HVAC 451 and HVAC 462) | 4 | |
| ECON | 221 | Principles of Economics 1 | 3 | |
| | | Cultural Enrichment Elective | 3 | #REF! |
| | | Social Awareness Elective | 3 | |
| | | Total | 13 | |

Learning Outcomes Include: 1) analyze & select commercial/industrial HVAC systems for specific applications, 2) design commercial/industrial HVAC systems, given design parameters, building type, & geographic location, 3) select secondary equipment for specific commercial/industrial ducting & piping systems, 4) select primary equipment for specific commercial/industrial ducting & piping systems, 5) commission a commercial or industrial HVAC system, 6) perform an energy audit of an actual facility & analyze utilities for proper applications; Operation & Maintenance & Energy Conservation Measures for potential energy savings; & Implementation feasibility using payback calculations, 7) understand, utilize & develop estimates, specs, economic costs, & analysis codes & standards, 8) program control sequences for specific commercial & industrial HVAC systems & equipment.

## COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)** (proposed) **HVAC**

☐ **Number (current)** (proposed) **312**

☐ **LEC ___ LAB ___ SEM ___ (current)**
(Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current) Control Theory & Application**

(proposed) **Control Theory & Application**

☒ **Credit Hours (current)** 4

(proposed) 4

☒ **Prerequisites (current)**

(proposed) C- (or better) in MATH 126, HVAC321 & HVAC342

**Co-requisite (current)**

☒ **Course Description (current): (125 words maximum)**

(current & proposed): The study of control loop theory related to commercial and industrial comfort, process and safety applications. The course focuses on analog electronic and pneumatic control components and their systems used in new and existing installations. Lab exercises concentrate on control system operation and analysis.

☒ **Course Outcomes and Assessment Plan (current & proposed)**

**(current & proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding of control terminology, equipment and documentation
2. Describing loop components and configurations
3. Understanding and applying transfer functions
4. Performing control valve and damper sizing and selection
5. Understanding and application of control modes and process characteristics
6. Performing modulating control loop calibration

**Instructional Unit Topic Descriptions and Time Allocations**

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Terminology | 3 | 3 |
| II. | Loop Components | 6 | 6 |
| III. | Elements of a Transfer Function | 6 | 6 |
| IV. | Application of a Transfer Function | 6 | 3 |
| V. | Sensors | 6 | 3 |

| | | | |
|---|---|---|---|
| VI. | Controllers | 3 | 6 |
| VII. | Process Characteristics | 3 | 3 |
| VIII. | Modulating Final Control Devices | 3 | 3 |
| IX. | Documentation | 12 | 12 |
| | Total Hours | 45 | 45 |

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Terminology<br>A. Understand and apply control terminology.<br>B. Identify control system components by name. |
| II. | Loop Components<br>A. Identify low and high volume pneumatic control systems.<br>B. Identify process variable and final control device for a specific control loop.<br>C. Identify a open or closed control loop.<br>D. Identify a control loop used for safety.<br>E. Identify the feedback utilized in a control loop.<br>F. Define the purpose and function of different controllers (pneumatic, electronic) |
| III. | Elements of a Transfer Function<br>A. Define, apply and calculate the following terms:<br>a. Throttling range<br>b. Proportional gain<br>c. Proportional band<br>d. Gain<br>e. Error<br>f. Bias<br>g. Setpoint<br>h. Signal path, type and terminations |
| IV. | Application of a Transfer Function<br>A. Calculate a transfer function for a sensor and then utilize to calibrate the sensor.<br>B. Utilize transfer functions to predict signal values for controllers and final control device positions.<br>C. Apply setpoint reset to multiple applications |
| V. | Sensors<br>A. Understand the various types of sensors by point type (analog / digital).<br>B. Understand the various types of sensors by output signal (mA, V, ohm, pneumatic, semiconductor)<br>C. Understand the proper installation, best practice, calibration, handling and termination of sensors of all types.<br>D. Understand current sensor manufacturer literature.<br>E. Plot a sensor response in a computer application.<br>F. Create a spreadsheet for calculating and graphing a linear transfer function. |
| VI. | Controllers<br>A. Understand the types of controllers (electronic, pneumatic, digital).<br>B. Understand the different modes of control (2 position, timed two position, incremental, Proportional (P), Proportional + Integral (PI), Proportional + Integral + Derivative (PID), Proportional + Derivative (PD).<br>C. Utilize a tuning process to return a process with an unstable controller to a steady state error.<br>D. Identify different loop responses (underdamped, overdamped, critically |

| | |
|---|---|
| | damped, unstable with increasing amplitude, unstable with constant amplitude)<br>E. Examine linear response and response over time of a control loop. |
| VII. | Process Characteristics<br>A. Understand process characteristics and terms, such as heat transfer, process time lags, time constant, thermal capacitance and thermal resistance.<br>B. Understand the affects of time constant on control modes.<br>C. Understand the affects of thermal capacitance on control modes.<br>D. Understand the affects of thermal resistance on control modes.<br>E. Select a controller output based on calculated thermal characteristics of sample spaces. |
| VIII. | Modulating Final Control Devices<br>A. Understand the various components that make up a control valve.<br>B. Understand the various types of control valves.<br>C. Understand the various ways to connect valves to a system.<br>D. Understand how various control valves are applied.<br>E. Understand the following control valve engineering terms: (size, authority, CV).<br>F. Understand the various components that make up a damper.<br>G. Understand the various types of dampers.<br>H. Understand the various ways to connect dampers.<br>I. Understand how various dampers are applied.<br>J. Size and select control valves for a sample project. |
| IX. | Documentation<br>A. Understand control plans and specifications.<br>B. Understand, generate and utilize flow charts, point schedules, wiring details and bill of materials.<br>C. Understand changes made to control documentation, including: RFI, bulletin, addendum.<br>D. Generate control documentation for a sample project using plans and specs., includes the following documents:<br>a. Flow diagram<br>b. Point schedule<br>c. Wiring detail<br>d. Bill of material |

**Minimum Required Student Laboratory Activities**

| | |
|---|---|
| I. | Identify commercial control components for Air Handling, Hot and Chilled Water systems. |
| II. | Student will diagram basic control loops for commercial heating, cooling, and ventilation strategies. |
| III. | Student will perform point verification for Air Handling Unit controls. |
| IV. | Student will calculate transfer function for several system components. |
| V. | Student will examine current control literature and graph sensor functions. |
| VI. | Student will perform point verification for multiple HVAC systems. |
| VII. | Student will Commission multiple HVAC systems. Student will use Question and Answer programming to create an Application Specific program. Student will examine Proportional and Integral response in a functional loop. |
| VIII. | Student will assemble and calibrate a pneumatic control loop. Student will examine loop operation and correct mal-functioning loop. |
| IX. | Student will extract job information from control specifications create a bill of materials, flow diagram with sequence of operation, and point schedule for a control project. Student will then assemble control submittals from previous lab work. |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

## COURSE INFORMATION FORM

## FORM E

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)** ☒ **Number (current)** ☐ **LEC ___ LAB ___ SEM ___ (current)**

(proposed) **HVAC** (proposed) **321** (Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current)**

(proposed) **HVAC Air System Select-Design**

☒ **Credit Hours (current)** ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) **4** (proposed) Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management (proposed)

☒ **Course Description (current): (125 words maximum)**

(proposed): A study of air systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.

☒ **Course Outcomes and Assessment Plan (current)**

**(proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Assessment Code:
1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | Assessment |
|---|---|---|
| | | |
| I. | Introduction | |
| II. | Applied Psychrometrics<br>A. Review basic psychrometrics.<br>B. Apply psychrometrics to the air system design process | 1.<br>2.<br>3. |
| III. | Air Diffusion<br>A. Determine type, size and location of diffusers and grilles.<br>B. Determine location and size of ventilation air intake.<br>C. Determine location and size of exhaust air grille. | 1.<br>2.<br>3. |
| IV. | Ductwork<br>A. Calculate cross-sectional area of a duct.<br>B. Calculate velocity of air in a duct.<br>C. Calculate volume of air in a duct.<br>D. Determine space air flow requirements.<br>E. Determine type, size and routing of duct system (including | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | ventilation air intake and exhaust ducts). | |
| V. | Air System Pressure Loss Calculations<br>A. Find fitting loss coefficients from tabular data.<br>B. Calculate friction loss in a duct system.<br>C. Utilize manufacturer's computer software to calculate duct system friction loss. | 1.<br>2.<br>3. |
| VI. | Air System Configuration<br>A. Describe the components and operating characteristics of a(n)<br>a. single zone air system.<br>b. terminal reheat air system.<br>c. dual-duct air system.<br>d. Multizone air system.<br>e. variable air volume system.<br>f. variable volume, variable temperature (VVT) system.<br>g. induction air system. | 1.<br>2. |
| VII. | Fan Selection and Performance<br>A. Identify two main categories of fans.<br>a. forward curve fans.<br>b. backward inclined and air foil fans.<br>c. radial blade fans.<br>d. propeller fans.<br>e. vane-axial fans.<br>f. tube-axial fans.<br>B. Select a fan from manufacturer's performance data.<br>C. Use fan laws to plot system curve on fan performance curve.<br>D. Select proper motor horsepower for circulating fan.<br>E. Describe effects of varying fan volume on fan performance curve. | 1.<br>2.<br>3. |
| VIII. | Duct System Design Procedure<br>A. Utilizing all available information design an air system in its entirety (diffuser to fan). | 1.<br>2.<br>3. |
| IX. | Air System Testing and Balancing<br>A. Identify and summarize the function of instruments used to balance air systems.<br>B. Determine actual operating characteristics of fans.<br>C. Determine flow rates of air systems using various flow measuring devices.<br>D. Calculate the resistance in a ductwork system. | 1.<br>2.<br>3. |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
**(proposed)**

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Applied Psychrometrics | 6 | 6 |
| III. | Air Diffusion | 6 | 3 |

| | | | |
|---|---|---|---|
| IV. | Ductwork | 5 | 3 |
| V. | Air System Pressure Loss Calculations | 3 | 6 |
| VI. | Air System Configurations | 6 | 3 |
| VII. | Fan Selection and Performance | 6 | 6 |
| VIII. | Duct System Design Procedure | 6 | 6 |
| IX. | Air System Testing and Balancing | 3 | 6 |
| X. | Exams | 3 | 6 |
| | | | |
| | Total Hours | 45 | 45 |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

**COURSE INFORMATION FORM** **FORM E**

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)** ☐ **Number (current)** ☐ **LEC ___ LAB ___ SEM ___ (current)**

(proposed) **HVAC** (proposed) **325** (Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current)**

(proposed) **HVAC Hydronic System Select-Design**

☒ **Credit Hours (current)** ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) **4** (proposed) C- (or better) in HVAC 321, HVAC 342 and MATH126 (proposed)

☒ **Course Description (current): (125 words maximum)**

(proposed): A study of water systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.

☒ **Course Outcomes and Assessment Plan (current)**

**(proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Assessment Code:
1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | Assessment |
|---|---|---|
| I. | Introduction | |
| II. | Hydronic System Definition and Classification<br>A. Classify hydronic systems based upon flow generation, temperature, pressure, piping and pumping arrangement.<br>B. Explain the advantages and disadvantages of various piping and pumping arrangements.<br>C. Calculate primary and secondary flowrates and temperatures in primary-secondary pumping arrangements. | 1.<br>2. |
| III. | Terminal Devices<br>A. Determine type, size and location of finned tube radiation units.<br>B. Determine type, size and location of hot water convector units.<br>C. Determine type, size and location of cabinet unit heaters.<br>D. Determine type, size and location of unit heaters. | 1.<br>2.<br>3. |
| IV. | Hydronic System Design Procedure<br>A. Select terminal devices based on load requirements and calculate the required flow of water for each temperature control zone. | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | B. Determine pipe size required to carry desired water flowrate based upon friction loss and velocity.<br>C. Calculate equivalent length of pipe fittings in piping network.<br>D. Calculate friction loss of piping circuits.<br>E. Determine pressure losses of equipment and terminal units from manufacturer's data.<br>F. Calculate total head loss in closed loop piping systems.<br>G. Use pump affinity laws to plot system curve on pump performance curve for closed loop piping system.<br>H. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>I. Calculate total head loss in open piping systems.<br>J. Use pump affinity laws to plot system curve on pump performance curve for open loop piping system.<br>K. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>L. Select proper motor horsepower for circulating pump from manufacturer's performance data.<br>M. Develop parallel pump performance curves and identify operating points.<br>N. Develop series pump performance curves and identify operating points.<br>O. Analyze the effects of glycol on pump performance.<br>P. Determine the type, size and location of the system expansion tank.<br>Q. Utilize manufacturer's computer software to calculate piping system friction loss.<br>R. Utilize manufacturer's computer software to select proper circulating pump.<br>S. Utilize manufacturer's computer software to select proper expansion tank size. | |
| V. | Flow Control Devices<br>A. Explain the application of various service valves in hydronic systems.<br>B. Explain the relationship between heat transfer, temperature differential and flow through a terminal convection element.<br>C. Explain the relationship between valve port configuration and stem travel.<br>D. Explain the relationship between energy transfer and valve stem travel for various valve types.<br>E. Define the control flow coefficient (Cv).<br>F. Select two-way modulating and three-way mixing and diverting valves using the flow coefficient (Cv). | 1.<br>2.<br>3. |
| VI. | Pumps<br>A. Identify the components and summarize the operation of a centrifugal pump.<br>B. Explain the relationship between flowrate and total dynamic head in a closed hydronic system.<br>C. Explain the difference between open and closed hydronic systems. | 1.<br>2.<br>3. |
| VII. | Balancing Hydronic Systems<br>A. Identify and summarize the function of instruments used to balance hydronic systems.<br>B. Determine circulating pump impeller size.<br>C. Determine actual operating characteristics of circulating pump.<br>D. Determine flow rates of hydronic circuits using various flow | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | measuring devices.<br>E. Calculate resistance necessary to pre-balance hydronic circuit.<br>F. Determine new impeller size to produce required flowrate. | |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
**(proposed)**

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Hydronic System Definition and Classification | 2 | 3 |
| III. | Terminal Devices | 6 | 3 |
| VI. | Hydronic System Design Procedure | 12 | 15 |
| V. | Flow Control Devices | 9 | 6 |
| VI. | Pumps | 9 | 6 |
| VII. | Balancing Hydronic Systems | 3 | 6 |
| VIII. | Exams | 3 | 6 |
| | Total Hours | 45 | 45 |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

## COURSE INFORMATION FORM

## FORM E

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC** ☐ **Number (current) 350** ☐ **LEC ___ LAB ___ SEM ___ (current)**

(proposed) **HVAC** (proposed) **350** (Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current) Contracting Issues in HVACR**

(proposed) **Contracting Issues in HVACR**

☒ **Credit Hours (current)** 4 ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) 4 (proposed) C- (or better) in MATH 126, HVAC321 & HVAC342

☒ **Course Description (current): (125 words maximum)**

(current & proposed): The study of contracting issues as related to the HVACR industry. The course focuses on plans and specifications, estimating, budget issues, project management, economic cost analysis and codes and standards, all from the perspective of an HVACR professional. Lab exercises focus on application of contracting issues to a sample project.

☒ **Course Outcomes and Assessment Plan (current & proposed)**

**(current & proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding and utilization of plans and specifications
2. Understanding and developing an HVACR estimate
3. Identifying and handling budgetary issues
4. Understanding and performing key duties of Project Management
5. Understanding and utilization of appropriate codes and standards
6. Performing an economic cost analysis

**Instructional Unit Topic Descriptions and Time Allocations**

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Specifications | 3 | 3 |
| II. | Plans | 3 | 3 |
| III. | Estimating | 12 | 12 |
| IV. | Budget Issues | 3 | 3 |
| V. | Project Management | 6 | 6 |

| | | | |
|---|---|---|---|
| VI. | Codes and Standards | 6 | 6 |
| VII. | Economic Analysis | 10 | 12 |
| VIII. | Evaluation | 2 | 0 |
| | Total Hours | 45 | 45 |

**Learning Outcomes for Each Instructional Unit**

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Specifications<br>A. Define the divisions and numbering system used in specification.<br>B. Predictably locate specific information using the above system.<br>C. Identify all new industry specification formats<br>D. Define the role of the Construction Specification Institute in construction documentation.<br>E. Define terms and conditions<br>F. Define cost impact from terms and conditions<br>G. Complete sample documentation including: (method of procedure, AIA billing, approved change orders, insurance needs for material not on site, schedule of values, bulletin, addendum) |
| II. | Plans<br>A. Locate and understand abbreviations.<br>B. Locate and understand symbols.<br>C. Utilize abbreviations and symbols in a sample project.<br>D. Identify types of details and their links to other drawings.<br>E. Define the use of Mechanical schedules.<br>F. Use schedules to locate specific mechanical information.<br>G. Develop a mechanical schedule for a sample project.<br>H. Locate discrepancies between plans and specs.<br>I. Identify the cost impact of discrepancies between plans and specs.<br>J. Define what an addendum is and how it impacts bid form format.<br>K. Define what a bulletin is and identify situations for use.<br>L. Identify and complete documentation for discrepancy resolution, including: RFI, Bulletin and Addendum. |
| III. | Estimating<br>A. Define the different estimating methods: (manual and software).<br>B. Define scope of work for mechanical trades and identify issues.<br>C. Complete a scope of work for a sample project.<br>D. Define a Bid / negotiated job including: bid documents, customer relations, spec. reference to owners authority, issues related to negotiated work.<br>E. Define a Design / build job including: advantages / disadvantages, customer relations, code compliance and plan review.<br>F. Define a Bid / specification job including: sources of opportunity (builders exchange), public vs. private bid, bid requirements (bonding, insurance), bid documents, specific issues relative to bid and spec. jobs.<br>G. Identify issues regarding material, including: billing, shipping, storage, insurance, incorrect, schedule of value and unit pricing.<br>H. Define what targeted work is and issues including: union vs. private, long term benefits, actual cost of work.<br>I. Identify equipment needed for job.<br>J. Identify equipment issues including: responsibility, operating implications, temporary heating, enclosures, unit pricing, warranty start, shipping and availability (job schedule).<br>K. Perform a mechanical take-off including: piping, duct, controls, primary and |

| | |
|---|---|
| | secondary equipment<br>L. Identify labor concerns and issues including: union vs. non-union, prevailing wage, job site foreman, skills needed vs. skill available, per diem.<br>M. Define the term burden<br>N. Define the term Risk and items associated with the following: designer, mechanical contractor, piping contractor, sheet metal contractor, control contractor, sub-contracted work.<br>O. Perform a risk analysis for a sample job.<br>P. Define terms and conditions and their implications.<br>Q. Define warranty and the following issues: jobsite specifics, early equipment start-up, start date, owner acceptance, certificate of occupancy, significant completion and contract requirements.<br>R. Identify the roles of general and sub contractors on a job.<br>S. Develop a flow chart of job site hierarchy.<br>T. Define the risk of sub-contracting.<br>U. Identify sub-contactors cost methods including: unit pricing, detailed bid, time and material, single line bid.<br>V. Identify site specific requirements including: rough in, minority contracting, scheduling, general terms and conditions, parking, trash removal, after hour work, staging areas, special equipment.<br>W. Identify and define other misc. estimated areas including: drug testing, background checks, safety training, customer training, set up and tear down, trade coordination, weather issues, etc. |
| IV. | Budget Issues<br>A. Define the process of discovery including customer interview.<br>B. Develop a quick budget.<br>C. Define risk analysis and thresh hold of risk. |
| V. | Project Management<br>A. Define the post award of bid steps.<br>B. Define the Project Management Professional (PMP)<br>C. Identify the PMP certificate process<br>D. Develop a project management plan for a sample project.<br>E. Define scope review and identify duplication of responsibility.<br>F. Define scheduling including the following topics: gant schedule, project contractor meeting, manpower, delivery, equipment and critical path.<br>G. Identify and define job documents including: change orders, submittals, bulletin, addendum, bid alternate, RFI, pencil copy, RFP, RFQ, job close out, payment app.<br>H. Identify equipment rental needs.<br>I. Identify security and safety issues including compliance and documentation.<br>J. Identify coordination issues with other trades.<br>K. Identify sub-contractor issues and scheduling.<br>L. Define quality control issues.<br>M. Identify personnel issues including: safety, drug screening, job site etiquette. |
| VI. | Codes and Standards<br>A. Identify and define the following code and standard organizations: ASHRAE, SMACNA, IESNA, ANSI, OSHA, ISO.<br>B. Determine the applicable code from local, state, federal, international.<br>C. Correctly use and interpret a code book.<br>D. Identify what an inspector wants.<br>E. Define the term standards of care. |
| VII. | Economic Analysis<br>A. Define the following financial terms:<br>a. Net present value<br>b. Discount rate<br>c. Rate-of-Return (ROR) |

| | |
|---|---|
| | d. Return-on-investment (ROI)<br>e. Inflation<br>f. Depreciation<br>g. Taxes<br>h. Fuel Cost Escalation<br>B. Define methods of cash flow analysis including: simple payback, life cycle cash flow analysis (present worth method & annual cash flow method).<br>C. Utilize available software to perform cash flow analysis. |

**Minimum Required Student Laboratory Activities**

| | |
|---|---|
| I. | Identify pertinent areas within a specification regarding a specific job. |
| II. | Student will existing plans to answer job specific question. Student will develop a mechanical equipment schedule. |
| III. | Student will complete a scope of work, mechanical take-off, risk analysis, develop a and flow chart as key components in an estimate. |
| IV. | Student will develop a quick budget for a sample job. |
| V. | Student will layout basic information and concerns for a sample job, including scheduling. |
| VI. | Student will utilize a variety of codes to comply with a sample job. |
| VII. | Student will do a manual economic cost analysis on a sample job. |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

# COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC** ☐ **Number (current) 393** ☐ **LEC ___ LAB ___ SEM ___ (current)**

(proposed) **HVAC** (proposed) **393** (Enter Contact Hours per week)
LEC _4__ LAB ___ SEM ___(proposed):

☒ **Title (current) Summer Internship**

(proposed) **Summer Internship**

☒ **Credit Hours (current)** 4 ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) 4 (proposed) C- or better in HVAC 312, 325 & 350

☒ **Course Description (current): (125 words maximum)**

(current & proposed): Ten week minimum work experience. Students will gain a variety of commercial and industrial system and energy related experiences to include in part or in whole: new and retrofit system selection and design (including CAD); load calculation and system analysis or problem solving; system balance (testing, adjusting & balancing); system commissioning; control balancing and control work; energy related experience (e.g. energy auditing and payback calculation); estimating, bidding and proposal development; project management.

☒ **Course Outcomes and Assessment Plan (current & proposed)**

**(current & proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Students satisfactorily completing this course will gain a variety of commercial and industrial system and energy related experiences to include in part or in whole: new and retrofit system selection and design (including CAD); load calculation and system analysis or problem solving; system balance (testing, adjusting & balancing); system commissioning; control balancing and control work; energy related experience (e.g. energy auditing and payback calculation); estimating, bidding and proposal development; project management.

**Associate Provost's Signature:** Paul Blake Date 4/1/14

# COURSE INFORMATION FORM

# FORM E
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC**

(proposed) **HVAC**

☐ **Number (current) 415**

(proposed) **415**

☐ **LEC ___ LAB ___ SEM ___ (current)**

(Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current) Direct Digital Control**

(proposed) **Direct Digital Control**

☒ **Credit Hours (current) 4**

(proposed) **4**

☒ **Prerequisites (current)**

(proposed) C- or better in MATH 126 and HVAC 393

**Co-requisite (current)**

☒ **Course Description (current): (125 words maximum)**

(proposed): The study of digital electronic control of HVAC mechanical systems to maximize their operating efficiency in commercial and industrial applications. The layout, programming and operation of the building management system will be emphasized.

☒ **Course Outcomes and Assessment Plan (current & proposed)**

## (current & proposed): Learning Outcomes and Assessment for Each Instructional Unit

Students satisfactorily completing this course will achieve proficiency in:

1. Application of numbering systems and binary logic
2. Recognition, application and troubleshooting of DDC systems
3. Programming DDC systems
4. Development and understanding of DDC documentation
5. Performing DDC loop tuning

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction to Course, DDC | 1 | 0 |
| II. | Numbering Systems | 2 | 3 |
| III. | Binary Logic | 3 | 3 |
| IV. | Microcomputers / DDC Systems | 3 | 3 |
| V. | Specifications and Hardware | 3 | 3 |
| VI. | DDC Database Information | 5 | 6 |
| VII. | Program Statements | 5 | 3 |

| | | | |
|---|---|---|---|
| VIII. | Writing DDC Programs | 7 | 9 |
| IX. | Load Management Functions | 4 | 3 |
| X. | Downloading Programs | 2 | 3 |
| XI. | Loop Editing and Tuning | 2 | 3 |
| XII. | Archiving Data | 4 | 3 |
| | Total Hours | 45 | 45 |

**Learning Outcomes for Each Instructional Unit**

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction and DDC Background<br>A. Understand course policy and requirements.<br>B. Describe the differences, advantages and disadvantages of digital control systen when compared to analog control systems. |
| II. | Numbering Systems<br>A. Demonstrate an understanding of the characteristics and applications of binary numbering systems.<br>B. Demonstrate an understanding of the characteristics and applications of octal numbering systems.<br>C. Demonstrate an understanding of the characteristics and applications of hexadecimal numbering systems. |
| III. | Binary Logic<br>A. Demonstrate an understanding of the characteristics and applications of binary logic and logic gates.<br>B. Demonstrate an understanding of the characteristics and applications of truth tables. |
| IV. | Microcomputers / DDC Systems<br>A. Demonstrate an understanding of the characteristics and applications of the following Microcomputer and DDC system components:<br>a. Power supply<br>b. Microprocessor<br>c. Registers<br>d. Memory (RAM and ROM)<br>e. I/O Interfaces (D/A and A/D converters) |
| V. | Specification and Hardware<br>A. Demonstrate an understanding of the process of developing the following:<br>a. Proposal<br>b. Job Prints<br>c. Hardware specifications (cut sheets)<br>d. Description of Operation<br>e. DDC control program<br>B. Identify and explain the purpose of various components which make up a DDC system.<br>C. Analyze DDC system hardware, software, point operation and field wiring to ensure the lab system is completely operable.<br>D. Identify the different field I/O devices and know the correct way to terminate those devices at the termination board of the DDC system and at the field locations. |
| VI. | DDC Database Information<br>A. Describe a DDC database.<br>B. Develop a DDC database.<br>C. Program a DDC database. |

| | |
|---|---|
| VII. | Program Statements<br>A. Understand programming syntax and error resolution.<br>B. Develop and test software strategies to control various HVAC processes. |
| VIII. | Writing DDC Programs<br>A. Develop flowcharts and convert into computer program instruction statements.<br>B. Develop a DDC operating program from a description of operation, using correct statements, sequences and syntax. |
| IX. | Load Management Functions<br>A. Demonstrate an understanding of the theory, application and software associated with the different energy management strategies, including:<br>a. TOD<br>b. OSS<br>c. DLC<br>d. DC |
| X. | Downloading Programs<br>A. Download, upload, enable, disable, edit and monitor a DDC program to operate the equipment. |
| XI. | Loop Editing and Tuning<br>A. Demonstrate the ability to correctly troubleshoot hardware and software problems within a digital control system.<br>B. Tune DDC loops for proper operation |
| XII. | Archiving Data<br>A. Demonstrate the ability to archive information, set up point monitors and access point to override program control. |

## Minimum Required Student Laboratory Activities

| | |
|---|---|
| II. | Student will apply different numbering systems including binary, octal and hexadecimal. |
| III. | Student will apply binary logic using truth tables and logic gates. |
| IV. | Student will apply knowledge to various components which make up a microcomputer including the power supply, microprocessor, registers, memory (RAM and ROM), I/O interfaces (D/A and A/D converters). |
| V. | Student will analyze DDC system hardware, software, point operation and field wiring to ensure the lab system is completely operable. |
| VI. | Student will identify the different field I/O devices and know the correct way to terminate those devices at the termination board of the DDC system and at the field.<br>Student will accurately program a DDC database. |
| VII. | Student will develop and test software strategies to control various HVAC processes. |
| VIII. | Student will develop flow charts and convert the chart into computer program instruction statements.<br>Student will develop a DDC operating program from a description of operation, using correct statements, sequences and syntax. |
| IX. | Student will apply the theory, application and software associated with the different energy management strategies, TOD, OSS, DLC, and DC. |
| X. | Student will download, upload, enable, disable, edit and monitor a DDC program to operate the equipment in the lab. |
| XI. | Student will correctly troubleshoot hardware and software problems within a digital control system.<br>Student will tune DDC loops for proper operation. |
| XII. | Student will archive information, set up point monitors and access point to override program control. |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

# COURSE INFORMATION FORM

## FORM E

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)** (proposed) **HVAC**

☐ **Number (current)** (proposed) **462**

☐ **LEC ___ LAB ___ SEM ___ (current)**

(Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current)**

(proposed) **HVAC Primary Equipment Selection**

☒ **Credit Hours (current)** (proposed) **4**

☒ **Prerequisites (current)** (proposed) C- (or better) in MATH 126 & HVAC393

**Co-requisite (current)** (proposed)

☒ **Course Description (current): (125 words maximum)**

(proposed): The selection, application and layout of state-of-the-art equipment and systems for commercial and industrial buildings. Emphasis will be placed upon the energy efficiency, integration of equipment into a complete system, and sequence of operation.

☒ **Course Outcomes and Assessment Plan (current)**

**(proposed): Learning Outcomes and Assessment for Each Instructional Unit**

**Assessment Code (AC):**

1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | AC |
|---|---|---|
| I. | Introduction and Primary System Overview<br>A. Understand course policy and requirements.<br>B. Define the various categories of primary HVAC equipment, design and selection process and document development. | |
| II. | Chiller Systems<br>A. Define all the types of chiller systems and support components.<br>B. Apply and design a chiller system.<br>C. Select a chiller system from available vendors.<br>D. Develop all documentation for chiller design: piping schematics, chiller schedule, submittal documentation. | 1.<br>2.<br>3. |
| III. | Cooling Tower Systems<br>A. Define all the types of cooling tower systems and support components.<br>B. Apply and design a cooling tower system.<br>C. Select a cooling tower system from available vendors.<br>D. Develop all documentation for a cooling tower design: piping schematics, cooling tower schedule, submittal documentation. | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| IV. | Boiler Systems<br>A. Define all the types of boiler systems and support components.<br>B. Apply and design a boiler system.<br>C. Select a boiler system from available vendors.<br>D. Develop all documentation for a boiler design: piping schematics, boiler tower schedule, submittal documentation. | 1.<br>2.<br>3. |
| V. | Air Handling Units<br>A. Define all the types of air handling units and support components.<br>B. Apply and design an air handling unit.<br>C. Select an air handling unit from available vendors.<br>D. Develop all documentation for an AHU design: piping schematics, AHU schedule, submittal documentation. | 1.<br>2.<br>3. |
| VI. | Heat Exchangers<br>A. Define all the types of heat exchangers and support components.<br>B. Apply and design a heat exchanger.<br>C. Select a heat exchanger from available vendors.<br>D. Develop all documentation for a heat exchanger design: piping schematics, heat exchanger schedule, submittal documentation. | 1.<br>2.<br>3. |
| VII. | Thermal Storage<br>A. Define all the types of thermal storage and support components.<br>B. Apply and design a thermal storage system.<br>C. Select a thermal storage system from available vendor.<br>D. Develop all documentation for a thermal storage system design: piping schematics, thermal storage schedule, submittal documentation. | 1.<br>2. |
| VIII. | Dehumidification<br>A. Define all the types of dehumidification and support components.<br>B. Apply and design a dehumidification system.<br>C. Select a dehumidification system from an available vendor.<br>D. Develop all documentation for a dehumidification system: dehumidification schedule, submittal documentation. | 1.<br>2.<br>3. |
| IX. | Heat Pumps<br>A. Define all the types of heat pumps and support components.<br>B. Apply and design a heat pump system.<br>C. Select a heat pump system from an available vendor.<br>D. Develop all documentation for a heat pump system: piping schematics, heat pump schedule, submittal documentation. | 1.<br>2.<br>3. |
| X. | Class Project<br>A. Given a set of building specification: Apply, design, select and develop all documentation for a complete project building HVAC system.<br>B. Illustrate the full load energy consumption of the HVAC system<br>C. Illustrate a sequence of operation for the HVAC system | 1.<br>2.<br>3. |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
(proposed)

**Instructional Unit Topic Descriptions and Time Allocations**

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|

| | | | |
|---|---|---|---|
| I. | Introduction to Course, Overview of HVAC Primary Systems | 1 | 0 |
| II. | Chiller systems | 9 | 6 |
| III. | Cooling tower systems | 6 | 3 |
| IV. | Boiler systems | 6 | 6 |
| V. | Air Handling Units | 9 | 6 |
| VI. | Heat Exchangers | 3 | 3 |
| VII. | Thermal storage | 2 | 3 |
| VIII. | Dehumidification | 2 | 3 |
| IX. | Heat pumps | 3 | 3 |
| X. | Course Project | 2 | 12 |
| XI. | Exams | 2 | 0 |
| | Total Hours | 45 | 45 |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

# COURSE INFORMATION FORM

# FORM E
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC** ☒ **Number (current) 499** ☐ **LEC 2 LAB 9 SEM ___ (current)**

(proposed) **HVAC** (proposed) **499** (Enter Contact Hours per week)
LEC _2__ LAB _6__ SEM ___(proposed):

☐ **Title (current) Commerical HVAC System Design**

(proposed) **Commercial HVAC System Design**

☒ **Credit Hours (current) 5** ☒ **Prerequisites (current) HVAC 415 and HAVC 451 with a C- or better Co-requisite (current)**

(proposed) **4** (proposed) HVAC 415, HVAC 451, and HVAC 462 with a grade of C- or better.
(proposed)

☒ **Course Description (current): (125 words maximum)**
Given building architectural plans, appropriate software, codes and standards and owner's requirements, students will select appropriate HVAC system, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation. This course meets General Education Requirements: Writing Intensive.
(proposed): Given building architectural plans, appropriate software, codes and standards and owner's requirements, students will select appropriate HVAC system, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation. This course meets General Education Requirements: Writing Intensive.

☒ **Course Outcomes and Assessment Plan (current)**

## Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding the overall HVAC system design procedure.
2. Analyzing owner & building requirements for proper equipment selection.
3. Computerized load calculation and building simulation related to the HVAC design process.
4. Developing system layouts, working drawings, specification and control sequence of operation.

## (proposed): Learning Outcomes and Assessment for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

Note: Each Learning unit has written assignments which build toward the final class project as this is a Capstone class, continual feedback is given to individual students as well as student groups as the final project is a group based learning project.

| | |
|---|---|
| I. | Introduction and Project Overview<br>A. Understand the purpose and course objectives |

| | |
|---|---|
| | B. Understand the project timeline |
| II. | Design Procedure<br>A. Identify the processes of HVAC design |
| III. | System Analysis and Selection<br>A. Apply factors affecting zoning decisions to system selection.<br>B. Evaluate architectural considerations and its affect upon system selection.<br>C. Evaluate system configuration and performance in relationship to building and zoning considerations.<br>D. Evaluate economics in relationship to budgetary considerations (first cost and operating costs).<br>E. Summarize system performance.<br>F. Identify potential systems to meet performance requirements. |
| IV. | Base Load Information<br>A. Indentify indoor design requirements based upon occupancy and applicable codes.<br>B. Identify indoor air quality requirements. |
| V. | Miscellaneous Base Load<br>A. Describe ventilation characteristics of various systems. |
| VI. | Initial Design Load<br>A. Assemble building base load information.<br>B. Calculate building base load.<br>C. Assemble building miscellaneous base load information.<br>D. Calculate miscellaneous base load.<br>E. Calculate building load. |
| VII. | Applied Load Analysis<br>A. Understand load analysis terminology.<br>B. Calculate equipment sizing loads.<br>C. Determine ventilation requirements for indoor air quality, economizer and building pressurization.<br>D. Perform load line analysis based upon design load.<br>E. Identify preliminary control strategies and modes.<br>F. Identify methods to control humidity.<br>G. Apply psychrometric analysis. |
| VIII. | Equipment Selection<br>A. Identify critical conditions for cooling coil selection.<br>B. Select cooling coil.<br>C. Identify miscellaneous accessories.<br>D. Select air handling equipment.<br>E. Select chiller.<br>F. Select heat rejection equipment.<br>G. Identify critical conditions for heating coil selection.<br>H. Select heating coil.<br>I. Identify miscellaneous heating accessories.<br>J. Select boiler.<br>K. Identify availability and verify electrical rate structure.<br>L. Identify availability and verify fossil fuel rate structure.<br>M. Analyze applicability of energy enhancing systems. |
| IX. | Building Simulation<br>A. Input utility data.<br>B. Input building data.<br>C. Input plant data.<br>D. Generate component and annual energy costs. |
| X. | System Sizing and Layout<br>A. Select size and layout air distribution system.<br>B. Calculate air pressure losses and select fan.<br>C. Select size and layout water distribution system. |

| | |
|---|---|
| | D. Calculate water pressure losses and select circulating pump. |
| XI. | Working Drawings<br>A. Identify standards and drawing arrangement.<br>B. Develop working drawings for piping, ductwork, details, schematics and control diagrams and schedules. |
| XII. | Specifications<br>A. Understand the purpose and format for mechanical specifications.<br>B. Understand the purpose and format for control specifications. |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
(proposed)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction and Project Overview | 1 | 0 |
| II. | Design Procedure | 1 | 0 |
| III. | System Analysis and Selection | 2 | 6 |
| IV. | Base Load Information | 2 | 12 |
| V. | Miscellaneous Base Load | 2 | 6 |
| VI. | Initial Design Load | 2 | 6 |
| VII. | Applied Load Analysis | 2 | 6 |
| VIII. | Equipment Selection | 4 | 6 |
| IX. | Building Simulation | 2 | 6 |
| X. | System Sizing and Layout | 3 | 12 |
| XI. | Working Drawings | 2 | 18 |
| XI. | Specifications | 2 | 6 |
| XII. | Project Report | 2 | 6 |
| XIII. | Exams | 3 | 0 |
| | Total Hours | 30 | 90 |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

**COURSE INFORMATION FORM** **FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC** ☐ **Number (current) 451** ☐ **LEC ___ LAB ___ SEM ___ (current)**

(proposed) **HVAC** (proposed) **451** (Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current)** Energy Audit and Analysis

(proposed) Energy Audit and Analysis

☒ **Credit Hours (current) 4** ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) **4** (proposed) C- or better in MATH 126 and HVAC 393

☒ **Course Description (current): (125 words maximum)**

(proposed): The survey of utility rate structures, billing energy consumption and energy profiling of commercial and industrial buildings. On-site audit projects will report on recommendations to building envelopes, HVACR systems and control systems with regard to payback. Oral and written presentations are a requirement of this senior project course. This course meets General Education Requirements: Writing Intensive.

☒ **Course Outcomes and Assessment Plan (current & proposed)**

**(current & proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding and evaluating various utility tariffs.
2. Understanding the history and politics of energy.
3. Conducting all forms of energy audit.
4. Building envelope evaluation and O&M/ECM recommendation.
5. HVAC system evaluation and O&M/ECM recommendation.
6. Lighting & Other electrical evaluation and O&M/ECM recommendation.
7. Application of energy estimating methods.

**Instructional Unit Topic Descriptions and Time Allocations**

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Units of Energy | 1 | 0 |
| II. | Energy History / Energy Audit Types / Energy code / Standards | 9 | 3 |
| III. | Utility Bill Analysis | 8 | 6 |
| IV. | Energy Estimating Methods | 3 | 3 |

| | | | |
|---|---|---|---|
| V. | Envelope, HVAC, Lighting & Other Electric Improvements | 12 | 12 |
| VI. | Steam systems | 6 | 3 |
| VII. | Technical Assistance Audit and Class Project | 3 | 18 |
| VIII. | Evaluation | 3 | 0 |
| | Total Hours | 45 | 45 |

**Learning Outcomes for Each Instructional Unit**

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Units of Energy<br>A. Define the units of energy for various energy sources.<br>B. Apply the appropriate energy unit in energy calculations. |
| II. | Energy History / Energy Audit Types / Energy Code / Standards<br>A. Explain the recent history of energy conservation<br>B. Differentiate between the three types of energy audits (walk thru, mini-audit and technical assistance audit.<br>C. Apply the correct energy audit type for a given situation.<br>D. Perform all steps in all forms of energy audits.<br>E. Utilize current energy codes and standards during the course of an energy audit.<br>F. Make recommendations utilizing current energy codes and standards. |
| III. | Utility Bill Analysis<br>A. Define the various rate structures for electricity.<br>B. Calculate an electric bill at various rate structures.<br>C. Define the terms demand, kW, capacity and power.<br>D. Define the terms electrical use, consumption, kWh and energy.<br>E. Define cost recovery factor.<br>F. Define electrical surcharges.<br>G. Define and calculate power factor.<br>H. Accurately read electrical meters.<br>I. Make recommendations on local vs. de-regulated electrical purchase.<br>J. Calculate the correct tax exemption status for manufacturing buildings.<br>K. Define the various rate structures for gas (natural and propane).<br>L. Define the various rate structures for other energy sources.<br>M. Use computer spreadsheets to assist in utility bill analysis.<br>N. Use utility billing history to establish a utility use baseline.<br>O. Use utility billing for building comparison to other similar buildings. |
| IV. | Energy Estimating Methods<br>A. Define, calculate and utilize the degree day method of energy estimating method.<br>B. Define, calculate and utilize the bin energy estimating method.<br>C. Define, calculate and utilize the correlation energy estimating method.<br>D. Define and utilize complex computer energy estimating methods.<br>E. Explain the strengths and limitations of each method. |
| V. | Envelope, HVAC, Lighting & Other Electric Improvements<br>A. Evaluate a building's envelope and make energy recommendations.<br>B. Evaluate a building's HVAC systems and make energy recommendations.<br>C. Evaluate a building's Lighting and other electrical and make energy recommendations.<br>D. Use various hand calculations to determine energy savings in all the above areas.<br>E. Use computer design and load programs to determine complex energy savings situations for all of the above areas. |

| | |
|---|---|
| | F. Establish a ranked order of Operation and Maintenance recommendations according to simple payback.<br>G. Establish a ranked order of Energy Conservation Measures according to simple payback. |
| VI. | Steam Systems<br>A. Define basic steam principles.<br>B. Utilize the appropriate steam charts.<br>C. Recognize and describe various steam systems and components.<br>D. Evaluate a buildings steam system and make energy recommendations. |
| VII. | Technical Assist Audit and Class Project<br>A. Collect on-site data for a technical assist audit.<br>B. Analyze utility billing for project building.<br>C. Establish a energy usage history for project building.<br>D. Place all collected data into a load calculation and computer simulation program.<br>E. Evaluate building envelope, HVAC systems, Lighting and other electrical systems, Control systems for optimal energy efficiency and building performance.<br>F. Calculate energy savings for operational and maintenance issues.<br>G. Calculate energy savings for energy conservation measures.<br>H. Develop a detailed, professional energy audit report.<br>I. Deliver the energy audit results in a formal presentation. |

**Minimum Required Student Laboratory Activities**

| | |
|---|---|
| I. | Student will collect accurate information on a project building, including: envelope data, HVAC data, lighting data, control data, other electrical data, utility data. |
| II. | Student will use above data, blueprints and building specifications to develop a building simulation. |
| III. | Student will use various hand calculations to validate the outcome of the computer simulation. |
| IV. | Student will use the building simulation program to test complex "what if" energy savings measures to determine rank order of payback. |
| V. | Student will write up a professional energy audit report including the following sections: Building history, Utility history, Computer profile, Mechanical system information, Control information, Lighting & other electrical information, Operational and Maintenance Recommendations, Energy conservation measure recommendations. |
| VI. | Student will deliver an oral presentation to Ferris staff and students on energy audit findings. |
| VII. | Student will deliver an oral presentation to the building owner and representatives. |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

# COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC** ☒ **Number (current) 499** ☐ **LEC 2 LAB 9 SEM ___ (current)**

(proposed) **HVAC** (proposed) **499** (Enter Contact Hours per week)
LEC _2__ LAB _6__ SEM ___(proposed):

☐ **Title (current) Commerical HVAC System Design**

(proposed) **Commercial HVAC System Design**

☒ **Credit Hours (current) 5** ☒ **Prerequisites (current) HVAC 415 and HAVC 451 with a C- or better** **Co-requisite (current)**

(proposed) **4** (proposed) HVAC 415, HVAC 451, and HVAC 462 with a grade of C- or better.
(proposed)

☒ **Course Description (current): (125 words maximum)**
Given building architectural plans, appropriate software, codes and standards and owner's requirements, students will select appropriate HVAC system, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation. This course meets General Education Requirements: Writing Intensive.
(proposed): Given building architectural plans, appropriate software, codes and standards and owner's requirements, students will select appropriate HVAC system, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation. This course meets General Education Requirements: Writing Intensive.

☒ **Course Outcomes and Assessment Plan (current)**

## Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding the overall HVAC system design procedure.
2. Analyzing owner & building requirements for proper equipment selection.
3. Computerized load calculation and building simulation related to the HVAC design process.
4. Developing system layouts, working drawings, specification and control sequence of operation.

## (proposed): Learning Outcomes and Assessment for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

Note: Each Learning unit has written assignments which build toward the final class project as this is a Capstone class, continual feedback is given to individual students as well as student groups as the final project is a group based learning project.

| | |
|---|---|
| I. | Introduction and Project Overview<br>A. Understand the purpose and course objectives |

| | |
|---|---|
| | B. Understand the project timeline |
| II. | Design Procedure<br>A. Identify the processes of HVAC design |
| III. | System Analysis and Selection<br>A. Apply factors affecting zoning decisions to system selection.<br>B. Evaluate architectural considerations and its affect upon system selection.<br>C. Evaluate system configuration and performance in relationship to building and zoning considerations.<br>D. Evaluate economics in relationship to budgetary considerations (first cost and operating costs).<br>E. Summarize system performance.<br>F. Identify potential systems to meet performance requirements. |
| IV. | Base Load Information<br>A. Indentify indoor design requirements based upon occupancy and applicable codes.<br>B. Identify indoor air quality requirements. |
| V. | Miscellaneous Base Load<br>A. Describe ventilation characteristics of various systems. |
| VI. | Initial Design Load<br>A. Assemble building base load information.<br>B. Calculate building base load.<br>C. Assemble building miscellaneous base load information.<br>D. Calculate miscellaneous base load.<br>E. Calculate building load. |
| VII. | Applied Load Analysis<br>A. Understand load analysis terminology.<br>B. Calculate equipment sizing loads.<br>C. Determine ventilation requirements for indoor air quality, economizer and building pressurization.<br>D. Perform load line analysis based upon design load.<br>E. Identify preliminary control strategies and modes.<br>F. Identify methods to control humidity.<br>G. Apply psychrometric analysis. |
| VIII. | Equipment Selection<br>A. Identify critical conditions for cooling coil selection.<br>B. Select cooling coil.<br>C. Identify miscellaneous accessories.<br>D. Select air handling equipment.<br>E. Select chiller.<br>F. Select heat rejection equipment.<br>G. Identify critical conditions for heating coil selection.<br>H. Select heating coil.<br>I. Identify miscellaneous heating accessories.<br>J. Select boiler.<br>K. Identify availability and verify electrical rate structure.<br>L. Identify availability and verify fossil fuel rate structure.<br>M. Analyze applicability of energy enhancing systems. |
| IX. | Building Simulation<br>A. Input utility data.<br>B. Input building data.<br>C. Input plant data.<br>D. Generate component and annual energy costs. |
| X. | System Sizing and Layout<br>A. Select size and layout air distribution system.<br>B. Calculate air pressure losses and select fan.<br>C. Select size and layout water distribution system. |

| | |
|---|---|
| | D. Calculate water pressure losses and select circulating pump. |
| XI. | Working Drawings<br>A. Identify standards and drawing arrangement.<br>B. Develop working drawings for piping, ductwork, details, schematics and control diagrams and schedules. |
| XII. | Specifications<br>A. Understand the purpose and format for mechanical specifications.<br>B. Understand the purpose and format for control specifications. |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
(proposed)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction and Project Overview | 1 | 0 |
| II. | Design Procedure | 1 | 0 |
| III. | System Analysis and Selection | 2 | 6 |
| IV. | Base Load Information | 2 | 12 |
| V. | Miscellaneous Base Load | 2 | 6 |
| VI. | Initial Design Load | 2 | 6 |
| VII. | Applied Load Analysis | 2 | 6 |
| VIII. | Equipment Selection | 4 | 6 |
| IX. | Building Simulation | 2 | 6 |
| X. | System Sizing and Layout | 3 | 12 |
| XI. | Working Drawings | 2 | 18 |
| XI. | Specifications | 2 | 6 |
| XII. | Project Report | 2 | 6 |
| XIII. | Exams | 3 | 0 |
| | Total Hours | 30 | 90 |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

# MODIFY A COURSE

**Course Data Entry Form**

**FORM F**

Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**
a. Course Prefix **HVAC** b. Number **312** c. Title **Control Theory & Application**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in HVAC 321, HVAC342, and MATH 126

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# CREATE NEW COURSE

# FORM F

**Course Data Entry Form**

Rev. September 2012

**COMPLETE ALL SECTIONS BELOW. If this course is to be used as a prerequisite for other university courses, Form F's that reflect the prerequisite change must be submitted for those courses as well. See Appendix E Instructions for Completing Forms.**

**I. ACTION TO BE TAKEN: CREATE A NEW COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. NEW COURSE ATTRIBUTES:**

**a.** Course Prefix **HVAC** **b.** Number **321** **c.** Contact Hours **3** LECture **3** LAB ☐Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

**d.** ☐ Practicum ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

**e.** Course Title: **HVAC Air System Select-Design** (Limit to 30 characters including punctuation and spaces.)

**f.** College Code: **CET** **g.** Department Code: **HVAC** **h.** Credit Hours: Check (x) type ☐ Variable ☒ Fixed

**i.** Enter number in box: **4** Minimum Credit Hours **j.** **4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☒ Yes ☐ No
If yes, Max Times **3** or Max Credits Awarded **3 times**

**l.** Levels: Check (x) ☒ Undergraduate ☐ Graduate ☐ Professional

**m.** Grade Method: Check (x) ☒ Normal Grading ☐ Credit/No Credit (Pass/Fail)

**n.** Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☒ No

**o.** Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.
A study of air systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.

**q.** Term(s) Offered: **Fall** **r.** Max Section Enrollment: **16** **s.** Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management

**t.** Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# CREATE NEW COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**COMPLETE ALL SECTIONS BELOW. If this course is to be used as a prerequisite for other university courses, Form F's that reflect the prerequisite change must be submitted for those courses as well. See Appendix E Instructions for Completing Forms.**

**I. ACTION TO BE TAKEN: CREATE A NEW COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. NEW COURSE ATTRIBUTES:**

a. Course Prefix **HVAC** b. Number **325** c. Contact Hours **3** LECture **3** LAB ☐Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: **HVAC Hydronic System Select-Design** (Limit to 30 characters including punctuation and spaces.)

f. College Code: **CET** g. Department Code: **HVAC** h. Credit Hours: Check (x) type ☐ Variable ☒ Fixed

i. Enter number in box: **4** Minimum Credit Hours j. **4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☒ Yes ☐ No
If yes, Max Times **3** or Max Credits Awarded **3 times**

l. Levels: Check (x) ☒ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☒ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☒ No

o. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.
A study of water systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.

q. Term(s) Offered: **Spring** r. Max Section Enrollment: **16** s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- (or better) in HVAC 321, HVAC 342 and MATH126

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# MODIFY A COURSE

**FORM F**

## Course Data Entry Form

Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**

a. Course Prefix **HVAC** b. Number **350** c. Title **Contracting Issues in HVACR**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in HVAC 321, HVAC 342, and MATH 126

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# MODIFY A COURSE

## Course Data Entry Form

# FORM F

Rev. September 2012

I. **ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

II. **COURSE TO BE MODIFIED:**

a. Course Prefix **HVAC** b. Number **393** c. Title **Summer Internship**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

III. **MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in HVAC 312, 325 & 350

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**

a. Course Prefix **HVAC** b. Number **415** c. Title **Direct Digital Control**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded

l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in MATH 126 and HVAC 393

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# MODIFY A COURSE

**Course Data Entry Form**

# FORM F

Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**

a. Course Prefix **HVAC** b. Number **451** c. Title Energy Audit and Analysis

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded

l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in MATH 126 and HVAC 393

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

24

# CREATE NEW COURSE

**Course Data Entry Form**

# FORM F

Rev. September 2012

**COMPLETE ALL SECTIONS BELOW. If this course is to be used as a prerequisite for other university courses, Form F's that reflect the prerequisite change must be submitted for those courses as well. See Appendix E Instructions for Completing Forms.**

**I. ACTION TO BE TAKEN: CREATE A NEW COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. NEW COURSE ATTRIBUTES:**

a. Course Prefix **HVAC** b. Number **462** c. Contact Hours **3** LECture **3** LAB ☐Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: **HVAC Primary Equipment Selection** (Limit to 30 characters including punctuation and spaces.)

f. College Code: **CET** g. Department Code: **HVAC** h. Credit Hours: Check (x) type ☐ Variable ☒ Fixed

i. Enter number in box: **4** Minimum Credit Hours j. **4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) Yes ☐ No
If yes, Max Times **3** or Max Credits Awarded **3 times**

l. Levels: Check (x) ☒ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☒ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☒ No

o. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

The selection, application and layout of state-of-the-art equipment and systems for commercial and industrial buildings. Emphasis will be placed upon the energy efficiency, integration of equipment into a complete system, and sequence of operation.

q. Term(s) Offered: **Fall/Spring/Summer** r. Max Section Enrollment: **16** s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- (or better) in MATH 126 & HVAC393

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/26/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**

a. Course Prefix **HVAC** b. Number **499** c. Title Commercial HVAC System Design

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. h, i, j, k, s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours **2** LECture **6** LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☒ Fixed

i. Enter number in box: **4** Minimum Credit Hours j. **4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☒ Yes ☐ No
If yes, Max Times **3** or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in HVAC 415, HVAC 451 and HVAC 462

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# CREATE NEW COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**COMPLETE ALL SECTIONS BELOW. If this course is to be used as a prerequisite for other university courses, Form F's that reflect the prerequisite change must be submitted for those courses as well. See Appendix E Instructions for Completing Forms.**

**I. ACTION TO BE TAKEN: CREATE A NEW COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. NEW COURSE ATTRIBUTES:**

a. Course Prefix **HVAC** b. Number **462** c. Contact Hours **3** LECture **3** LAB ☐ Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: **HVAC Primary Equipment Selection** (Limit to 30 characters including punctuation and spaces.)

f. College Code: **CET** g. Department Code: **HVAC** h. Credit Hours: Check (x) type ☐ Variable ☒ Fixed

i. Enter number in box: **4** Minimum Credit Hours j. **4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☒ Yes ☐ No
If yes, Max Times **3** or Max Credits Awarded **3 times**

l. Levels: Check (x) ☒ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☒ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☒ No

o. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

The selection, application and layout of state-of-the-art equipment and systems for commercial and industrial buildings. Emphasis will be placed upon the energy efficiency, integration of equipment into a complete system, and sequence of operation.

q. Term(s) Offered: **Fall/Spring/Summer** r. Max Section Enrollment: **16** s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- (or better) in MATH 126 & HVAC393

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# Delete a Course

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**I. ACTION TO BE TAKEN: DELETE COURSE FROM CATALOG.**

The course listed below will be removed from the Ferris State University Catalog.
(See Appendix E Instructions for Completing Forms.)

**a**. Desired Term Effective: Term Fall Year 2014

**II. CURRENT COURSE TO BE DELETED FROM CATALOG:**

**a**. Course Prefix **HVAC**
**b**. Number **331**
**c**. Enter Contact Hours per week in boxes. LECture 3 LAB 3 Seminar
**d**. INDependent Study ☐ Practicum: [Check (x) box as appropriate. See definitions in Appendix E.)

**e**. Full Course Title: **Secondary System Select-Design**

**UCC Chair Signature/Date:**

Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:**

Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd: ____ Date Completed: ____ Entered: SCACRSE __ SCADETL __SCARRES __ SCAPREQ __**

**Paula L Hadley-Kennedy**

---

**From:** Sandy L Alspach <SandyAlspach@ferris.edu>
**Sent:** Friday, March 21, 2014 11:47 AM
**To:** Douglas F Zentz; John R Schmidt
**Cc:** Chrystal R Roach; Elise M Gramza; Paul Blake; Paula Hadley-Kennedy; Douglas F Zentz; Victor I Piercey; David M Marion; Kristy L Motz; Steven Karnes; Olukemi O Fadayomi; Adnan Dakkuri; Tracey D Boncher
**Subject:** HVACR Curriculum Modification and new courses proposal

Gentlemen,

UCC is holding your proposal, pending receipt of the following:

Form Es for all modifications and reinstitution of HVAC 462
This "new and improved" Form E is now signed and dated by the Associate Provost for Academic Affairs and becomes the "course of record" going forward.

Form Fs:
- HVAC 321, 325, 462: if the intent is that these courses are repeatable, Records will need to know how many times and/or maximum credits that can be earned
- HVAC 499: a LEC/LAB course cannot be variable credit. You could accomplish this option by changing the course to Practicum
- Form F Delete for HVAC 331

We meet at noon on Monday; send corrected forms directly to Paula Hadley in the Academic Senate office.

**Paula L Hadley-Kennedy**

---

**From:** Douglas F Zentz
**Sent:** Friday, March 21, 2014 3:13 PM
**To:** Paula L Hadley-Kennedy
**Cc:** Sandy L Alspach; Donna J Schmidt; John R Schmidt
**Attachments:** Form F - HVAC331 - Delete Course.pdf; Form F - HVAC321 - HVAC 2013 Proposal.pdf; Form F - HVAC325 - HVAC 2013 Proposal.pdf; Form F - HVAC462 - HVAC 2013 Proposal.pdf; Form F - HVAC499 - HVAC 2013 Proposal.pdf

Paula,

Pere the direction of the UCC, here are the required forms with minor modifications as requested. Please note there is zero need for a modified Form E on HVAC462 as the course is not changing (only the course number is changing) and the original packet has a Form E for HVAC462.

Doug Zentz
Associate Professor/HVACR Department Coordinator
School of Built Environment
College of Engineering Technology
Ferris State University
Office Ph: (231) 591-3083
Cell: (231) 250-4394

**FORM A**

Revised September 2012

# PROPOSAL SUMMARY AND ROUTING FORM

## Proposal Title: HVACR On-Line Modification and Creation of HVAC 322, HVAC323, HVAC326 & HVAC 327

**Initiating Individual:** Doug Zentz **Initiating Department or Unit:** HVACR
**Contact Person's Name:** Doug Zentz **e-mail:** zentzd@ferris.edu **phone:** 3083

- ☐ Group I - A – New degree, major, concentration, minor, or redirection of a current offering
- ☐ Group I - B – Deletion of a degree, major, concentration, or minor
- ☒ Group II - A – New Course, modification of a course, deletion of a course
- ☒ Group II - B – Minor curriculum clean-up
- ☐ Group III – Certificates (☐ College Credit ☐ Non-Credit)
- ☐ Group IV – Other Site Locations (☐ College Credit ☐ Non-Credit)

| | Signature | Date | Vote/Action * Number count ** |
|---|---|---|---|
| Program Representative ** | | | ____Support<br>____Support with Concerns<br>____Not Support<br>____Abstain |
| Department/School/Faculty Representative Vote ** | | | ____Support<br>____Support with Concerns<br>____Not Support<br>____Abstain |
| Department/School Administrator | | | ____Support<br>____Support with Concerns<br>____Not Support |
| College Curriculum Committee/Faculty | | | ____Support<br>____Support with Concerns<br>____Not Support<br>____Abstain |
| Dean | | | ____Support<br>____Support with Concerns<br>____Not Support |
| University Curriculum Committee ** | | | ____Support<br>____Support with Concerns<br>____Not Support<br>____Abstain |
| Senate ** | | | ____Support<br>____Support with Concerns<br>____Not Support<br>____Abstain |
| Academic Affairs | | | ____Support<br>____Hold<br>____Not Support |

* Support with Concerns or Not Support must include identification of specific concerns with appropriate rationale.
** Number count must be given for all members present and/or voting.

**To be completed by Academic Affairs** **Date/Term of Implementation:** ___________________

______________________ ______________________________ ______________________________
**President (Date Approved)** **Board of Trustees (Date Approved)** **Academic Officers of MI (Date Approved)**

## 1. Proposal Summary

(Summary is generally less than one page. Briefly: state what is proposed with a summary of rationale and highlights.)

**BACKGROUND**

The HVAC Bachelor degree began in the mid 1980's when Ferris was on quarters, and during this time period the HVAC Bachelor degree had two junior level "*secondary system select-design*" courses; one was centered on air side systems and the other one was centered on water (hydronic) side systems. When Ferris moved to semester based courses, these two "*secondary system select-design*" courses were blended together to a 5 credit "*HVAC Secondary System Select-Design*" class (known as HVAC 331). Although manageable, the amount of course content within this course is beyond the normal junior level class and in some semesters it was difficult to cover all learning outcomes. In 2009, it was determined through advisory board input that another course, HVAC 350 – Contracting Issues in HVAC, should be created and to provide the needed credits for this new class it was determined that HVAC 331 should be reduced to 4 credits by reducing some of the learning outcomes (moving them to another HVAC course). It has been 4 years now and the result of this change, along with Advisory Board input, has concluded there is a strong need to return to two separate "*secondary system select-design*" courses (one air side and the other water (hydronic) side); thus, the HVAC department wants to create HVAC 321, "*HVAC Air Side System Select-Design*" and HVAC 325, "*HVAC Hydronic System Select-Design*". These new courses are being offered on campus via the traditional teaching method.

Furthermore, the HVAC program started an On-Line version of the Bachelor degree about 12 years ago and HVAC331 was split into two courses for the on-line students. The first course includes the lecture component and the computer-based lab component; while the second course includes the hands-on lab component. Thus, the on-line version was HVAC332 (3 credit lecture) and HVAC333 (1 credit lab). Following the thought process of copying the "traditional on campus" course sequence, the new On-line courses will be the following.

**HVAC322**: HVAC322 (Air Systems Select-Design) will cover the air systems segment of the old HVAC332 course and will provide the ability for enriched learning (following the direction of our Advisory Board). This course will be provided via 100% on-line learning and includes some elements of the lab learning which can be delivered via on-line lecture and assignments.

**HVAC323**: HVAC323 (Air Systems Hands-on Laboratory) will cover the "hands-on" segment and enhanced learning of HVAC322. HVAC323 will be offered when the on-line students come to Big Rapids for the laboratory learning experience during the summer after taking HVAC322.

**HVAC326**: HVAC326 (Hydronic Systems Select-Design) will cover the hydronic segment of the old HVAC332 course and will provide the ability for enriched learning (following the direction of our Advisory Board). This course will be provided via 100% on-line learning and includes some elements of the lab learning which can be delivered via on-line lecture and assignments.

**HVAC327**: HVAC327 (Hydronic Hands-on Laboratory) will cover the "hands-on" segment and enhanced learning of HVAC326. HVAC327 will be offered to the on-line students when they come to Ferris (Big Rapids) for HVAC323.

**Other Changes Reflected in Form D**: The prior curriculum modification for the HVAC Bachelor degree addressed additional changes which are also reflected in Form D of this proposal (the on-line Bachelor degree is the same degree as the traditional students on campus earn). These changes include the substitution of COMM221 with ENGL311 as this change was a direct result of our last APR along with input from our advisory board. The other change was a reduction in credit hours of the capstone class, HVAC499, from 5 credits to 4 credits (experience has shown there is no need for three lab sessions per week). Since both of these were addressed in detail on the prior curriculum modification, the only reflection here is within Form D (check sheets).

**PREREQUISITE CHANGE**: Due to the addition of new HVAC courses (HVAC 322, & HVAC 326), and deletion of HVAC 332, there is a need to change the prerequisite in HVAC313. This proposal includes this minor change within the enclosed Form F sheet for HVAC 313,

**SUMMARY:** Under this proposal:

- Overall SCH for On-Line BS students remain the same.
- HVAC 332 is replaced with HVAC 322,
- HVAC 326 is added to junior year.
- HVAC323 is the Hands-on Lab component of HVAC322
- HVAC327 is the Hands-on Lab component of HVAC326
- HVAC313 has its prerequisite modified to reflect the above changes

**2. Summary of Curricular Action (check all that apply to this proposal)**

☐ **Degree** ☒ **Major** ☐ **Minor** ☐ **Concentration** ☐ **Certificate** ☒ **Course**

☒ **New** ☒ **Modification** ☒ **Deletion**

**Name of Degree, Major, etc. : HVACR Engineering Technology and Energy Management**

**3. Summary of All Course Action Required** **Contact Senate Secretary or UCC Chair if additional spaces are required.**

**a. Newly Created Courses to be Added to FSU Catalog:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 322 | Air Systems Select-Design |
| HVAC | 326 | Hydronic Systems Select-Design |
| HVAC | 323 | Air Systems Hands-on Laboratory |
| HVAC | 327 | Hydronic Hands-on Laboratory |

**b. Courses to be Deleted from FSU Catalog:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 332 | HVAC Secondary System Select-Design |
| HVAC | 333 | Secondary System Laboratory |

**c. Existing Course(s) to be Modified:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 313 | HVAC Control Theory and Applications |

**d. Addition of existing FSU courses to program**

| Prefix | Number | Title |
|---|---|---|

**e. Removal of existing FSU courses from program**

| Prefix | Number | Title |
|---|---|---|

**4. Summary of All Consultations**

| Form Sent (B or C) | Date Sent | Responding Dept. | Date Received & by Whom |
|---|---|---|---|
| Form C | 2/7/14 | FLITE | |

**5. Will External Accreditation be sought? (For new programs or certificates only)**

☐ **Yes** ☒ **No**

**If yes, name the organization involved with accreditation for this program.**

**6. Program Checksheets affected by this proposal (check all that apply to this proposal)**

☒ Add Course ☒ Delete Course ☒ Modify Course ☐ Change Prerequisite ☐ Move from required to elective
☐ Move from elective to required ☐ Change Outcomes and Assessment Plan ☒ Change credit hours

List all Checksheets affected by this proposal:

| College | Department | Program |
|---|---|---|
| CET | HVACR | HVACR Engineering Technology and Energy Management |

#16-046

**Form A**

Revised Jan. 2015

## PROPOSAL SUMMARY AND ROUTING FORM

**Proposal Title:** HVAC 127, Advanced HVACR Controls

**Initiating Individual**: Brian Holton **Initiating Department or Unit**: HVACR Program

**Contact Person's Name**: Brian Holton **Email**: holt8@ferris.edu **Phone:** 591-2322

☐ **Group I-A** – New Degree, major, concentration, minor, or redirection of a current offering

☐ **Group I-B** – Deletion of a degree, major, concentration, or minor

☒ **Group II-A** – New Course, modification of a course, deletion of a course

☐ **Group II-B** – Minor Curriculum Clean-up

☐ **Group III** – Certificate (☐ College Credit ☐ Non-credit ☐ New Certificate)

☐ **Group IV** – Other site location (☐ College Credit ☐ Non-credit )

| | PLEASE PRINT AND SIGN YOUR NAME | DATE | VOTE/ACTION * Number Count |
|---|---|---|---|
| **Program Representative** ** | Brian Holton<br>Brian Holton | 11/16/15 | 1 Support 1 voting<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| **Department/School/Faculty Representative Vote** ** | DOUGLAS ZENTZ<br>D.T. Zentz | 11/16/15 | 9 Support 9 voting<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| **Department/School Administrator** | JOHN R. SCHMIDT<br>John Schmidt | 12/2/2015 | 6 Support School + Director = 7<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| **College Curriculum Committee/Faculty** | Chuck Drake<br>Chuck Drake | 12-14-15 | 8 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| **UCC Representative** | Brian Holton<br>Brian Holton | 12-14-15 | X Support<br>0 Hold<br>0 Not Support |
| **Dean** | [signature] | 12/15/15 | X Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| **University Curriculum Committee** ** | [signature] | 1/11/16 | ✓ Support 10 – 0<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| **Senate** ** | K. Thompson | 1/21/16 | ✓ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| **Academic Affairs** | [signature] | 1/13/16 | ✓ Support<br>__ Hold<br>__ Not Support |

* Support with Concerns or Not Support must include identification of specific concern with appropriate rationale.

** Number Count must be given for all members present and/or voting.

To be completed by Academic Affairs    Date of Implementation: Fall 2016

VPAA
JAN 11 2016
PROVOST

Date Approved    Board of Trustees (Date Approved)    Academic Officers of MI (Date Approved)

**More advanced electric and electronic devices have become commonplace in the HVACR industry. In order to prepare students for successful employment the HVACR program has agreed that a new course focused on specific controls and devices is required. A needs assessment survey was conducted during the 2015 spring advisory committee meeting. The results of that survey were used to form the learning objectives for the proposed new course. To maintain the associate degree at the current total credit hours the faculty decided to eliminate ISYS 105. The rational for this decision was based upon students demonstrating skills outlined in the objectives for ISYS 105 as a result of their secondary education. The new course will further differentiate Ferris State University from technical schools and community colleges that offer HVAC certificates and associate degrees.**

2. Summary of Curricular Action (Check all that apply to this proposal)

   ☐ Degree ☐ Major ☐ Minor ☐ Concentration ☐ Certificate ☒ Course

   ☒ New ☒ Modification ☒ Deletion

   Name of Degree, Major, etc.: **HVACR Technology**

3. Summary of All Course Action Required: Addition of class, elimination of class

   A. Newly Created Courses to be Added to the Catalog

   | Prefix | Number | Title |
   |---|---|---|
   | **HVAC** | 127 | **Advanced HVACR Controls** |

   B. Courses to be Deleted from FSU Catalog n/a

   | Prefix | Number | Title |
   |---|---|---|
   | Click here to enter text. | Click here to enter text. | Click here to enter text. |

   C. Existing Courses to be Modified

   | Prefix | Number | Title |
   |---|---|---|
   | HVAC | 117 | Advanced Electricity Circuits |

   D. Addition of existing FSU courses to program n/a

   | Prefix | Number | Title |
   |---|---|---|
   | Click here to enter text. | Click here to enter text. | Click here to enter text. |

   E. Removal of existing FSU courses from program

   | Prefix | Number | Title |
   |---|---|---|
   | **ISYS 105** | **Intro Micro Systems-Software** | |

4. Summary of All Consultations

   | Form Sent (B or C) | Date Sent | Responding Department | Date Received & By Whom |
   |---|---|---|---|
   | **Form C** | **Not required – no FLITE resources required** | | |
   | **Form B** | **11-2-2015** | **Business - Computer Information Systems** | **11-2-2015 Larry Bajor** |

5. Will External Accreditation be sought? (For new programs or certificates only)

   ☐ Yes ☒ No

   If yes, name the organization involved with accreditation for this program. Click here to enter text.

6. Is a PCAF required? ☐ Yes ☒ No Is the PCAF approved? ☐ Yes ☐ No (If yes, supply link on Academic Affairs website where PCAF is posted.

7. Program Checksheets affected by this proposal (Check all that apply to this proposal)

   ☒ Add Course ☒ Delete Course ☐ Modify Course ☒ Change Prerequisite ☐ Move from required to elective
   ☐ Move from elective to required ☐ Change Outcomes and Assessment Plan ☐ Change Credit hours

8. List all Checksheets affected by this proposal:

   | College | Department | Program |
   |---|---|---|
   | **CET** | **School of Built Environment** | **HVACR** |

## CURRICULUM CONSULTATION FORM

## FORM B

Effective Fall 2015

To be completed by each department affected by the proposed change, addition, or deletion. Potential duplication of coursework is reason for consultation.

1. This completed form must be forwarded with the proposal to the administrator of the department to be consulted.

2. The department must respond within 10 business days of receipt of this form to ensure inclusion in the final proposal. The completed original is returned to the Academic Senate Office to be inserted into the proposal and a copy is returned to the initiator.

   The department must acknowledge receipt of this form and the proposal in writing to the initiator.

   **Failure to respond by 10 business days of receipt of this form is interpreted as support for the proposal.**

3. The Proposing Department must address any concerns raised by the consulted department. This response must be in writing and will be included in the proposal following the original consultation form.

**RE: Proposal Title HVAC 127, Advanced HVACR Controls**

**Initiator(s): Brian Holton**

**Proposal Contact**: Brain Holton **Date Sent:** 11-2-2015

**Department: Business - Computer Information Systems** **Campus Address: BUS 212F**
Lawrence Bajor

**Responding Department:** Click here to enter text.

Administrator: Click here to enter text.Date Received: Click here to enter text. Date Returned: Click here to enter text.

Based upon department faculty review on Click here to enter text. (Date) we:

☐ Support the above proposal.
☐ Support the above proposal with the modifications and concerns listed below.
☐ Do not support the proposal for the reasons listed below.

Comment regarding the impact this proposal has on current curriculum including prerequisites, scheduling, room assignments, and/or faculty load for your department. Use additional pages, if necessary. Click here to enter text.

**Brian Holton** No reply to form B

**From:** Brian Holton
**Sent:** Thursday, November 12, 2015 7:30 AM
**To:** Lawrence H Bajor
**Subject:** FW: Curriculum proposal Form B as required
**Attachments:** Form A Proposal Summary & Routing.docx; Form B Consultation.docx

I have not received a reply to this required communication for the curriculum proposal process.

Brian Holton

**From:** Brian Holton
**Sent:** Saturday, October 31, 2015 2:25 PM
**To:** Lawrence H Bajor <LawrenceBajor@ferris.edu>
**Subject:** Curriculum proposal Form B as required

Hello Larry.
I have attached the forms A and B as required per the university curriculum proposal procedures.
We are proposing the addition of an HVAC class and eliminating ISYS 105 from our degree requirement.
All HVAC Program faculty have voted to support this proposal.

Please review and send the form back.

Thank you,

Brian Holton
HVACR Program
Ferris State University
Office: 231-591-2322

6

**Brian Holton** No reply to form B

**From:** Brian Holton
**Sent:** Thursday, November 12, 2015 1:33 PM
**To:** Lawrence H Bajor
**Subject:** RE: Curriculum proposal Form B as required
**Attachments:** HVAC 127 Advanced HVACR Controls.pdf

Thank you for the reply.
I attached the full proposal, the check sheets - - both current and proposed - - are included.
Our associate degree students do not take any business classes. They are not required to work with excel in the associate degree.
I think at one time this course was a good requirement for students. Things have certainly changed for young people.

Thank you for considering our proposal.
Sincerely,
Brian Holton

**From:** Lawrence H Bajor
**Sent:** Thursday, November 12, 2015 12:38 PM
**To:** Brian Holton <BrianHolton@ferris.edu>
**Cc:** Teresa K Cook <TeresaCook@ferris.edu>; Clyde W Hardman <ClydeHardman@ferris.edu>
**Subject:** Re: Curriculum proposal Form B as required

Brian,
I have it before me. I have just seen it. Thank you for the heads up. I am well aware of the curriculum proposal proceedures. Let me see if I can get a few people to look at it before the Monday deadline. In business knowledge of Excel is very basic, similar to knowing how to use a hammer. Most of us with experience outside of teaching have spent considerable portions of our careers using the Microsoft Office Suite. If ISYS105 is required, what business courses are these individuals taking? Could you please send me a relevant check sheet. In the near future, ISYS 105 is going to be made a prerequisite for a number of COB courses. This is not a requirement without a purpose. Without this course a student will not be able to progress.

Your faculty should be the experts in their field. For the most part, my faculty will support whatever another department wants to do usually with the reservations I have already listed. Please send to me the relevant check sheet. I am uncertain where to look.

LB

---

**From:** Brian Holton
**Sent:** Saturday, October 31, 2015 2:24 PM
**To:** Lawrence H Bajor
**Subject:** Curriculum proposal Form B as required

Hello Larry.
I have attached the forms A and B as required per the university curriculum proposal procedures.

We are proposing the addition of an HVAC class and eliminating ISYS 105 from our degree requirement. All HVAC Program faculty have voted to support this proposal.

Please review and send the form back.

Thank you,

Brian Holton
HVACR Program
Ferris State University
Office: 231-591-2322

# FORM D – Current Program Requirements

Ferris State University

Imagine More

## Associate in Applied Science

# HVACR Technology

## Program Academic Requirements

| Student: | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|
| email: | | ID: | | | Ferris | |
| Advisor: | | Ph: | | 1 | Transfer | |

| | | MAJOR | Cr | Gr | Pts | S | Yr | Code | Notes |
|---|---|---|---|---|---|---|---|---|---|
| HVAC | 101 | Intro to Refrig & A/C Systems (co-req MATH 116) | 4 | | | | | | |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111) | 4 | | | | | | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | | | | | | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111) | 4 | | | | | | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC111) | 5 | | | | | | |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117 & MATH 116) | 5 | | | | | | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102,117 & MATH 116) | 5 | | | | | | |
| HVAC | 235 | Advanced Heating-Mech System (C- or better in HVAC 117, 132 & MATH 116) | 5 | | | | | | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132 & MATH 116) | 4 | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | |
| ENGL | 150 | English 1 | 3 | | | | | | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | | | | | | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | |
| ISYS | 105 | Microcomputer Applications | 3 | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | |
| MATH | 116 | Interm. Algebra & Numerical Trig (C- in MATH 110 or 19 ACT) | 4 | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, BIOL 111. Course must have a lab) | 4 | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | |
| | | **FRESHMEN SEMINAR** | | | | | | | |
| FSUS | 100 | FSU Seminar | 1 | | | | | | |

**Unofficial Statistics**

| | |
|---|---|
| Major: Total Crs / Earned Crs / Honor Points | 40 |
| Degree: Total Crs / Earned Crs / Honor Points | 67 |
| GPA Major: | - |
| GPA Degree: | - |

AAS Minimum General Education Requirements:

Cultural Enrichment (CE) – 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3/4 credits

Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential/light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems.

# Form D - Current Course Sequence Guide

FERRIS STATE UNIVERSITY
Imagine More

Associate in Applied Science

# HVACR Technology

Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 1 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 101 | Introduction to Refrigeration & A/C Systems (co-req MATH 116) | 4 | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | |
| MATH | 116 | Intermediate Algebra & Numerical Trigonometry (C- in MATH 110 or 19ACT) | 4 | |
| ENGL | 150 | English 1 | 3 | |
| FSUS | 100 | FSU Seminar | 1 | |
| | | Total | 16 | |

| YEAR 1 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111) | 4 | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111) | 4 | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111) | 5 | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, or BIOL 111. Must Include a Lab Section) | 4 | |
| | | Total | 17 | |

| YEAR 2 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 235 | Advanced Heating-Mechanical Systems (C- or higher in HVAC 117, 132 & MATH 116) | 5 | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132 & MATH116) | 4 | |
| ISYS | 105 | Microcomputer Applications | 3 | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Total | 18 | |

| YEAR 2 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117, & MATH 116) | 5 | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117& MATH116) | 5 | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | |
| | | Social Awareness Elective | 3 | |
| | | Total | 16 | |

AAS Minimum General Education Requirements

Cultural Enrichment (CE) - 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3-4 credits Reference: gttp://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential / light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems.

# FORM D – Proposed Program Requirements

FERRIS STATE UNIVERSITY
Imagine More

Associate in Applied Science

# HVACR Technology

Program Academic Requirements

| Student: | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|
| email: | | ID: | | | Ferris | |
| Advisor: | | Ph: | | 1 | Transfer | |

| | | | Cr | Gr | Pts | S | Yr | Code | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | **MAJOR** | | | | | | | |
| HVAC | 101 | Intro to Refrig & A/C Systems (co-req MATH 116) | 4 | | | | | | |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111) | 4 | | | | | | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | | | | | | |
| HVAC | 117 | Advanced Electricity-Circuits | 4 | | | | | | |
| HVAC | 127 | Advanced HVACR Controls (C- or better in HVAC 117) | 3 | | | | | | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC111) | 5 | | | | | | |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117 & MATH 116) | 5 | | | | | | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102,117 & MATH 116) | 5 | | | | | | |
| HVAC | 235 | Advanced Heating-Mech System (C- or better in HVAC 117, 132 & MATH 116) | 5 | | | | | | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132 & MATH 116) | 4 | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | |
| ENGL | 150 | English 1 | 3 | | | | | | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | | | | | | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | |
| MATH | 116 | Interm. Algebra & Numerical Trig (ACT 19 or MATH 110) | 4 | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, BIOL 111. Course must have a lab) | 4 | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | |
| | | **FRESHMEN SEMINAR** | | | | | | | |
| FSUS | 100 | FSU Seminar | 1 | | | | | | |

**Unofficial Statistics**

| | |
|---|---|
| Major: Total Crs / Earned Crs / Honor Points | 40 |
| Degree: Total Crs / Earned Crs / Honor Points | 67 |
| GPA Major: | - |
| GPA Degree: | - |

AAS Minimum General Education Requirements:
Cultural Enrichment (CE) – 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3/4 credits
Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential/light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems, 7) Demonstrate ability to install, troubleshoot and repair HVACR controls

# Form D - Proposed Course Sequence Guide

FERRIS STATE UNIVERSITY

Imagine More

Associate in Applied Science

## HVACR Technology

Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 1 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 101 | Introduction to Refrigeration & A/C Systems (co-req MATH 116) | 4 | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | |
| HVAC | 117 | Advanced Electricity-Circuits | 4 | |
| MATH | 116 | Intermediate Algebra & Numerical Trigonometry (C- in MATH 110 or 19ACT) | 4 | |
| FSUS | 100 | FSU Seminar | 1 | |
| | | Total | 17 | |
| **YEAR 1 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111) | 4 | |
| HVAC | 127 | Advanced HVACR Controls (C- or better in HVAC 117) | 3 | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111) | 5 | |
| ENGL 150 | | English 1 | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Total | 18 | |
| **YEAR 2 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 235 | Advanced Heating-Mechanical Systems (C- or better in HVAC 117, 132 & MATH 116) | 5 | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132 & MATH 116 ) | 4 | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, or | 4 | |
| | | Total | 16 | |
| **YEAR 2 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117 & MATH 116) | 5 | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117 & MATH 116 ) | 5 | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | |
| | | Social Awareness Elective | 3 | |
| | | Total | 16 | |

AAS Minimum General Education Requirements

Cultural Enrichment (CE) - 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3-4 credits Reference: gttp://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential/light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems, 7) Demonstrate ability to install, troubleshoot and repair HVACR controls

**COURSE INFORMATION FORM** **FORM E**

**Effective Fall 2015**

**Complete all items below (New or Current)**

**Check all boxes where modifications are being made.**

*The following information is provided for a new course information*

**Course Identification**

☐**Prefix (current)** Click here to enter text. ☐**Number (current)**Click here to enter text. **Contact Hours (current):** Click here to enter text.

Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☒**Prefix (proposed) HVAC** ☐**Number (proposed)127 Contact Hours (proposed):** 5 **2 Lecture hours and 3 lab hours per week**

Lecture ☒Lab ☒ Seminar ☐ [Enter contact hours per week in blank above.]

☐**Title (current):**

☐ **Title (proposed): Advanced HVACR Controls**

☐**Credit Hours (current):**Click here to enter text. ☐**Prerequisites (current):** Click here to enter text.☐**Co-requisites (current):** Click here to enter text.

☐ **Credit Hours (proposed):3** ☐ **Prerequisites (proposed): HVAC 117 with C- or better**☐**Co-requisites (proposed):** Click here to enter text.

☐**Course Description (current) 125 words maximum:** Click here to enter text

☒**Course Description (proposed) 125 words maximum: The study of advanced controls related to residential and commercial applications. The course focuses on control components, wiring, and control sequences used in direct digital control systems. Lab exercises concentrate on control system wiring, operation, and troubleshooting**

☐**Course Outcomes and Assessment Plan (current):** Click here to enter text.

☐**Course Outcomes and Assessment Plan (proposed):**

**Student Learning Outcomes – Program level- Trac Dat**
Demonstrate ability to install, troubleshoot and repair HVACR controls

**Student Learning Outcomes – Course Level Trac Dat**
Define terms related to HVACR control systems
Demonstrate ability to install HVACR controls
Demonstrate ability to troubleshoot and repair HVACR controls



**Student Learning Outcomes Overview**

Students satisfactorily completing this course will demonstrate knowledge, skills and abilities related to the following instructiona units.

1. HVACR control terminology
2. Direct digital controls (DDC) basics
3. Valve and damper actuators
4. Variable frequency drives (VFD)
5. Air-side economizer controls
6. Variable Air Volume and Change-over bypass (VVT) controls
7. Advanced residential and light commercial thermostats
8. Emerging technologies
9. Pneumatic controls

**Learning Outcomes for Each Instructional Unit**

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| 1 | Terminology<br>1. Explain terms associated with HVACR control systems |
| 2 | Direct Digital Controls<br><br>1. Identify typical input and output components - - AI, DI, AO and DO - - used in HVACR.<br>2. Explain analog and digital inputs and outputs (AI, DI, AO and DO).<br>3. Explain passive and active sensors.<br>4. Verify correct inputs and outputs for an operating control system.<br>5. Explain typical control sequences for common HVAC applications, i.e. RTU, AHU, and VAC terminal.<br>6. Explain common problems and related troubleshooting techniques.<br>7. Analyze operating control loops and apply control terminology to explanations<br>8. Describe, and differentiate between, communication protocols, i.e., BAC Net and LON works.<br>9. Explain applicable wiring types and electrical code installation issues.<br>10. Identify the different programming tools used to program different controllers.<br><br>11. Use basic troubleshooting techniques to identify problems. |
| 3 | Valve and Damper Actuators<br><br>1. Describe the types and applications for the HVACR industry.<br>2. List the typical operating electrical inputs for actuators used in the HVACR industry.<br>3. Explain the common problems that occur with HVACR actuators.<br>4. Explain why dampers are normally open or normally closed and how this relates to actuator selection and installation.<br>5. Describe basic sizing concepts |
| 4 | Variable Frequency Drives<br><br>1. Describe the purpose and operation for typical HVACR applications<br>2. Describe the function of the major components of a VFD.<br>3. Explain safety concerns related to servicing of VFD's<br>4. Explain the relation between frequency and speed.<br>5. Explain the relationship between speed and energy savings for air and water system applications.<br>6. Differentiate between soft start- stop and variable speed applications.<br>7. Diagram the typical wiring of a VFD used in air and water system applications.<br>8. Explain the common maintenance tasks for VFD's.<br>9. Explain the common problems that occur with VFD's and related troubleshooting procedures. |

| | |
|---|---|
| | 10. Explain the affects VFD's may have on building electrical supplies and methods for addressing those concerns. |
| 5 | Air-side economizer controls<br><br>1. Explain purpose and application for air-side economizers.<br>2. Explain air-side economizer operation (typical sequence of operation).<br>3. Explain the common change-over control methods.<br>4. Describe common maintenance and inspection issues.<br>5. Describe common economizer problems.<br>6. Compare different economizer controls, i.e. packaged versus programmable |
| 6 | Variable Air Volume and Change-over bypass (VVT) controls<br><br>1. Explain purpose and application for Variable air Volume systems.<br>2. Explain purpose and application for Change-over bypass (VVT) systems<br>3. Describe operation of common VAV terminals, i.e. pressure dependent, pressure independent, series fan, parallel fan.<br>4. Describe typical control components for VAV and VVT systems. |
| 7 | Advanced residential and light commercial thermostats<br><br>1. Describe communication concepts, wired and wireless<br>2. Explain types, capabilities and applications.<br>3. Describe wiring practices and concerns. |
| 8 | Emerging technologies<br><br>1. Analyze an HVACR control or test instrument that uses emerging technology. |
| 9 | Pneumatic controls<br><br>1. Describe, and differentiate between, 1 pipe and 2 pipe systems.<br>2. Describe, and differentiate between, single and dual input receiver controllers.<br>3. Describe function of air compressor and air drier stations, i.e., regulators, auto-drains, check valves, unloaders, and final filters.<br>4. Explain common maintenance tasks for air compressor and air drier stations.<br>5. Explain common problems associated with pneumatic control systems. |

**Minimum Required Student Laboratory Activities**

| | |
|---|---|
| I | Student will demonstrate safe practices related to personal, electrical and tool safety every day while working in the lab. Student will demonstrate safe and competent operation of hand tools and instruments. |
| 2 | Direct Digital Controls<br><br>1. Demonstrate ability to measure electrical signal or resistance for passive and active sensors.<br>2. Demonstrate ability to measure or verify Triac or relay output.<br>3. Demonstrate ability to complete basic configuration or programming.<br>4. Demonstrate ability to assemble the necessary components, and complete wiring for a specified application. |
| 3 | Valve and Damper Actuators<br><br>1. Wire and operate various actuators.<br>2. Demonstrate ability to test and troubleshoot actuators. |
| 4 | Variable Frequency Drives |

| | |
|---|---|
| | 1. Identify the major components of a VFD.<br>2. Wire and configure a VFD and motor to provide a soft start and stop via a switch. Start and test operation in manual speed control mode.<br>3. Complete all configurations and parameter settings for a VFD for a specified motor and application using the VFD, PID function<br>4. Troubleshooting, basic parameters, wiring connections and input signals. |
| 5 | Air-side economizer controls<br>1. Wire and configure an economizer control<br>2. Test an operating economizer<br>3. Demonstrate ability to troubleshoot an economizer system. |
| 6 | Variable Air Volume and Change-over bypass (VVT) controls<br>1. Identify main components of a VAV terminal<br>2. Complete all configurations for a VAV digital controller for a specified motor and application |
| 7 | Advanced residential and light commercial thermostats<br>1. Demonstrate ability to read manufacture literature and configure advanced thermostat per sample specification. |
| 8 | Emerging technologies<br>1. Research emerging technology for HVACR controls and tools and produce a written report or oral presentation to demonstrate knowledge of the technology and proper application of the technology. |
| 9 | Pneumatic controls<br>1. Identify common components.<br>2. Demonstrate ability to calibrate a pneumatic thermostat. |

**Assessment Plan:**

| Assessment Method | Criterion for Success |
|---|---|
| Assessments – Quiz, or exams, internally developed | 85% proficiency |
| Performance: faculty observe and evaluate student performance during laboratory tasks or assessments or both. | Knowledge, skills, and ability to complete assigned tasks or lab assessments with 85% proficiency or better |
| | |

☐**Course Outline including Time Allocation (current):** Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☒**Course Outline including Time Allocation (proposed):** Click here to enter text.

**Instructional Unit Topic Descriptions and Time Allocations**

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| 1 | HVACR control terminology | 1 | 0 |
| 2 | Direct digital control (DDC) basics | 7 | 12 |
| 3 | Valve and damper actuators | 4 | 6 |
| 4 | Variable frequency drives (VFD) | 4 | 6 |
| 5 | Air-side economizer controls | 4 | 6 |
| 6 | Variable Air Volume and Change-over bypass (VVT) controls | 4 | 6 |
| 7 | Advanced residential and light commercial thermostats | 2 | 3 |
| 8 | Emerging technologies | 2 | 3 |
| 9 | Pneumatic controls | 2 | 3 |
| | Total hours | 30 | 45 |

1/13/15

# COURSE INFORMATION FORM

# FORM E

Effective Fall 2015

**Complete all items below (New or Current)**

**Check all boxes where modifications are being made.**

## Course Identification

☐**Prefix (current) HVAC** ☐**Number (current)117 Contact Hours (current):** 6

Lecture ☒Lab ☒ Seminar ☐ [Enter contact hours per week in blank above.]

☐**Prefix (proposed)** Click here to enter text. ☐**Number (proposed)**Click here to enter text. **Contact Hours (proposed):** Click here to enter text.

Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐**Title (current):Advanced Electricity Circuits**

☐ **Title (proposed):** Click here to enter text

☐**Credit Hours (current):4** ☐**Prerequisites (current): HVAC 111 with C- or better**☐**Co-requisites (current):** Click here to enter text.

☐**Credit Hours (proposed):**Click here to enter text. ☒**Prerequisites (proposed): none** ☐**Co-requisites (proposed):** Click here to enter text.

☐**Course Description (current) 125 words maximum: AC electrical theory and application, concentrating on the operation, installation and analysis of HVACR components and control circuits. The components include single and polyphase transformer and motors, heating and air conditioning controls, commercial timers, motor starters, contactors, relays and other control devices. Lab exercises focus on developing wiring diagrams; wiring, troubleshooting and analyzing circuits based on lecture material.**

☐**Course Description (proposed) 125 words maximum: No Change**

☐**Course Outcomes and Assessment Plan (current):**

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction, Orientation, and Safety.<br>A. Apply all safety procedures required in this course. |
| II. | Alternating current.<br>A. Define the characteristics of AC run and start capacitors with respect to: construction, operating and troubleshooting characteristics, phase shifts and CEMF.<br>B. Define the characteristics of AC induction motors with respect to: construction, operating and troubleshooting characteristics, CEMF and resulting phase shifts. |
| III. | AC Capacitor applications.<br>A. Describe the use of capacitors in AC applications, such as starting and running of single phase motors and power factor correction. |
| IV. | Single phase transformers.<br>A. Describe the operation and use of single phase transformers for controls, ignition circuits and voltage correction. |
| V. | Three Phase Transformers.<br>A. Describe the operation and use of delta and wye three phase transformers for power distribution and voltage correction |
| VI. | AC induction motors.<br>A. Define the characteristics of AC run and start capacitors.<br>B. Define the starting and running characteristics, construction, CEMF and resulting phase shifts of the following motor types: CSIR, CSCR, SP, PSC, Synchronous, Shaded pole and Universal. |
| VII. | Single phase motor characteristics.<br>A. Define the starting, running and other operating characteristics of AC induction motor starting relays; potential, solid state and centrifugal switches.<br>B. Identify the correct starting relay to use with a specific single phase motor. |
| VIII. | Three phase motors.<br>A. Explain the purpose, operation and application of wye-delta starting schemes. |
| IX. | Motor starters.<br>A. Explain the different types and troubleshooting techniques for motor starters. |
| X. | Wiring diagrams.<br>A. Explain the use of a wiring diagram for troubleshooting. |
| XI. | Low voltage thermostats.<br>A. Explain how a heat/cool thermostat operates and is properly wired. |
| XII. | Defrost timer.<br>A. Describe the sequence of operation and application of various types of defrost timers and circuits. |
| XIII. | Conductor sizing and over current protection.<br>A. Use NEC to properly size wire and describe the problems associated with improperly sized and misapplied conductors.<br>B. Describe operation of various types of circuit breaker, fuses and circuit protectors. |
| XIV. | Measuring devices.<br>A. Identify and describe the application of thermistors, RTD's, humidity sensors and static pressure sensors.<br>B. Demonstrate knowledge of the operating characteristics and circuits using solid state transducers in HVAC applications.<br>C. Demonstrate knowledge of the proper procedure for troubleshooting solid state control boards by accurately answering homework and test questions.<br>D. Demonstrate knowledge of the proper procedure for troubleshooting solid state control boards by accurately answering homework and test questions. |
| XV. | Modulating control loops.<br>A. Describe temperature control loop terminology components and operation. |

Click here to enter text.

☐**Course Outcomes and Assessment Plan (proposed): No Change**

☐**Course Outline including Time Allocation (current):** Click here to enter text.

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction, Orientation, and Safety | 1 | 0 |
| II. | Alternating current | 1 | 3 |
| III. | AC Capacitor applications | 3 | 3 |
| IV. | Single phase transformers | 6 | 3 |
| V. | Three phase transformers | 3 | 3 |
| VI. | AC induction motors | 3 | 6 |
| VII. | Single phase motor characteristics | 3 | 3 |
| VIII. | Three phase motors | 3 | 3 |
| IX. | Motor starters | 6 | 3 |
| X. | Wiring diagrams | 3 | 3 |
| XI. | Low voltage thermostats | 3 | 3 |
| XII. | Defrost timers | 3 | 3 |
| XIII. | Conductor sizing and over current protection | 3 | 3 |
| XIV. | Measuring Devices | 1 | 3 |
| XV. | Modulating Control Loops | 3 | 3 |
| | Total Hours | 45 | 45 |

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐**Course Outline including Time Allocation (proposed): No Change**

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

1/13/15

## CREATE NEW COURSE – Course Data Entry Form

**FORM F-C**

**Effective Fall 2015**

**COMPLETE ALL SECTIONS BELOW.** If this course is to be used as a prerequisite for other university courses, FORM F's that reflect the prerequisite change must be submitted for all those courses as well. See Appendix E for Completing Forms.

### I. ACTION TO BE TAKEN: CREATE A NEW COURSE

Desired Term Effective (6 digit code): **201608** Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

### II. NEW COURSE ATTRIBUTES:

A. Course Prefix**: HVAC** B. Number: **127**

C. Contact Hours**: 5** Lecture ☒Lab ☒ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.] **3 Hours in lab, 2 hours in lecture**

D. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]

E. Course Title: **Advanced HVACR Controls** [Limit to 30 characters including punctuation and spaces]

F. College Code: **CET** G. Department Code: **HVAC** H. Credit Hours: Variable ☐Fixed ☒

I. Minimum Credit Hours: **3** J. Maximum Credit Hours: 3 [Enter number is space.]

K. Hours May be Repeated for Extra Credit: Yes ☐ No ☒ If yes, max times Click here to enter text.Or max credits Click here to enter text. awarded.

L. Levels: Undergraduate ☒ Graduate ☐ Professional ☐

M. Grade Method: Normal Grading ☒ Credit/No Credit (Pass/Fail) ☐

N. Does proposed new course replace an equivalent course? Yes ☐ No ☒

O. Equivalent Course: Prefix: Click here to enter text. Number: Click here to enter text.

P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE. Click here to enter text.

**The study of advanced controls related to residential and commercial applications. The course focuses on control components, wiring, and control sequences used in direct digital control systems. Lab exercises concentrate on control system wiring, operation, and troubleshooting.**

Q. Term Offered: **Fall and Spring** R. Max Section Enrollment: **16** Lecture: **32** Lab:**16**

S. Prerequisites or Restrictions: If none, leave blank. HVAC 117 with C- or better

T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces. Click here to enter text.

***To be completed by Academic Affairs Office:*** **Standards & Measures Coding and General Education Code**

Basic Skill (BS) ☐ General Education ☐ Occupational Education ☐ G E Codes: Click here to enter text.

UCC Chair Signature/Date

Academic Affairs Approval Signature/Date 1/13/15

**OFFICE OF THE REGISTRAR USE ONLY**

Date Rec'd: Click here to enter text. Date Completed: Click here to enter text. Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐

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## MODIFY A COURSE – Course Data Entry Form

**FORM F-M**

**Effective Fall 2015**

### I. ACTION TO BE TAKEN: MODIFY A COURSE

Desired Term Effective (6 digit code): **201608** Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

### II. COURSE TO BE MODIFIED:

A. Course Prefix: **HVAC** B. Number: **117**

C. Course Title: **Advanced Electricity - Circuits**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: S** See Appendix E Instructions for Completing Forms.

**Note: removing a prerequisite, course will now be scheduled first freshman semester**

**III. MODIFICATIONS**

A. Course Prefix: Click here to enter text. B. Number: Click here to enter text.
B. Contact Hours: Click here to enter text. Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]
C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]
D. Course Title: Click here to enter text. [Limit to 30 characters including punctuation and spaces]
E. College Code: Click here to enter text. G. Department Code: Click here to enter text. H. Credit Hours: Variable ☐Fixed ☐
I. Minimum Credit Hours: Click here to enter text. J. Maximum Credit Hours: Click here to enter text. [Enter number is space.]
K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Click here to enter text.Or max credits Click here to enter text. awarded.
L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐
M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐
N. Does proposed new course replace an equivalent course? Yes ☐ No ☐
O. Equivalent Course: Prefix: Click here to enter text. Number: Click here to enter text.
P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE. Click here to enter text.

Q. Term Offered: R. Max Section Enrollment: Lecture: Lab:
S. Prerequisites or Restrictions: If none, leave blank. Click here to enter text.
T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces. Click here to enter text.

***To be completed by Academic Affairs Office:*** **Standards & Measures Coding and General Education Code**

Basic Skill (BS) ☐ General Education ☐ Occupational Education ☐ G E Codes: Click here to enter text.

UCC Chair Signature/Date

Academic Affairs Approval Signature/Date 1/13/15

**OFFICE OF THE REGISTRAR USE ONLY**

Date Rec'd: Click here to enter text. Date Completed: Click here to enter text. Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐

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**Form A**

Revised Jan. 2015

## PROPOSAL SUMMARY AND ROUTING FORM

**Proposal Title:** HVAC 127, Advanced HVACR Controls

**Initiating Individual**: Brian Holton **Initiating Department or Unit**: HVACR Program

**Contact Person's Name**: Brian Holton **Email**: holt8@ferris.edu **Phone:** 591-2322

☐ **Group I-A** – New Degree, major, concentration, minor, or redirection of a current offering

☐ **Group I-B** – Deletion of a degree, major, concentration, or minor

☒ **Group II-A** – New Course, modification of a course, deletion of a course

☐ **Group II-B** – Minor Curriculum Clean-up

☐ **Group III** – Certificate (☐ College Credit ☐ Non-credit ☐ New Certificate)

☐ **Group IV** – Other site location (☐ College Credit ☐ Non-credit )

| | PLEASE PRINT AND SIGN YOUR NAME | DATE | VOTE/ACTION * Number Count |
|---|---|---|---|
| **Program Representative** ** | Brian Holton<br>Brian Holton | 11/16/15 | 1 Support (1 voting)<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| **Department/School/Faculty Representative Vote** ** | DOUGLAS ZENTZ<br>D. F. Zentz | 11/16/15 | 9 Support (9 voting)<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| **Department/School Administrator** | JOHN R. SCHMIDT<br>John Schmidt | 12/2/2015 | 6 Support school + Director = 7<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| **College Curriculum Committee/Faculty** | Chuck Drake<br>Chuck Drake | 12-14-15 | 8 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| **UCC Representative** | Brian Holton<br>Brian Holton | 12-14-15 | X Support<br>0 Hold<br>0 Not Support |
| **Dean** | [signature] | 12/15/15 | X Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| **University Curriculum Committee** ** | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| **Senate** ** | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| **Academic Affairs** | | | __ Support<br>__ Hold<br>__ Not Support |

* Support with Concerns or Not Support <u>must</u> include identification of specific concern with appropriate rationale.

** Number Count <u>must</u> be given for all members present and/or voting.

To be completed by Academic Affairs    Date of Implementation:

_______________    _______________    _______________

President (Date Approved    Board of Trustees (Date Approved)    Academic Officers of MI (Date Approved)

**More advanced electric and electronic devices have become commonplace in the HVACR industry. In order to prepare students for successful employment the HVACR program has agreed that a new course focused on specific controls and devices is required. A needs assessment survey was conducted during the 2015 spring advisory committee meeting. The results of that survey were used to form the learning objectives for the proposed new course. To maintain the associate degree at the current total credit hours the faculty decided to eliminate ISYS 105. The rational for this decision was based upon students demonstrating skills outlined in the objectives for ISYS 105 as a result of their secondary education. The new course will further differentiate Ferris State University from technical schools and community colleges that offer HVAC certificates and associate degrees.**

2. Summary of Curricular Action (Check all that apply to this proposal)

☐ Degree ☐ Major ☐ Minor ☐ Concentration ☐ Certificate ☒ Course

☒ New ☐ Modification ☒ Deletion

Name of Degree, Major, etc.: **HVACR Technology**

3. Summary of All Course Action Required: Addition of class, elimination of class
   A. Newly Created Courses to be Added to the Catalog

| Prefix | Number | Title |
|---|---|---|
| **HVAC** | 127 | **Advanced HVACR Controls** |

   B. Courses to be Deleted from FSU Catalog n/a

| Prefix | Number | Title |
|---|---|---|
| Click here to enter text. | Click here to enter text. | Click here to enter text. |

   C. Existing Courses to be Modified

| Prefix | Number | Title |
|---|---|---|
| HVAC | 117 | Advanced Electricity Circuits |

   D. Addition of existing FSU courses to program n/a

| Prefix | Number | Title |
|---|---|---|
| Click here to enter text. | Click here to enter text. | Click here to enter text. |

   E. Removal of existing FSU courses from program

| Prefix | Number | Title |
|---|---|---|
| **ISYS 105** | **Intro Micro Systems-Software** | |

4. Summary of All Consultations

| Form Sent (B or C) | Date Sent | Responding Department | Date Received & By Whom |
|---|---|---|---|
| **Form C** | **Not required – no FLITE resources required** | | |
| **Form B** | **11-2-2015** | **Business - Computer Information Systems** | **11-2-2015 Larry Bajor** |

5. Will External Accreditation be sought? (For new programs or certificates only)
   ☐ Yes ☒ No

   If yes, name the organization involved with accreditation for this program. Click here to enter text.

6. Is a PCAF required? ☐ Yes ☒ No Is the PCAF approved? ☐ Yes ☐ No (If yes, supply link on Academic Affairs website where PCAF is posted.

7. Program Checksheets affected by this proposal (Check all that apply to this proposal)
   ☒ Add Course ☒ Delete Course ☐ Modify Course ☒ Change Prerequisite ☐ Move from required to elective
   ☐ Move from elective to required ☐ Change Outcomes and Assessment Plan ☐ Change Credit hours

8. List all Checksheets affected by this proposal:

| College | Department | Program |
|---|---|---|
| **CET** | **School of Built Environment** | **HVACR** |

## CURRICULUM CONSULTATION FORM

## FORM B

Effective Fall 2015

To be completed by each department affected by the proposed change, addition, or deletion. Potential duplication of coursework is reason for consultation.

1. This completed form must be forwarded with the proposal to the administrator of the department to be consulted.
2. The department must respond within 10 business days of receipt of this form to ensure inclusion in the final proposal. The completed original is returned to the Academic Senate Office to be inserted into the proposal and a copy is returned to the initiator.

   The department must acknowledge receipt of this form and the proposal in writing to the initiator.

   **Failure to respond by 10 business days of receipt of this form is interpreted as support for the proposal.**
3. The Proposing Department must address any concerns raised by the consulted department. This response must be in writing and will be included in the proposal following the original consultation form.

**RE: Proposal Title HVAC 127, Advanced HVACR Controls**

**Initiator(s): Brian Holton**

**Proposal Contact**: Brain Holton **Date Sent**: 11-2-2015

**Department: Business - Computer Information Systems** **Campus Address: BUS 212F**
Lawrence Bajor

**Responding Department:** Click here to enter text.

Administrator: Click here to enter text. Date Received: Click here to enter text. Date Returned: Click here to enter text.

Based upon department faculty review on Click here to enter text. (Date) we:

☐ Support the above proposal.
☐ Support the above proposal with the modifications and concerns listed below.
☐ Do not support the proposal for the reasons listed below.

Comment regarding the impact this proposal has on current curriculum including prerequisites, scheduling, room assignments, and/or faculty load for your department. Use additional pages, if necessary. Click here to enter text.

**Brian Holton** No reply to form B

**From:** Brian Holton
**Sent:** Thursday, November 12, 2015 7:30 AM
**To:** Lawrence H Bajor
**Subject:** FW: Curriculum proposal Form B as required
**Attachments:** Form A Proposal Summary & Routing.docx; Form B Consultation.docx

I have not received a reply to this required communication for the curriculum proposal process.

Brian Holton

**From:** Brian Holton
**Sent:** Saturday, October 31, 2015 2:25 PM
**To:** Lawrence H Bajor <LawrenceBajor@ferris.edu>
**Subject:** Curriculum proposal Form B as required

Hello Larry.
I have attached the forms A and B as required per the university curriculum proposal procedures.
We are proposing the addition of an HVAC class and eliminating ISYS 105 from our degree requirement.
All HVAC Program faculty have voted to support this proposal.

Please review and send the form back.

Thank you,

Brian Holton
HVACR Program
Ferris State University
Office: 231-591-2322

**Brian Holton** No reply to form B

**From:** Brian Holton
**Sent:** Thursday, November 12, 2015 1:33 PM
**To:** Lawrence H Bajor
**Subject:** RE: Curriculum proposal Form B as required
**Attachments:** HVAC 127 Advanced HVACR Controls.pdf

Thank you for the reply.
I attached the full proposal, the check sheets - - both current and proposed - - are included.
Our associate degree students do not take any business classes. They are not required to work with excel in the associate degree.
I think at one time this course was a good requirement for students. Things have certainly changed for young people.

Thank you for considering our proposal.
Sincerely,
Brian Holton

**From:** Lawrence H Bajor
**Sent:** Thursday, November 12, 2015 12:38 PM
**To:** Brian Holton <BrianHolton@ferris.edu>
**Cc:** Teresa K Cook <TeresaCook@ferris.edu>; Clyde W Hardman <ClydeHardman@ferris.edu>
**Subject:** Re: Curriculum proposal Form B as required

Brian,
I have it before me. I have just seen it. Thank you for the heads up. I am well aware of the curriculum proposal proceedures. Let me see if I can get a few people to look at it before the Monday deadline. In business knowledge of Excel is very basic, similar to knowing how to use a hammer. Most of us with experience outside of teaching have spent considerable portions of our careers using the Microsoft Office Suite. If ISYS105 is required, what business courses are these individuals taking? Could you please send me a relevant check sheet. In the near future, ISYS 105 is going to be made a prerequisite for a number of COB courses. This is not a requirement without a purpose. Without this course a student will not be able to progress.

Your faculty should be the experts in their field. For the most part, my faculty will support whatever another department wants to do usually with the reservations I have already listed. Please send to me the relevant check sheet. I am uncertain where to look.

LB

**From:** Brian Holton
**Sent:** Saturday, October 31, 2015 2:24 PM
**To:** Lawrence H Bajor
**Subject:** Curriculum proposal Form B as required

Hello Larry.
I have attached the forms A and B as required per the university curriculum proposal procedures.

We are proposing the addition of an HVAC class and eliminating ISYS 105 from our degree requirement. All HVAC Program faculty have voted to support this proposal.

Please review and send the form back.

Thank you,

Brian Holton
HVACR Program
Ferris State University
Office: 231-591-2322

# FORM D – Proposed Program Requirements

FERRIS STATE UNIVERSITY
Imagine More

**Associate in Applied Science**

# HVACR Technology

**Program Academic Requirements**

| Student: | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|
| email: | | ID: | | | Ferris | |
| Advisor: | | Ph: | | 1 | Transfer | |

| | | | Cr | Gr | Pts | S | Yr | Code | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | **MAJOR** | | | | | | | |
| HVAC | 101 | Intro to Refrig & A/C Systems (co-req MATH 116) | 4 | | | | | | |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111) | 4 | | | | | | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | | | | | | |
| HVAC | 117 | Advanced Electricity-Circuits | 4 | | | | | | |
| HVAC | 127 | Advanced HVACR Controls (C- or better in HVAC 117) | 3 | | | | | | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC111) | 5 | | | | | | |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102,117 & MATH 116) | 5 | | | | | | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102,117 & MATH 116) | 5 | | | | | | |
| HVAC | 235 | Advanced Heating-Mech System (C- or better in HVAC 117,132 & MATH 116) | 5 | | | | | | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101,132 & MATH 116) | 4 | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | |
| ENGL | 150 | English 1 | 3 | | | | | | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | | | | | | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | |
| MATH | 116 | Interm. Algebra & Numerical Trig (ACT 19 or MATH 110) | 4 | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, BIOL 111. Course must have a lab) | 4 | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | |
| | | **FRESHMEN SEMINAR** | | | | | | | |
| FSUS | 100 | FSU Seminar | 1 | | | | | | |

**Unofficial Statistics**

| | |
|---|---|
| Major: Total Crs / Earned Crs / Honor Points | 40 |
| Degree: Total Crs / Earned Crs / Honor Points | 67 |
| GPA Major: | - |
| GPA Degree: | - |

AAS Minimum General Education Requirements:
Cultural Enrichment (CE) – 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3/4 credits
Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential/light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems, 7) Demonstrate ability to install, troubleshoot and repair HVACR controls

# Form D - Proposed Course Sequence Guide

Ferris State University
Imagine More

Associate in Applied Science

## HVACR Technology

Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 1 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 101 | Introduction to Refrigeration & A/C Systems (co-req MATH 116) | 4 | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | |
| HVAC | 117 | Advanced Electricity-Circuits | 4 | |
| MATH | 116 | Intermediate Algebra & Numerical Trigonometry (C- in MATH 110 or 19ACT) | 4 | |
| FSUS | 100 | FSU Seminar | 1 | |
| | | Total | 17 | |

| YEAR 1 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111) | 4 | |
| HVAC | 127 | Advanced HVACR Controls (C- or better in HVAC 117) | 3 | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111) | 5 | |
| ENGL 150 | | English 1 | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Total | 18 | |

| YEAR 2 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 235 | Advanced Heating-Mechanical Systems (C- or better in HVAC 117, 132 & MATH 116) | 5 | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132 & MATH 116 ) | 4 | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, or | 4 | |
| | | Total | 16 | |

| YEAR 2 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117 & MATH 116) | 5 | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117 & MATH 116 ) | 5 | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | |
| | | Social Awareness Elective | 3 | |
| | | Total | 16 | |

AAS Minimum General Education Requirements

Cultural Enrichment (CE) - 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3-4 credits Reference: gttp://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential/light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems, 7) Demonstrate ability to install, troubleshoot and repair HVACR controls

8

# FORM D – Current Program Requirements

FERRIS STATE UNIVERSITY
Imagine More

Associate in Applied Science

# HVACR Technology

## Program Academic Requirements

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Student: | | | | | | | Code | Location | Crs |
| email: | | ID: | | | | | | Ferris | |
| Advisor: | | Ph: | | | | | 1 | Transfer | |

| | | | Cr | Gr | Pts | S | Yr | Code | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | **MAJOR** | | | | | | | |
| HVAC | 101 | Intro to Refrig & A/C Systems (co-req MATH 116) | 4 | | | | | | |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111) | 4 | | | | | | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | | | | | | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111) | 4 | | | | | | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC111) | 5 | | | | | | |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117 & MATH 116) | 5 | | | | | | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102,117 & MATH 116) | 5 | | | | | | |
| HVAC | 235 | Advanced Heating-Mech System (C- or better in HVAC 117, 132 & MATH 116) | 5 | | | | | | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132 & MATH 116) | 4 | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | |
| ENGL | 150 | English 1 | 3 | | | | | | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | | | | | | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | |
| ISYS | 105 | Microcomputer Applications | 3 | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | |
| MATH | 116 | Interm. Algebra & Numerical Trig (C- in MATH 110 or 19 ACT) | 4 | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, BIOL 111. Course must have a lab) | 4 | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | |
| | | **FRESHMEN SEMINAR** | | | | | | | |
| FSUS | 100 | FSU Seminar | 1 | | | | | | |
| | | **Unofficial Statistics** | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 67 | | | | | | |
| | | GPA Major: | - | | | | | | |
| | | GPA Degree: | - | | | | | | |

AAS Minimum General Education Requirements:
Cultural Enrichment (CE) – 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3/4 credits
Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential/light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems.

# Form D - Current Course Sequence Guide

Ferris State University
Imagine More

Associate in Applied Science

## HVACR Technology

Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 1 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 101 | Introduction to Refrigeration & A/C Systems (co-req MATH 116) | 4 | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | |
| MATH | 116 | Intermediate Algebra & Numerical Trigonometry (C- in MATH 110 or 19ACT) | 4 | |
| ENGL | 150 | English 1 | 3 | |
| FSUS | 100 | FSU Seminar | 1 | |
| | | Total | 16 | |
| **YEAR 1 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111) | 4 | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111) | 4 | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111) | 5 | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, or BIOL 111. Must Include a Lab Section) | 4 | |
| | | Total | 17 | |
| **YEAR 2 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 235 | Advanced Heating-Mechanical Systems (C- or higher in HVAC 117, 132 & MATH 116) | 5 | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132 & MATH116) | 4 | |
| ISYS | 105 | Microcomputer Applications | 3 | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Total | 18 | |
| **YEAR 2 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117, & MATH 116) | 5 | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117& MATH116) | 5 | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | |
| | | Social Awareness Elective | 3 | |
| | | Total | 16 | |

AAS Minimum General Education Requirements

Cultural Enrichment (CE) - 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3-4 credits Reference: gttp://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential / light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems.

## COURSE INFORMATION FORM

## FORM E

**Effective Fall 2015**

**Complete all items below (New or Current)**

**Check all boxes where modifications are being made.**

*The following information is provided for a new course information*

**Course Identification**

☐**Prefix (current)** Click here to enter text. ☐**Number (current)**Click here to enter text. **Contact Hours (current):** Click here to enter text.

Lecture ☐Lab ☐ Seminar ☒ [Enter contact hours per week in blank above.]

☒**Prefix (proposed) HVAC** ☐**Number (proposed)127 Contact Hours (proposed):** 5 **2 Lecture hours and 3 lab hours per week**

Lecture ☒Lab ☒ Seminar ☐ [Enter contact hours per week in blank above.]

☐**Title (current):**

☐ **Title (proposed): Advanced HVACR Controls**

☐**Credit Hours (current):**Click here to enter text. ☐**Prerequisites (current):** Click here to enter text.☐**Co-requisites (current):** Click here to enter text.

☐ **Credit Hours (proposed):3** ☐ **Prerequisites (proposed): HVAC 117 with C- or better**☐**Co-requisites (proposed):** Click here to enter text.

☐**Course Description (current) 125 words maximum:** Click here to enter text.

☒**Course Description (proposed) 125 words maximum: The study of advanced controls related to residential and commercial applications. The course focuses on control components, wiring, and control sequences used in direct digital control systems. Lab exercises concentrate on control system wiring, operation, and troubleshooting**

☐**Course Outcomes and Assessment Plan (current):** Click here to enter text.

☐**Course Outcomes and Assessment Plan (proposed):**

**Student Learning Outcomes – Program level- Trac Dat**
Demonstrate ability to install, troubleshoot and repair HVACR controls

**Student Learning Outcomes – Course Level Trac Dat**
Define terms related to HVACR control systems
Demonstrate ability to install HVACR controls
Demonstrate ability to troubleshoot and repair HVACR controls

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction, Orientation, and Safety.<br>A. Apply all safety procedures required in this course. |
| II. | Alternating current.<br>A. Define the characteristics of AC run and start capacitors with respect to: construction, operating and troubleshooting characteristics, phase shifts and CEMF.<br>B. Define the characteristics of AC induction motors with respect to: construction, operating and troubleshooting characteristics, CEMF and resulting phase shifts. |
| III. | AC Capacitor applications.<br>A. Describe the use of capacitors in AC applications, such as starting and running of single phase motors and power factor correction. |
| IV. | Single phase transformers.<br>A. Describe the operation and use of single phase transformers for controls, ignition circuits and voltage correction. |
| V. | Three Phase Transformers.<br>A. Describe the operation and use of delta and wye three phase transformers for power distribution and voltage correction |
| VI. | AC induction motors.<br>A. Define the characteristics of AC run and start capacitors.<br>B. Define the starting and running characteristics, construction, CEMF and resulting phase shifts of the following motor types: CSIR, CSCR, SP, PSC, Synchronous, Shaded pole and Universal. |
| VII. | Single phase motor characteristics.<br>A. Define the starting, running and other operating characteristics of AC induction motor starting relays; potential, solid state and centrifugal switches.<br>B. Identify the correct starting relay to use with a specific single phase motor. |
| VIII. | Three phase motors.<br>A. Explain the purpose, operation and application of wye-delta starting schemes. |
| IX. | Motor starters.<br>A. Explain the different types and troubleshooting techniques for motor starters. |
| X. | Wiring diagrams.<br>A. Explain the use of a wiring diagram for troubleshooting. |
| XI. | Low voltage thermostats.<br>A. Explain how a heat/cool thermostat operates and is properly wired. |
| XII. | Defrost timer.<br>A. Describe the sequence of operation and application of various types of defrost timers and circuits. |
| XIII. | Conductor sizing and over current protection.<br>A. Use NEC to properly size wire and describe the problems associated with improperly sized and misapplied conductors.<br>B. Describe operation of various types of circuit breaker, fuses and circuit protectors. |
| XIV. | Measuring devices.<br>A. Identify and describe the application of thermistors, RTD's, humidity sensors and static pressure sensors.<br>B. Demonstrate knowledge of the operating characteristics and circuits using solid state transducers in HVAC applications.<br>C. Demonstrate knowledge of the proper procedure for troubleshooting solid state control boards by accurately answering homework and test questions.<br>D. Demonstrate knowledge of the proper procedure for troubleshooting solid state control boards by accurately answering homework and test questions. |
| XV. | Modulating control loops.<br>A. Describe temperature control loop terminology components and operation. |

Click here to enter text.

☐**Course Outcomes and Assessment Plan (proposed): No Change**

☐**Course Outline including Time Allocation (current):** Click here to enter text.

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction, Orientation, and Safety | 1 | 0 |
| II. | Alternating current | 1 | 3 |
| III. | AC Capacitor applications | 3 | 3 |
| IV. | Single phase transformers | 6 | 3 |
| V. | Three phase transformers | 3 | 3 |
| VI. | AC induction motors | 3 | 6 |
| VII. | Single phase motor characteristics | 3 | 3 |
| VIII. | Three phase motors | 3 | 3 |
| IX. | Motor starters | 6 | 3 |
| X. | Wiring diagrams | 3 | 3 |
| XI. | Low voltage thermostats | 3 | 3 |
| XII. | Defrost timers | 3 | 3 |
| XIII. | Conductor sizing and over current protection | 3 | 3 |
| XIV. | Measuring Devices | 1 | 3 |
| XV. | Modulating Control Loops | 3 | 3 |
| | Total Hours | 45 | 45 |

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐**Course Outline including Time Allocation (proposed): No Change**

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

**Student Learning Outcomes Overview**

Students satisfactorily completing this course will demonstrate knowledge, skills and abilities related to the following instructional units.

1. HVACR control terminology
2. Direct digital controls (DDC) basics
3. Valve and damper actuators
4. Variable frequency drives (VFD)
5. Air-side economizer controls
6. Variable Air Volume and Change-over bypass (VVT) controls
7. Advanced residential and light commercial thermostats
8. Emerging technologies
9. Pneumatic controls

**Learning Outcomes for Each Instructional Unit**

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| 1 | Terminology<br>1. Explain terms associated with HVACR control systems |
| 2 | Direct Digital Controls<br><br>1. Identify typical input and output components - - AI, DI, AO and DO - - used in HVACR.<br>2. Explain analog and digital inputs and outputs (AI, DI, AO and DO).<br>3. Explain passive and active sensors.<br>4. Verify correct inputs and outputs for an operating control system.<br>5. Explain typical control sequences for common HVAC applications, i.e. RTU, AHU, and VAC terminal.<br>6. Explain common problems and related troubleshooting techniques.<br>7. Analyze operating control loops and apply control terminology to explanations<br>8. Describe, and differentiate between, communication protocols, i.e., BAC Net and LON works.<br>9. Explain applicable wiring types and electrical code installation issues.<br>10. Identify the different programming tools used to program different controllers.<br><br>11. Use basic troubleshooting techniques to identify problems. |
| 3 | Valve and Damper Actuators<br><br>1. Describe the types and applications for the HVACR industry.<br>2. List the typical operating electrical inputs for actuators used in the HVACR industry.<br>3. Explain the common problems that occur with HVACR actuators.<br>4. Explain why dampers are normally open or normally closed and how this relates to actuator selection and installation.<br>5. Describe basic sizing concepts |
| 4 | Variable Frequency Drives<br><br>1. Describe the purpose and operation for typical HVACR applications<br>2. Describe the function of the major components of a VFD.<br>3. Explain safety concerns related to servicing of VFD's<br>4. Explain the relation between frequency and speed.<br>5. Explain the relationship between speed and energy savings for air and water system applications.<br>6. Differentiate between soft start- stop and variable speed applications.<br>7. Diagram the typical wiring of a VFD used in air and water system applications.<br>8. Explain the common maintenance tasks for VFD's. |

| | |
|---|---|
| | 9. Explain the common problems that occur with VFD's and related troubleshooting procedures.<br><br>10. Explain the affects VFD's may have on building electrical supplies and methods for addressing those concerns. |
| 5 | Air-side economizer controls<br><br>1. Explain purpose and application for air-side economizers.<br>2. Explain air-side economizer operation (typical sequence of operation).<br>3. Explain the common change-over control methods.<br>4. Describe common maintenance and inspection issues.<br>5. Describe common economizer problems.<br>6. Compare different economizer controls, i.e. packaged versus programmable |
| 6 | Variable Air Volume and Change-over bypass (VVT) controls<br><br>1. Explain purpose and application for Variable air Volume systems.<br>2. Explain purpose and application for Change-over bypass (VVT) systems<br>3. Describe operation of common VAV terminals, i.e. pressure dependent, pressure independent, series fan, parallel fan.<br>4. Describe typical control components for VAV and VVT systems. |
| 7 | Advanced residential and light commercial thermostats<br><br>1. Describe communication concepts, wired and wireless<br>2. Explain types, capabilities and applications.<br>3. Describe wiring practices and concerns. |
| 8 | Emerging technologies<br><br>1. Analyze an HVACR control or test instrument that uses emerging technology. |
| 9 | Pneumatic controls<br><br>1. Describe, and differentiate between, 1 pipe and 2 pipe systems.<br>2. Describe, and differentiate between, single and dual input receiver controllers.<br>3. Describe function of air compressor and air drier stations, i.e., regulators, auto-drains, check valves, unloaders, and final filters.<br>4. Explain common maintenance tasks for air compressor and air drier stations.<br>5. Explain common problems associated with pneumatic control systems. |

**Minimum Required Student Laboratory Activities**

| | |
|---|---|
| I | Student will demonstrate safe practices related to personal, electrical and tool safety every day while working in the lab. Student will demonstrate safe and competent operation of hand tools and instruments. |
| 2 | Direct Digital Controls<br><br>1. Demonstrate ability to measure electrical signal or resistance for passive and active sensors.<br>2. Demonstrate ability to measure or verify Triac or relay output.<br>3. Demonstrate ability to complete basic configuration or programming.<br>4. Demonstrate ability to assemble the necessary components, and complete wiring for a specified application. |
| 3 | Valve and Damper Actuators<br><br>1. Wire and operate various actuators.<br>2. Demonstrate ability to test and troubleshoot actuators. |

| | |
|---|---|
| 4 | Variable Frequency Drives<br><br>1. Identify the major components of a VFD.<br>2. Wire and configure a VFD and motor to provide a soft start and stop via a switch. Start and test operation in manual speed control mode.<br>3. Complete all configurations and parameter settings for a VFD for a specified motor and application using the VFD, PID function<br>4. Troubleshooting, basic parameters, wiring connections and input signals. |
| 5 | Air-side economizer controls<br>1. Wire and configure an economizer control<br>2. Test an operating economizer<br>3. Demonstrate ability to troubleshoot an economizer system. |
| 6 | Variable Air Volume and Change-over bypass (VVT) controls<br><br>1. Identify main components of a VAV terminal<br>2. Complete all configurations for a VAV digital controller for a specified motor and application |
| 7 | Advanced residential and light commercial thermostats<br><br>1. Demonstrate ability to read manufacture literature and configure advanced thermostat per sample specification. |
| 8 | Emerging technologies<br>1. Research emerging technology for HVACR controls and tools and produce a written report or oral presentation to demonstrate knowledge of the technology and proper application of the technology. |
| 9 | Pneumatic controls<br><br>1. Identify common components.<br>2. Demonstrate ability to calibrate a pneumatic thermostat. |

**Assessment Plan:**

| Assessment Method | Criterion for Success |
|---|---|
| Assessments – Quiz, or exams, internally developed | 85% proficiency |
| Performance: faculty observe and evaluate student performance during laboratory tasks or assessments or both. | Knowledge, skills, and ability to complete assigned tasks or lab assessments with 85% proficiency or better |
| | |

☐**Course Outline including Time Allocation (current):** Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☒**Course Outline including Time Allocation (proposed):** Click here to enter text.

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| 1 | HVACR control terminology | 1 | 0 |
| 2 | Direct digital control (DDC) basics | 7 | 12 |
| 3 | Valve and damper actuators | 4 | 6 |
| 4 | Variable frequency drives (VFD) | 4 | 6 |
| 5 | Air-side economizer controls | 4 | 6 |
| 6 | Variable Air Volume and Change-over bypass (VVT) controls | 4 | 6 |
| 7 | Advanced residential and light commercial thermostats | 2 | 3 |
| 8 | Emerging technologies | 2 | 3 |
| 9 | Pneumatic controls | 2 | 3 |
| | Total hours | 30 | 45 |

## COURSE INFORMATION FORM

## FORM E

**Effective Fall 2015**

**Complete all items below (New or Current)**

**Check all boxes where modifications are being made.**

### Course Identification

☐**Prefix (current) HVAC** ☐**Number (current)117 Contact Hours (current):** 6

Lecture ☒Lab ☒ Seminar ☐ [Enter contact hours per week in blank above.]

☐**Prefix (proposed)** Click here to enter text. ☐**Number (proposed)**Click here to enter text. **Contact Hours (proposed):** Click here to enter text.

Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐**Title (current):Advanced Electricity Circuits**

☐ **Title (proposed):** Click here to enter text.

☐**Credit Hours (current):4** ☐**Prerequisites (current): HVAC 111 with C- or better**☐**Co-requisites (current):** Click here to enter text.

☐**Credit Hours (proposed):**Click here to enter text. ☒**Prerequisites (proposed): none** ☐**Co-requisites (proposed):** Click here to enter text.

☐**Course Description (current) 125 words maximum: AC electrical theory and application, concentrating on the operation, installation and analysis of HVACR components and control circuits. The components include single and polyphase transformer and motors, heating and air conditioning controls, commercial timers, motor starters, contactors, relays and other control devices. Lab exercises focus on developing wiring diagrams; wiring, troubleshooting and analyzing circuits based on lecture material.**

☐**Course Description (proposed) 125 words maximum: No Change**

☐**Course Outcomes and Assessment Plan (current):**

18

## CREATE NEW COURSE – Course Data Entry Form

**FORM F-C**

**Effective Fall 2015**

**COMPLETE ALL SECTIONS BELOW.** If this course is to be used as a prerequisite for other university courses, FORM F's that reflect the prerequisite change must be submitted for all those courses as well. See Appendix E for Completing Forms.

### I. ACTION TO BE TAKEN: CREATE A NEW COURSE

Desired Term Effective (6 digit code): **201608** Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

### II. NEW COURSE ATTRIBUTES:

A. Course Prefix: **HVAC** B. Number: **127**

C. Contact Hours: **5** Lecture ☒Lab ☒ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.] **3 Hours in lab, 2 hours in lecture**

D. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]

E. Course Title: **Advanced HVACR Controls** [Limit to 30 characters including punctuation and spaces]

F. College Code: **CET** G. Department Code: **HVAC** H. Credit Hours: Variable ☐Fixed ☒

I. Minimum Credit Hours: **3** J. Maximum Credit Hours: 3 [Enter number is space.]

K. Hours May be Repeated for Extra Credit: Yes ☐ No ☒ If yes, max times Click here to enter text.Or max credits Click here to enter text. awarded.

L. Levels: Undergraduate ☒ Graduate ☐ Professional ☐

M. Grade Method: Normal Grading ☒ Credit/No Credit (Pass/Fail) ☐

N. Does proposed new course replace an equivalent course? Yes ☐ No ☒

O. Equivalent Course: Prefix: Click here to enter text. Number: Click here to enter text.

P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE. Click here to enter text.

**The study of advanced controls related to residential and commercial applications. The course focuses on control components, wiring, and control sequences used in direct digital control systems. Lab exercises concentrate on control system wiring, operation, and troubleshooting.**

Q. Term Offered: **Fall and Spring** R. Max Section Enrollment: **16** Lecture: **32** Lab:**16**

S. Prerequisites or Restrictions: If none, leave blank. HVAC 117 with C- or better

T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces. Click here to enter text.

*To be completed by Academic Affairs Office:* **Standards & Measures Coding and General Education Code**

Basic Skill (BS) ☐ General Education ☐ Occupational Education ☐ G E Codes: Click here to enter text.

UCC Chair Signature/Date ______________________

Academic Affairs Approval Signature/Date ______________________

**OFFICE OF THE REGISTRAR USE ONLY**

Date Rec'd: Click here to enter text. Date Completed: Click here to enter text. Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐

# MODIFY A COURSE – Course Data Entry Form

**FORM F-M**

**Effective Fall 2015**

## I. ACTION TO BE TAKEN: MODIFY A COURSE

Desired Term Effective (6 digit code): **201608** Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

## II. COURSE TO BE MODIFIED:

A. Course Prefix: **HVAC** B. Number: **117**

C. Course Title: **Advanced Electricity - Circuits**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: S** See Appendix E Instructions for Completing Forms.

**Note: removing a prerequisite, course will now be scheduled first freshman semester**

### III. MODIFICATIONS

A. Course Prefix: Click here to enter text. B. Number: Click here to enter text.

B. Contact Hours: Click here to enter text. Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]

C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]

D. Course Title: Click here to enter text. [Limit to 30 characters including punctuation and spaces]

E. College Code: Click here to enter text. G. Department Code: Click here to enter text. H. Credit Hours: Variable ☐Fixed ☐

I. Minimum Credit Hours: Click here to enter text. J. Maximum Credit Hours: Click here to enter text. [Enter number is space.]

K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Click here to enter text.Or max credits Click here to enter text. awarded.

L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐

M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐

N. Does proposed new course replace an equivalent course? Yes ☐ No ☐

O. Equivalent Course: Prefix: Click here to enter text. Number: Click here to enter text.

P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE. Click here to enter text.

Q. Term Offered: R. Max Section Enrollment: Lecture: Lab:

S. Prerequisites or Restrictions: If none, leave blank. Click here to enter text.

T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces. Click here to enter text.

***To be completed by Academic Affairs Office:*** **Standards & Measures Coding and General Education Code**

Basic Skill (BS) ☐ General Education ☐ Occupational Education ☐ G E Codes: Click here to enter text.

UCC Chair Signature/Date

Academic Affairs Approval Signature/Date

**OFFICE OF THE REGISTRAR USE ONLY**

Date Rec'd: Click here to enter text. Date Completed: Click here to enter text. Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐

Form A

Effective Fall 2015

# PROPOSAL SUMMARY AND ROUTING FORM

Proposal Title: HVAC 285: HVAC System Design using BIM

Initiating Individual: Mike Feutz Initiating Department or Unit: HVAC

Contact Person's Name: Mike Feutz Email: feutzm@ferris.edu Phone: x2351

☐ Group I-A – New Degree, major, concentration, minor, or redirection of a current offering

☐ Group I-B – Deletion of a degree, major, concentration, or minor

☒ Group II-A – New Course, modification of a course, deletion of a course

☐ Group II-B – Minor Curriculum Clean-up

☐ Group III – Certificate (☐ College Credit ☐ Non-credit ☐ New Certificate)

☐ Group IV – Other site location (☐ College Credit ☐ Non-credit)

| | PLEASE PRINT AND SIGN YOUR NAME | DATE | VOTE/ACTION * Number Count |
|---|---|---|---|
| Program Representative ** | Mike Feutz | 4-28-16 | 1 Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| Department/School/Faculty Representative Vote ** | DOUGLAS FENTZ<br>D.F. Fz | 4-28-16 | 9 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| Department/School Administrator<br>School of Built Environment C.C. | JOHN R. SCHMIDT<br>DIRECTOR, SBE<br>John Schmidt | 10/4/2016 | 7 Support (6 COMMITTEE + DIRECTOR)<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| College Curriculum Committee/Faculty | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| UCC Representative | | | __ Support<br>__ Hold<br>__ Not Support |
| Dean | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| University Curriculum Committee ** | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| Senate ** | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| Academic Affairs | | | __ Support<br>__ Hold<br>__ Not Support |

* Support with Concerns or Not Support must include identification of specific concern with appropriate rationale.

** Number Count must be given for all members present and/or voting.

To be completed by Academic Affairs Date of Implementation: Click here to enter text.

President (Date Approved

Board of Trustees (Date Approved)

Academic Officers of MI (Date Approved)

1. Proposal Summary: (Summary is generally less than one page. Briefly state what is proposed with a summary of rationale and highlights)

This proposes to replace the campus-based ARCH 110 *Computer Graphics-ARCH-HVACR* with a fully online HVAC 285 *HVAC System Design using BIM*. (Building Information Modeling or BIM is a process by which buildings are designed and "built" virtually before they are built physically). This proposal follows a proposal that was approved 2/5/2016 to deliver a similar experimental course (HVAC 290 *HVAC System Design using BIM*) beginning summer 2016.

ARCH 110, a service class offered exclusively to HVAC students, started as an AutoCAD class when AutoCAD was the mainstream tool used in the built environment. An introduction to BIM (using Revit software) was added to ARCH 110 several years ago in response to changing industry practices. No online version of ARCH 110 is available, and distance learning students earning their B.S. in HVAC Engineering Technology and Energy Management have found it impossible to find a similar course (or substitute class without several prerequisites) in their locale. As a new online course, the proposal offers a class that, since 2003, online students had to find elsewhere. In addition to pedagogical rational, the proposal offers a financial advantage through new tuition generated.

HVAC faculty met with ARCH faculty coordinator Diane Nagelkirk early in fall 2015 to discuss the development of an online version of ARCH 110 as a collaborative effort between the architectural and HVAC faculty. Early interest by the ARCH faculty faded and HVAC faculty took up the effort, which spawned the proposal for an experimental fully online course, followed by this proposal for a permanent fully online course.

Meanwhile, HVAC faculty surveyed industry employers to discover the need for graduates to gain knowledge of 2D CAD (AutoCAD) and/or 3D BIM. The unanimous response was to discontinue teaching AutoCAD and focus exclusively on BIM. During the past 10 or 15 years, BIM has transitioned from a competitive advantage used by some industry professionals to a requirement for all industry professionals. As such, graduates will find themselves working with models developed using BIM software.

The models themselves are built by architects and shared with the mechanical engineers and contractors who design and coordinate the fabrication and installation of the mechanical systems. Though current software such as Navisworks and BIM 360 Glue facilitate the sharing of models between various entities (architects, engineers, contractors, owners, etc.), each discipline is responsible for their own scope of work. As such, it is necessary for HVAC students to focus on BIM functions and processes related to mechanical system. Additionally, through the efforts of HVAC faculty coordinating with industry experts, it became obvious that this new BIM class would create a platform for further integration of BIM in the existing higher level HVAC classes. This discovery, along with the history of HVAC faculty teaching in the fully online environment, supports the proposal for a new HVAC class created and taught by HVAC faculty. Finally, with the new class the HVAC program gains the ability to make fluid changes in response to future HVAC industry demands and advisory board recommendations.

BIM not evolutionary, it is revolutionary. Industry uses language such as "transformational" and "paradigm shift" to describe it. We are in the midst of the most dramatic change in the design and construction of the built environment in history. And the revolution has only begun. The change is dynamic and rapid. As such, it is impossible to draft a course outline that will be as current next year as it is this year. Thus, the outline and course outcomes in this proposal are concise and have been drafted to be as broad as possible to allow flexibility without burdening the curriculum change process. Advances in the industry and software will be incorporated into HVAC 285, as will lessons learned during delivery of the experimental HVAC 290 *HVAC System Design using BIM,* without affecting the outline or learning outcomes.

Please note that this proposal affects only the baccalaureate degree in HVAC. This degree is a 2 + 2 program and ladders from an associate degree in HVACR. As such, no documents (Forms D) for the associate degree program are included in this proposal.

1. Proposal Summary: (Summary is generally less than one page. Briefly state what is proposed with a summary of rationale and highlights)

This proposes to replace the campus-based ARCH 110 *Computer Graphics-ARCH-HVACR* with a fully online HVAC 285 *HVAC System Design using BIM*. (Building Information Modeling or BIM is a process by which buildings are designed and "built" virtually before they are built physically). This proposal follows a proposal that was approved 2/5/2016 to deliver a similar experimental course (HVAC 290 *HVAC System Design using BIM*) beginning summer 2016.

ARCH 110, a service class offered exclusively to HVAC students, started as an AutoCAD class when AutoCAD was the mainstream tool used in the built environment. An introduction to BIM (using Revit software) was added to ARCH 110 several years ago in response to changing industry practices. No online version of ARCH 110 is available, and distance learning students earning their B.S. in HVAC Engineering Technology and Energy Management have found it impossible to find a similar course (or substitute class without several prerequisites) in their locale. As a new online course, the proposal offers a class that, since 2003, online students had to find elsewhere. In addition to pedagogical rational, the proposal offers a financial advantage through new tuition generated.

HVAC faculty met with ARCH faculty coordinator Diane Nagelkirk early in fall 2015 to discuss the development of an online version of ARCH 110 as a collaborative effort between the architectural and HVAC faculty. Early interest by the ARCH faculty faded and HVAC faculty took up the effort, which spawned the proposal for an experimental fully online course, followed by this proposal for a permanent fully online course.

Meanwhile, HVAC faculty surveyed industry employers to discover the need for graduates to gain knowledge of 2D CAD (AutoCAD) and/or 3D BIM. The unanimous response was to discontinue teaching AutoCAD and focus exclusively on BIM. During the past 10 or 15 years, BIM has transitioned from a competitive advantage used by some industry professionals to a requirement for all industry professionals. As such, graduates will find themselves working with models developed using BIM software.

The models themselves are built by architects and shared with the mechanical engineers and contractors who design and coordinate the fabrication and installation of the mechanical systems. Though current software such as Navisworks and BIM 360 Glue facilitate the sharing of models between various entities (architects, engineers, contractors, owners, etc.), each discipline is responsible for their own scope of work. As such, it is necessary for HVAC students to focus on BIM functions and processes related to mechanical system. Additionally, through the efforts of HVAC faculty coordinating with industry experts, it became obvious that this new BIM class would create a platform for further integration of BIM in the existing higher level HVAC classes. This discovery, along with the history of HVAC faculty teaching in the fully online environment, supports the proposal for a new HVAC class created and taught by HVAC faculty. Finally, with the new class the HVAC program gains the ability to make fluid changes in response to future HVAC industry demands and advisory board recommendations.

BIM not evolutionary, it is revolutionary. Industry uses language such as "transformational" and "paradigm shift" to describe it. We are in the midst of the most dramatic change in the design and construction of the built environment in history. And the revolution has only begun. The change is dynamic and rapid. As such, it is impossible to draft a course outline that will be as current next year as it is this year. Thus, the outline and course outcomes in this proposal are concise and have been drafted to be as broad as possible to allow flexibility without burdening the curriculum change process. Advances in the industry and software will be incorporated into HVAC 285, as will lessons learned during delivery of the experimental HVAC 290 *HVAC System Design using BIM,* without affecting the outline or learning outcomes.

Please note that this proposal affects only the baccalaureate degree in HVAC. This degree is a 2 + 2 program and ladders from an associate degree in HVACR. As such, no documents (Forms D) for the associate degree program are included in this proposal.

2. Summary of Curricular Action (Check all that apply to this proposal)

☐ Degree ☐ Major ☐ Minor ☐ Concentration ☐ Certificate ☒ Course

☒ New ☐ Modification ☐ Deletion

Name of Degree, Major, etc.: B.S. in HVAC Engineering Technology and Energy Management

3.Summary of All Course Action Required: Add HVAC 285 to catalog, delete ARCH 110 from HVAC BS checksheets (campus and online), add HVAC 285 as a prerequisite to HVAC 321, 322, 325, 326 & 350, add 285 as a co-requisite to HVAC 342, clean up prerequisites for online courses, and reorder online courses to include the proposed course in a logical sequence (includes changing start from fall to summer.

A. Newly Created Courses to be Added to the Catalog

| Prefix | Number | Title |
|---|---|---|
| HVAC | 285 | HVAC System Design using BIM |

B. Courses to be Deleted from FSU Catalog

| Prefix | Number | Title |
|---|---|---|
| Click here to enter text. | Click here to enter text. | Click here to enter text. |

C. Existing Courses to be Modified

| Prefix | Number | Title |
|---|---|---|
| Click here to enter text. | Click here to enter text. | Click here to enter text. |

D. Addition of existing FSU courses to program

| Prefix | Number | Title |
|---|---|---|
| Click here to enter text. | Click here to enter text. | Click here to enter text. |

E. Removal of existing FSU courses from program

| Prefix | Number | Title |
|---|---|---|
| ARCH | 110 | Computer Graphics-ARCH-HVACR |

4. Summary of All Consultations

| Form Sent (B or C) | Date Sent | Responding Department | Date Received & By Whom |
|---|---|---|---|
| Form B | 4/6/2016 | ARCH | |

5. Will External Accreditation be sought? (For new programs or certificates only)
☐ Yes ☒ No

If yes, name the organization involved with accreditation for this program. Click here to enter text.

6. Is a PCAF required? ☐ Yes ☒ No Is the PCAF approved? ☐ Yes ☐ No (If yes, supply link on Academic Affairs website where PCAF is posted. )

7. Program Checksheets affected by this proposal (Check all that apply to this proposal)
BS in HVAC Engineering Technology and Energy Management (See Forms D for both on campus and online)
☒ Add Course ☒ Delete Course ☐ Modify Course ☒ Change Prerequisite ☐ Move from required to elective
☐ Move from elective to required ☐ Change Outcomes and Assessment Plan ☐ Change Credit hours

8. List all Checksheets affected by this proposal:

| College | Department | Program |
|---|---|---|
| TE (Engineering Technology) | HVAC | B.S. (online and on campus |

FORM D – Current: Campus Students

FERRIS STATE UNIVERSITY

Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Program Academic Requirements

| | | | | | |
|---|---|---|---|---|---|
| Student: | | Code | Location | Crs |
| email: | ID: | | Ferris | |
| Advisor: | Ph: | 1 | Transfer | |

| | | MAJOR | Cr | Gr | Pts | S | Yr | Code | Notes |
|---|---|---|---|---|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 321 and HVAC 342 and MATH 126) | 4 | | | | | | |
| HVAC | 321 | HVAC Air Side System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | |
| HVAC | 325 | HVAC Hydronic System Select-Design (HVAC 321 and HVAC 342 and MATH 126) | 4 | | | | | | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to Bachelor of Science in HVAC Engineering Technology (code HVAC) | 4 | | | | | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321 and HVAC 342 and MATH 126) | 4 | | | | | | |
| HVAC | 393 | Summer Internship (HVAC 312 and HVAC 350 and HVAC 325, all with a grade of C- or better) | 4 | | | | | | |
| HVAC | 415 | Direct Digital Control (MATH 126and HVAC 393 with a grade of C- or better) | 4 | | | | | | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (HVAC 393 and MATH 126 with C- or better in both) | 4 | | | | | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (HVAC 393 and MATH 126 all with a grade of C- or better) | 4 | | | | | | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (HVAC 415 and HVAC 451 and HVAC 462 all with a grade of C- or better) | 4 | | | | | | |
| | | TECHNICAL RELATED | | | | | | | |
| ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | 2 | | | | | | |
| | | COMMUNICATIONS COMPETENCE | | | | | | | |
| ENGL | 331 | Advanced Technical Writing | 3 | | | | | | |
| | | QUANTITATIVE SKILLS | | | | | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | | | | | |
| | | SCIENTIFIC UNDERSTANDING | | | | | | | |
| | | Scientific Understanding Elective | 4 | | | | | | |
| | | CULTURAL ENRICHMENT | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | SOCIAL AWARENESS | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | |
| ECON | 221 | Principles of Economics 1 | 3 | | | | | | |

Unofficial Statistics

| | |
|---|---|
| Major: Total Crs / Earned Crs / Honor Points | 40 |
| Degree: Total Crs / Earned Crs / Honor Points | 65 |
| GPA Major: | - |
| GPA Degree: | - |

Bachelor of Science General Education Requirements:

One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr)

Multiple requirements may be satisfied by a single course.

Cultural Enrichment – 9 credits (3 credits in course > 200 level), Social Awareness - 9credits (3 credits in course > 200 level)

[Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

Ferris State University

Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

| Student: | | ID: | |
|---|---|---|---|

| YEAR 3 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 321 | HVAC Air Side System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to Bachelor of Science in HVAC Engineering Technology (code HVAC) | 4 | |
| ARCH | 110 | Intro to Computer Graphics in ARCH for HVACR Students | 2 | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116)- (Students who took MATH115 shall take MATH120) | 4 | |
| ENGL | 311 | Advanced Technical Writing | 3 | |
| | | Total | 17 | |

| YEAR 3 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 321 and HVAC 342 and MATH 126) | 4 | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321 and HVAC 342 and MATH 126) | 4 | |
| HVAC | 325 | HVAC Hydronic System Select-Design (HVAC 321 and HVAC 342 and MATH 126) | 4 | |
| | | Scientific Understanding Elective | 4 | |
| MATH | | Students who took MATH 115 and MATH 120 shall take MATH 130 | | |
| | | Total | 16 | |

| YEAR 3 - SUMMER SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 393 | Summer Internship (HVAC 312 and HVAC 350 and HVAC 325, all with a grade of C- or better) | 4 | |
| | | Total | 4 | |

| YEAR 4 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 415 | Direct Digital Control (MATH 126and HVAC 393 with a grade of C- or better) | 4 | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (HVAC 393 and MATH 126 all with a grade of C- or better) | 4 | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (HVAC 393 and MATH 126 with C- or better in both) | 4 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Total | 15 | |

| YEAR 4 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 499 | Commercial HVAC System Design [WIC] (HVAC 415 and HVAC 451 and HVAC 462 all with a grade of C- or better) | 4 | |
| ECON | 221 | Principles of Economics 1 | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Social Awareness Elective | 3 | |
| | | Total | 13 | |

Learning Outcomes Include: 1) analyze & select commercial/industrial HVAC systems for specific applications, 2) design commercial/industrial HVAC systems, given design parameters, building type, & geographic location, 3) select secondary equipment for specific commercial/industrial ducting & piping systems, 4) select primary equipment for specific commercial/industrial ducting & piping systems, 5) commission a commercial or industrial HVAC system, 6) perform an energy audit of an actual facility & analyze utilities for proper applications; Operation & Maintenance & Energy Conservation Measures for potential energy savings; & implementation feasibility using payback calculations, 7) understand, utilize & develop estimates, specs, economic costs, & analysis codes & standards, 8) program control sequences for specific commercial & industrial HVAC systems & equipment.

Ferris State University
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Program Academic Requirements

| Student | | Number | | Cont | |
|---|---|---|---|---|---|

| Major | | | Cr | Notes | Grade |
|---|---|---|---|---|---|
| HVAC | 285 | HVAC System Design using BIM (Department approval) | 2 | | |
| HVAC | 312 | Control Theory & Application (Control Theory & Application (C- or better in HVAC 285, 321 & 342) | 4 | | |
| HVAC | 321 | HVAC Air Side System Select-Design (HVAC 285 co-requisite and Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management prerequisite) | 4 | | |
| HVAC | 325 | HVAC Hydronic System Select-Design (C- or better in HVAC 285, 321, & 342) | 4 | | |
| HVAC | 342 | Load Calculation & Energy Code (HVAC 285 co-requisite and Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management prerequisite) | 4 | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 285, 321 & 342, or HVAC 285, 322, & 342) | 4 | | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 313, 326 & 350 or HVAC 312, 325 & 350) | 4 | | |
| HVAC | 415 | Direct Digital Control (C- or better in HVAC 393 & MATH 126) | 4 | | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in HVAC 393 & MATH 126) | 4 | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in HVAC 393 & MATH 126) | 4 | | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, 451 & 462) | 4 | | |
| | | COMMUNICATIONS COMPETENCE | | | |
| ENGL | 311 | Advanced Technical Writing | 3 | | |
| | | QUANTITATIVE SKILLS | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | |
| | | SCIENTIFIC UNDERSTANDING | | | |
| | | Scientific Understanding Elective | 4 | | |
| | | CULTURAL ENRICHMENT | | | |
| | | Cultural Enrichment Elective | 3 | | |
| | | Cultural Enrichment Elective | 3 | | |
| | | SOCIAL AWARENESS | | | |
| | | Social Awareness Elective | 3 | | |
| ECON | 221 | Principles of Economics 1 | 3 | | |

ADMISSION REQUIREMENTS: Students entering the HVACR Engineering Technology and Energy Management program must have completed the HVACR Technology program at Ferris or an equivalent A.A.S. program at another institution (or equivalent) with a minimum 2.5 GPA. In addition, students should possess computer literacy skills and have completed college intermediate algebra and trigonometry and a scientific understanding course.

PROGRESSION REQUIREMENTS: Progression in the program requires a "C-" or better in all HVAC coursework.

GRADUATION REQUIREMENTS: The HVACR Engineering Technology and Energy Management program at Ferris leads to a bachelor of science degree. Graduation requires a minimum 2.0 GPA in the major and overall. A minimum of 30 credits must be earned at Ferris for this degree, and a minimum of 40 credits must be 300 and 400 level courses. Taking all HVAC courses in this checksheet fulfills these requirements. Students must complete all general education requirements as outlined on the General Education website.

BACHELOR OF SCIENCE GENERAL EDUCATION REQUIREMENTS:

One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr) Multiple requirements may be satisfied by a single course.

Cultural Enrichment – 9 credits (3 credits in course > 100 level), Social Awareness - 9credits (3 credits in course > 100 level) [Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

FSU SUNSET POLICY: If a student returns to the university after an interrupted enrollment of two semesters (not including summer semester), the requirements of the curriculum (including General Education) which are in force at the time of return must be met, not the requirements in effect at the time of original admission. In special circumstances, the academic department head/chair/coordinator/director may permit the student to finish under the program requirements in force at the time of original admission to the program.

FERRIS STATE UNIVERSITY
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

| Student: | | ID: | |
|---|---|---|---|

| YEAR 3 - FALL SEMESTER | | | Crs | Gr | Notes |
|---|---|---|---|---|---|
| HVAC | 285 | HVAC System Design using BIM (Department approval) | 2 | | |
| HVAC | 321 | HVAC Air Side System Select-Design (HVAC 285 co-requisite and Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management prerequisite) | 4 | | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116)- (Students who took MATH 115 shall take MATH 120) | 4 | | |
| HVAC | 342 | Load Calculation & Energy Code (HVAC 285 co-requisite and Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management prerequisite) | 4 | | |
| ENGL | 311 | Advanced Technical Writing | 3 | | |
| | | Total | 17 | | |
| YEAR 3 - SPRING SEMESTER | | | Crs | Gr | Notes |
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 285, 321 & 342) | 4 | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 285, 321 & 342, or HVAC 285, 322, & 342) | 4 | | |
| HVAC | 325 | HVAC Hydronic System Select-Design (C- or better in HVAC 285, 321, & 342) | 4 | | |
| | | Scientific Understanding Elective | 4 | | |
| MATH | | Students who took MATH 115 and MATH 120 shall take MATH 130 | | | |
| | | Total | 16 | | |
| YEAR 3 - SUMMER SEMESTER | | | Crs | Gr | Notes |
| HVAC | 393 | Summer Internship (C- or better in HVAC 313, 326 & 350 or HVAC 312, 325 & 350) | 4 | | |
| | | Total | 4 | | |
| YEAR 4 - FALL SEMESTER | | | Crs | Gr | Notes |
| HVAC | 415 | Direct Digital Control (C- or better in HVAC 393 & MATH 126) | 4 | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in HVAC 393 & MATH 126) | 4 | | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in HVAC 393 & MATH 126) | 4 | | |
| | | Cultural Enrichment Elective | 3 | | |
| | | Total | 15 | | |
| YEAR 4 - SPRING SEMESTER | | | Crs | Gr | Notes |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, 451 & 462) | 4 | | |
| ECON | 221 | Principles of Economics 1 | 3 | | |
| | | Cultural Enrichment Elective | 3 | | |
| | | Social Awareness Elective | 3 | | |
| | | Total | 13 | | |

Learning Outcomes Include: 1) analyze & select commercial/industrial HVAC systems for specific applications, 2) design commercial/industrial HVAC systems, given design parameters, building type, & geographic location, 3) select secondary equipment for specific commercial/industrial ducting & piping systems, 4) select primary equipment for specific commercial/industrial ducting & piping systems, 5) commission a commercial or industrial HVAC system, 6) perform an energy audit of an actual facility; analyze utilities for proper applications of rate; analyze O&M (Operation & Maintenance) and ECMs (Energy Conservation Measures) for potential energy savings; determine feasibility using payback calculations, 7) utilize & develop estimates, specifications, economic costs, & analyze codes & standards, 8) program control sequences for specific commercial & industrial HVAC systems & equipment.

Ferris State University
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Program Academic Requirements

| Student: | | | Code | Location | Crs |
|---|---|---|---|---|---|
| email: | | ID: | | Ferris | |
| Advisor: | | Ph: | 1 | Transfer | |

| | | MAJOR | Cr | Gr | Pts | S | Yr | Code | Notes |
|---|---|---|---|---|---|---|---|---|---|
| HVAC | 313 | HVAC Control Theory and Applications (HVAC 342 with a grade of C- or better) | 3 | | | | | | |
| HVAC | 314 | HVAC Control Laboratory (HVAC 313 with a grade of C- or better) | 1 | | | | | | |
| HVAC | 322 | Air Systems Select-Design (HVAC 342 & HVAC 313 with a grade of C- or better) | 3 | | | | | | |
| HVAC | 323 | Air Systems Laboratory (HVAC 322 with a grade of C- or better) | 1 | | | | | | |
| HVAC | 326 | Hydronic System Selection & Design (HVAC 322, HVAC 313 & HVAC 342 with a grade of C- or better) | 3 | | | | | | |
| HVAC | 327 | Hydronic Laboratory (HVAC 326 co-requisite) | 1 | | | | | | |
| HVAC | 342 | Load Analysis & Energy Modeling (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | |
| HVAC | 350 | Contracting Issues in HVACR (HVAC 342 with a grade of C- or better) | 4 | | | | | | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 325 & 350) | 4 | | | | | | |
| HVAC | 415 | Direct Digital Control (C- or better in HVAC 393 & MATH 126) | 4 | | | | | | |
| | | TECHNICAL RELATED | | | | | | | |
| ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | 2 | | | | | | |
| | | COMMUNICATIONS COMPETENCE | | | | | | | |
| ENGL | 331 | Advanced Technical Writing | 3 | | | | | | |
| | | QUANTITATIVE SKILLS | | | | | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | | | | | |
| | | SCIENTIFIC UNDERSTANDING | | | | | | | |
| | | Scientific Understanding Elective | 4 | | | | | | |
| | | CULTURAL ENRICHMENT | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | SOCIAL AWARENESS | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | |
| ECON | 221 | Principles of Economics 1 | 3 | | | | | | |

Unofficial Statistics

| | |
|---|---|
| Major: Total Crs / Earned Crs / Honor Points | 40 |
| Degree: Total Crs / Earned Crs / Honor Points | 65 |
| GPA Major: | - |
| GPA Degree: | - |

Bachelor of Science General Education Requirements:
One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr)
Multiple requirements may be satisfied by a single course.
Cultural Enrichment – 9 credits (3 credits in course > 100 level), Social Awareness - 9credits (3 credits in course > 100 level)
[Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

Ferris State University
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

Course Sequence Guide

| Student: | | | | ID: | |
|---|---|---|---|---|---|
| Fall | HVAC | 342 | Load Analysis & Energy Modeling (Admission to BS in HVACR Engineering Technology) | | 4 |
| Spring | HVAC | 313 | HVAC Control Theory and Applications (HVAC 342 with a grade of C- or better) | | 3 |
| Summer | HVAC | 322 | Air Systems Select-Design (HVAC 342 & HVAC 313 with a grade of C- or better) | | 3 |
| Summer | HVAC | 323 | Air Systems Laboratory (HVAC 322 with a grade of C- or better) | | 1 |
| Summer | HVAC | 314 | HVAC Control Laboratory (HVAC 313 with a grade of C- or better) | | 1 |
| Summer | HVAC | 327 | Hydronic Laboratory (HVAC 326 co-requisite) | | 1 |
| Fall | HVAC | 326 | Hydronic System Selection & Design (HVAC 322, HVAC 313 & HVAC 342 with a grade of C- or better) | | 3 |
| Spring | HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321 and HVAC 342) | | 4 |
| Summer | HVAC | 451 | Energy Audit and Analysis (C- or better in HVAC 393 & MATH 126) | | 4 |
| Fall | HVAC | 415 | Direct Digital Control (C- or better in HVAC 393 & MATH 126) | | 4 |
| Spring | HVAC | 462 | Primary Equipment Selection (C- or better in HVAC 393 & MATH 126) | | 4 |
| Summer | HVAC | 499 | Commercial HVAC System Design (HVAC 415, and HVAC 451, HVAC 462 all with a grade of C- or better) | | 4 |
| | HVAC | 393 | Summer Internship (C- or better in HVAC 312, 325 & 350) | | 4 |
| | ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | | 2 |
| | ECON | 221 | Principles of Economics 1 | | 3 |
| | | | Social Awareness Elective | | 3 |
| | | | Cultural Enrichment Elective | | 3 |
| | | | Cultural Enrichment Elective | | 3 |
| | | | Scientific Understanding Elective | | 4 |
| | MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) Students who took MATH 115 and MATH 120 shall take MATH 130 | | 4 |
| | ENGL | 311 | Advanced Technical Writing | | 3 |
| | | | | Total | 65 |

Learning Outcomes Include: 1) analyze & select commercial/industrial HVAC systems for specific applications, 2) design commercial/industrial HVAC systems, given design parameters, building type, & geographic location, 3) select secondary equipment for specific commercial/industrial ducting & piping systems, 4) select primary equipment for specific commercial/industrial ducting & piping systems, 5) commission a commercial or industrial HVAC system, 6) perform an energy audit of an actual facility & analyze utilities for proper applications; Operation & Maintenance & Energy Conservation Measures for potential energy savings; & implementation feasibility using payback calculations, 7) **understand** utilize & develop estimates, specs, economic costs, & analysis codes & standards, 8) program control sequences for specific commercial & industrial HVAC systems & equipment.

FORM D – Proposed: Online Students

Ferris State University
Imagine More

**Bachelor of Science Degree**

# HVACR Engineering Technology and Energy Management

**Program Academic Requirements**

| Student | | Number | | Contact | |
|---|---|---|---|---|---|

| Major | | | Cr | Notes | Grade |
|---|---|---|---|---|---|
| HVAC | 285 | HVAC System Design using BIM (Department approval) | 2 | | |
| HVAC | 313 | HVAC Control Theory and Applications (C- or better in HVAC 285 & 342) | 3 | | |
| HVAC | 314 | HVAC Control Laboratory (C- or better in HVAC 313) | 1 | | |
| HVAC | 322 | Air Systems Select-Design (C- or better in HVAC 285, 313, & 342) | 3 | | |
| HVAC | 323 | Air Systems Laboratory (C- or better in HVAC 322) | 1 | | |
| HVAC | 326 | Hydronic System Selection & Design (C- or better in HVAC 285, 322, 313 & 342) | 3 | | |
| HVAC | 327 | Hydronic Laboratory (HVAC 326 co-requisite) | 1 | | |
| HVAC | 342 | Load Calculation & Energy Code (HVAC 285 co-requisite and Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management prerequisite) | 4 | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 285, 321 & 342, or HVAC 285, 322, & 342) | 4 | | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 313, 326 & 350 or HVAC 312, 325 & 350) | 4 | | |
| HVAC | 415 | Direct Digital Control (C- or better in HVAC 393 & MATH 126) | 4 | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in HVAC 393 & MATH 126) | 4 | | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in HVAC 393 & MATH 126) | 4 | | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, 451 & 462) | 4 | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 42 | | |
| | | COMMUNICATIONS COMPETENCE | | | |
| ENGL | 311 | Advanced Technical Writing | 3 | | |
| | | QUANTITATIVE SKILLS | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | |
| | | SCIENTIFIC UNDERSTANDING | | | |
| | | Scientific Understanding Elective | 4 | | |
| | | CULTURAL ENRICHMENT | | | |
| | | Cultural Enrichment Elective | 3 | | |
| | | Cultural Enrichment Elective | 3 | | |
| | | SOCIAL AWARENESS | | | |
| | | Social Awareness Elective | 3 | | |
| ECON | 221 | Principles of Economics 1 | 3 | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 65 | | |

ADMISSION REQUIREMENTS: Students entering the HVACR Engineering Technology and Energy Management program must have completed the HVACR Technology program at Ferris or an equivalent A.A.S. program at another institution (or equivalent) with a minimum 2.5 GPA. In addition, students should possess computer literacy skills and have completed college intermediate algebra and trigonometry and a scientific understanding course.

PROGRESSION REQUIREMENTS: Progression in the program requires a "C-" or better in all HVAC coursework.

GRADUATION REQUIREMENTS: The HVACR Engineering Technology and Energy Management program at Ferris leads to a bachelor of science degree. Graduation requires a minimum 2.0 GPA in the major and overall. A minimum of 30 credits must be earned at Ferris for this degree, and a minimum of 40 credits must be 300 and 400 level courses. Taking all HVAC courses in this checksheet fulfills these requirements. Students must complete all general education requirements as outlined on the General Education website.

BACHELOR OF SCIENCE GENERAL EDUCATION REQUIREMENTS:

One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr) Multiple requirements may be satisfied by a single course.

Cultural Enrichment – 9 credits (3 credits in course > 100 level), Social Awareness - 9credits (3 credits in course > 100 level) [Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

FSU SUNSET POLICY: If a student returns to the university after an interrupted enrollment of two semesters (not including summer semester), the requirements of the curriculum (including General Education) which are in force at the time of return must be met, not the requirements in effect at the time of original admission. In special circumstances, the academic department head/chair/coordinator/director may permit the student to finish under the program requirements in force at the time of original admission to the program.

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

Course Sequence Guide

Student: | ID:

| Course Sequence | | | | Crs | Gr | Notes |
|---|---|---|---|---|---|---|
| Summer | HVAC | 285 | HVAC System Design using BIM (Department approval) | 2 | | |
| Fall | HVAC | 342 | Load Calculation & Energy Code (HVAC 285 co-requisite and Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management prerequisite) | 4 | | |
| Spring | HVAC | 313 | HVAC Control Theory and Applications (C- or better in HVAC 285 & 342) | 3 | | |
| Summer | HVAC | 322 | Air Systems Select-Design (C- or better in HVAC 285, 313, & 342) | 3 | | |
| Fall | HVAC | 326 | Hydronic System Selection & Design (C- or better in HVAC 285, 322, 313 & 342) | 3 | | |
| Spring | HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 285, 321 & 342, or HVAC 285, 322, & 342) | 4 | | |
| Summer | HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in HVAC 393 & MATH 126) | 4 | | |
| Summer | HVAC | 323 | Air Systems Laboratory (C- or better in HVAC 322) | 1 | | |
| Summer | HVAC | 314 | HVAC Control Laboratory (C- or better in HVAC 313) | 1 | | |
| Summer | HVAC | 327 | Hydronic Laboratory (HVAC 326 co-requisite) | 1 | | |
| Fall | HVAC | 415 | Direct Digital Control (C- or better in MATH 126 & HVAC 393) | 4 | | |
| Spring | HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in MATH 126 & HVAC 393) | 4 | | |
| Summer | HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, 451 & 462) | 4 | | |
| To be taken as student's schedule allows | HVAC | 393 | Summer Internship (C- or better in HVAC 313, 326 & 350 or HVAC 312, 325 & 350) | 4 | | |
| | ECON | 221 | Principles of Economics 1 | 3 | | |
| | | | Social Awareness Elective | 3 | | |
| | | | Cultural Enrichment Elective | 3 | | |
| | | | Cultural Enrichment Elective | 3 | | |
| | | | Scientific Understanding Elective | 4 | | |
| | MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116). Students who took MATH 115 and MATH 120 shall take MATH 130 | 4 | | |
| | ENGL | 311 | Advanced Technical Writing | 3 | | |
| | | | Total | 65 | | |

Learning Outcomes Include: 1) analyze & select commercial/industrial HVAC systems for specific applications, 2) design commercial/industrial HVAC systems, given design parameters, building type, & geographic location, 3) select secondary equipment for specific commercial/industrial ducting & piping systems, 4) select primary equipment for specific commercial/industrial ducting & piping systems, 5) commission a commercial or industrial HVAC system, 6) p **perform an energy audit of an actual facility; analyze utilities for proper applications of rate; analyze O&M (Operation & Maintenance) and ECMs (Energy Conservation Measures) for potential energy savings; determine feasibility using payback calculations**, 7) utilize & develop estimates, specs, economic costs, & analysis codes & standards, 8) program control sequences for specific commercial & industrial HVAC systems & equipment.

COURSE INFORMATION FORM

FORM E

Effective Fall 2015

Complete all items below (New or Current)

Check all boxes where modifications are being made.

## Course Identification

☐Prefix (current) Click here to enter text. ☐Number (current)Click here to enter text. Contact Hours (current): Click here to enter text.

Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☒Prefix (proposed) HVAC ☒Number (proposed)285 Contact Hours (proposed): 4, 1 lecture, 3 lab

Lecture ☒Lab ☒ Seminar ☐ [Enter contact hours per week in blank above.]

☐Title (current):Click here to enter text.

☒ Title (proposed): HVAC System Design using BIM

☐Credit Hours (current):Click here to enter text. ☐Prerequisites (current): Click here to enter text.☐Co-requisites (current): Click here to enter text.

☒Credit Hours (proposed):2 ☒Prerequisites (proposed): Department approval ☐Co-requisites (proposed): None

☐Course Description (current) 125 words maximum: Click here to enter text.

☒Course Description (proposed) 125 words maximum: Design of mechanical systems for buildings using Building Information Modeling (BIM). For HVAC students only.

☐Course Outcomes and Assessment Plan (current): Click here to enter text.

☒Course Outcomes and Assessment Plan (proposed):

| Course Outcomes | Assessment Plan |
|---|---|
| 1. Define BIM and Revit terms | Locally developed comprehensive exams |
| 2. Start, open and save projects | Portfolio |
| 3. Create foundational project elements (datum (levels), elevations, 2D and 3D views, details, legends, schedules, sheets, families) | Portfolio |
| 4. Apply view commands (zoom, pan, rotate, visual styles, detail level, hide/reveal/filter elements, visibility/graphic overrides, reference planes, 2D and 3D sections, camera and walkthrough views) | Portfolio |
| 5. Identify and employ user interface tools (quick access toolbar, status bar, application menu, ribbon, options bar, navigation cube, project browser, properties palette, navigation bar, system browser, status bar) | Portfolio |
| 6. Load, insert, select, and edit components (families) | Portfolio |
| 7. Modify elements (move, copy, rotate, offset, align, spit, mirror, trim, extend, array) | Portfolio |
| 8. Create spaces and zones | Portfolio |
| 9. Prepare, analyze and export heating and cooling loads | Portfolio |
| 10. Add, connect, and modify mechanical equipment, ducts and pipes, fittings, accessories, insulation and lining | Portfolio |

| | |
|---|---|
| 11. Create, modify, test, and inspect HVAC systems | Portfolio |
| 12. Create, modify, annotate, and print construction documents (sheets, details, schedules, legends, tags) | Portfolio |

☐Course Outline including Time Allocation (current): Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☒Course Outline including Time Allocation (proposed):

| NO. | Course Outline | Time Allocation |
|---|---|---|
| 1 | Introduction | 5% |
| 2 | Basic Drawing and Modify Tools | 10% |
| 3 | Basic HVAC Systems Tools | 10% |
| 4 | HVAC Systems Projects | 15% |
| 5 | Working with Views | 5% |
| 6 | Spaces and Zones | 5% |
| 7 | Energy Analysis | 10% |
| 8 | HVAC Networks | 15% |
| 9 | Advanced Systems for HVAC | 15% |
| 10 | Construction Documents | 5% |
| 11 | Tags, Schedules, Details | 5% |
| | Total Hours | 100% |

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

COURSE INFORMATION FORM

FORM E
Effective Fall 2015

Complete all items below (New or Current)
Check all boxes where modifications are being made.

Course Identification
☐Prefix (current) HVAC ☐Number (current)313 Contact Hours (current): 3
Lecture 3 ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Prefix (proposed) Click here to enter text. ☐Number (proposed)Click here to enter text. Contact Hours (proposed): Click here to enter text.
Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Title (current):Control Theory – Application 1
☐ Title (proposed): Click here to enter text.

☐Credit Hours (current):3 ☒Prerequisites (current): HVAC 332 with a grade of C- or better.☐Co-requisites (current): Click here to enter text.
☐Credit Hours (proposed):Click here to enter text. ☒Prerequisites (proposed): C- or better in HVAC 285 & 342 ☒Co-requisites (proposed): Click here to enter text.
☐Course Description (current) 125 words maximum: The study of control loop theory related to commercial and industrial comfort, process and safety applications. The course focuses on analog electronic and pneumatic control components and their systems used in new and existing installations.
☐Course Description (proposed) 125 words maximum: Click here to enter text.

☐Course Outcomes and Assessment Plan (current):

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Terminology<br>A. Apply control terminology.<br>B. Identify control system components by name. |
| II. | Loop Components<br>A. Identify low and high volume pneumatic control systems.<br>B. Identify process variable and final control device for a specific control loop.<br>C. Identify an open or closed control loop.<br>D. Identify a control loop used for safety.<br>E. Identify the feedback utilized in a control loop. |
| III. | Elements of a Transfer Function<br>A. Apply the following terms:<br>a. Throttling range<br>b. Proportional gain<br>c. Proportional band<br>d. Gain<br>e. Error<br>f. Bias<br>g. Setpoint<br>h. Signal path, type and terminations |
| IV. | Application of a Transfer Function<br>A. Calculate a transfer function for a sensor and then utilize to calibrate the sensor.<br>B. Utilize transfer functions to predict signal values for controllers and final control device positions.<br>C. Apply setpoint reset to multiple applications |
| V. | Sensors<br>A. Apply proper installation, best practice, calibration, handling and termination of sensors of all types.<br>B. Plot a sensor response in a computer application.<br>C. Create a spreadsheet for calculating and graphing a linear transfer function. |
| VI. | Controllers<br>A. Understand the types of controllers (electronic, pneumatic, digital). |

| | |
|---|---|
| | B. Understand the different modes of control (2 position, timed two position, incremental, Proportional (P), Proportional + Integral (PI), Proportional + Integral + Derivative (PID), Proportional + Derivative (PD).<br>C. Utilize a tuning process to return a process with an unstable controller to a steady state error.<br>D. Identify different loop responses (underdamped, overdamped, critically damped, unstable with increasing amplitude, unstable with constant amplitude)<br>E. Examine linear response and response over time of a control loop. |
| VII. | Process Characteristics<br>A. Select a controller output based on calculated thermal characteristics of sample spaces. |
| VIII. | Modulating Final Control Devices<br>A. Identify the various components that make up a control valve.<br>B. Identify the various types of control valves.<br>C. Identify the various ways to connect valves to a system.<br>D. Identify how various control valves are applied.<br>E. Identify the following control valve engineering terms: (size, authority, CV).<br>F. Identify the various components that make up a damper.<br>G. Identify the various types of dampers.<br>H. Identify the various ways to connect dampers.<br>I. Identify how various dampers are applied.<br>J. Size and select control valves for a sample project. |
| IX. | Documentation<br>A. Use control plans and specifications.<br>B. Understand changes made to control documentation, including: RFI, bulletin, addendum.<br>C. Generate control documentation for a sample project using plans and specs., includes the following documents:<br>a. Flow diagram<br>b. Point schedule<br>c. Wiring detail<br>d. Bill of material |

## Minimum Required Student Laboratory Activities

| | |
|---|---|
| I. | Identify commercial control components for Air Handling, Hot and Chilled Water systems. |
| II. | Student will calculate transfer function for several system components. |
| III. | Student will examine current control literature and graph sensor functions. |
| IV. | Student will perform point verification for multiple HVAC systems. |
| V | Student will Commission multiple HVAC systems. Student will use Question and Answer programming to create an Application Specific program. Student will examine Proportional and Integral response in a functional loop. |
| VI. | Student will assemble and calibrate a pneumatic control loop. Student will examine loop operation and correct malfunctioning loop. |

Click here to enter text.

☐Course Outcomes and Assessment Plan (proposed): Click here to enter text.

☐Course Outline including Time Allocation (current):

## Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding of control terminology, equipment and documentation
2. Describing loop components and configurations
3. Understanding and applying transfer functions
4. Performing control valve and damper sizing and selection
5. Understanding and application of control modes and process characteristics
6. Performing modulating control loop calibration

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lab Hours |
|---|---|---|

| | | |
|---|---|---|
| I. | Terminology | 3 |
| II. | Loop Components | 6 |
| III. | Elements of a Transfer Function | 6 |
| IV. | Application of a Transfer Function | 3 |
| V. | Sensors | 3 |
| VI. | Controllers | 6 |
| VII. | Process Characteristics | 3 |
| VIII. | Modulating Final Control Devices | 3 |
| IX. | Documentation | 12 |
| | Total Hours | 45 |

Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐Course Outline including Time Allocation (proposed): Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

COURSE INFORMATION FORM

FORM E

Effective Fall 2015

Complete all items below (New or Current)
Check all boxes where modifications are being made.

Course Identification

☐Prefix (current) HVAC ☐Number (current) 321 Contact Hours (current): 6
Lecture 3 ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Prefix (proposed) Click here to enter text. ☐Number (proposed)Click here to enter text. Contact Hours (proposed): Click here to enter text.
Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Title (current):HVAC Air System Select-Design
☐ Title (proposed): Click here to enter text.

☐Credit Hours (current):3 X Prerequisites (current):Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management ☐Co-requisites (current): Click here to enter text.
☐Credit Hours (proposed):Click here to enter text. X Prerequisites (proposed): Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management X Co-requisites (proposed): HVAC 285
☐Course Description (current) 125 words maximum: A study of air systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.
☐Course Description (proposed) 125 words maximum: Click here to enter text.

☐Course Outcomes and Assessment Plan (current):
Learning Outcomes and Assessment for Each Instructional Unit
Assessment Code:

1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | Assessment |
|---|---|---|
| | | |
| I. | Introduction | |
| II. | Applied Psychrometrics<br>A. Review basic psychrometrics.<br>B. Apply psychrometrics to the air system design process | 1.<br>2.<br>3. |
| III. | Air Diffusion<br>A. Determine type, size and location of diffusers and grilles.<br>B. Determine location and size of ventilation air intake.<br>C. Determine location and size of exhaust air grille. | 1.<br>2.<br>3. |
| IV. | Ductwork<br>A. Calculate cross-sectional area of a duct.<br>B. Calculate velocity of air in a duct.<br>C. Calculate volume of air in a duct.<br>D. Determine space air flow requirements.<br>E. Determine type, size and routing of duct system (including ventilation air intake and exhau ducts). | 1.<br>2.<br>3. |
| V. | Air System Pressure Loss Calculations<br>A. Find fitting loss coefficients from tabular data.<br>B. Calculate friction loss in a duct system.<br>C. Utilize manufacturer's computer software to calculate duct system friction loss. | 1.<br>2.<br>3. |
| VI. | Air System Configuration<br>A. Describe the components and operating characteristics of a(n)<br>a. single zone air system.<br>b. terminal reheat air system.<br>c. dual-duct air system. | 1.<br>2. |

| | | |
|---|---|---|
| | d. Multizone air system.<br>e. variable air volume system.<br>f. variable volume, variable temperature (VVT) system.<br>g. induction air system. | |
| VII. | Fan Selection and Performance<br>A. Identify two main categories of fans.<br>a. forward curve fans.<br>b. backward inclined and air foil fans.<br>c. radial blade fans.<br>d. propeller fans.<br>e. vane-axial fans.<br>f. tube-axial fans.<br>B. Select a fan from manufacturer's performance data.<br>C. Use fan laws to plot system curve on fan performance curve.<br>D. Select proper motor horsepower for circulating fan.<br>E. Describe effects of varying fan volume on fan performance curve. | 1.<br>2.<br>3. |
| VIII. | Duct System Design Procedure<br>A. Utilizing all available information design an air system in its entirety (diffuser to fan). | 1.<br>2.<br>3. |
| IX. | Air System Testing and Balancing<br>A. Identify and summarize the function of instruments used to balance air systems.<br>B. Determine actual operating characteristics of fans.<br>C. Determine flow rates of air systems using various flow measuring devices.<br>D. Calculate the resistance in a ductwork system. | 1.<br>2.<br>3. |

Click here to enter text.

☐Course Outcomes and Assessment Plan (proposed): Click here to enter text.

☐Course Outline including Time Allocation (current): Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hou | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Applied Psychrometrics | 6 | 6 |
| III. | Air Diffusion | 6 | 3 |
| IV. | Ductwork | 5 | 3 |
| V. | Air System Pressure Loss Calculations | 3 | 6 |
| VI. | Air System Configurations | 6 | 3 |
| VII. | Fan Selection and Performance | 6 | 6 |
| VIII. | Duct System Design Procedure | 6 | 6 |
| IX. | Air System Testing and Balancing | 3 | 6 |
| X. | Exams | 3 | 6 |
| | | | |
| | Total Hours | 45 | 45 |

Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐Course Outline including Time Allocation (proposed): Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

COURSE INFORMATION FORM

FORM E
Effective Fall 2015

Complete all items below (New or Current)
Check all boxes where modifications are being made.

Course Identification HVAC 322 Air Systems Select Design
☐Prefix (current) HVAC ☐Number (current)322 Contact Hours (current): 3
Lecture ☐3 Lab ☐ 0 Seminar ☐ [Enter contact hours per week in blank above.]

☐Prefix (proposed) Click here to enter text. ☐Number (proposed)Click here to enter text. Contact Hours (proposed): Click here to enter text.
Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Title (current):Air Systems Select Design
☐ Title (proposed): Click here to enter text.

☐Credit Hours (current):3 ☒Prerequisites (current): Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management ☐Co-requisites (current): Click here to enter text.
☐Credit Hours (proposed):Click here to enter text. ☒Prerequisites (proposed): C- or better in HVAC 285, 313 & 342☐Co-requisites (proposed): Click here to enter text.
☐Course Description (current) 125 words maximum: A study of air systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort. Prerequisites: Admission to the Online Bachelor of Science in HVAC Engineering Technology and Energy Management.

☐Course Description (proposed) 125 words maximum: Click here to enter text.

☐Course Outcomes and Assessment Plan (current):

Learning Outcomes and Assessment for Each Instructional Unit

Assessment Code:
1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications. Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | Assessment |
|---|---|---|
| | | |
| I. | Introduction | |
| II. | Applied Psychrometrics<br>A. Review basic psychrometrics.<br>B. Apply psychrometrics to the air system design process | 1.<br>2.<br>3. |
| III. | Air Diffusion<br>A. Determine type, size and location of diffusers and grilles.<br>B. Determine location and size of ventilation air intake.<br>C. Determine location and size of exhaust air grille. | 1.<br>2.<br>3. |
| IV. | Ductwork<br>A. Calculate cross-sectional area of a duct.<br>B. Calculate velocity of air in a duct.<br>C. Calculate volume of air in a duct.<br>D. Determine space air flow requirements.<br>E. Determine type, size and routing of duct system (including ventilation air intake and exhaust ducts). | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| V. | Air System Pressure Loss Calculations<br>A. Find fitting loss coefficients from tabular data.<br>B. Calculate friction loss in a duct system.<br>C. Utilize manufacturer's computer software to calculate duct system friction loss. | 1.<br>2.<br>3. |
| VI. | Air System Configuration<br>A. Describe the components and operating characteristics of a(n)<br>a. single zone air system.<br>b. terminal reheat air system.<br>c. dual-duct air system.<br>d. Multizone air system.<br>e. variable air volume system.<br>f. variable volume, variable temperature (VVT) system.<br>g. induction air system. | 1.<br>2. |
| VII. | Fan Selection and Performance<br>A. Identify two main categories of fans.<br>a. forward curve fans.<br>b. backward inclined and air foil fans.<br>c. radial blade fans.<br>d. propeller fans.<br>e. vane-axial fans.<br>f. tube-axial fans.<br>B. Select a fan from manufacturer's performance data.<br>C. Use fan laws to plot system curve on fan performance curve.<br>D. Select proper motor horsepower for circulating fan.<br>E. Describe effects of varying fan volume on fan performance curve. | 1.<br>2.<br>3. |
| VIII. | Duct System Design Procedure<br>A. Utilizing all available information design an air system in its entirety (diffuser to fan). | 1.<br>2.<br>3. |
| IX. | Air System Testing and Balancing<br>A. Identify and summarize the function of instruments used to balance air systems.<br>B. Determine actual operating characteristics of fans.<br>C. Determine flow rates of air systems using various flow measuring devices.<br>D. Calculate the resistance in a ductwork system. | 1.<br>2.<br>3. |

☐Course Outcomes and Assessment Plan (proposed): Click here to enter text.

☐Course Outline including Time Allocation (current):

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Applied Psychrometrics | 6 | 2 |
| III. | Air Diffusion | 6 | 1 |
| IV. | Ductwork | 5 | 3 |
| V. | Air System Pressure Loss Calculations | 3 | 2 |
| VI. | Air System Configurations | 6 | 4 |
| VII. | Fan Selection and Performance | 6 | 3 |
| VIII. | Duct System Design Procedure | 6 | 3 |
| IX. | Air System Testing and Balancing | 3 | 0 |
| X. | Exams | 3 | 2 |
| | | | |
| | Total Hours | 45 | 20* |

NOTE: * - The Lab learning components will be delivered via on-line lectures and on-line assessment, the "Hands-On" learning will be delivered through HVAC323 when the on-line students come to Ferris for the face-to-face class delivery.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐Course Outline including Time Allocation (proposed): Click here to enter text.
Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

COURSE INFORMATION FORM

FORM E
Effective Fall 2015

Complete all items below (New or Current)
Check all boxes where modifications are being made.

Course Identification

☐Prefix (current) HVAC ☐Number (current)325 Contact Hours (current): 6
Lecture 3 ☐Lab 3 ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Prefix (proposed) Click here to enter text. ☐Number (proposed)Click here to enter text. Contact Hours (proposed): Click here to enter text.
Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Title (current):HVAC Hydronic System Select-Design
☐ Title (proposed): Click here to enter text.

☐Credit Hours (current):4 ☒Prerequisites (current): C- (or better) in HVAC 321, HVAC 342 ☐Co-requisites (current): Click here to enter text.

☐Credit Hours (proposed):Click here to enter text. ☒Prerequisites (proposed): C- or better in HVAC 285, 321, 342 ☐Co-requisites (proposed): Click here to enter text.
☐Course Description (current) 125 words maximum: A study of water systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.
☐Course Description (proposed) 125 words maximum: Click here to enter text.

☐Course Outcomes and Assessment Plan (current):

Learning Outcomes and Assessment for Each Instructional Unit

Assessment Code:

1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | Assessment |
|---|---|---|
| I. | Introduction | |
| II. | Hydronic System Definition and Classification<br>A. Classify hydronic systems based upon flow generation, temperature, pressure, piping and pumping arrangement.<br>B. Explain the advantages and disadvantages of various piping and pumping arrangements.<br>C. Calculate primary and secondary flowrates and temperatures in primary-secondary pumping arrangements. | 1.<br>2. |
| III. | Terminal Devices<br>A. Determine type, size and location of finned tube radiation units.<br>B. Determine type, size and location of hot water convector units.<br>C. Determine type, size and location of cabinet unit heaters.<br>D. Determine type, size and location of unit heaters. | 1.<br>2.<br>3. |
| IV. | Hydronic System Design Procedure<br>A. Select terminal devices based on load requirements and calculate the required flow of water for each temperature control zone.<br>B. Determine pipe size required to carry desired water flowrate based upon friction loss and velocity.<br>C. Calculate equivalent length of pipe fittings in piping network. | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | D. Calculate friction loss of piping circuits.<br>E. Determine pressure losses of equipment and terminal units from manufacturer's data.<br>F. Calculate total head loss in closed loop piping systems.<br>G. Use pump affinity laws to plot system curve on pump performance curve for closed loop piping system.<br>H. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>I. Calculate total head loss in open piping systems.<br>J. Use pump affinity laws to plot system curve on pump performance curve for open loop piping system.<br>K. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>L. Select proper motor horsepower for circulating pump from manufacturer's performance data.<br>M. Develop parallel pump performance curves and identify operating points.<br>N. Develop series pump performance curves and identify operating points.<br>O. Analyze the effects of glycol on pump performance.<br>P. Determine the type, size and location of the system expansion tank.<br>Q. Utilize manufacturer's computer software to calculate piping system friction loss.<br>R. Utilize manufacturer's computer software to select proper circulating pump.<br>S. Utilize manufacturer's computer software to select proper expansion tank size. | |
| V. | Flow Control Devices<br>A. Explain the application of various service valves in hydronic systems.<br>B. Explain the relationship between heat transfer, temperature differential and flow through a terminal convection element.<br>C. Explain the relationship between valve port configuration and stem travel.<br>D. Explain the relationship between energy transfer and valve stem travel for various valve types.<br>E. Define the control flow coefficient (Cv).<br>F. Select two-way modulating and three-way mixing and diverting valves using the flow coefficient (Cv). | 1.<br>2.<br>3. |
| VI. | Pumps<br>A. Identify the components and summarize the operation of a centrifugal pump.<br>B. Explain the relationship between flowrate and total dynamic head in a closed hydronic system.<br>C. Explain the difference between open and closed hydronic systems. | 1.<br>2.<br>3. |
| VII. | Balancing Hydronic Systems<br>A. Identify and summarize the function of instruments used to balance hydronic systems.<br>B. Determine circulating pump impeller size.<br>C. Determine actual operating characteristics of circulating pump.<br>D. Determine flow rates of hydronic circuits using various flow measuring devices.<br>E. Calculate resistance necessary to pre-balance hydronic circuit.<br>F. Determine new impeller size to produce required flowrate. | 1.<br>2.<br>3. |

Click here to enter text.

☐Course Outcomes and Assessment Plan (proposed): Click here to enter text.

☐Course Outline including Time Allocation (current):

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Hydronic System Definition and Classification | 2 | 3 |
| III. | Terminal Devices | 6 | 3 |
| VI. | Hydronic System Design Procedure | 12 | 15 |
| V. | Flow Control Devices | 9 | 6 |
| VI. | Pumps | 9 | 6 |
| VII. | Balancing Hydronic Systems | 3 | 6 |
| VIII. | Exams | 3 | 6 |

| | | | |
|---|---|---|---|
| | Total Hours | 45 | 45 |

Click here to enter text.
Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐Course Outline including Time Allocation (proposed): Click here to enter text.
Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

COURSE INFORMATION FORM

FORM E
Effective Fall 2015

Complete all items below (New or Current)
Check all boxes where modifications are being made.

Course Identification
☐Prefix (current) HVAC ☐Number (current)326 Contact Hours (current): 3
Lecture 3 ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Prefix (proposed) Click here to enter text. ☐Number (proposed)Click here to enter text. Contact Hours (proposed): Click here to enter text.
Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Title (current):Hydronic Systems Select-Design
☐ Title (proposed): Click here to enter text.

☐Credit Hours (current):3 ☒Prerequisites (current): C- (or better) in HVAC 322☐Co-requisites (current): Click here to enter text.
☐Credit Hours (proposed):Click here to enter text. ☒Prerequisites (proposed): C- or better in HVAC 285, 322, 313 & 342 ☐Co-requisites (proposed): Click here to enter text.
☐Course Description (current) 125 words maximum: A study of water systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.
☐Course Description (proposed) 125 words maximum: Click here to enter text.

☐Course Outcomes and Assessment Plan (current): Learning Outcomes and Assessment for Each Instructional Unit

Assessment Code:

1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | Assessment |
|---|---|---|
| I. | Introduction | |
| II. | Hydronic System Definition and Classification<br>A. Classify hydronic systems based upon flow generation, temperature, pressure, piping and pumping arrangement.<br>B. Explain the advantages and disadvantages of various piping and pumping arrangements.<br>C. Calculate primary and secondary flowrates and temperatures in primary-secondary pumping arrangements. | 1.<br>2. |
| III. | Terminal Devices<br>A. Determine type, size and location of finned tube radiation units.<br>B. Determine type, size and location of hot water convector units.<br>C. Determine type, size and location of cabinet unit heaters.<br>D. Determine type, size and location of unit heaters. | 1.<br>2.<br>3. |
| IV. | Hydronic System Design Procedure<br>A. Select terminal devices based on load requirements and calculate the required flow of water for each temperature control zone.<br>B. Determine pipe size required to carry desired water flowrate based upon friction loss and velocity.<br>C. Calculate equivalent length of pipe fittings in piping network.<br>D. Calculate friction loss of piping circuits.<br>E. Determine pressure losses of equipment and terminal units from manufacturer's data.<br>F. Calculate total head loss in closed loop piping systems.<br>G. Use pump affinity laws to plot system curve on pump performance curve for closed loop piping system.<br>H. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>I. Calculate total head loss in open piping systems.<br>J. Use pump affinity laws to plot system curve on pump performance curve for open loop piping system. | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | K. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>L. Select proper motor horsepower for circulating pump from manufacturer's performance data.<br>M. Develop parallel pump performance curves and identify operating points.<br>N. Develop series pump performance curves and identify operating points.<br>O. Analyze the effects of glycol on pump performance.<br>P. Determine the type, size and location of the system expansion tank.<br>Q. Utilize manufacturer's computer software to calculate piping system friction loss.<br>R. Utilize manufacturer's computer software to select proper circulating pump.<br>S. Utilize manufacturer's computer software to select proper expansion tank size. | |
| V. | Flow Control Devices<br>A. Explain the application of various service valves in hydronic systems.<br>B. Explain the relationship between heat transfer, temperature differential and flow through a terminal convection element.<br>C. Explain the relationship between valve port configuration and stem travel.<br>D. Explain the relationship between energy transfer and valve stem travel for various valve types.<br>E. Define the control flow coefficient (Cv).<br>F. Select two-way modulating and three-way mixing and diverting valves using the flow coefficient (Cv). | 1.<br>2.<br>3. |
| VI. | Pumps<br>A. Identify the components and summarize the operation of a centrifugal pump.<br>B. Explain the relationship between flowrate and total dynamic head in a closed hydronic system.<br>C. Explain the difference between open and closed hydronic systems. | 1.<br>2.<br>3. |
| VII. | Balancing Hydronic Systems<br>A. Identify and summarize the function of instruments used to balance hydronic systems.<br>B. Determine circulating pump impeller size.<br>C. Determine actual operating characteristics of circulating pump.<br>D. Determine flow rates of hydronic circuits using various flow measuring devices.<br>E. Calculate resistance necessary to pre-balance hydronic circuit.<br>F. Determine new impeller size to produce required flowrate. | 1.<br>2.<br>3. |

Click here to enter text.

☐Course Outcomes and Assessment Plan (proposed): Click here to enter text.

☐Course Outline including Time Allocation (current):

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Hydronic System Definition and Classification | 2 | 3 |
| III. | Terminal Devices | 6 | 3 |
| VI. | Hydronic System Design Procedure | 12 | 3 |
| V. | Flow Control Devices | 9 | 4 |
| VI. | Pumps | 9 | 4 |
| VII. | Balancing Hydronic Systems | 3 | 1 |
| VIII. | Exams | 3 | 2 |
| | Total Hours | 45 | 20* |

Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐Course Outline including Time Allocation (proposed): Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

COURSE INFORMATION FORM

FORM E
Effective Fall 2015

Complete all items below (New or Current)
Check all boxes where modifications are being made.

Course Identification

☐Prefix (current) HVAC ☐Number (current)312 Contact Hours (current): 4
Lecture 3 ☐Lab 3☒ Seminar ☐ [Enter contact hours per week in blank above.]

☐Prefix (proposed) Click here to enter text. ☐Number (proposed)Click here to enter text. Contact Hours (proposed): Click here to enter text.
Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Title (current):Control Theory – Application 1
☐ Title (proposed): Click here to enter text.

☐Credit Hours (current):3 ☒Prerequisites (current): C- or better in HVAC 321 and HVAC 342. ☐Co-requisites (current): Click here to enter text.
☐Credit Hours (proposed):Click here to enter text. ☒Prerequisites (proposed): C- or better in HVAC 285, 321 & 342 ☐Co-requisites (proposed): Click here to enter text.
☐Course Description (current) 125 words maximum: The study of control loop theory related to commercial and industrial comfort, process and safety applications. The course focuses on analog electronic and pneumatic control components and their systems used in new and existing installations.
☐Course Description (proposed) 125 words maximum: Click here to enter text.

☐Course Outcomes and Assessment Plan (current):

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Terminology<br>C. Apply control terminology.<br>D. Identify control system components by name. |
| II. | Loop Components<br>F. Identify low and high volume pneumatic control systems.<br>G. Identify process variable and final control device for a specific control loop.<br>H. Identify an open or closed control loop.<br>I. Identify a control loop used for safety.<br>J. Identify the feedback utilized in a control loop. |
| III. | Elements of a Transfer Function<br>B. Apply the following terms:<br>a. Throttling range<br>b. Proportional gain<br>c. Proportional band<br>d. Gain<br>e. Error<br>f. Bias<br>g. Setpoint<br>h. Signal path, type and terminations |
| IV. | Application of a Transfer Function<br>D. Calculate a transfer function for a sensor and then utilize to calibrate the sensor.<br>E. Utilize transfer functions to predict signal values for controllers and final control device positions.<br>F. Apply setpoint reset to multiple applications |
| V. | Sensors<br>D. Apply proper installation, best practice, calibration, handling and termination of sensors of all types.<br>E. Plot a sensor response in a computer application.<br>F. Create a spreadsheet for calculating and graphing a linear transfer function. |
| VI. | Controllers<br>F. Understand the types of controllers (electronic, pneumatic, digital).<br>G. Understand the different modes of control (2 position, timed two position, incremental, Proportional (P), Proportional + Integral (PI), Proportional + Integral + Derivative (PID), Proportional + Derivative (PD). |

| | |
|---|---|
| | H. Utilize a tuning process to return a process with an unstable controller to a steady state error.<br>I. Identify different loop responses (underdamped, overdamped, critically damped, unstable with increasing amplitude, unstable with constant amplitude)<br>J. Examine linear response and response over time of a control loop. |
| VII. | Process Characteristics<br>B. Select a controller output based on calculated thermal characteristics of sample spaces. |
| VIII. | Modulating Final Control Devices<br>K. Identify the various components that make up a control valve.<br>L. Identify the various types of control valves.<br>M. Identify the various ways to connect valves to a system.<br>N. Identify how various control valves are applied.<br>O. Identify the following control valve engineering terms: (size, authority, CV).<br>P. Identify the various components that make up a damper.<br>Q. Identify the various types of dampers.<br>R. Identify the various ways to connect dampers.<br>S. Identify how various dampers are applied.<br>T. Size and select control valves for a sample project. |
| IX. | Documentation<br>D. Use control plans and specifications.<br>E. Understand changes made to control documentation, including: RFI, bulletin, addendum.<br>F. Generate control documentation for a sample project using plans and specs., includes the following documents:<br>a. Flow diagram<br>b. Point schedule<br>c. Wiring detail<br>d. Bill of material |

Minimum Required Student Laboratory Activities

| | |
|---|---|
| I. | Identify commercial control components for Air Handling, Hot and Chilled Water systems. |
| II. | Student will calculate transfer function for several system components. |
| III. | Student will examine current control literature and graph sensor functions. |
| IV. | Student will perform point verification for multiple HVAC systems. |
| V | Student will Commission multiple HVAC systems. Student will use Question and Answer programming to create an Application Specific program. Student will examine Proportional and Integral response in a functional loop. |
| VI. | Student will assemble and calibrate a pneumatic control loop. Student will examine loop operation and correct mal-functioning loop. |

Click here to enter text.

☐Course Outcomes and Assessment Plan (proposed): Click here to enter text.

☐Course Outline including Time Allocation (current):

Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

7. Understanding of control terminology, equipment and documentation
8. Describing loop components and configurations
9. Understanding and applying transfer functions
10. Performing control valve and damper sizing and selection
11. Understanding and application of control modes and process characteristics
12. Performing modulating control loop calibration

Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lab Hours |
|---|---|---|
| I. | Terminology | 3 |
| II. | Loop Components | 6 |
| III. | Elements of a Transfer Function | 6 |

| | | |
|---|---|---|
| IV. | Application of a Transfer Function | 3 |
| V. | Sensors | 3 |
| VI. | Controllers | 6 |
| VII. | Process Characteristics | 3 |
| VIII. | Modulating Final Control Devices | 3 |
| IX. | Documentation | 12 |
| | Total Hours | 45 |

Click here to enter text.
Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐Course Outline including Time Allocation (proposed): Click here to enter text.
Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

COURSE INFORMATION FORM

FORM E
Effective Fall 2015

Complete all items below (New or Current)
Check all boxes where modifications are being made.

Course Identification: Load Analysis-Energy Modeling (HVAC 342)
☐Prefix (current) HVAC ☐Number (current)342 Contact Hours (current): 6
Lecture 3☐Lab 3 ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Prefix (proposed) Click here to enter text. ☐Number (proposed)Click here to enter text. Contact Hours (proposed): Click here to enter text.
Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Title (current):Load Analysis-Energy Modeling
☐ Title (proposed): Click here to enter text.

☐Credit Hours (current):4 ☒Prerequisites (current): Admission to Bachelor of Science in HVAC Engineering Technology (code HVAC)☐Co-requisites (current): Click here to enter text.
☐Credit Hours (proposed):Click here to enter text. ☒Prerequisites (proposed): Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management ☒Co-requisites (proposed): HVAC 285
☐Course Description (current) 125 words maximum: Complete heat loss and gain calculations for commercial and industrial buildings will be performed manually and through currently available computer software. Student will layout and design systems for maximum energy efficiency. Energy estimating methods will be studied and an analysis of an actual building using the Performance Rating Method as described in ASHRAE Standard 90.1 appendix G. Current federal, state and local codes and standards will be examined as they apply to HVAC systems.

☐Course Description (proposed) 125 words maximum: Click here to enter text.

☐Course Outcomes and Assessment Plan (current):
Upon Completion of each Instructional unit, the learner will be able to satisfactorily: Students satisfactorily completing this course will achieve proficiency in:

1. Heat loss calculations for commercial and industrial buildings.
2. Heat gain calculations for commercial and industrial buildings.
3. Using psychrometrics in the equipment selection process.
4. HVAC load calculation and system design
5. Understanding the different energy estimating methods.

| | |
|---|---|
| I. | Introduction<br>E. Define the overview of the load calculation and building simulation process. |
| II. | Building Heat Transfer<br>A. Define all the factors that affect heat transfer in a building.<br>B. Define heat transfer due to conduction<br>C. Define heat transfer due to convection<br>D. Define heat transfer due to radiation<br>E. Define R-value and U-value<br>F. Calculate total R-value and U-value<br>G. Define infiltration<br>H. Define sensible and latent load<br>I. Define lighting, equipment and people loads |
| III. | Heat Loss Load Calculations<br>A. List the total heat gains and heat losses for a net heat loss condition (heating or winter condition).<br>B. Use the conduction manual formula to calculate a heat loss transfer.<br>C. Use the convection manual formula to calculate a heat loss transfer.<br>D. Use reference standards and handbooks to determine R and U values.<br>E. Use reference standards and handbooks to determine design heating weather data.<br>F. Perform manual calculations to determine total heat loss for a small building.<br>G. Perform computer calculation to determine total heat loss for a small building. |

| | |
|---|---|
| | H. Use manual calculations to validate the computer data for heat loss. |
| IV. | Heat Gain Load Calculations<br>A. List the total heat gains and heat losses for a net heat gain condition (cooling or summer condition).<br>B. Use the conduction manual formula to calculate a heat gain transfer.<br>C. Use the convection manual formula to calculate a heat gain transfer.<br>D. Use reference standards and handbooks to determine design cooling weather data.<br>E. Use reference standards and handbooks to determine heat gains from lighting, equipment and people.<br>F. Perform manual calculations to determine total heat gain for a small building.<br>G. Perform computer calculation to determine total heat gain for a small building.<br>H. Use manual calculations to validate the computer data for heat gain. |
| V. | Psychrometric Process for Equipment Selection<br>A. Determine the psychrometric process for a particular system or building design.<br>B. Understand the heating psychrometric process.<br>C. Understand the cooling psychrometric process.<br>D. Using the psychrometric process determine the design entering and leaving coil conditions for design and equipment selection purposes. |
| VI. | HVAC System Design<br>A. Outline the basic steps in the HVAC equipment design process.<br>B. List criteria for system design.<br>C. List criteria for plant design.<br>D. List criteria for terminal unit design. |
| VII. | Energy Estimating Methods<br>A. Define what balance point temperature is.<br>B. Define heating degree day and cooling degree day energy estimating method.<br>C. Using reference sources for heating degree day information, use in a simple energy savings formula.<br>D. Define what the bin energy estimating method is.<br>E. Define what the correlation energy estimating method is.<br>F. Using manufacturers' correlation data, calculate the energy savings in a simple heat loss or gain problem.<br>G. Describe how computer programs calculate heat loss and heat gain.<br>H. Using the computer program, calculate the energy saving between two different energy conservation measures. |

Minimum Required Student Laboratory Activities

| | |
|---|---|
| I. | Student will discuss the need for load calculations and energy estimating methods. |
| II. | Student will diagram the total heat losses and gains for both the summer condition and the winter condition. The student will define and use all of the basic heat transfer formulas. |
| III. | Student will perform a manual heat loss calculation. The student will perform a computer heat loss calculation. |
| IV. | Student will perform a manual heat gain calculation. The student will perform a computer heat gain calculation. |
| V. | Student will plot several psychrometric processes for both heating and cooling applications. |
| VI. | Student will enter appropriate system, plant and terminal unit design considerations into a building simulation program. |
| VII. | Student will perform several manual energy estimating method calculations on a variety of different systems within a project building. Students will start a real building for future use in the HVAC451 course. All data will be collected and a load calculation run. |

Click here to enter text.

☐**Course Outcomes and Assessment Plan (proposed):** Click here to enter text.

☐Course Outline including Time Allocation (current): Student Learning Outcomes

Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Building heat transfer | 2 | 0 |
| III. | Heat Loss load calculations | 12 | 12 |
| IV. | Heat gain load calculations | 12 | 15 |

| | | | |
|---|---|---|---|
| V. | Psychrometrics and equipment selection | 6 | 6 |
| VI. | HVAC system design | 3 | 6 |
| VII. | Energy Estimating Methods | 6 | 6 |
| VIII. | Exams | 3 | 0 |

Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐Course Outline including Time Allocation (proposed): Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

COURSE INFORMATION FORM

FORM E

Effective Fall 2015

Complete all items below (New or Current)
Check all boxes where modifications are being made.

Course Identification

☐Prefix (current) HVAC ☐Number (current)350 Contact Hours (current): 6
Lecture 3 ☐Lab 3 ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Prefix (proposed) Click here to enter text. ☐Number (proposed)Click here to enter text. Contact Hours (proposed): Click here to enter text.
Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Title (current):Contracting Issues in HVACR
☐ Title (proposed): Click here to enter text.

☐Credit Hours (current):4 ☒Prerequisites (current): C- or better in HVAC 321 and HVAC 342☐Co-requisites (current): Click here to enter text.
☐Credit Hours (proposed):Click here to enter text. ☒Prerequisites (proposed): C- or better in HVAC 285, 321 & 342, or HVAC 285, 322, & 342 ☐Co-requisites (proposed): Click here to enter text.
☐Course Description (current) 125 words maximum: The study of contracting issues as related to the HVACR industry. The course focuses on plans and specifications, estimating, budget issues, project management, economic cost analysis and codes and standards, all from the perspective of an HVACR professional. Lab exercises focus on application of contracting issues to a sample project.

☐Course Description (proposed) 125 words maximum: Click here to enter text.

☐Course Outcomes and Assessment Plan (current):

Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Specifications<br>A. Define the divisions and numbering system used in specification.<br>B. Predictably locate specific information using the above system.<br>C. Identify all new industry specification formats<br>D. Define the role of the Construction Specification Institute in construction documentation.<br>E. Define terms and conditions<br>F. Define cost impact from terms and conditions<br>G. Complete sample documentation including: (method of procedure, AIA billing, approved change orders, insurance needs for material not on site, schedule of values, bulletin, addendum) |
| II. | Plans<br>A. Locate and understand abbreviations.<br>B. Locate and understand symbols.<br>C. Utilize abbreviations and symbols in a sample project.<br>D. Identify types of details and their links to other drawings.<br>E. Define the use of Mechanical schedules.<br>F. Use schedules to locate specific mechanical information.<br>G. Develop a mechanical schedule for a sample project.<br>H. Locate discrepancies between plans and specs.<br>I. Identify the cost impact of discrepancies between plans and specs.<br>J. Define what an addendum is and how it impacts bid form format.<br>K. Define what a bulletin is and identify situations for use.<br>L. Identify and complete documentation for discrepancy resolution, including: RFI, Bulletin and Addendum. |
| III. | Estimating<br>A. Define the different estimating methods: (manual and software).<br>B. Define scope of work for mechanical trades and identify issues.<br>C. Complete a scope of work for a sample project.<br>D. Define a Bid / negotiated job including: bid documents, customer relations, spec. reference to owner's authority, issues related to negotiated work.<br>E. Define a Design / build job including: advantages / disadvantages, customer relations, code compliance and plan review. |

| | |
|---|---|
| | F. Define a Bid / specification job including: sources of opportunity (builders exchange), public vs. private bid, bid requirements (bonding, insurance), bid documents, specific issues relative to bid and spec. jobs.<br>G. Identify issues regarding material, including: billing, shipping, storage, insurance, incorrect, schedule of value and unit pricing.<br>H. Define what targeted work is and issues including: union vs. private, long term benefits, actual cost of work.<br>I. Identify equipment needed for job.<br>J. Identify equipment issues including: responsibility, operating implications, temporary heating, enclosures, unit pricing, warranty start, shipping and availability (job schedule).<br>K. Perform a mechanical take-off including: piping, duct, controls, primary and secondary equipment<br>L. Identify labor concerns and issues including: union vs. non-union, prevailing wage, job site foreman, skills needed vs. skill available, per diem.<br>M. Define the term burden<br>N. Define the term Risk and items associated with the following: designer, mechanical contractor, piping contractor, sheet metal contractor, control contractor, sub-contracted work.<br>O. Perform a risk analysis for a sample job.<br>P. Define terms and conditions and their implications.<br>Q. Define warranty and the following issues: jobsite specifics, early equipment start-up, start date, owner acceptance, certificate of occupancy, significant completion and contract requirements.<br>R. Identify the roles of general and sub contractors on a job.<br>S. Develop a flow chart of job site hierarchy.<br>T. Define the risk of sub-contracting.<br>U. Identify sub-contractors cost methods including: unit pricing, detailed bid, time and material, single line bid.<br>V. Identify site specific requirements including: rough in, minority contracting, scheduling, general terms and conditions, parking, trash removal, after hour work, staging areas, and special equipment.<br>W. Identify and define other misc. estimated areas including: drug testing, background checks, safety training, customer training, set up and tear down, trade coordination, weather issues, etc. |
| IV. | Budget Issues<br>A. Define the process of discovery including customer interview.<br>B. Develop a quick budget.<br>C. Define risk analysis and thresh hold of risk. |
| V. | Project Management<br>A. Define the post award of bid steps.<br>B. Define the Project Management Professional (PMP)<br>C. Identify the PMP certificate process<br>D. Develop a project management plan for a sample project.<br>E. Define scope review and identify duplication of responsibility.<br>F. Define scheduling including the following topics: gant schedule, project contractor meeting, manpower, delivery, equipment and critical path.<br>G. Identify and define job documents including: change orders, submittals, bulletin, addendum, bid alternate, RFI, pencil copy, RFP, RFQ, job close out, payment app.<br>H. Identify equipment rental needs.<br>I. Identify security and safety issues including compliance and documentation.<br>J. Identify coordination issues with other trades.<br>K. Identify sub-contractor issues and scheduling.<br>L. Define quality control issues.<br>M. Identify personnel issues including: safety, drug screening, job site etiquette. |
| VI. | Codes and Standards<br>A. Identify and define the following code and standard organizations: ASHRAE, SMACNA, IESNA, ANSI, OSHA, ISO.<br>B. Determine the applicable code from local, state, federal, international.<br>C. Correctly use and interpret a code book.<br>D. Identify what an inspector wants.<br>E. Define the term standards of care. |
| VII. | Economic Analysis<br>A. Define the following financial terms:<br>a. Net present value<br>b. Discount rate<br>c. Rate-of-Return (ROR)<br>d. Return-on-investment (ROI)<br>e. Inflation<br>f. Depreciation |

| | |
|---|---|
| | g. Taxes<br>h. Fuel Cost Escalation<br>B. Define methods of cash flow analysis including: simple payback, life cycle cash flow analysis (present worth method & annual cash flow method).<br>C. Utilize available software to perform cash flow analysis. |

Minimum Required Student Laboratory Activities

| | |
|---|---|
| I. | Identify pertinent areas within a specification regarding a specific job. |
| II. | Student will existing plans to answer job specific question. Student will develop a mechanical equipment schedule. |
| III. | Student will complete a scope of work, mechanical take-off, risk analysis, and develop a flow chart as key components in an estimate. |
| IV. | Student will develop a quick budget for a sample job. |
| V. | Student will layout basic information and concerns for a sample job, including scheduling. |
| VI. | Student will utilize a variety of codes to comply with a sample job. |
| VII. | Student will do a manual economic cost analysis on a sample job. |

Click here to enter text.

☐Course Outcomes and Assessment Plan (proposed): Click here to enter text.

☐Course Outline including Time Allocation (current): **Learning Outcomes and Assessment for Each Instructional Unit**

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding and utilization of plans and specifications
2. Understanding and developing an HVACR estimate
3. Identifying and handling budgetary issues
4. Understanding and performing key duties of Project Management
5. Understanding and utilization of appropriate codes and standards
6. Performing an economic cost analysis

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Specifications | 3 | 3 |
| II. | Plans | 3 | 3 |
| III. | Estimating | 12 | 12 |
| IV. | Budget Issues | 3 | 3 |
| V. | Project Management | 6 | 6 |
| VI. | Codes and Standards | 6 | 6 |
| VII. | Economic Analysis | 10 | 12 |
| VIII. | Evaluation | 2 | 0 |
| | Total Hours | 45 | 45 |

Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐Course Outline including Time Allocation (proposed): Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

COURSE INFORMATION FORM

FORM E
Effective Fall 2015

Complete all items below (New or Current)
Check all boxes where modifications are being made.

Course Identification
☐Prefix (current) HVAC ☐Number (current)393 Contact Hours (current): 4
Lecture 4 ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Prefix (proposed) Click here to enter text. ☐Number (proposed)Click here to enter text. Contact Hours (proposed): Click here to enter text.
Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Title (current):Summer Internship
☐ Title (proposed): Click here to enter text.

☐Credit Hours (current):4 ☒ Prerequisites (current): C- or better in HVAC 312, 325 & 350 ☐Co-requisites (current): Click here to enter text.
☐Credit Hours (proposed):Click here to enter text. ☒ Prerequisites (proposed): C- or better in HVAC 313, 326 & 350 or HVAC 312, 325 & 350 ☐Co-requisites (proposed): Click here to enter text.
☐Course Description (current) 125 words maximum:
☐Course Description (proposed) 125 words maximum: Click here to enter text.

☐Course Outcomes and Assessment Plan (current): Ten week minimum work experience. Students will gain a variety of commercial and industrial system and energy related experiences to include in part or in whole: new and retrofit system selection and design (including CAD); load calculation and system analysis or problem solving; system balance (testing, adjusting & balancing); system commissioning; control balancing and control work; energy related experience (e.g. energy auditing a payback calculation); estimating, bidding and proposal development; project management.
Click here to enter text.
☐Course Outcomes and Assessment Plan (proposed):
☐Course Outline including Time Allocation (current):

Click here to enter text.
Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐Course Outline including Time Allocation (proposed): Click here to enter text.
Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

## COURSE INFORMATION FORM

## FORM E

Effective Fall 2015

Complete all items below (New or Current)
Check all boxes where modifications are being made.

### Course Identification

☐Prefix (current) HVAC ☐Number (current)451 Contact Hours (current): 6
Lecture 3 ☐Lab 3 ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Prefix (proposed) Click here to enter text. ☐Number (proposed)Click here to enter text. Contact Hours (proposed): Click here to enter text.
Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Title (current):Energy Audit and Analysis
☐ Title (proposed): Click here to enter text.

☐Credit Hours (current):4 ☒ Prerequisites (current): HVAC 393 and MATH 126 all with a grade of C- or better.☐Co-requisites (current): Click here to enter text.
☐Credit Hours (proposed):Click here to enter text. ☒Prerequisites (proposed): C- or better in HVAC 393 & MATH 126☐Co-requisites (proposed): Click here to enter text.
☐Course Description (current) 125 words maximum: The survey of utility rate structures, billing energy consumption, and energy profiling of commercial and industrial buildings. On-site audit projects will report on recommendations to building envelopes, HVACR systems, and control systems, with regard to paybacks. Oral and written presentations are a requirement of this senior project course. This course meets General Education Requirements: Writing Intensive.

☐Course Description (proposed) 125 words maximum: Click here to enter text.

☐Course Outcomes and Assessment Plan (current):

### Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding and evaluating various utility tariffs.
2. Understanding the history and politics of energy.
3. Conducting all forms of energy audit.
4. Building envelope evaluation and O&M/ECM recommendation.
5. HVAC system evaluation and O&M/ECM recommendation.
6. Lighting & Other electrical evaluation and O&M/ECM recommendation.
7. Application of energy estimating methods.

Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Units of Energy | 1 | 0 |
| II. | Energy History / Energy Audit Types / Energy code / Standards | 9 | 3 |
| III. | Utility Bill Analysis | 8 | 6 |
| IV. | Energy Estimating Methods | 3 | 3 |
| V. | Envelope, HVAC, Lighting & Other Electric Improvements | 12 | 12 |
| VI. | Steam systems | 6 | 3 |
| VII. | Technical Assistance Audit and Class Project | 3 | 18 |
| VIII. | Evaluation | 3 | 0 |
| | Total Hours | 45 | 45 |

Click here to enter text.
☐Course Outcomes and Assessment Plan (proposed): Click here to enter text.

☐Course Outline including Time Allocation (current): Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Units of Energy<br>A. Define the units of energy for various energy sources.<br>B. Apply the appropriate energy unit in energy calculations. |
| II. | Energy History / Energy Audit Types / Energy Code / Standards<br>A. Explain the recent history of energy conservation<br>B. Differentiate between the three types of energy audits (walk thru, mini-audit and technical assistance audit.<br>C. Apply the correct energy audit type for a given situation.<br>D. Perform all steps in all forms of energy audits.<br>E. Utilize current energy codes and standards during the course of an energy audit.<br>F. Make recommendations utilizing current energy codes and standards. |
| III. | Utility Bill Analysis<br>A. Define the various rate structures for electricity.<br>B. Calculate an electric bill at various rate structures.<br>C. Define the terms demand, kW, capacity and power.<br>D. Define the terms electrical use, consumption, kWh and energy.<br>E. Define cost recovery factor.<br>F. Define electrical surcharges.<br>G. Define and calculate power factor.<br>H. Accurately read electrical meters.<br>I. Make recommendations on local vs. de-regulated electrical purchase.<br>J. Calculate the correct tax exemption status for manufacturing buildings.<br>K. Define the various rate structures for gas (natural and propane).<br>L. Define the various rate structures for other energy sources.<br>M. Use computer spreadsheets to assist in utility bill analysis.<br>N. Use utility billing history to establish a utility use baseline.<br>O. Use utility billing for building comparison to other similar buildings. |
| IV. | Energy Estimating Methods<br>A. Define, calculate and utilize the degree day method of energy estimating method.<br>B. Define, calculate and utilize the bin energy estimating method.<br>C. Define, calculate and utilize the correlation energy estimating method.<br>D. Define and utilize complex computer energy estimating methods.<br>E. Explain the strengths and limitations of each method. |
| V. | Envelope, HVAC, Lighting & Other Electric Improvements<br>A. Evaluate a building's envelope and make energy recommendations.<br>B. Evaluate a building's HVAC systems and make energy recommendations.<br>C. Evaluate a building's Lighting and other electrical and make energy recommendations.<br>D. Use various hand calculations to determine energy savings in all the above areas.<br>E. Use computer design and load programs to determine complex energy savings situations for all of the above areas.<br>F. Establish a ranked order of Operation and Maintenance recommendations according to simple payback.<br>G. Establish a ranked order of Energy Conservation Measures according to simple payback. |
| VI. | Steam Systems<br>A. Define basic steam principles.<br>B. Utilize the appropriate steam charts.<br>C. Recognize and describe various steam systems and components.<br>D. Evaluate a buildings steam system and make energy recommendations. |
| VII. | Technical Assist Audit and Class Project<br>A. Collect on-site data for a technical assist audit.<br>B. Analyze utility billing for project building.<br>C. Establish an energy usage history for project building.<br>D. Place all collected data into a load calculation and computer simulation program.<br>E. Evaluate building envelope, HVAC systems, Lighting and other electrical systems, Control systems for optimal energy efficiency and building performance.<br>F. Calculate energy savings for operational and maintenance issues.<br>G. Calculate energy savings for energy conservation measures.<br>H. Develop a detailed, professional energy audit report.<br>I. Deliver the energy audit results in a formal presentation. |

Minimum Required Student Laboratory Activities

| | |
|---|---|
| I. | Student will collect accurate information on a project building, including: envelope data, HVAC data, lighting data, control data, other electrical data, and utility data. |

| | |
|---|---|
| II. | Student will use above data, blueprints and building specifications to develop a building simulation. |
| III. | Student will use various hand calculations to validate the outcome of the computer simulation. |
| IV. | Student will use the building simulation program to test complex "what if" energy savings measures to determine rank order of payback. |
| V. | Student will write up a professional energy audit report including the following sections: Building history, Utility history, Computer profile, Mechanical system information, Control information, Lighting & other electrical information, Operational and Maintenance Recommendations, Energy conservation measure recommendations. |
| VI. | Student will deliver an oral presentation to Ferris staff and students on energy audit findings. |
| VII. | Student will deliver an oral presentation to the building owner and representatives. |

Click here to enter text.
Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐Course Outline including Time Allocation (proposed): Click here to enter text.
Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

COURSE INFORMATION FORM

FORM E

Effective Fall 2015

Complete all items below (New or Current)
Check all boxes where modifications are being made.

Course Identification

☐Prefix (current) HVAC ☐Number (current)499 Contact Hours (current): 8
Lecture 2 ☐Lab 6 ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Prefix (proposed) Click here to enter text. ☐Number (proposed)Click here to enter text. Contact Hours (proposed): Click here to enter text.
Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☐Title (current):Commercial HVAC System Design
☐ Title (proposed): Click here to enter text.

☐Credit Hours (current):4 ☒ Prerequisites (current): HVAC 415, HVAC 451, and HVAC 462, all with a grade of C- or better.☐Co-requisites (current): Click here to enter text.

☐Credit Hours (proposed):Click here to enter text. ☒ Prerequisites (proposed): C- or better in HVAC 415, 451 & 462 ☐Co-requisites (proposed): Click here to enter text.

☐Course Description (current) 125 words maximum: Given building architectural plans, appropriate software, codes and standards and owner's requirements, students will select appropriate HVAC system, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation. This course meets General Education Requirements: Writing Intensive.

☐Course Description (proposed) 125 words maximum: Click here to enter text.

☐Course Outcomes and Assessment Plan (current):

Learning Outcomes and Assessment for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

Note: Each Learning unit has written assignments which build toward the final class project as this is a Capstone class, continual feedback is given t individual students as well as student groups as the final project is a group based learning project.

| | |
|---|---|
| I. | Introduction and Project Overview<br>A. Understand the purpose and course objectives<br>B. Understand the project timeline |
| II. | Design Procedure<br>A. Identify the processes of HVAC design |
| III. | System Analysis and Selection<br>A. Apply factors affecting zoning decisions to system selection.<br>B. Evaluate architectural considerations and its affect upon system selection.<br>C. Evaluate system configuration and performance in relationship to building and zoning considerations.<br>D. Evaluate economics in relationship to budgetary considerations (first cost and operating costs).<br>E. Summarize system performance.<br>F. Identify potential systems to meet performance requirements. |
| IV. | Base Load Information<br>A. Identify indoor design requirements based upon occupancy and applicable codes.<br>B. Identify indoor air quality requirements. |
| V. | Miscellaneous Base Load<br>A. Describe ventilation characteristics of various systems. |
| VI. | Initial Design Load<br>A. Assemble building base load information.<br>B. Calculate building base load.<br>C. Assemble building miscellaneous base load information.<br>D. Calculate miscellaneous base load.<br>E. Calculate building load. |
| VII. | Applied Load Analysis<br>A. Understand load analysis terminology.<br>B. Calculate equipment sizing loads.<br>C. Determine ventilation requirements for indoor air quality, economizer and building pressurization.<br>D. Perform load line analysis based upon design load. |

| | |
|---|---|
| | E. Identify preliminary control strategies and modes.<br>F. Identify methods to control humidity.<br>G. Apply psychrometric analysis. |
| VIII. | Equipment Selection<br>A. Identify critical conditions for cooling coil selection.<br>B. Select cooling coil.<br>C. Identify miscellaneous accessories.<br>D. Select air handling equipment.<br>E. Select chiller.<br>F. Select heat rejection equipment.<br>G. Identify critical conditions for heating coil selection.<br>H. Select heating coil.<br>I. Identify miscellaneous heating accessories.<br>J. Select boiler.<br>K. Identify availability and verify electrical rate structure.<br>L. Identify availability and verify fossil fuel rate structure.<br>M. Analyze applicability of energy enhancing systems. |
| IX. | Building Simulation<br>A. Input utility data.<br>B. Input building data.<br>C. Input plant data.<br>D. Generate component and annual energy costs. |
| X. | System Sizing and Layout<br>A. Select size and layout air distribution system.<br>B. Calculate air pressure losses and select fan.<br>C. Select size and layout water distribution system.<br>D. Calculate water pressure losses and select circulating pump. |
| XI. | Working Drawings<br>A. Identify standards and drawing arrangement.<br>B. Develop working drawings for piping, ductwork, details, schematics and control diagrams and schedules. |
| XII. | Specifications<br>A. Understand the purpose and format for mechanical specifications.<br>B. Understand the purpose and format for control specifications. |

Click here to enter text.

☐Course Outcomes and Assessment Plan (proposed): Click here to enter text.

☐Course Outline including Time Allocation (current): Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction and Project Overview | 1 | 0 |
| II. | Design Procedure | 1 | 0 |
| III. | System Analysis and Selection | 2 | 6 |
| IV. | Base Load Information | 2 | 12 |
| V. | Miscellaneous Base Load | 2 | 6 |
| VI. | Initial Design Load | 2 | 6 |
| VII. | Applied Load Analysis | 2 | 6 |
| VIII. | Equipment Selection | 4 | 6 |
| IX. | Building Simulation | 2 | 6 |
| X. | System Sizing and Layout | 3 | 12 |
| XI. | Working Drawings | 2 | 18 |
| XI. | Specifications | 2 | 6 |
| XII. | Project Report | 2 | 6 |
| XIII. | Exams | 3 | 0 |
| | Total Hours | 30 | 90 |

Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☐Course Outline including Time Allocation (proposed): Click here to enter text.

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

## CREATE NEW COURSE – Course Data Entry Form

FORM F-C

Effective Fall 2015

COMPLETE ALL SECTIONS BELOW. If this course is to be used as a prerequisite for other university courses, FORM F's that reflect the prerequisite change must be submitted for all those courses as well. See Appendix E for Completing Forms.

### I. ACTION TO BE TAKEN: CREATE A NEW COURSE

Desired Term Effective (6 digit code): 201705 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

### II. NEW COURSE ATTRIBUTES:

A. Course Prefix: HVAC B. Number: 285
C. Contact Hours: 4 (1 lecture, 3 lab) Lecture ☒Lab ☒ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]

Note: *uccmanualwforms10292015 E.10. II. c.* instructs initiators to enter how many contact hours per week students will be in lecture mode" and "enter how many contact hours per week students will be in laboratory mode." The check boxes above allow only a check or no check. It was not evident to the initiator how to enter the lecture/lab hours to comply with the instructions, so they were added in parenthesis following the contact hour quantity.

D. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]
E. Course Title: HVAC System Design using BIM [Limit to 30 characters including punctuation and spaces]
F. College Code: TE G. Department Code: HVAC H. Credit Hours: Variable ☐Fixed ☒
I. Minimum Credit Hours: 2 J. Maximum Credit Hours: 2 [Enter number is space.]
K. Hours May be Repeated for Extra Credit: Yes ☐ No ☒ If yes, max times Click here to enter text.Or max credits Click here to enter text. awarded.
L. Levels: Undergraduate ☒ Graduate ☐ Professional ☐
M. Grade Method: Normal Grading ☒ Credit/No Credit (Pass/Fail) ☐
N. Does proposed new course replace an equivalent course? Yes ☒ No ☐
O. Equivalent Course: Prefix: ARCH Number: 110
P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE. Design of mechanical systems for buildings using Building Information Modeling (BIM). For HVAC students only.

Q. Term Offered: F, SP, SU (FALL SPRING SUMMER) R. Max Section Enrollment: 16 Lecture: 16 Lab: 16
S. Prerequisites or Restrictions: If none, leave blank. Department Approval
T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces. Click here to enter text.

***To be completed by Academic Affairs Office:*** **Standards & Measures Coding and General Education Code**

Basic Skill (BS) ☐ General Education ☐ Occupational Education ☐ G E Codes: Click here to enter text.

UCC Chair Signature/Date

Academic Affairs Approval Signature/Date

**OFFICE OF THE REGISTRAR USE ONLY**

Date Rec'd: Click here to enter text. Date Completed: Click here to enter text. Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐

# MODIFY A COURSE – Course Data Entry Form

**FORM F-M**
Effective Fall 2015

## I. ACTION TO BE TAKEN: MODIFY A COURSE

Desired Term Effective (6 digit code): 201705 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

## II. COURSE TO BE MODIFIED: HVAC 312

A. Course Prefix: HVAC B. Number: 312

C. Course Title: Control Theory – Application

LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: S See Appendix E Instructions for Completing Forms.

III. MODIFICATIONS

A. Course Prefix: Click here to enter text. B. Number: Click here to enter text.

B. Contact Hours: Click here to enter text. Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]

C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]

D. Course Title: Click here to enter text. [Limit to 30 characters including punctuation and spaces]

E. College Code: Click here to enter text. G. Department Code: Click here to enter text. H. Credit Hours: Variable ☐Fixed ☐

I. Minimum Credit Hours: Click here to enter text. J. Maximum Credit Hours: Click here to enter text. [Enter number is space.]

K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Click here to enter text.Or max credits Click here to enter text. awarded.

L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐

M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐

N. Does proposed new course replace an equivalent course? Yes ☐ No ☐

O. Equivalent Course: Prefix: Click here to enter text. Number: Click here to enter text.

P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE. Click here to enter text.

Q. Term Offered: R. Max Section Enrollment: Lecture: Lab:

S. Prerequisites or Restrictions: If none, leave blank. C- or better in HVAC 285, 321 & 342

T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces. Click here to enter text.

| |
|---|
| *To be completed by Academic Affairs Office:* Standards & Measures Coding and General Education Code<br>Basic Skill (BS) ☐ General Education ☐ Occupational Education ☐ G E Codes: Click here to enter text. |

UCC Chair Signature/Date

Academic Affairs Approval Signature/Date

| |
|---|
| OFFICE OF THE REGISTRAR USE ONLY<br>Date Rec'd: Click here to enter text. Date Completed: Click here to enter text. Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐ |

# MODIFY A COURSE – Course Data Entry Form

FORM F-M

## I. ACTION TO BE TAKEN: MODIFY A COURSE
Effective Fall 2015

Desired Term Effective (6 digit code): 201705 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

## II. COURSE TO BE MODIFIED: HVAC 313

A. Course Prefix: HVAC B. Number: 313

C. Course Title: Control Theory – Application 1

LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: S See Appendix E Instructions for Completing Forms.

III. MODIFICATIONS

A. Course Prefix: B. Number:

B. Contact Hours: Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]

C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]

D. Course Title: [Limit to 30 characters including punctuation and spaces]

E. College Code: G. Department Code: H. Credit Hours: Variable ☐Fixed ☐

I. Minimum Credit Hours: J. Maximum Credit Hours: [Enter number is space.]

K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Or max credits awarded.

L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐

M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐

N. Does proposed new course replace an equivalent course? Yes ☐ No ☐

O. Equivalent Course: Prefix: Number:

P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE.

Q. Term Offered: R. Max Section Enrollment: Lecture: Lab:

S. Prerequisites or Restrictions: If none, leave blank. C- or better in HVAC 285 & 342

T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces.

UCC Chair Signature/Date

Academic Affairs Approval Signature/Date

| OFFICE OF THE REGISTRAR USE ONLY |
|---|
| Date Rec'd: Date Completed: Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐ |

## MODIFY A COURSE – Course Data Entry Form FORM F-M

### I. ACTION TO BE TAKEN: MODIFY A COURSE

Effective Fall 2015

Desired Term Effective (6 digit code): 201705 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

### II. COURSE TO BE MODIFIED:

A. Course Prefix: HVAC B. Number: 321

C. Course Title: HVAC Air System Select-Design

LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: S,T See Appendix E Instructions for Completing Forms.

### III. MODIFICATIONS

A. Course Prefix: B. Number:

B. Contact Hours: Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]

C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]

D. Course Title: [Limit to 30 characters including punctuation and spaces]

E. College Code: G. Department Code: H. Credit Hours: Variable ☐Fixed ☐

I. Minimum Credit Hours: J. Maximum Credit Hours: [Enter number is space.]

K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Or max credits awarded.

L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐

M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐

N. Does proposed new course replace an equivalent course? Yes ☐ No ☐

O. Equivalent Course: Prefix: Number:

P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE.

Q. Term Offered: R. Max Section Enrollment: Lecture: Lab:

S. Prerequisites or Restrictions: If none, leave blank. Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management

T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces. HVAC 285

UCC Chair Signature/Date Academic Affairs Approval Signature/Date

| OFFICE OF THE REGISTRAR USE ONLY |
|---|
| Date Rec'd: Date Completed: Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐ |

MODIFY A COURSE – Course Data Entry Form FORM F-M

## I. ACTION TO BE TAKEN: MODIFY A COURSE

Effective Fall 2015

Desired Term Effective (6 digit code): 201705 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

## II. COURSE TO BE MODIFIED: HVAC 322 Air Systems Select Design

A. Course Prefix: HVAC B. Number: 322

C. Course Title: Air Systems Select Design

LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: Q,S See Appendix E Instructions for Completing Forms.

## III. MODIFICATIONS

A. Course Prefix: B. Number:

B. Contact Hours: Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]

C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]

D. Course Title: [Limit to 30 characters including punctuation and spaces]

E. College Code: G. Department Code: H. Credit Hours: Variable ☐Fixed ☐

I. Minimum Credit Hours: J. Maximum Credit Hours: [Enter number is space.]

K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Or max credits awarded.

L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐

M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐

N. Does proposed new course replace an equivalent course? Yes ☐ No ☐

O. Equivalent Course: Prefix: Number:

P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE.

Q. Term Offered: F,SP,SU R. Max Section Enrollment: Lecture: Lab:

S. Prerequisites or Restrictions: If none, leave blank. C- or better in HVAC 285, 313 & 342 Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces.

UCC Chair Signature/Date

Academic Affairs Approval Signature/Date

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|---|
| Date Rec'd: Date Completed: Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐ |

# MODIFY A COURSE – Course Data Entry Form FORM F-M

## I. ACTION TO BE TAKEN: MODIFY A COURSE

Effective Fall 2015

Desired Term Effective (6 digit code): 201705 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

## II. COURSE TO BE MODIFIED:

A. Course Prefix: HVAC B. Number: 325
C. Course Title: HVAC Hydronic System Select-Design

LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: S See Appendix E Instructions for Completing Forms.

## III. MODIFICATIONS

A. Course Prefix: B. Number:
B. Contact Hours: Lecture ☐ Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]
C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]
D. Course Title: [Limit to 30 characters including punctuation and spaces]
E. College Code: G. Department Code: H. Credit Hours: Variable ☐ Fixed ☐
I. Minimum Credit Hours: J. Maximum Credit Hours: [Enter number is space.]
K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Or max credits awarded.
L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐
M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐
N. Does proposed new course replace an equivalent course? Yes ☐ No ☐
O. Equivalent Course: Prefix: Number:
P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE.

Q. Term Offered: R. Max Section Enrollment: Lecture: Lab:
S. Prerequisites or Restrictions: If none, leave blank. C- or better in HVAC 285, 321 & 342
T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces.

UCC Chair Signature/Date Academic Affairs Approval Signature/Date

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|---|
| Date Rec'd: Date Completed: Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐ |

MODIFY A COURSE – Course Data Entry Form FORM F-M

## I. ACTION TO BE TAKEN: MODIFY A COURSE

Effective Fall 2015

Desired Term Effective (6 digit code): 201705 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

## II. COURSE TO BE MODIFIED:

A. Course Prefix: HVAC B. Number: 326

C. Course Title: Hydronic Systems Select - Design

LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: Q,S See Appendix E Instructions for Completing Forms.

## III. MODIFICATIONS

A. Course Prefix: B. Number:
B. Contact Hours: Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]
C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]
D. Course Title: [Limit to 30 characters including punctuation and spaces]
E. College Code: G. Department Code: H. Credit Hours: Variable ☐Fixed ☐
I. Minimum Credit Hours: J. Maximum Credit Hours: [Enter number is space.]
K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Or max credits awarded.
L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐
M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐
N. Does proposed new course replace an equivalent course? Yes ☐ No ☐
O. Equivalent Course: Prefix: Number:
P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE.

Q. Term Offered: F,SU R. Max Section Enrollment: Lecture: Lab:
S. Prerequisites or Restrictions: If none, leave blank. C- or better in HVAC 285, 322, 313 & 342
T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces.

UCC Chair Signature/Date Academic Affairs Approval Signature/Date

| OFFICE OF THE REGISTRAR USE ONLY |
| --- |
| Date Rec'd: Date Completed: Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐ |

# MODIFY A COURSE – Course Data Entry Form  FORM F-M

## I. ACTION TO BE TAKEN: MODIFY A COURSE

Effective Fall 2015

Desired Term Effective (6 digit code): 201705 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

## II. COURSE TO BE MODIFIED:

A. Course Prefix: HVAC B. Number: 342

C. Course Title: Load Analysis-Energy Modeling

LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: Q ,S, T See Appendix E Instructions for Completing Forms.

## III. MODIFICATIONS

A. Course Prefix: B. Number:

B. Contact Hours: Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]

C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]

D. Course Title: [Limit to 30 characters including punctuation and spaces]

E. College Code: G. Department Code: H. Credit Hours: Variable ☐Fixed ☐

I. Minimum Credit Hours: J. Maximum Credit Hours: [Enter number is space.]

K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Or max credits awarded.

L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐

M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐

N. Does proposed new course replace an equivalent course? Yes ☐ No ☐

O. Equivalent Course: Prefix: Number:

P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE.

Q. Term Offered: F,SP,SU R. Max Section Enrollment: Lecture: Lab:

S. Prerequisites or Restrictions: If none, leave blank. Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management

T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces. HVAC 285

UCC Chair Signature/Date  Academic Affairs Approval Signature/Date

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| Date Rec'd: Date Completed: Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐ |

# MODIFY A COURSE – Course Data Entry Form

FORM F-M

## I. ACTION TO BE TAKEN: MODIFY A COURSE

Effective Fall 2015

Desired Term Effective (6 digit code): 201705 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

## II. COURSE TO BE MODIFIED:

A. Course Prefix: HVAC B. Number: 350

C. Course Title: Contracting Issues in HVACR

LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: S See Appendix E Instructions for Completing Forms.

## III. MODIFICATIONS

A. Course Prefix: B. Number:

B. Contact Hours: Lecture ☐ Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]

C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]

D. Course Title: [Limit to 30 characters including punctuation and spaces]

E. College Code: G. Department Code: H. Credit Hours: Variable ☐ Fixed ☐

I. Minimum Credit Hours: J. Maximum Credit Hours: [Enter number is space.]

K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Or max credits awarded.

L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐

M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐

N. Does proposed new course replace an equivalent course? Yes ☐ No ☐

O. Equivalent Course: Prefix: Number:

P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE.

Q. Term Offered: R. Max Section Enrollment: Lecture: Lab:

S. Prerequisites or Restrictions: If none, leave blank. C- or better in HVAC 285, 321 & 342, or HVAC 285, 322, & 342

T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces.

UCC Chair Signature/Date

Academic Affairs Approval Signature/Date

| OFFICE OF THE REGISTRAR USE ONLY |
|---|
| Date Rec'd: Date Completed: Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐ |

# MODIFY A COURSE – Course Data Entry Form FORM F-M

## I. ACTION TO BE TAKEN: MODIFY A COURSE

Effective Fall 2015

Desired Term Effective (6 digit code): 201705 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

## II. COURSE TO BE MODIFIED:

A. Course Prefix: HVAC B. Number: 393

C. Course Title: Summer Internship

LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: S See Appendix E Instructions for Completing Forms.

III. MODIFICATIONS

A. Course Prefix: B. Number:

B. Contact Hours: Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]

C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]

D. Course Title: [Limit to 30 characters including punctuation and spaces]

E. College Code: G. Department Code: H. Credit Hours: Variable ☐Fixed ☐

I. Minimum Credit Hours: J. Maximum Credit Hours: [Enter number is space.]

K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Or max credits awarded.

L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐

M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐

N. Does proposed new course replace an equivalent course? Yes ☐ No ☐

O. Equivalent Course: Prefix: Number:

P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE.

Q. Term Offered: R. Max Section Enrollment: Lecture: Lab:

S. Prerequisites or Restrictions: If none, leave blank. C- or better in HVAC 313, 326 & 350 or HVAC 312, 325 & 350

T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces.

UCC Chair Signature/Date Academic Affairs Approval Signature/Date

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|---|
| Date Rec'd: Date Completed: Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐ |

MODIFY A COURSE – Course Data Entry Form FORM F-M

I. ACTION TO BE TAKEN: MODIFY A COURSE

Effective Fall 2015

Desired Term Effective (6 digit code): 201705 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

## II. COURSE TO BE MODIFIED:

A. Course Prefix: HVAC B. Number: 451

C. Course Title: Energy Audit and Analysis

LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: Q,S See Appendix E Instructions for Completing Forms.

III. MODIFICATIONS

A. Course Prefix: B. Number:
B. Contact Hours: Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]
C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]
D. Course Title: [Limit to 30 characters including punctuation and spaces]
E. College Code: G. Department Code: H. Credit Hours: Variable ☐Fixed ☐
I. Minimum Credit Hours: J. Maximum Credit Hours: [Enter number is space.]
K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Or max credits awarded.
L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐
M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐
N. Does proposed new course replace an equivalent course? Yes ☐ No ☐
O. Equivalent Course: Prefix: Number:
P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE.

Q. Term Offered: F,SP,SU R. Max Section Enrollment: Lecture: Lab:
S. Prerequisites or Restrictions: If none, leave blank. C- or better in HVAC 393 & MATH 126
T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces.

UCC Chair Signature/Date Academic Affairs Approval Signature/Date

| OFFICE OF THE REGISTRAR USE ONLY |
|---|
| Date Rec'd: Date Completed: Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐ |

## MODIFY A COURSE – Course Data Entry Form                                FORM F-M

### I. ACTION TO BE TAKEN: MODIFY A COURSE
Effective Fall 2015

Desired Term Effective (6 digit code): 201705 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

### II. COURSE TO BE MODIFIED:
A. Course Prefix: HVAC B. Number: 499
C. Course Title: Commercial HVAC System Design

LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW: Q,S See Appendix E Instructions for Completing Forms.

III. MODIFICATIONS

A. Course Prefix: B. Number:
B. Contact Hours: Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]
C. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]
D. Course Title: [Limit to 30 characters including punctuation and spaces]
E. College Code: G. Department Code: H. Credit Hours: Variable ☐Fixed ☐
I. Minimum Credit Hours: J. Maximum Credit Hours: [Enter number is space.]
K. Hours May be Repeated for Extra Credit: Yes ☐ No ☐ If yes, max times Or max credits awarded.
L. Levels: Undergraduate ☐ Graduate ☐ Professional ☐
M. Grade Method: Normal Grading ☐ Credit/No Credit (Pass/Fail) ☐
N. Does proposed new course replace an equivalent course? Yes ☐ No ☐
O. Equivalent Course: Prefix: Number:
P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE.
Q. Term Offered: SP,SU R. Max Section Enrollment: Lecture: Lab:
S. Prerequisites or Restrictions: If none, leave blank. C- or better in HVAC 415, 451 & 462
T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces.

UCC Chair Signature/Date                                Academic Affairs Approval Signature/Date

| OFFICE OF THE REGISTRAR USE ONLY |
|---|
| Date Rec'd: Date Completed: Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐ |

| OFFICE OF THE REGISTRAR USE ONLY |
|---|
| Date Rec'd: Click here to enter text. Date Completed: Click here to enter text. Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐ |

16-057

**Form A**

Effective Fall 2015

# PROPOSAL SUMMARY AND ROUTING FORM

**Proposal Title:** HVAC 290: HVAC System Design using BIM

**Initiating Individual**: Mike Feutz **Initiating Department or Unit**: HVAC

**Contact Person's Name**:Mike Feutz **Email**: feutzm@ferris.edu **Phone:** x2351

☐ **Group I-A** – New Degree, major, concentration, minor, or redirection of a current offering

☐ **Group I-B** – Deletion of a degree, major, concentration, or minor

☒ **Group II-A** – New Course, modification of a course, deletion of a course

☐ **Group II-B** – Minor Curriculum Clean-up

☐ **Group III** – Certificate (☐ College Credit ☐ Non-credit ☐ New Certificate)

☐ **Group IV** – Other site location (☐ College Credit ☐ Non-credit)

| | PLEASE PRINT AND SIGN YOUR NAME | DATE | VOTE/ACTION * Number Count |
|---|---|---|---|
| Program Representative ** | MIKE FEUTZ<br>Mike Feutz | 1/12/16 | ✓ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| Department/School/Faculty Representative Vote ** | DOUGLAS ZENTZ<br>D Zentz | 1/12/16 | 4 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| Department/School Administrator | SCHOOL OF BUILT ENVIRNMENT CURRICULUM COMMITTEE JS<br>SCHOOL DIRECTOR<br>John Schmidt → supports | 1/21/2016 | 5 Support<br>1 Support with Concerns See Attachment<br>__ Not Support<br>__ Abstain |
| College Curriculum Committee/Faculty | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| UCC Representative | | | __ Support<br>__ Hold<br>__ Not Support |
| Dean | Gary Schmidt | 1/22/16 | X Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| University Curriculum Committee ** | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| Senate ** | | | __ Support<br>__ Support with Concerns<br>__ Not Support<br>__ Abstain |
| Academic Affairs | [signature] | 2/5/16 | X Support<br>__ Hold<br>__ Not Support |

* Support with Concerns or Not Support must include identification of specific concern with appropriate rationale.

** Number Count must be given for all members present and/or voting.

To be completed by Academic Affairs

Date of Implementation: Summer 2016

VPAA
FEB 05 2016
PROVOST

President (Date Approved

Board of Trustees (Date Approved)

Academic Officers of MI (Date Approved)

1. Proposal Summary: (Summary is generally less than one page. Briefly state what is proposed with a summary of rationale and highlights)

Building Information Modeling (BIM) is a process by which buildings are designed and "built" virtually before they are built physically. The virtual building is known as the model. BIM software has revolutionized the design and construction industries to the point where all related documents are generated within the model. Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) industry professionals collaborate with other design and construction entities to integrate the delivery of a building project using software that merges models from all entities into one comprehensive model. BIM has become ubiquitous in the HVACR industry and all graduates find themselves involved in the process of building or using the model. Knowledge of BIM is thus necessary for graduates to be current in the field.

Currently, the HVACR curriculum includes ARCH 110, a class that includes both AutoCAD (drafting software) and Revit (a BIM software). No online version of ARCH 110 is available, and distance learning students earning their B.S. in HVAC Engineering Technology and Energy Management have found it impossible to find a similar course (or substitute class without several prerequisites) in their locale.

As such, the HVACR faculty propose to offer an experimental online version of the course during summer 2016 as an equivalent to ARCH 110. The course would not be an exact "duplicate" of ARCH 110, as it would include only BIM (Revit), and not AutoCAD. HVAC faculty propose this change based on feedback from stakeholders in the industry, who report that 3D (BIM) is rapidly replacing 2D design and will be the dominate platform within three to five years.

Though curriculum proposals focus on pedagogical reasoning, this proposal also includes a financial advantage. Since 2003, when the first online cohort of the BS in HVAC began, online students have taken their AutoCAD course elsewhere and transferred the credits to Ferris. This course would bring those tuition dollars to Ferris for the first time. Because this is a brand new experimental course to be taught online, the proposal caps enrollment at 12 students per section. Current plans include a permanent course to replace this one (proposal is in the works as of this writing). The permanent course would cap enrollment at 16, like all other HVAC online courses.

2. Summary of Curricular Action (Check all that apply to this proposal)

☐ Degree ☐ Major ☐ Minor ☐ Concentration ☐ Certificate ☒ Course

☒ New ☐ Modification ☐ Deletion

Name of Degree, Major, etc.: B.S. in HVAC Engineering Technology and Energy Management

3. Summary of All Course Action Required: **This is a new experimental course. As such, there are no modifications to be made to the catalog, no existing courses to be deleted or modified, no existing FSU courses to be added or removed from the program.**

A. Newly Created Courses to be Added to the Catalog

| Prefix | Number | Title |
|---|---|---|

B. Courses to be Deleted from FSU Catalog

| Prefix | Number | Title |
|---|---|---|

C. Existing Courses to be Modified

| Prefix | Number | Title |
|---|---|---|

D. Addition of existing FSU courses to program

| Prefix | Number | Title |
|---|---|---|

E. Removal of existing FSU courses from program

| Prefix | Number | Title |
|---|---|---|

4. Summary of All Consultations

| Form Sent (B or C) | Date Sent | Responding Department | Date Received & By Whom |
|---|---|---|---|

5. Will External Accreditation be sought? (For new programs or certificates only)

   ☐ Yes ☒ No

   If yes, name the organization involved with accreditation for this program.

6. Is a PCAF required? ☐ Yes ☒ No Is the PCAF approved? ☐ Yes ☐ No (If yes, supply link on Academic Affairs website where PCAF is posted. )

7. Program Checksheets affected by this proposal (Check all that apply to this proposal)

   **This is a new experimental course. As such, there are no modifications to be made to the checksheet.**

   ☐ Add Course ☐ Delete Course ☐ Modify Course ☐ Change Prerequisite ☐ Move from required to elective

   ☐ Move from elective to required ☐ Change Outcomes and Assessment Plan ☐ Change Credit hours

8. List all Checksheets affected by this proposal: **NONE**

| College | Department | Program |
|---|---|---|

# FERRIS STATE UNIVERSITY
SCHOOL OF BUILT ENVIRONMENT

**JOHN R. SCHMIDT, PH.D.**

**DIRECTOR**

**PROFESSOR, CONSTRUCTION TECHNOLOGY & MANAGEMENT**

---

**DATE:** 21 Jan 2016

**TO:** Dean Schult, CET Curriculum Committee, and University Curriculum Committee

**COPY:** SBE – Curriculum Committee

**SUBJECT:** Attachment to Form A: Comments from Faculty / Director of School of Built Environment

---

Professor Hanna's Comments related to Support with Concerns:

Dr. Schmidt and Members of the SBE Curriculum Committee:

I support the proposal to delete ARCH 110 and replace it with an online HVAC course that includes BIM and deletes CADD. Course content is the province of the degree granting faculty. My reservations are procedural and are based on the following:

1. There is no signature page showing the formal vote of the HVAC faculty. I accept that this was a unanimous HVAC faculty vote supporting this proposal. However, as a Senate representative from CET, I have vocally voted to reject proposals not showing the wishes of the program faculty. To do so with this proposal would be hypocritical on my part and in my opinion be grounds for rejection by both the University Curriculum Committee and the Academic Senate.
2. This proposal is in my mind conceptually incomplete. This proposal is about replacing an existing course. The affected program faculty (ATFM) need to be officially notified and subsequently provide a formal program response to this change. To say this proposal does not affect any other course or program is not correct and antithetical to the ultimate purpose of this curriculum change.

Respectfully submitted,
David Hanna, Professor
Construction Department Representative to the SBR Curriculum Committee

==================================================================================

Director Schmidt's Comments:

1. The signature sheet was provided separately and prior to this final vote, confirming the unanimous agreement of the faculty.
2. The proposal is for an "experimental" course. While the future use of ARCH 110 is indeed in jeopardy, at this point of the process, for the development of the experimental course, ARCH 110 remains on the checksheet and in the catalog.
3. This course has the potential to serve as the spark for a more general certificate program for the entire School of Built Environment.

605 S. Warren Avenue, Granger 227
Big Rapids, MI 49307-2287
Phone: (231) 591-3773
Fax: (231) 591-3587
www.ferris.edu/sbe

## COURSE INFORMATION FORM

## FORM E

Effective Fall 2015

**Complete all items below (New or Current)**

**Check all boxes where modifications are being made.**

### Course Identification

☐**Prefix (current)** ☐**Number (current) Contact Hours (current):**

Lecture ☐Lab ☐ Seminar ☐ [Enter contact hours per week in blank above.]

☒**Prefix (proposed) HVAC** ☒**Number (proposed)290 Contact Hours (proposed):** 4, 1 lecture, 3 lab

Lecture ☒Lab ☒ Seminar ☐ [Enter contact hours per week in blank above.]

☐**Title (current):**

☒ **Title (proposed):** HVAC System Design using BIM

☐**Credit Hours (current):** ☐**Prerequisites (current):** ☐**Co-requisites (current):**

☒**Credit Hours (proposed):2** ☒**Prerequisites (proposed):** *Department approval*☒**Co-requisites (proposed): None**

☐**Course Description (current) 125 words maximum:**

☒**Course Description (proposed) 125 words maximum:** Design of mechanical systems for buildings using Building Information Modeling (BIM). For HVAC students only.

☐**Course Outcomes and Assessment Plan (current):**

☒**Course Outcomes and Assessment Plan (proposed):**

| Course Outcomes | Assessment Plan |
|---|---|
| 1. Define BIM and Revit terms | Locally developed comprehensive exams |
| 2. Start, open and save projects | Portfolio |
| 3. Create foundational project elements (datum (levels), elevations, 2D and 3D views, details, legends, schedules, sheets, families) | Portfolio |
| 4. Apply view commands (zoom, pan, rotate, visual styles, detail level, hide/reveal/filter elements, visibility/graphic overrides, reference planes, 2D and 3D sections, camera and walkthrough views) | Portfolio |
| 5. Identify and employ user interface tools (quick access toolbar, status bar, application menu, ribbon, options bar, navigation cube, project browser, properties palette, navigation bar, system browser, status bar) | Portfolio |
| 6. Load, insert, select, and edit components (families) | Portfolio |
| 7. Modify elements (move, copy, rotate, offset, align, spit, mirror, trim, extend, array) | Portfolio |
| 8. Create spaces and zones | Portfolio |
| 9. Prepare, analyze and export heating and cooling loads | Portfolio |
| 10. Add, connect, and modify mechanical equipment, ducts and pipes, fittings, accessories, insulation and lining | Portfolio |
| 11. Create, modify, test, and inspect HVAC systems | Portfolio |

| | |
|---|---|
| 12. Create, modify, annotate, and print construction documents (sheets, details, schedules, legends, tags) | Portfolio |

☐**Course Outline including Time Allocation (current):**

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

☒**Course Outline including Time Allocation (proposed):**

| NO. | Course Outline | Time Allocation |
|---|---|---|
| 1 | Introduction | 5% |
| 2 | Basic Drawing and Modify Tools | 10% |
| 3 | Basic HVAC Systems Tools | 10% |
| 4 | HVAC Systems Projects | 15% |
| 5 | Working with Views | 5% |
| 6 | Spaces and Zones | 5% |
| 7 | Energy Analysis | 10% |
| 8 | HVAC Networks | 15% |
| 9 | Advanced Systems for HVAC | 15% |
| 10 | Construction Documents | 5% |
| 11 | Tags, Schedules, Details | 5% |
| | Total Hours | 100% |

Express time allocation in one of the following formats for a 3 credit hour course; adjust accordingly: Weeks (15 weeks), Hours (45 hours, assuming 3 contact hours per week, Percentages (100 percent)

[signature]
2/5/16

## CREATE NEW COURSE – Course Data Entry Form

**FORM F-C**

**Effective Fall 2015**

**COMPLETE ALL SECTIONS BELOW.** If this course is to be used as a prerequisite for other university courses, FORM F's that reflect the prerequisite change must be submitted for all those courses as well. See Appendix E for Completing Forms.

### I. ACTION TO BE TAKEN: CREATE A NEW COURSE

Desired Term Effective (6 digit code): 201605 Examples: 201601 (Spring), 201605 (Summer) NOTE: The first four digits indicate year, the next two digits indicate month in which term.

### II. NEW COURSE ATTRIBUTES:

A. Course Prefix: HVAC B. Number: 290

C. Contact Hours: 4 (1 lecture, 3 lab) Lecture ☒Lab ☒ Seminar ☐ [Enter contact hours per week in blank. See formula for contact hours to credit hours in Appendix E.]

Note: *uccmanualwforms10292015 E.10. II. c.* instructs initiators to enter how many contact hours per week students will be in lecture mode" and "enter how many contact hours per week students will be in laboratory mode." The check boxes above allow only a check or no check. It was not evident to the initiator how to enter the lecture/lab hours to comply with the instructions, so they were added in parenthesis following the contact hour quantity.

D. Practicum ☐ Independent Study ☐ [Check Box as appropriate. See Definitions in Appendix E]

E. Course Title: HVAC System Design using BIM [Limit to 30 characters including punctuation and spaces]

F. College Code: TE G. Department Code: HVAC H. Credit Hours: Variable ☐Fixed ☒

I. Minimum Credit Hours: 2 J. Maximum Credit Hours: 2 [Enter number is space.]

K. Hours May be Repeated for Extra Credit: Yes ☐ No ☒ If yes, max times Or max credits awarded.

L. Levels: Undergraduate ☒ Graduate ☐ Professional ☐

M. Grade Method: Normal Grading ☒ Credit/No Credit (Pass/Fail) ☐

N. Does proposed new course replace an equivalent course? Yes ☒ No ☐

O. Equivalent Course: Prefix: ARCH Number: 110

P. Catalog Description: Limit to 125 words – PLEASE BE CONCISE. Design of mechanical systems for buildings using Building Information Modeling (BIM). For HVAC students only.

Q. Term Offered: F, SP, SU (FALL SPRING SUMMER) R. Max Section Enrollment: 12 Lecture: 12 Lab: 12

S. Prerequisites or Restrictions: If none, leave blank. *Department Approval*

T. Co-requisites: Courses must be taken concurrently. If none, leave blank. Limit to 100 characters including punctuation and spaces.

***To be completed by Academic Affairs Office:* Standards & Measures Coding and General Education Code**

Basic Skill (BS) ☐ General Education ☐ Occupational Education ☐ G E Codes:

UCC Chair Signature/Date

Academic Affairs Approval Signature/Date
[signature] 2/5/16

**OFFICE OF THE REGISTRAR USE ONLY**

Date Rec'd: Date Completed: Entered: SCACRSE ☐ SCADETL ☐ SCARRES ☐ SCAPREQ ☐

**FORM A**
**College of Engineering Technology**

Revised 05/08/2009

# PROPOSAL SUMMARY AND ROUTING FORM

## Proposal Title: HVAC342 Course name & description modification

**Initiating Unit or Individual:** Joseph Pacella
**Contact Person's Name:** Joseph Pacella **e-mail:** pacellj@ferris.edu **phone:** 3586
**Date or Term of Proposal Implementation:** 201205

- ☐ **Group I - A – New degree/major or major, redirection of a current offering, or elimination of a degree, major or minor**
- ☐ **Group I - B – New minors or concentrations**
- X **Group II - A – Minor curriculum clean-up and course changes**
- ☐ **Group II - B – New Course**
- ☐ **Group III - Certificates**
- ☐ **Group IV – Off-Campus Programs**

| Group/Individual | Signature | Date | Vote/Action * |
|---|---|---|---|
| Program Faculty/Committee | [signature] | 12/5/11 | 7 Support<br>___ Support with Concerns<br>___ Not Support |
| School Committee | [signature] | 12/9/11 | 6 Support<br>0 Support with Concerns<br>0 Not Support |
| College Curriculum Committee | [signature] | 12/14/11 | 10 Support<br>0 Support with Concerns<br>0 Not Support |
| Dean | [signature] | 1/31/12 | ✓ Support<br>___ Support with Concerns<br>___ Not Support |
| University Curriculum Committee | | | ___ Support<br>___ Support with Concerns<br>___ Not Support |
| Senate | | | ___ Support<br>___ Support with Concerns<br>___ Not Support |
| Academic Affairs | | | ___ Support<br>___ Support with Concerns<br>___ Not Support |

* Support with Concerns or Not Support must include a list of specific concerns. Votes must be shown for faculty groups. Administrators check appropriate action taken.

**To be completed by Academic Affairs**

| | | |
|---|---|---|
| ______ **President (Date Approved)** | ______ **Board of Trustees (Date Approved)** | ______ **President's Council (Date Approved)** |

## 1. Proposal Summary

(Summary is generally less than one page. Briefly: state what is proposed with a summary of rationale and highlights. Additional rationale may be attached.)

This proposal is to modify an existing course HVAC 342 Load Calculation—Energy Code. This proposal is also designed to clean up course pre-requisites for HVAC 312, HVAC 350 & HVAC 362 as these courses are in the student rotation after HVAC 342. Therefore HVAC 342 needs to be included in the prerequisite. HVAC 312, HVAC 313, HVAC 342, HVAC 350 and HVAC 362 need a math clean-up on their prerequisite. This Proposal also clarifies the potential sequence of math courses as transfer students usually do not have credit for MATH116.

Currently, <u>HVAC 342 Load Calculation–Energy Code</u> has two typographical errors in the course description that require correction. We propose to modify the name of the course, correct the errors in the course description and slightly modify the course description. The proposed course name modification is to rename the course <u>HVAC 342 Load Analysis-Energy Modeling</u>. The purpose of adding energy modeling into the course name is to correctly identify to our students a part of the course purpose. Energy modeling has been used since the inception of our program and we are actively teaching the process in the existing HVAC 342 course and in the HVAC 451 course. It is an invaluable tool in determining building efficiency and in meeting existing LEED building rating system requirements. Created by the USBGC, the LEED rating system has been developed to classify and rate building construction and renovation projects. The rating systems are point based with a building having to reach a minimum point level (LEED Certified building) to a maximum point level of 105 (LEED Platinum). In order to accurately determine the points earned from the energy saving portion of the rating system, an energy model of the building must be performed and the percentage of energy saved due to proposed building modifications is determined. The energy modeling is located in one of the required texts, for the course;, ASHRAE Standard 90.1. In this standard, appendix G clearly describes the process that our students need employ to accurately model a facility with an energy priority.

The math class, MATH126, listed in the BS checksheet for HVACR Engineering Technology has always been an issue with students which transfer to Ferris as an incoming junior due to the fact their math transfer credit is usually MATH115. This typical student usually takes MATH120 and then MATH130 or MATH126. The notes for this within the checksheet are not as clear as they could be, so a minor modification to the wording was done to clarify this typical path for a transfer student.

Finally, HVAC312 and HVAC313 are currently titled "Control Theory – Application 2" and "Control Theory – Application 1", respectively. There is no reason for the "2" and "1" in the titles, so this submittal proposes to change the name of both courses to simply "Control Theory- Application". Note that HVAC 312 and HVAC 313 are essentially the same course, with 312 offered as the campus-based version and 313 serving as the online version. HVAC313 has one less credit than HVAC312 and requires students to visit campus during the summer to complete the requirements of that single credit through HVAC314. In total, the outcomes for HVAC312 are identical to the combined outcomes of HVAC313 and HVAC314. This arrangement is necessary due to the laboratory components of HVAC312 that cannot be completed online. It is similar to the campus-based HVAC331 and its corresponding online version HVAC332 and summer lab component HVAC333. Both HVAC331 and HVAC332 are named identical in the current course catalog.

## 2. Summary of All Course Action Required*

a. Newly Created Courses to FSU:

| Prefix | Number | Title |
|---|---|---|

b. Courses to be Deleted From FSU Catalog:

| Prefix | Number | Title |
|---|---|---|

c. Existing Course(s) to be Modified:

| Prefix | Number | Title |
|---|---|---|
| HVAC | 342 | Load Calculation—Energy Code |
| HVAC | 312 | Control Theory - Application 2 |
| HVAC | 313 | Control Theory - Application 1 |
| HVAC | 362 | Primary Equipment Selection |
| HVAC | 350 | Contracting Issues in HVACR |

d. Addition of existing FSU courses to program

| Prefix | Number | Title |
|---|---|---|

e. Removal of existing FSU courses from program

| Prefix | Number | Title |
|---|---|---|

3. **Summary of All Consultations**

| Form Sent (B or C) | Date Sent | Responding Dept. | Date Received & by Whom |
| --- | --- | --- | --- |

4. **Will External Accreditation be Sought? (For new programs or certificates only)**

**__________ Yes** **_____X______ No**

**If yes, name the organization involved with accreditation for this program.**

5. **Program Check sheets affected by this proposal.** **BS HVACR Engineering Technology** Checksheet, the prerequisites for HVAC 312, HVAC 350 & HVAC 362 have added HVAC 342 as a pre-requisite.

**FORM D CURRENT**

FERRIS STATE UNIVERSITY

*Imagine More*

Bachelor of Science Degree

# HVACR Engineering Technology

Course Sequence Guide

| | | | |
|---|---|---|---|
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 3 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 331 | Secondary System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to BS in HVACR Engineering Technology) | 4 | |
| ARCH | 110 | Intro to Computer Graphics in ARCH for HVACR Students | 2 | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116) | 4 | |
| | | Social Awareness Elective | 3 | |
| | | **Total** | **17** | |

| YEAR 3 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 331, MATH 116 or 120) | 4 | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 331, MATH 116 or 120) | 4 | |
| HVAC | 362 | Primary Equipment Selection (C- or better in HVAC 331, MATH 116 or 120) | 4 | |
| | | Scientific Understanding Elective | 4 | |
| MATH | | Students who took MATH 115 or 116 in fall take MATH 126 or 130 | | |
| | | **Total** | **16** | |

| YEAR 3 - SUMMER SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 350 & 362) | 4 | |
| | | **Total** | **4** | |

Submit Application for Graduation.

| YEAR 4 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 415 | Direct Digital Control (C- in MATH 126 or 130, HVAC 393) | 4 | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- in MATH 126 or 130, HVAC 393) | 4 | |
| COMM | 221 | Small Group Decision Making | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | **Total** | **14** | |

| YEAR 4 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415 and 451) | 5 | |
| ECON | 221 | Principles of Economics 1 | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Directed Elective | 3 | |
| | | **Total** | **14** | |

Students must complete 40 credits at or above the 300 level in the bachelor program. Three credits of 300 level coursework must be taken in the social awareness and/or cultural enrichment courses to meet this requirement. From among the cultural enrichment and social awareness coursework, at least one global consciousness course and one REG course must be taken.

Ferris State University
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology

## Program Academic Requirements

| Student: | | | Code | Location | Crs |
|---|---|---|---|---|---|
| email: | | ID: | | Ferris | |
| Advisor: | | Ph: | 1 | Transfer | |

| | | MAJOR | Cr | Gr | Pts | S | Yr | Code | Notes |
|---|---|---|---|---|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 331, MATH 116 or 120) | 4 | | | | | | |
| HVAC | 331 | Secondary System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 331, MATH 116 or 120) | 4 | | | | | | |
| HVAC | 362 | Primary HVAC Equipment Selection (C- or better in HVAC 331, MATH 116 or 120) | 4 | | | | | | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 350 & 362) | 4 | | | | | | |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 or 130, HVAC 393) | 4 | | | | | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 or 130, HVAC 393) | 4 | | | | | | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, 451) | 5 | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | |
| ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | 2 | | | | | | |
| | | Directed Elective (See Your Advisor) | 3 | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | |
| COMM | 221 | Small Group Decision Making | 3 | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | |
| | | Scientific Understanding Elective | 4 | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | |
| ECON | 221 | Principles of Economics 1 | 3 | | | | | | |

Unofficial Statistics

| | |
|---|---|
| Major: Total Crs / Earned Crs / Honor Points | 37 |
| Degree: Total Crs / Earned Crs / Honor Points | 65 |
| GPA Major: | - |
| GPA Degree: | - |

Bachelor of Science General Education Requirements:
One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr)
Multiple requirements may be satisfied by a single course.
Cultural Enrichment - 9 credits (3 credits in course > 200 level), Social Awareness - 9credits (3 credits in course > 200 level)
Students must complete 40 credits at or above the 300 level. [Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

**FORM D PROPOSED**

FERRIS STATE UNIVERSITY
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology

Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 3 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 331 | Secondary System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | |
| HVAC | 342 | Load Analysis & Energy Modeling (Admission to BS in HVACR Engineering Technology) | 4 | |
| ARCH | 110 | Intro to Computer Graphics in ARCH for HVACR Students | 2 | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116)- (Students who took MATH115 shall take MATH120) | 4 | |
| | | Social Awareness Elective | 3 | |
| | | Total | 17 | |

| YEAR 3 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | |
| HVAC | 362 | Primary Equipment Selection (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | |
| | | Scientific Understanding Elective | 4 | |
| MATH | | Students who took MATH 115 and MATH 120 shall take MATH 130 | | |
| | | Total | 16 | |

| YEAR 3 - SUMMER SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 350 & 362) | 4 | |
| | | Total | 4 | |

Submit Application for Graduation.

| YEAR 4 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 415 | Direct Digital Control (C- in MATH 126 or 130, and HVAC 393) | 4 | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- in MATH 126 or 130, and HVAC 393) | 4 | |
| COMM | 221 | Small Group Decision Making | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Total | 14 | |

| YEAR 4 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415 and 451) | 5 | |
| ECON | 221 | Principles of Economics 1 | 3 | |
| | | Cultural Enrichment Elective | 3 | |

| | | |
|---|---|---|
| Directed Elective | | 3 |
| | Total | 14 |

Students must complete 40 credits at or above the 300 level in the bachelor program. Three credits of 300 level coursework must be taken in the social awareness and/or cultural enrichment courses to meet this requirement. From among the cultural enrichment and social awareness coursework, at least one global consciousness course and one REG course must be taken.

FERRIS STATE UNIVERSITY
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology

## Program Academic Requirements

| Student: | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|
| email: | | ID: | | | Ferris | |
| Advisor: | | Ph: | | 1 | Transfer | |

| | | MAJOR | Cr | Gr | Pts | S | Yr | Code | Notes |
|---|---|---|---|---|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 331, HVAC342, and MATH 116 or 120) | 4 | | | | | | |
| HVAC | 331 | Secondary System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | | | | | | |
| HVAC | 362 | Primary HVAC Equipment Selection (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | | | | | | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 350 & 362) | 4 | | | | | | |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 or 130, and HVAC 393) | 4 | | | | | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 or 130, and HVAC 393) | 4 | | | | | | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, and 451) | 5 | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | |
| ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | 2 | | | | | | |
| | | Directed Elective (See Your Advisor) | 3 | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | |
| COMM | 221 | Small Group Decision Making | 3 | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | |
| | | Scientific Understanding Elective | 4 | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | |

| | | | |
|---|---|---|---|
| | | Social Awareness Elective | 3 |
| ECON | 221 | Principles of Economics 1 | 3 |

**Unofficial Statistics**

| | |
|---|---|
| Major: Total Crs / Earned Crs / Honor Points | 37 |
| Degree: Total Crs / Earned Crs / Honor Points | 65 |
| GPA Major: | - |
| GPA Degree: | - |

Bachelor of Science General Education Requirements:
One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr)
Multiple requirements may be satisfied by a single course.
Cultural Enrichment – 9 credits (3 credits in course > 200 level), Social Awareness - 9credits (3 credits in course > 200 level)
Students must complete 40 credits at or above the 300 level. [Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

**MODIFY COURSE** **FORM F**
**Course Data Entry Form** **Modify Course**
Rev. 07/23/07

**I. ACTION TO BE TAKEN: MODIFY AN EXISTING COURSE**
Notes:
1. Complete all parts of Sections I and II; complete only those items in Section III that represent changes.
2. If either prefix or number is being changed, use 'Delete Course' and 'Create New Course' forms rather than this form.

a. List the changes to be made (**See Proposed Changes a through p below**): d, p

b. Term Effective (6 digit code only): 201205 **Examples: 200801(Spring), 200805(Summer), 200808(Fall)**
**Note: The first four digits indicate year, the next two digits indicate month in which term begins.**

**II. CURRENT:** Include information that is in the current course database.
**a**. Course Prefix HVAC **b**. Number 312 **c**. Enter Contact Hours per week in boxes.
LECture 3 LAB 3 INDependent Study – Check (x) ☐
Practicum: ☐ Seminar: ☐
**d**. Course Title: Control Theory – Application 1

**III. PROPOSED CHANGES: Complete only those boxes that represent proposed changes identified in Section I. Leave all other spaces blank.**
**a**. Course Prefix ☐ **b**. Number ☐ **c**. Enter Contact Hours per week in boxes.
LECture ☐ LAB ☐ INDependent Study – Check (x) ☐
Practicum: ☐ Seminar: ☐
**d**. Course Title: **Control Theory – Application** (Limit to 30 characters/spaces.)

**e**. College Code: ☐ **f.** Department Code: ☐

Credit Hours: Check (x) type and enter maximum and minimum hours in boxes.

**g**. Type: ☐ Variable ☐ Fixed **h**. Maximum Credit Hours ☐ **i**. Minimum Credit Hours ☐ .

**j**. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No

**k**. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

**l**. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit only (Pass/Fail)

**m. CATALOG DESCRIPTION** – Limit to 75 words – PLEASE BE CONCISE.
**n**. Term(s) Offered: ☐ (See instructions for listing.) **o**. Max. Section Enrollment: ☐

**p. Prerequisites/Co-requisites/Restrictions: Limited to 100 spaces.** C- or better in HVAC 331, HVAC342, and MATH 116 or 120

**UCC Chair Signature/Date:** ______________________ ___/___/___

**Academic Affairs Approval Signature/Date:** ______________________ ___/___/___

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**Office of the Registrar use ONLY**

**Date Rec'd: ____ Date Completed: ____ Entered: SCACRSE __ SCADETL __SCARRES __ SCAPREQ __**

# MODIFY COURSE

**FORM F**

**Course Data Entry Form**

**Modify Course**
Rev. 07/23/07

**I. ACTION TO BE TAKEN: MODIFY AN EXISTING COURSE**

Notes:

1. Complete all parts of Sections I and II; complete only those items in Section III that represent changes.
2. If either prefix or number is being changed, use 'Delete Course' and 'Create New Course' forms rather than this form.

a. List the changes to be made (**See Proposed Changes a through p below**): d, p

b. Term Effective (6 digit code only): 201205 **Examples: 200801(Spring), 200805(Summer), 200808(Fall)**
**Note: The first four digits indicate year, the next two digits indicate month in which term begins.**

**II. CURRENT:** Include information that is in the current course database.

**a**. Course Prefix: HVAC
**b**. Number: 313
**c**. Enter Contact Hours per week in boxes.
LECture 3 LAB 0 INDependent Study – Check (x) ☐
Practicum: ☐ Seminar: ☐

**d**. Course Title: Control Theory – Application 1

**III. PROPOSED CHANGES: Complete only those boxes that represent proposed changes identified in Section I. Leave all other spaces blank.**

**a**. Course Prefix: ☐
**b**. Number: ☐
**c**. Enter Contact Hours per week in boxes.
LECture ☐ LAB ☐ INDependent Study – Check (x) ☐
Practicum: ☐ Seminar: ☐

**d**. Course Title: **Control Theory – Application** (Limit to 30 characters/spaces.)

**e**. College Code: ☐ **f.** Department Code: ☐

Credit Hours: Check (x) type and enter maximum and minimum hours in boxes.

**g**. Type: ☐ Variable ☐ Fixed **h**. Maximum Credit Hours ☐ **i**. Minimum Credit Hours ☐ .

**j**. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No

**k**. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

**l**. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit only (Pass/Fail)

**m. CATALOG DESCRIPTION** – Limit to 75 words – PLEASE BE CONCISE.

**n**. Term(s) Offered: ☐ (See instructions for listing.) **o**. Max. Section Enrollment: ☐

**p. Prerequisites/Co-requisites/Restrictions: Limited to 100 spaces.** C- or better in HVAC 331, and MATH 116 or 120

---

**UCC Chair Signature/Date:** ______________________ ___/___/___

**Academic Affairs Approval Signature/Date:** ______________________ ___/___/___

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE __ SCADETL __SCARRES __ SCAPREQ __**

## MODIFY COURSE

**Course Data Entry Form**

**FORM F**

**Modify Course**
Rev. 07/23/07

**I. ACTION TO BE TAKEN: MODIFY AN EXISTING COURSE**

Notes:

1. Complete all parts of Sections I and II; complete only those items in Section III that represent changes.
2. If either prefix or number is being changed, use 'Delete Course' and 'Create New Course' forms rather than this form.

a. List the changes to be made (**See Proposed Changes a through p below**): d, m, p

b. Term Effective (6 digit code only): 201208 **Examples: 200801(Spring), 200805(Summer), 200808(Fall)**
**Note: The first four digits indicate year, the next two digits indicate month in which term begins.**

**II. CURRENT:** Include information that is in the current course database.

**a.** Course Prefix: HVAC
**b.** Number: 342
**c.** Enter Contact Hours per week in boxes.
LECture 3 LAB 3 INDependent Study – Check (x) ☐
Practicum: ☐ Seminar: ☐

**d.** Course Title: Load Calculation-Energy Code

**III. PROPOSED CHANGES: Complete only those boxes that represent proposed changes identified in Section I. Leave all other spaces blank.**

**a.** Course Prefix ☐
**b.** Number ☐
**c.** Enter Contact Hours per week in boxes.
LECture ☐ LAB ☐ INDependent Study – Check (x) ☐
Practicum: ☐ Seminar: ☐

**d.** Course Title: **Load Analysis-Energy Modeling** (Limit to 30 characters/spaces.)

**e.** College Code: ☐ **f.** Department Code: ☐

Credit Hours: Check (x) type and enter maximum and minimum hours in boxes.

**g.** Type: ☐ Variable ☐ Fixed **h.** Maximum Credit Hours ☐ **i.** Minimum Credit Hours ☐

**j.** May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No

**k.** Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

**l.** Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit only (Pass/Fail)

**m. CATALOG DESCRIPTION** – Limit to 75 words – PLEASE BE CONCISE.
Complete heat loss and heat gain calculations for commercial and industrial buildings will be performed manually and through currently available computer software. Students will layout and design systems for maximum energy efficiency. Energy estimating methods will be studied and an analysis of an actual building using the Performance Rating Method as described in ASHRAE Standard 90.1 appendix G. Current federal, state and local codes and standards will be examined as they apply to HVAC systems.

**n.** Term(s) Offered: ☐ (See instructions for listing.) **o.** Max. Section Enrollment: ☐

**p. Prerequisites/Co-requisites/Restrictions:** Admission to Bachelor of Science in HVAC Engineering Technology (code HVAC). **Limited to 100 spaces.** ☐

**UCC Chair Signature/Date:** ____________________ __/__/__

**Academic Affairs Approval Signature/Date:** ____________________ __/__/__

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**Office of the Registrar use ONLY**

Date Rec'd: ____ Date Completed: ____ Entered: SCACRSE __ SCADETL __SCARRES __ SCAPREQ __

# MODIFY COURSE

**FORM F**

## Course Data Entry Form

**Modify Course**
Rev. 07/23/07

**I. ACTION TO BE TAKEN: MODIFY AN EXISTING COURSE**

Notes:

1. Complete all parts of Sections I and II; complete only those items in Section III that represent changes.
2. If either prefix or number is being changed, use 'Delete Course' and 'Create New Course' forms rather than this form.

a. List the changes to be made (**See Proposed Changes a through p below**): p

b. Term Effective (6 digit code only): 201208 **Examples: 200801(Spring), 200805(Summer), 200808(Fall)**
**Note: The first four digits indicate year, the next two digits indicate month in which term begins.**

**II. CURRENT:** Include information that is in the current course database.

**a**. Course Prefix: **HVAC**
**b**. Number: **350**
**c**. Enter Contact Hours per week in boxes.
LECture 3 LAB 3 INDependent Study – Check (x) ☐
Practicum: ☐ Seminar: ☐

**d**. Course Title: Contracting Issues in HVACR

**III. PROPOSED CHANGES: Complete only those boxes that represent proposed changes identified in Section I. Leave all other spaces blank.**

**a**. Course Prefix ☐
**b**. Number ☐
**c**. Enter Contact Hours per week in boxes.
LECture ☐ LAB ☐ INDependent Study – Check (x) ☐
Practicum: ☐ Seminar: ☐

**d**. Course Title: (Limit to 30 characters/spaces.)

**e**. College Code: ☐ **f.** Department Code: ☐

Credit Hours: Check (x) type and enter maximum and minimum hours in boxes.

**g**. Type: ☐ Variable ☐ Fixed **h**. Maximum Credit Hours ☐ **i**. Minimum Credit Hours ☐

**j**. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No

**k**. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

**l**. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit only (Pass/Fail)

**m. CATALOG DESCRIPTION** – Limit to 75 words – PLEASE BE CONCISE.
**n**. Term(s) Offered: ☐ (See instructions for listing.) **o**. Max. Section Enrollment: ☐

**p. Prerequisites/Co-requisites/Restrictions: Limited to 100 spaces.** C- or better in HVAC 331, HVAC 342, and MATH 116 or 120

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**UCC Chair Signature/Date:** ______________________ ___/___/___

**Academic Affairs Approval Signature/Date:** ______________________ ___/___/___

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __**SCARRES** __ **SCAPREQ** __

## MODIFY COURSE

**Course Data Entry Form** — **FORM F** — **Modify Course**

Rev. 07/23/07

**I. ACTION TO BE TAKEN: MODIFY AN EXISTING COURSE**

Notes:

1. Complete all parts of Sections I and II; complete only those items in Section III that represent changes.
2. If either prefix or number is being changed, use 'Delete Course' and 'Create New Course' forms rather than this form.

a. List the changes to be made (**See Proposed Changes a through p below**): p

b. Term Effective (6 digit code only): 201208 **Examples: 200801(Spring), 200805(Summer), 200808(Fall)**
**Note: The first four digits indicate year, the next two digits indicate month in which term begins.**

**II. CURRENT:** Include information that is in the current course database.

**a.** Course Prefix: HVAC

**b.** Number: 362

**c.** Enter Contact Hours per week in boxes.
LECture 3 LAB 3 INDependent Study – Check (x) ☐
Practicum: ☐ Seminar: ☐

**d.** Course Title: Primary Equipment Selection

**III. PROPOSED CHANGES: Complete only those boxes that represent proposed changes identified in Section I. Leave all other spaces blank.**

**a.** Course Prefix ☐

**b.** Number ☐

**c.** Enter Contact Hours per week in boxes.
LECture ☐ LAB ☐ INDependent Study – Check (x) ☐
Practicum: ☐ Seminar: ☐

**d.** Course Title: (Limit to 30 characters/spaces.)

**e.** College Code: ☐ **f.** Department Code: ☐

Credit Hours: Check (x) type and enter maximum and minimum hours in boxes.

**g.** Type: ☐ Variable ☐ Fixed **h.** Maximum Credit Hours ☐ **i.** Minimum Credit Hours ☐ .

**j.** May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No

**k.** Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

**l.** Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit only (Pass/Fail)

**m. CATALOG DESCRIPTION** – Limit to 75 words – PLEASE BE CONCISE.

**n.** Term(s) Offered: ☐ (See instructions for listing.) **o.** Max. Section Enrollment: ☐

**p. Prerequisites/Co-requisites/Restrictions: Limited to 100 spaces.** C- or better in HVAC 331, HVAC 342, and MATH 116 or 120

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**UCC Chair Signature/Date:** ______________________ ___/___/___

**Academic Affairs Approval Signature/Date:** ______________________ ___/___/___

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# FORM A

Revised September 2012

## PROPOSAL SUMMARY AND ROUTING FORM

## Proposal Title: HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325

**Initiating Individual:** Doug Zentz **Initiating Department or Unit:** HVACR
**Contact Person's Name:** Doug Zentz **e-mail:** zentzd@ferris.edu **phone:** 3083

☐ Group I - A – New degree, major, concentration, minor, or redirection of a current offering
☐ Group I - B – Deletion of a degree, major, concentration, or minor
☒ Group II - A – New Course, modification of a course, deletion of a course
☒ Group II - B – Minor curriculum clean-up
☐ Group III – Certificates (☐ College Credit ☐ Non-Credit)
☐ Group IV – Other Site Locations (☐ College Credit ☐ Non-Credit)

| | Signature | Date | Vote/Action * Number count ** |
|---|---|---|---|
| Program Representative ** | | | ____Support<br>____Support with Concerns<br>____Not Support<br>____Abstain |
| Department/School/Faculty Representative Vote ** | | | ____Support<br>____Support with Concerns<br>____Not Support<br>____Abstain |
| Department/School Administrator | | | ____Support<br>____Support with Concerns<br>____Not Support |
| College Curriculum Committee/Faculty | | | ____Support<br>____Support with Concerns<br>____Not Support<br>____Abstain |
| Dean | | | ____Support<br>____Support with Concerns<br>____Not Support |
| University Curriculum Committee ** | | | ____Support<br>____Support with Concerns<br>____Not Support<br>____Abstain |
| Senate ** | | | ____Support<br>____Support with Concerns<br>____Not Support<br>____Abstain |
| Academic Affairs | | | ____Support<br>____Hold<br>____Not Support |

* Support with Concerns or Not Support <u>must</u> include identification of specific concerns with appropriate rationale.
** Number count <u>must</u> be given for all members present and/or voting.

**To be completed by Academic Affairs** **Date/Term of Implementation:** ________________

____________________ ____________________ ____________________
**President (Date Approved)** **Board of Trustees (Date Approved)** **Academic Officers of MI (Date Approved)**

## 1. Proposal Summary

(Summary is generally less than one page. Briefly: state what is proposed with a summary of rationale and highlights.)

**BACKGROUND**

The HVAC Bachelor degree began in the mid 1980's when Ferris was on quarters, and during this time period the HVAC Bachelor degree had two junior level "*secondary system select-design*" courses; one was centered on air side systems and the other one was centered on water (hydronic) side systems. When Ferris moved to semester based courses, these two "*secondary system select-design*" courses were blended together to a 5 credit "*HVAC Secondary System Select-Design*" class (known as HVAC 331). Although manageable, the amount of course content within this course is beyond the normal junior level class and in some semesters it was difficult to cover all learning outcomes. In 2009, it was determined through advisory board input that another course, HVAC 350 – Contracting Issues in HVAC, should be created and to provide the needed credits for this new class it was determined that HVAC 331 should be reduced to 4 credits by reducing some of the learning outcomes (moving them to another HVAC course). It has been 4 years now and the result of this change, along with Advisory Board input, has concluded there is a strong need to return to two separate "*secondary system select-design*" courses (one air side and the other water (hydronic) side); thus, the HVAC department wants to create HVAC 321, "*HVAC Air Side System Select-Design*" and HVAC 325, "*HVAC Hydronic System Select-Design*".

**CREATION OF HVAC 321 & HVAC 325**: HVAC 321 will be in fall semester of the junior year replacing HVAC 331 (the credits remain the same - 4). HVAC 325 (4 credits) will be in the spring semester of junior year as a new course and to accommodate this creation two things will occur. The needed 4 credits will come from the elimination of our "Directed (3 credit) Elective" course which is on our current check sheet and one credit from the reduction of the HVAC Capstone Experience Class, HVAC 499 (outlined below). Thus the overall credits for graduation remain the same. The splitting of HVAC 331 into HVAC 321 and HVAC 325 will allow a deeper learning experience for students in the learning outcomes including advanced computer system design (using BIM software) per our advisory board input and to satisfy requirements our industry expects from our graduates (this was a direct outcome from our last program APR).

**HVAC CAPSTONE EXPERIENCE MODIFICATION**: This proposal includes the modification of HVAC 499 from a 5 credit class to a 4 credit class by eliminating one of the weekly lab sessions. Currently, this class has two lecture hours per week and nine lab hours (three 3-hour sessions). This proposes to reduce lab to six hours per week (two 3-hour sessions).

Six hours of lab per week provides ample time for faculty to assist students. The reduction eliminates a lab session that experience has shown to be "supervised homework." The credit made available through this reduction is added to the three credits made available by eliminating the directed elective, providing four credits for HVAC 325 (shown above). Note; this change in credit hours will be phased in to reflect some current students working from existing check sheets.

This also proposes to correct a typographical (spelling) error in the title of the course, from *Commerical* HVAC System Design, to *Commercial* HVAC System Design

**CHANGE HVAC 362 to HVAC 462**: This proposes to move HVAC 362 from spring semester junior year to fall semester senior year. This move reverses a move that was made when HVAC 350 was introduced into the curriculum beginning in the 2010 academic year. At that time, the class was called HVAC 462 because it was held during senior year and was changed to HVAC 362 when it was moved to spring of junior year. It is arbitrary whether the course is held spring semester junior year or fall semester senior year, so this proposal simply changes the number to reflect where it is being offered in the curriculum. This transfer of HVAC 362 back to HVAC 462 will occur over a 2-year time period as to allow students which have started on the old check sheet to continue as we have other HVAC students in the On-line format as well.

**GENERAL EDUCATION MODIFICATION**: The HVAC Bachelor degree contains two WIC courses (HVAC 451 & HVAC 499); thus, the degree only has one class beyond the Associate level of two English classes and one Communication class. This current class is COMM 221, and has been a requirement for graduation with the HVAC Bachelor degree for many years. However, since the HVAC program created the On-line version of this degree it has been difficult for some students to either enroll in the Ferris offering of COMM 221 or to find a transferable equal to COMM 221. Additionally, our last APR indicated that our Bachelor degree graduates could use a higher level of technical writing skills to be more successful in industry. Thus, the HVAC department determined it is in the student's best interest to take ENGL 311 (Advanced Technical Writing) instead of COMM 221. This substitution follows the guidelines of the University and will allow our students easier access for graduation and better prepare them for success.

**PREREQUISITE CHANGES**: Due to the addition of 2 new HVAC courses (HVAC 321 & HVAC 325), deletion of HVAC 331, and the moving of HVAC 362 to HVAC 462, there is a need for changes in many of the HVAC 300 & 400 level course prerequisites. This proposal includes these minor changes within the enclosed Form F sheet for HVAC 312, HVAC 350, HVAC 393, HVAC 415, HVAC 451, HVAC 462 & HVAC 499. Note; these changes in prerequisites will be phased in to reflect some current students working from existing check sheets.

**SUMMARY:** Under this proposal:

- No changes are proposed for AAS students.
- Overall SCH for BS students remain the same.
- HVAC 499 drops from five credits to four, making one credit available.
- The directed elective is eliminated, making three credits available.
- HVAC 331 is replaced with HVAC 321, a four-credit course, to fall semester, junior year.
- HVAC 325, a four-credit course (using the four credits available from above), is added to spring semester, junior year.
- Move HVAC362 back to the senior year by changing it to HVAC462
- Removal of COMM 221 from the graduation requirement by the addition of ENGL 311 in its place
- Modification of prerequisites for 300 & 400 level HVAC courses to reflect the above changes

## 2. Summary of Curricular Action (check all that apply to this proposal)

☐ **Degree** ☒ **Major** ☐ **Minor** ☐ **Concentration** ☐ **Certificate** ☒ **Course**

☒ **New** ☒ **Modification** ☒ **Deletion**

**Name of Degree, Major, etc. :** **HVACR Engineering Technology and Energy Management**

## 3. Summary of All Course Action Required **Contact Senate Secretary or UCC Chair if additional spaces are required.**

**a. Newly Created Courses to be Added to FSU Catalog:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 321 | HVAC Air Side System Select-Design |
| HVAC | 325 | HVAC Hydronic System Select-Design |
| HVAC | 462 | HVAC Primary Equipment Selection |

**b. Courses to be Deleted from FSU Catalog:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 331 | HVAC Secondary System Select-Design |

**c. Existing Course(s) to be Modified:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 312 | Control Theory & Application |
| HVAC | 350 | Contracting Issues in HVACR |
| HVAC | 393 | Summer Internship |
| HVAC | 415 | Direct Digital Control |
| HVAC | 451 | Energy Audit and Analysis |
| HVAC | 499 | Commercial HVAC System Design |

**d. Addition of existing FSU courses to program**

| Prefix | Number | Title |
|---|---|---|
| ENGL | 311 | Advanced Technical Writing |

**e. Removal of existing FSU courses from program**

| Prefix | Number | Title |
|---|---|---|
| COMM | 221 | Small Group Decision Making |

## 4. Summary of All Consultations

| Form Sent (B or C) | Date Sent | Responding Dept. | Date Received & by Whom |
|---|---|---|---|
| Form B | 2/7/14 | Humanities | |
| Form B | 2/7/14 | Language and Literature | |
| Form C | 2/7/14 | FLITE | |

## 5. Will External Accreditation be sought? (For new programs or certificates only)

☐ **Yes** ☒ **No**

**If yes, name the organization involved with accreditation for this program.**

**6. Program Checksheets affected by this proposal (check all that apply to this proposal)**

☒ Add Course ☒ Delete Course ☒ Modify Course ☐ Change Prerequisite ☐ Move from required to elective
☐ Move from elective to required ☐ Change Outcomes and Assessment Plan ☒ Change credit hours

List all Checksheets affected by this proposal:

| College | Department | Program |
|---|---|---|
| CET | HVACR | HVACR Engineering Technology and Energy Management |

**FORM B**
Rev. September 2012

# CURRICULUM CONSULTATION FORM

To be completed by each department affected by the proposed change, addition, or deletion. Potential duplication of coursework is reason for consultation.

1. This completed form must be forwarded with the proposal to the administrator of the department to be consulted.

2. The department must respond within 10 business days of receipt of this form to insure inclusion in the final proposal. The completed original is returned to the Academic Senate office to be inserted into the proposal and a copy is returned to the initiator.

   The department must acknowledge receipt of this form and the proposal in writing to the initiator.

   **Failure to respond by 10 business days of receipt of this form is interpreted as support for the proposal.**

3. The Proposing Department must address any concerns raised by the consulted department. This response must be in writing and will be included in the proposal following the original consultation form.

**RE: Proposal Title** HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325

**Initiator(s):** Doug Zentz

**Proposal Contact**: Doug Zentz **Date Sent**: 2/7/14

**Department:** HVAC Engineering Technology **Campus Address:** GRN-227
(Please type)

**Responding Department: Humanities – JOH-117**

Administrator: Trinidy Williams Date Received: ______ Date Returned: _____

Based upon department faculty review on _____(date), we

- ☐ Support the above proposal.
- ☐ Support the above proposal with the modifications and concerns listed below.
- ☐ Do not support the proposal for the reasons listed below.

Comment regarding the impact this proposal has on current curriculum including prerequisites, scheduling, room assignments, and/or faculty load for your department. Use additional pages, if necessary.

**FORM B**
Rev. September 2012

# CURRICULUM CONSULTATION FORM

To be completed by each department affected by the proposed change, addition, or deletion. Potential duplication of coursework is reason for consultation.

1. This completed form must be forwarded with the proposal to the administrator of the department to be consulted.

2. The department must respond within 10 business days of receipt of this form to insure inclusion in the final proposal. The completed original is returned to the Academic Senate office to be inserted into the proposal and a copy is returned to the initiator.

   The department must acknowledge receipt of this form and the proposal in writing to the initiator.

   **Failure to respond by 10 business days of receipt of this form is interpreted as support for the proposal.**

3. The Proposing Department must address any concerns raised by the consulted department. This response must be in writing and will be included in the proposal following the original consultation form.

**RE: Proposal Title** HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325

**Initiator(s):**Doug Zentz

**Proposal Contact**: Doug Zentz **Date Sent**: 2/7/14

**Department:** HVAC Engineering Technology **Campus Address:** GRN-227
(Please type)

**Responding Department: Languages & Literature – ASC-3080**

Administrator: Andy Karafa Date Received: ______Date Returned: ______

Based upon department faculty review on ______(date), we

- ☐ Support the above proposal.
- ☐ Support the above proposal with the modifications and concerns listed below.
- ☐ Do not support the proposal for the reasons listed below.

Comment regarding the impact this proposal has on current curriculum including prerequisites, scheduling, room assignments, and/or faculty load for your department. Use additional pages, if necessary.

**FORM C**
Rev. September 2012

# FLITE SERVICES CONSULTATION FORM

To be completed by the liaison librarian and approved by the Dean of FLITE. FLITE must return the original form to the Academic Senate office to be inserted in the proposal and a copy to the initiator. FLITE must respond within 10 business days of receipt of this form to insure that the form is included in the final proposal.

**Failure to respond by 10 business days of receipt of this form is interpreted as support for the proposal.**

## RE: Proposal Title: HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325

**Projected number of students per year affected by proposed change: 75**

**Initiator(s):** Doug Zentz
**Proposal Contact**: Doug Zentz Date Sent: **2/7/14**

**Department:** HVAC Engineering Technology **Address:** GRN-227
(Please type)

**Liaison Librarian Signature: ________________________________ Date Received:**
**Dean of FLITE Signature: __________________________________ Date Returned:**

Based upon our review on (date), FLITE concludes that:

☐ Library resources to support the proposed curriculum change are currently available.

☐ Additional Library resources are needed but can be obtained from current funds.

☐ Support, but significant additional Library funds/resources are required in the amount of $____________.

☐ Does not support the proposal for reasons listed below.

**Comment regarding the impact this proposal will have on library resources, collection development, or other FLITE programs. Use additional pages if necessary.**

**FORM D – Current**

Ferris State University
Imagine More

Associate in Applied Science

# HVACR Technology

Program Academic Requirements

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Student: | | | | | | | | Code | Location | Crs |
| email: | | | ID: | | | | | | Ferris | |
| Advisor: | | | Ph: | | | | | 1 | Transfer | |
| | | **MAJOR** | Cr | Gr | Pts | S | Yr | Code | Notes | |
| HVAC | 101 | Intro to Refrig & A/C Systems (co-req MATH 116) | 4 | | | | | | | |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | | | | | | | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | | | | | | | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111, MATH 116) | 4 | | | | | | | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | | | | | | | |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | | | | | | | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102,117) | 5 | | | | | | | |
| HVAC | 235 | Advanced Heating-Mech System (C- or better in HVAC 117, 132) | 5 | | | | | | | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | | |
| ISYS | 105 | Microcomputer Applications | 3 | | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | | |
| ENGL | 150 | English 1 | 3 | | | | | | | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | | | | | | | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | | |
| MATH | 116 | Interm. Algebra & Numerical Trig (ACT 19 or MATH 110) | 4 | | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, BIOL 111. Course must have a lab) | 4 | | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | | |
| | | **FRESHMEN SEMINAR** | | | | | | | | |
| FSUS | 100 | FSU Seminar | 1 | | | | | | | |
| | | | | | | | | | | |
| | | **Unofficial Statistics** | | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 67 | | | | | | | |
| | | GPA Major: | - | | | | | | | |
| | | GPA Degree: | - | | | | | | | |

AAS Minimum General Education Requirements:
Cultural Enrichment (CE) – 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3/4 credits
Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Ferris State University
Imagine More

Associate in Applied Science

# HVACR Technology

## Course Sequence Guide

| | | | | |
|---|---|---|---|---|
| Student: | | | | |
| Email: | | ID: | | |
| Advisor: | | Ph: | | |

| | | | | |
|---|---|---|---|---|
| **YEAR 1 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 101 | Introduction to Refrigeration & A/C Systems (co-req MATH 116) | 4 | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | |
| MATH | 116 | Intermediate Algebra & Numerical Trigonometry (C- in MATH 110 or 19 ACT) | 4 | |
| ENGL | 150 | English 1 | 3 | |
| FSUS | 100 | FSU Seminar | 1 | |
| | | **Total** | **16** | |
| **YEAR 1 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111 and MATH 116) | 4 | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, or BIOL 111. Must Include a Lab Section) | 4 | |
| | | **Total** | **17** | |
| **YEAR 2 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 235 | Advanced Heating-Mechanical Systems (C- or better in HVAC 117, 132) | 5 | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | |
| ISYS | 105 | Microcomputer Applications | 3 | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | **Total** | **18** | |
| **YEAR 2 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117) | 5 | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | |
| | | Social Awareness Elective | 3 | |
| | | **Total** | **16** | |

AAS Minimum General Education Requirements

Cultural Enrichment (CE) - 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3-4 credits

Reference: gttp://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

FERRIS STATE UNIVERSITY
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Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Program Academic Requirements

| Student: | | | | | | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| email: | | | ID: | | | | | | | Ferris | |
| Advisor: | | | Ph: | | | | | | 1 | Transfer | |
| | | **MAJOR** | Cr | Gr | Pts | S | Yr | Code | Notes | | |
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 331, HVAC342, and MATH 116 or 120) | 4 | | | | | | | | |
| HVAC | 331 | Secondary System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | | | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | | | | | | | | |
| HVAC | 362 | Primary HVAC Equipment Selection (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | | | | | | | | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 350 & 362) | 4 | | | | | | | | |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 or 130, and HVAC 393) | 4 | | | | | | | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 or 130, and HVAC 393) | 4 | | | | | | | | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, and 451) | 5 | | | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | | | |
| ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | 2 | | | | | | | | |
| | | Directed Elective (See Your Advisor) | 3 | | | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | | | |
| COMM | 221 | Small Group Decision Making | 3 | | | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | | | |
| | | Scientific Understanding Elective | 4 | | | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | | | |
| ECON | 221 | Principles of Economics 1 | 3 | | | | | | | | |
| | | | | | | | | | | | |
| | | Unofficial Statistics | | | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 37 | | | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 65 | | | | | | | | |
| | | GPA Major: | - | | | | | | | | |
| | | GPA Degree: | - | | | | | | | | |

Bachelor of Science General Education Requirements:
One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr)
Multiple requirements may be satisfied by a single course.
Cultural Enrichment – 9 credits (3 credits in course > 200 level), Social Awareness - 9credits (3 credits in course > 200 level)
Students must complete 40 credits at or above the 300 level. [Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| | | | | |
|---|---|---|---|---|
| **YEAR 3 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 331 | Secondary System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | |
| HVAC | 342 | Load Analysis & Energy Modeling (Admission to BS in HVACR Engineering Technology) | 4 | |
| ARCH | 110 | Intro to Computer Graphics in ARCH for HVACR Students | 2 | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116)- (Students who took MATH115 shall take MATH120) | 4 | |
| | | Social Awareness Elective | 3 | |
| | | **Total** | **17** | |
| **YEAR 3 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | |
| HVAC | 362 | Primary Equipment Selection (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | |
| | | Scientific Understanding Elective | 4 | |
| MATH | | Students who took MATH 115 and MATH 120 shall take MATH 130 | | |
| | | **Total** | **16** | |
| **YEAR 3 - SUMMER SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 350 & 362) | 4 | |
| | | **Total** | **4** | |
| Submit Application for Graduation. | | | | |
| **YEAR 4 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 415 | Direct Digital Control (C- in MATH 126 or 130, and HVAC 393) | 4 | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- in MATH 126 or 130, and HVAC 393) | 4 | |
| COMM | 221 | Small Group Decision Making | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | **Total** | **14** | |
| **YEAR 4 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415 and 451) | 5 | |
| ECON | 221 | Principles of Economics 1 | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Directed Elective | 3 | |
| | | **Total** | **14** | |

Students must complete 40 credits at or above the 300 level in the bachelor program. Three credits of 300 level coursework must be taken in the social awareness and/or cultural enrichment courses to meet this requirement. From among the cultural enrichment and social awareness coursework, at least one global consciousness course and one REG course must be taken.

**FORM D – Proposed**

FERRIS STATE UNIVERSITY
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Associate in Applied Science

# HVACR Technology

Program Academic Requirements

| Student: | | | | | | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| email: | | | ID: | | | | | | | Ferris | |
| Advisor: | | | Ph: | | | | | | 1 | Transfer | |
| | | **MAJOR** | Cr | Gr | Pts | S | Yr | | Code | Notes | |
| HVAC | 101 | Intro to Refrig & A/C Systems (co-req MATH 116) | 4 | | | | | | | | |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | | | | | | | | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | | | | | | | | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111, MATH 116) | 4 | | | | | | | | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | | | | | | | | |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | | | | | | | | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102,117) | 5 | | | | | | | | |
| HVAC | 235 | Advanced Heating-Mech System (C- or better in HVAC 117, 132) | 5 | | | | | | | | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | | | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | | | |
| ISYS | 105 | Microcomputer Applications | 3 | | | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | | | |
| ENGL | 150 | English 1 | 3 | | | | | | | | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | | | | | | | | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | | | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | | | |
| MATH | 116 | Interm. Algebra & Numerical Trig (ACT 19 or MATH 110) | 4 | | | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | | | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, BIOL 111. Course must have a lab) | 4 | | | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | | | |
| | | **FRESHMEN SEMINAR** | | | | | | | | | |
| FSUS | 100 | FSU Seminar | 1 | | | | | | | | |
| | | | | | | | | | | | |
| | | **Unofficial Statistics** | | | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | | | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 67 | | | | | | | | |
| | | GPA Major: | - | | | | | | | | |
| | | GPA Degree: | - | | | | | | | | |

AAS Minimum General Education Requirements:
Cultural Enrichment (CE) – 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3/4 credits
Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Ferris State University
Imagine More

Associate in Applied Science

# HVACR Technology

## Course Sequence Guide

| | | | | |
|---|---|---|---|---|
| Student: | | | | |
| Email: | | ID: | | |
| Advisor: | | Ph: | | |

| | | | | |
|---|---|---|---|---|
| **YEAR 1 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 101 | Introduction to Refrigeration & A/C Systems (co-req MATH 116) | 4 | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | |
| MATH | 116 | Intermediate Algebra & Numerical Trigonometry (C- in MATH 110 or 19 ACT) | 4 | |
| ENGL | 150 | English 1 | 3 | |
| FSUS | 100 | FSU Seminar | 1 | |
| | | Total | 16 | |
| **YEAR 1 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111 and MATH 116) | 4 | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, or BIOL 111. Must Include a Lab Section) | 4 | |
| | | Total | 17 | |
| **YEAR 2 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 235 | Advanced Heating-Mechanical Systems (C- or better in HVAC 117, 132) | 5 | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | |
| ISYS | 105 | Microcomputer Applications | 3 | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Total | 18 | |
| **YEAR 2 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117) | 5 | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | |
| | | Social Awareness Elective | 3 | |
| | | Total | 16 | |

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential/light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems.

Ferris State University
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Program Academic Requirements

| Student: | | Code | Location | Crs |
|---|---|---|---|---|
| email: | ID: | | Ferris | |
| Advisor: | Ph: | 1 | Transfer | |

| | | MAJOR | Cr | Gr | Pts | S | Yr | Code | Notes | |
|---|---|---|---|---|---|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 321, HVAC342, and MATH 126) | 4 | | | | | | | |
| HVAC | 321 | HVAC Air Side System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | | |
| HVAC | 325 | HVAC Hydronic System Select-Design (C- or better in HVAC 321, HVAC342, and MATH 126) | 4 | | | | | | | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321, HVAC 342, and MATH 126) | 4 | | | | | | | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 325 & 350) | 4 | | | | | | | |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 and HVAC 393) | 4 | | | | | | | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in HVAC 393 and MATH 126) | 4 | | | | | | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 and HVAC 393) | 4 | | | | | | | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, HVAC 451 and HVAC 462) | 4 | | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | | |
| ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | 2 | | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | | |
| ENGL | 311 | Advanced Technical Writing | 3 | | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | | |
| | | Scientific Understanding Elective | 4 | | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | | |
| ECON | 221 | Principles of Economics 1 | 3 | | | | | | | |
| | | | | | | | | | | |
| | | Unofficial Statistics | | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 65 | | | | | | | |
| | | GPA Major: | - | | | | | | | |
| | | GPA Degree: | - | | | | | | | |

Bachelor of Science General Education Requirements:
One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr)
Multiple requirements may be satisfied by a single course.
Cultural Enrichment – 9 credits (3 credits in course > 200 level), Social Awareness - 9credits (3 credits in course > 200 level)
[Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

Ferris State University
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Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Course Sequence Guide

| Student: | | ID: | |
|---|---|---|---|

| YEAR 3 - FALL SEMESTER | | | Crs | Gr | |
|---|---|---|---|---|---|
| HVAC | 321 | HVAC Air Side System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | | |
| HVAC | 342 | Load Analysis & Energy Modeling (Admission to BS in HVACR Engineering Technology) | 4 | | |
| ARCH | 110 | Intro to Computer Graphics in ARCH for HVACR Students | 2 | | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116)- (Students who took MATH115 shall take MATH120) | 4 | | |
| ENGL | 311 | Advanced Technical Writing | 3 | | |
| | | Total | 17 | | |
| YEAR 3 - SPRING SEMESTER | | | Crs | Gr | |
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 321, HVAC342, and MATH 126) | 4 | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321, HVAC 342, and MATH 126) | 4 | | |
| HVAC | 325 | HVAC Hydronic System Select-Design (C- or better in HVAC 321, HVAC342, and MATH 126) | 4 | | |
| | | Scientific Understanding Elective | 4 | | |
| MATH | | Students who took MATH 115 and MATH 120 shall take MATH 130 | | | |
| | | Total | 16 | | |
| YEAR 3 - SUMMER SEMESTER | | | Crs | Gr | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 325 & 350) | 4 | | |
| | | Total | 4 | | |
| YEAR 4 - FALL SEMESTER | | | Crs | Gr | |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 and HVAC 393) | 4 | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 and HVAC 393) | 4 | | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in HVAC 393 and MATH 126) | 4 | | |
| | | Cultural Enrichment Elective | 3 | #REF! | |
| | | Total | 15 | | |
| YEAR 4 - SPRING SEMESTER | | | Crs | Gr | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, HVAC 451 and HVAC 462) | 4 | | |
| ECON | 221 | Principles of Economics 1 | 3 | | |
| | | Cultural Enrichment Elective | 3 | #REF! | |
| | | Social Awareness Elective | 3 | | |
| | | Total | 13 | | |

Learning Outcomes Include: 1) analyze & select commercial/industrial HVAC systems for specific applications, 2) design commercial/industrial HVAC systems, given design parameters, building type, & geographic location, 3) select secondary equipment for specific commercial/industrial ducting & piping systems, 4) select primary equipment for specific commercial/industrial ducting & piping systems, 5) commission a commercial or industrial HVAC system, 6) perform an energy audit of an actual facility & analyze utilities for proper applications; Operation & Maintenance & Energy Conservation Measures for potential energy savings; & implementation feasibility using payback calculations, 7) understand, utilize & develop estimates, specs, economic costs, & analysis codes & standards, 8) program control sequences for specific commercial & industrial HVAC systems & equipment.

# COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)** ☒ **Number (current)** ☐ **LEC ___ LAB ___ SEM ___ (current)**

(proposed) **HVAC** (proposed) **321** (Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current)**

(proposed) **HVAC Air System Select-Design**

☒ **Credit Hours (current)** ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) **4** (proposed) Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management (proposed)

☒ **Course Description (current): (125 words maximum)**

(proposed): A study of air systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.

☒ **Course Outcomes and Assessment Plan (current)**

**(proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Assessment Code:

1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | Assessment |
|---|---|---|
| | | |
| I. | Introduction | |
| II. | Applied Psychrometrics<br>A. Review basic psychrometrics.<br>B. Apply psychrometrics to the air system design process | 1.<br>2.<br>3. |
| III. | Air Diffusion<br>A. Determine type, size and location of diffusers and grilles.<br>B. Determine location and size of ventilation air intake.<br>C. Determine location and size of exhaust air grille. | 1.<br>2.<br>3. |
| IV. | Ductwork<br>A. Calculate cross-sectional area of a duct.<br>B. Calculate velocity of air in a duct.<br>C. Calculate volume of air in a duct.<br>D. Determine space air flow requirements.<br>E. Determine type, size and routing of duct system (including | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | ventilation air intake and exhaust ducts). | |
| V. | Air System Pressure Loss Calculations<br>A. Find fitting loss coefficients from tabular data.<br>B. Calculate friction loss in a duct system.<br>C. Utilize manufacturer's computer software to calculate duct system friction loss. | 1.<br>2.<br>3. |
| VI. | Air System Configuration<br>A. Describe the components and operating characteristics of a(n)<br>a. single zone air system.<br>b. terminal reheat air system.<br>c. dual-duct air system.<br>d. Multizone air system.<br>e. variable air volume system.<br>f. variable volume, variable temperature (VVT) system.<br>g. induction air system. | 1.<br>2. |
| VII. | Fan Selection and Performance<br>A. Identify two main categories of fans.<br>a. forward curve fans.<br>b. backward inclined and air foil fans.<br>c. radial blade fans.<br>d. propeller fans.<br>e. vane-axial fans.<br>f. tube-axial fans.<br>B. Select a fan from manufacturer's performance data.<br>C. Use fan laws to plot system curve on fan performance curve.<br>D. Select proper motor horsepower for circulating fan.<br>E. Describe effects of varying fan volume on fan performance curve. | 1.<br>2.<br>3. |
| VIII. | Duct System Design Procedure<br>A. Utilizing all available information design an air system in its entirety (diffuser to fan). | 1.<br>2.<br>3. |
| IX. | Air System Testing and Balancing<br>A. Identify and summarize the function of instruments used to balance air systems.<br>B. Determine actual operating characteristics of fans.<br>C. Determine flow rates of air systems using various flow measuring devices.<br>D. Calculate the resistance in a ductwork system. | 1.<br>2.<br>3. |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
**(proposed)**

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Applied Psychrometrics | 6 | 6 |
| III. | Air Diffusion | 6 | 3 |

| | | | |
|---|---|---|---|
| IV. | Ductwork | 5 | 3 |
| V. | Air System Pressure Loss Calculations | 3 | 6 |
| VI. | Air System Configurations | 6 | 3 |
| VII. | Fan Selection and Performance | 6 | 6 |
| VIII. | Duct System Design Procedure | 6 | 6 |
| IX. | Air System Testing and Balancing | 3 | 6 |
| X. | Exams | 3 | 6 |
| | | | |
| | Total Hours | 45 | 45 |

**Associate Provost's Signature:** ____________________________Date________

# COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)** ☐ **Number (current)** ☐ **LEC ___ LAB ___ SEM ___ (current)**

(proposed) **HVAC** (proposed) **325** (Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current)**

(proposed) **HVAC Hydronic System Select-Design**

☒ **Credit Hours (current)** ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) **4** (proposed) C- (or better) in HVAC 321, HVAC 342 and MATH126 (proposed)

☒ **Course Description (current): (125 words maximum)**

(proposed): A study of water systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.

☒ **Course Outcomes and Assessment Plan (current)**

**(proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Assessment Code:
1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | Assessment |
|---|---|---|
| I. | Introduction | |
| II. | Hydronic System Definition and Classification<br>A. Classify hydronic systems based upon flow generation, temperature, pressure, piping and pumping arrangement.<br>B. Explain the advantages and disadvantages of various piping and pumping arrangements.<br>C. Calculate primary and secondary flowrates and temperatures in primary-secondary pumping arrangements. | 1.<br>2. |
| III. | Terminal Devices<br>A. Determine type, size and location of finned tube radiation units.<br>B. Determine type, size and location of hot water convector units.<br>C. Determine type, size and location of cabinet unit heaters.<br>D. Determine type, size and location of unit heaters. | 1.<br>2.<br>3. |
| IV. | Hydronic System Design Procedure<br>A. Select terminal devices based on load requirements and calculate the required flow of water for each temperature control zone. | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | B. Determine pipe size required to carry desired water flowrate based upon friction loss and velocity.<br>C. Calculate equivalent length of pipe fittings in piping network.<br>D. Calculate friction loss of piping circuits.<br>E. Determine pressure losses of equipment and terminal units from manufacturer's data.<br>F. Calculate total head loss in closed loop piping systems.<br>G. Use pump affinity laws to plot system curve on pump performance curve for closed loop piping system.<br>H. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>I. Calculate total head loss in open piping systems.<br>J. Use pump affinity laws to plot system curve on pump performance curve for open loop piping system.<br>K. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>L. Select proper motor horsepower for circulating pump from manufacturer's performance data.<br>M. Develop parallel pump performance curves and identify operating points.<br>N. Develop series pump performance curves and identify operating points.<br>O. Analyze the effects of glycol on pump performance.<br>P. Determine the type, size and location of the system expansion tank.<br>Q. Utilize manufacturer's computer software to calculate piping system friction loss.<br>R. Utilize manufacturer's computer software to select proper circulating pump.<br>S. Utilize manufacturer's computer software to select proper expansion tank size. | |
| V. | Flow Control Devices<br>A. Explain the application of various service valves in hydronic systems.<br>B. Explain the relationship between heat transfer, temperature differential and flow through a terminal convection element.<br>C. Explain the relationship between valve port configuration and stem travel.<br>D. Explain the relationship between energy transfer and valve stem travel for various valve types.<br>E. Define the control flow coefficient (Cv).<br>F. Select two-way modulating and three-way mixing and diverting valves using the flow coefficient (Cv). | 1.<br>2.<br>3. |
| VI. | Pumps<br>A. Identify the components and summarize the operation of a centrifugal pump.<br>B. Explain the relationship between flowrate and total dynamic head in a closed hydronic system.<br>C. Explain the difference between open and closed hydronic systems. | 1.<br>2.<br>3. |
| VII. | Balancing Hydronic Systems<br>A. Identify and summarize the function of instruments used to balance hydronic systems.<br>B. Determine circulating pump impeller size.<br>C. Determine actual operating characteristics of circulating pump.<br>D. Determine flow rates of hydronic circuits using various flow | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | measuring devices.<br>E. Calculate resistance necessary to pre-balance hydronic circuit.<br>F. Determine new impeller size to produce required flowrate. | |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
**(proposed)**

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Hydronic System Definition and Classification | 2 | 3 |
| III. | Terminal Devices | 6 | 3 |
| VI. | Hydronic System Design Procedure | 12 | 15 |
| V. | Flow Control Devices | 9 | 6 |
| VI. | Pumps | 9 | 6 |
| VII. | Balancing Hydronic Systems | 3 | 6 |
| VIII. | Exams | 3 | 6 |
| | Total Hours | 45 | 45 |

**Associate Provost's Signature:** ____________________________Date_______

# COURSE INFORMATION FORM

# FORM E

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)** (proposed) **HVAC**

☐ **Number (current)** (proposed) **462**

☐ **LEC ___ LAB ___ SEM ___ (current)**

(Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current)**

(proposed) **HVAC Primary Equipment Selection**

☒ **Credit Hours (current)** (proposed) **4**

☒ **Prerequisites (current)** (proposed) C- (or better) in MATH 126 & HVAC393

**Co-requisite (current)** (proposed)

☒ **Course Description (current): (125 words maximum)**

(proposed): The selection, application and layout of state-of-the-art equipment and systems for commercial and industrial buildings. Emphasis will be placed upon the energy efficiency, integration of equipment into a complete system, and sequence of operation.

☒ **Course Outcomes and Assessment Plan (current)**

**(proposed): Learning Outcomes and Assessment for Each Instructional Unit**

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**Assessment Code** (**AC**):

1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | AC |
|---|---|---|
| I. | Introduction and Primary System Overview<br>A. Understand course policy and requirements.<br>B. Define the various categories of primary HVAC equipment, design and selection process and document development. | |
| II. | Chiller Systems<br>A. Define all the types of chiller systems and support components.<br>B. Apply and design a chiller system.<br>C. Select a chiller system from available vendors.<br>D. Develop all documentation for chiller design: piping schematics, chiller schedule, submittal documentation. | 1.<br>2.<br>3. |
| III. | Cooling Tower Systems<br>A. Define all the types of cooling tower systems and support components.<br>B. Apply and design a cooling tower system.<br>C. Select a cooling tower system from available vendors.<br>D. Develop all documentation for a cooling tower design: piping schematics, cooling tower schedule, submittal documentation. | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| IV. | Boiler Systems<br>A. Define all the types of boiler systems and support components.<br>B. Apply and design a boiler system.<br>C. Select a boiler system from available vendors.<br>D. Develop all documentation for a boiler design: piping schematics, boiler tower schedule, submittal documentation. | 1.<br>2.<br>3. |
| V. | Air Handling Units<br>A. Define all the types of air handling units and support components.<br>B. Apply and design an air handling unit.<br>C. Select an air handling unit from available vendors.<br>D. Develop all documentation for an AHU design: piping schematics, AHU schedule, submittal documentation. | 1.<br>2.<br>3. |
| VI. | Heat Exchangers<br>A. Define all the types of heat exchangers and support components.<br>B. Apply and design a heat exchanger.<br>C. Select a heat exchanger from available vendors.<br>D. Develop all documentation for a heat exchanger design: piping schematics, heat exchanger schedule, submittal documentation. | 1.<br>2.<br>3. |
| VII. | Thermal Storage<br>A. Define all the types of thermal storage and support components.<br>B. Apply and design a thermal storage system.<br>C. Select a thermal storage system from available vendor.<br>D. Develop all documentation for a thermal storage system design: piping schematics, thermal storage schedule, submittal documentation. | 1.<br>2. |
| VIII. | Dehumidification<br>A. Define all the types of dehumidification and support components.<br>B. Apply and design a dehumidification system.<br>C. Select a dehumidification system from an available vendor.<br>D. Develop all documentation for a dehumidification system: dehumidification schedule, submittal documentation. | 1.<br>2.<br>3. |
| IX. | Heat Pumps<br>A. Define all the types of heat pumps and support components.<br>B. Apply and design a heat pump system.<br>C. Select a heat pump system from an available vendor.<br>D. Develop all documentation for a heat pump system: piping schematics, heat pump schedule, submittal documentation. | 1.<br>2.<br>3. |
| X. | Class Project<br>A. Given a set of building specification: Apply, design, select and develop all documentation for a complete project building HVAC system.<br>B. Illustrate the full load energy consumption of the HVAC system<br>C. Illustrate a sequence of operation for the HVAC system | 1.<br>2.<br>3. |

☒ **Course Outline including Time Allocation (current)**

Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:

Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
(proposed)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|

| | | | |
|---|---|---|---|
| I. | Introduction to Course, Overview of HVAC Primary Systems | 1 | 0 |
| II. | Chiller systems | 9 | 6 |
| III. | Cooling tower systems | 6 | 3 |
| IV. | Boiler systems | 6 | 6 |
| V. | Air Handling Units | 9 | 6 |
| VI. | Heat Exchangers | 3 | 3 |
| VII. | Thermal storage | 2 | 3 |
| VIII. | Dehumidification | 2 | 3 |
| IX. | Heat pumps | 3 | 3 |
| X. | Course Project | 2 | 12 |
| XI. | Exams | 2 | 0 |
| | Total Hours | 45 | 45 |

**Associate Provost's Signature:** ____________________________Date_______

# COURSE INFORMATION FORM

# FORM E

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)** **HVAC** ☒ **Number (current)** **499** ☐ **LEC 2 LAB 9 SEM ___ (current)**

(proposed) **HVAC** (proposed) **499** (Enter Contact Hours per week)
LEC _2__ LAB _6__ SEM ___(proposed):

☐ **Title (current)** **Commerical HVAC System Design**

(proposed) **Commercial HVAC System Design**

☒ **Credit Hours (current)** **5** ☒ **Prerequisites (current)** **HVAC 415 and HAVC 451 with a C- or better** **Co-requisite (current)**

(proposed) **4** (proposed) HVAC 415, HVAC 451, and HVAC 462 with a grade of C- or better.
(proposed)

☒ **Course Description (current): (125 words maximum)**
Given building architectural plans, appropriate software, codes and standards and owner's requirements, students will select appropriate HVAC system, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation. This course meets General Education Requirements: Writing Intensive.
(proposed): Given building architectural plans, appropriate software, codes and standards and owner's requirements, students will select appropriate HVAC system, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation. This course meets General Education Requirements: Writing Intensive.

☒ **Course Outcomes and Assessment Plan (current)**

## Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding the overall HVAC system design procedure.
2. Analyzing owner & building requirements for proper equipment selection.
3. Computerized load calculation and building simulation related to the HVAC design process.
4. Developing system layouts, working drawings, specification and control sequence of operation.

## (proposed): Learning Outcomes and Assessment for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

Note: Each Learning unit has written assignments which build toward the final class project as this is a Capstone class, continual feedback is given to individual students as well as student groups as the final project is a group based learning project.

| | |
|---|---|
| I. | Introduction and Project Overview<br>A. Understand the purpose and course objectives |

| | |
|---|---|
| | B. Understand the project timeline |
| II. | Design Procedure<br>A. Identify the processes of HVAC design |
| III. | System Analysis and Selection<br>A. Apply factors affecting zoning decisions to system selection.<br>B. Evaluate architectural considerations and its affect upon system selection.<br>C. Evaluate system configuration and performance in relationship to building and zoning considerations.<br>D. Evaluate economics in relationship to budgetary considerations (first cost and operating costs).<br>E. Summarize system performance.<br>F. Identify potential systems to meet performance requirements. |
| IV. | Base Load Information<br>A. Indentify indoor design requirements based upon occupancy and applicable codes.<br>B. Identify indoor air quality requirements. |
| V. | Miscellaneous Base Load<br>A. Describe ventilation characteristics of various systems. |
| VI. | Initial Design Load<br>A. Assemble building base load information.<br>B. Calculate building base load.<br>C. Assemble building miscellaneous base load information.<br>D. Calculate miscellaneous base load.<br>E. Calculate building load. |
| VII. | Applied Load Analysis<br>A. Understand load analysis terminology.<br>B. Calculate equipment sizing loads.<br>C. Determine ventilation requirements for indoor air quality, economizer and building pressurization.<br>D. Perform load line analysis based upon design load.<br>E. Identify preliminary control strategies and modes.<br>F. Identify methods to control humidity.<br>G. Apply psychrometric analysis. |
| VIII. | Equipment Selection<br>A. Identify critical conditions for cooling coil selection.<br>B. Select cooling coil.<br>C. Identify miscellaneous accessories.<br>D. Select air handling equipment.<br>E. Select chiller.<br>F. Select heat rejection equipment.<br>G. Identify critical conditions for heating coil selection.<br>H. Select heating coil.<br>I. Identify miscellaneous heating accessories.<br>J. Select boiler.<br>K. Identify availability and verify electrical rate structure.<br>L. Identify availability and verify fossil fuel rate structure.<br>M. Analyze applicability of energy enhancing systems. |
| IX. | Building Simulation<br>A. Input utility data.<br>B. Input building data.<br>C. Input plant data.<br>D. Generate component and annual energy costs. |
| X. | System Sizing and Layout<br>A. Select size and layout air distribution system.<br>B. Calculate air pressure losses and select fan.<br>C. Select size and layout water distribution system. |

| | |
|---|---|
| | D. Calculate water pressure losses and select circulating pump. |
| XI. | Working Drawings<br>A. Identify standards and drawing arrangement.<br>B. Develop working drawings for piping, ductwork, details, schematics and control diagrams and schedules. |
| XII. | Specifications<br>A. Understand the purpose and format for mechanical specifications.<br>B. Understand the purpose and format for control specifications. |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
(proposed)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction and Project Overview | 1 | 0 |
| II. | Design Procedure | 1 | 0 |
| III. | System Analysis and Selection | 2 | 6 |
| IV. | Base Load Information | 2 | 12 |
| V. | Miscellaneous Base Load | 2 | 6 |
| VI. | Initial Design Load | 2 | 6 |
| VII. | Applied Load Analysis | 2 | 6 |
| VIII. | Equipment Selection | 4 | 6 |
| IX. | Building Simulation | 2 | 6 |
| X. | System Sizing and Layout | 3 | 12 |
| XI. | Working Drawings | 2 | 18 |
| XI. | Specifications | 2 | 6 |
| XII. | Project Report | 2 | 6 |
| XIII. | Exams | 3 | 0 |
| | Total Hours | 30 | 90 |

**Associate Provost's Signature:** ___________________________Date_______

# CREATE NEW COURSE

# FORM F

**Course Data Entry Form**

Rev. September 2012

**COMPLETE ALL SECTIONS BELOW. If this course is to be used as a prerequisite for other university courses, Form F's that reflect the prerequisite change must be submitted for those courses as well. See Appendix E Instructions for Completing Forms.**

**I. ACTION TO BE TAKEN: CREATE A NEW COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. NEW COURSE ATTRIBUTES:**

**a**. Course Prefix **HVAC** **b**. Number **321** **c**. Contact Hours **3** LECture **3** LAB ☐Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

**d.** ☐ Practicum ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

**e**. Course Title: **HVAC Air System Select-Design** (Limit to 30 characters including punctuation and spaces.)

**f**. College Code: **CET** **g**. Department Code: **HVAC** **h.** Credit Hours: Check (x) type ☐ Variable ☒ Fixed

**i**. Enter number in box: **4** Minimum Credit Hours **j**. **4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☒ Yes ☐ No
If yes, Max Times **3** or Max Credits Awarded

**l**. Levels: Check (x) ☒ Undergraduate ☐ Graduate ☐ Professional

**m**. Grade Method: Check (x) ☒ Normal Grading ☐ Credit/No Credit (Pass/Fail)

**n**. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☒ No

**o**. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE**.**
A study of air systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.

**q**. Term(s) Offered: **Fall** **r.** Max Section Enrollment: **16** **s**. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management

**t.** Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:**

____________________________ ___/___/___

**Academic Affairs Approval Signature/Date:**

____________________________ ___/___/___

**Office of the Registrar use ONLY**

**Date Rec'd: ____ Date Completed: ____ Entered: SCACRSE __ SCADETL __ SCARRES __ SCAPREQ __**

# CREATE NEW COURSE

# FORM F

**Course Data Entry Form**

Rev. September 2012

**COMPLETE ALL SECTIONS BELOW. If this course is to be used as a prerequisite for other university courses, Form F's that reflect the prerequisite change must be submitted for those courses as well. See Appendix E Instructions for Completing Forms.**

**I. ACTION TO BE TAKEN: CREATE A NEW COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. NEW COURSE ATTRIBUTES:**

**a**. Course Prefix **HVAC** **b**. Number **325** **c**. Contact Hours **3** LECture **3** LAB ☐ Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

**d.** ☐ Practicum ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

**e**. Course Title: **HVAC Hydronic System Select-Design** (Limit to 30 characters including punctuation and spaces.)

**f**. College Code: **CET** **g**. Department Code: **HVAC** **h.** Credit Hours: Check (x) type ☐ Variable ☒ Fixed

**i**. Enter number in box: **4** Minimum Credit Hours **j**. **4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☒ Yes ☐ No
If yes, Max Times **3** or Max Credits Awarded

**l**. Levels: Check (x) ☒ Undergraduate ☐ Graduate ☐ Professional

**m**. Grade Method: Check (x) ☒ Normal Grading ☐ Credit/No Credit (Pass/Fail)

**n**. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☒ No

**o**. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

A study of water systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.

**q**. Term(s) Offered: **Spring** **r.** Max Section Enrollment: **16** **s**. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- (or better) in HVAC 321, HVAC 342 and MATH126

**t.** Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** **Academic Affairs Approval Signature/Date:**

____________________________ ___/___/___ ____________________________ ___/___/___

**Office of the Registrar use ONLY**

**Date Rec'd: ____ Date Completed: ____ Entered: SCACRSE __ SCADETL __ SCARRES __ SCAPREQ __**

# MODIFY A COURSE — FORM F

**Course Data Entry Form** — Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**
**a**. Course Prefix **HVAC** **b**. Number **350** **c**. Title **Contracting Issues in HVACR**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

**a**. Course Prefix **b**. Number **c**. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

**d.** ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

**e**. Course Title: (Limit to 30 characters including punctuation and spaces.)

**f**. College Code: **g**. Department Code: **h.** Credit Hours: Check (x) type ☐ Variable ☐ Fixed

**i**. Enter number in box: Minimum Credit Hours **j**. Maximum Credit Hours .

**k**. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
**l**. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

**m**. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

**n**. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

**o**. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE**.**

**q**. Term(s) Offered: **r.** Max Section Enrollment: Section(s) Affected:

**s**. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in HVAC 321, HVAC 342, and MATH 126

**t.** Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office: -* Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** ____________________________ ___/___/___

**Academic Affairs Approval Signature/Date:** ____________________________ ___/___/___

**Office of the Registrar use ONLY**

**Date Rec'd: ____ Date Completed: ____ Entered: SCACRSE __ SCADETL __ SCARRES __ SCAPREQ __**

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**
**a**. Course Prefix **HVAC** **b**. Number **393** **c**. Title **Summer Internship**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

**a**. Course Prefix **b**. Number **c**. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

**d.** ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

**e**. Course Title: (Limit to 30 characters including punctuation and spaces.)

**f**. College Code: **g**. Department Code: **h.** Credit Hours: Check (x) type ☐ Variable ☐ Fixed

**i**. Enter number in box: Minimum Credit Hours **j**. Maximum Credit Hours .

**k**. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
**l**. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

**m**. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

**n**. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

**o**. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE**.**

**q**. Term(s) Offered: **r.** Max Section Enrollment: Section(s) Affected:

**s**. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in HVAC 312, 325 & 350

**t.** Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** ____________________________ ___/___/___

**Academic Affairs Approval Signature/Date:** ____________________________ ___/___/___

**Office of the Registrar use ONLY**

**Date Rec'd: ____ Date Completed: ____ Entered: SCACRSE __ SCADETL __ SCARRES __ SCAPREQ __**

# MODIFY A COURSE

**FORM F**

## Course Data Entry Form

Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**
**a**. Course Prefix **HVAC** **b**. Number **415** **c**. Title **Direct Digital Control**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

**a**. Course Prefix **b**. Number **c**. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

**d.** ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

**e**. Course Title: (Limit to 30 characters including punctuation and spaces.)

**f**. College Code: **g**. Department Code: **h.** Credit Hours: Check (x) type ☐ Variable ☐ Fixed

**i**. Enter number in box: Minimum Credit Hours **j**. Maximum Credit Hours .

**k**. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
**l**. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

**m**. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

**n**. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

**o**. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE**.**

**q**. Term(s) Offered: **r.** Max Section Enrollment: Section(s) Affected:

**s**. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in MATH 126 and HVAC 393

**t.** Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office: -* Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:**

____________________________ ___/___/___

**Academic Affairs Approval Signature/Date:**

____________________________ ___/___/___

**Office of the Registrar use ONLY**

**Date Rec'd: ____ Date Completed: ____ Entered: SCACRSE __ SCADETL __ SCARRES __ SCAPREQ __**

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**

**a**. Course Prefix **HVAC** **b**. Number **451** **c**. Title Energy Audit and Analysis

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

**a**. Course Prefix **b**. Number **c**. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

**d.** ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

**e**. Course Title: (Limit to 30 characters including punctuation and spaces.)

**f**. College Code: **g**. Department Code: **h.** Credit Hours: Check (x) type ☐ Variable ☐ Fixed

**i**. Enter number in box: Minimum Credit Hours **j**. Maximum Credit Hours .

**k**. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
**l**. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

**m**. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

**n**. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

**o**. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE**.**

**q**. Term(s) Offered: **r.** Max Section Enrollment: Section(s) Affected:

**s**. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in MATH 126 and HVAC 393

**t.** Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office: -* Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:**

_____________________________ ___/___/___

**Academic Affairs Approval Signature/Date:**

_____________________________ ___/___/___

**Office of the Registrar use ONLY**

**Date Rec'd: ____ Date Completed: ____ Entered: SCACRSE __ SCADETL __ SCARRES __ SCAPREQ __**

# CREATE NEW COURSE

# FORM F

**Course Data Entry Form**

Rev. September 2012

**COMPLETE ALL SECTIONS BELOW. If this course is to be used as a prerequisite for other university courses, Form F's that reflect the prerequisite change must be submitted for those courses as well. See Appendix E Instructions for Completing Forms.**

**I. ACTION TO BE TAKEN: CREATE A NEW COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. NEW COURSE ATTRIBUTES:**

**a**. Course Prefix **HVAC** **b**. Number **462** **c**. Contact Hours **3** LECture **3** LAB ☐Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

**d.** ☐ Practicum ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

**e**. Course Title: **HVAC Primary Equipment Selection** (Limit to 30 characters including punctuation and spaces.)

**f**. College Code: **CET** **g**. Department Code: **HVAC** **h.** Credit Hours: Check (x) type ☐ Variable ☒ Fixed

**i**. Enter number in box: **4** Minimum Credit Hours **j**. **4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☒ Yes ☐ No
If yes, Max Times **3** or Max Credits Awarded

**l**. Levels: Check (x) ☒ Undergraduate ☐ Graduate ☐ Professional

**m**. Grade Method: Check (x) ☒ Normal Grading ☐ Credit/No Credit (Pass/Fail)

**n**. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☒ No

**o**. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE**.**

The selection, application and layout of state-of-the-art equipment and systems for commercial and industrial buildings. Emphasis will be placed upon the energy efficiency, integration of equipment into a complete system, and sequence of operation.

**q**. Term(s) Offered: **Fall/Spring/Summer** **r.** Max Section Enrollment: **16** **s**. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- (or better) in MATH 126 & HVAC393

**t.** Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office: -* Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** **Academic Affairs Approval Signature/Date:**

________________________ ___/___/___ ________________________ ___/___/___

**Office of the Registrar use ONLY**

**Date Rec'd: ____ Date Completed: ____ Entered: SCACRSE __ SCADETL __ SCARRES __ SCAPREQ __**

# MODIFY A COURSE — FORM F

**Course Data Entry Form** — Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**

**a**. Course Prefix **HVAC** **b**. Number **499** **c**. Title Commercial HVAC System Design

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. h, i, j, s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

**a**. Course Prefix **b**. Number **c**. Contact hours **2** LECture **6** LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

**d.** ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

**e**. Course Title: (Limit to 30 characters including punctuation and spaces.)

**f**. College Code: **g**. Department Code: **h.** Credit Hours: Check (x) type ☒ Variable ☐ Fixed

**i**. Enter number in box: **4** Minimum Credit Hours **j**. **5** Maximum Credit Hours .

**k**. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
**l**. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

**m**. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

**n**. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

**o**. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE**.**

**q**. Term(s) Offered: **r.** Max Section Enrollment: Section(s) Affected:

**s**. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in HVAC 415, HVAC 451 and HVAC 462

**t.** Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** ____________________ ___/___/___

**Academic Affairs Approval Signature/Date:** ____________________ ___/___/___

**Office of the Registrar use ONLY**

**Date Rec'd: ____ Date Completed: ____ Entered: SCACRSE __ SCADETL __ SCARRES __ SCAPREQ __**

15-079

**FORM A**

Revised September 2014

# PROPOSAL SUMMARY AND ROUTING FORM

**Proposal Title: HVACR change to math prerequisite timing**

**Initiating Individual:** Mike Feutz **Initiating Department or Unit:** HVAC
**Contact Person's Name:** Mike Feutz **e-mail:** feutzm@ferris.edu **phone:** 2351

- ☐ Group I - A – New degree, major, concentration, minor, or redirection of a current offering
- ☐ Group I - B – Deletion of a degree, major, concentration, or minor
- ☐ Group II - A – New Course, modification of a course, deletion of a course
- ☒ Group II - B – Minor curriculum clean-up
- ☐ Group III – Certificates (☐ College Credit ☐ Non-Credit) ☐ New Certificate
- ☐ Group IV – Other Site Locations (☐ College Credit ☐ Non-Credit)

| | Signature<br>Print and sign your name. | Date | Vote/Action *<br>Number count ** |
|---|---|---|---|
| Program Representative ** | DOUGLAS F. ZENTZ | 3/3/15 | 9 Support<br>0 Support with Concerns<br>0 Not Support<br>1 Abstain (SABBATICAL) |
| Department/School/Faculty Representative Vote ** | John Schmidt | 3/19/15 | 5 Support<br>0 Support with Concerns<br>0 Not Support<br>1 Abstain (on travel) |
| Department/School - Administrator | John Schmidt | 3/19/15 | X Support<br>___ Support with Concerns<br>___ Not Support |
| College Curriculum Committee/Faculty | CHUCK DRAKE | 4/2/15 | 9 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| Dean | LARRY SCHULT | 4/3/15 | ✓ Support<br>___ Support with Concerns<br>___ Not Support |
| University Curriculum Committee ** | | 9-10-15 | ✓ Support 6-0<br>___ Support with Concerns<br>___ Not Support<br>___ Abstain |
| Senate ** | K. Thomas | 9-15-15 | ✓ Support<br>___ Support with Concerns<br>___ Not Support<br>___ Abstain |
| Academic Affairs | | 9/28/15 | X Support<br>___ Hold<br>___ Not Support |

* Support with Concerns or Not Support must include identification of specific concerns with appropriate rationale.
** Number count must be given for all members present and/or voting.

| To be completed by Academic Affairs | | Date/Term of Implementation: SPRING 2016 |
|---|---|---|
| President (Date Approved) | Board of Trustees (Date Approved) | Academic Officers of MI (Date Approved) |

VPAA
SEP 16 2015
PROVOST

**FORM A**

Revised September 2014

# PROPOSAL SUMMARY AND ROUTING FORM

## Proposal Title: HVACR change to math prerequisite timing

**Initiating Individual:** Mike Feutz **Initiating Department or Unit:** HVAC
**Contact Person's Name:** Mike Feutz **e-mail:** feutzm@ferris.edu **phone:** 2351

- ☐ Group I - A – New degree, major, concentration, minor, or redirection of a current offering
- ☐ Group I - B – Deletion of a degree, major, concentration, or minor
- ☐ Group II - A – New Course, modification of a course, deletion of a course
- ☒ Group II - B – Minor curriculum clean-up
- ☐ Group III – Certificates (☐ College Credit ☐ Non-Credit) ☐ New Certificate
- ☐ Group IV – Other Site Locations (☐ College Credit ☐ Non-Credit)

| | Signature<br>Print and sign your name. | Date | Vote/Action *<br>Number count ** |
|---|---|---|---|
| Program Representative ** | DOUGLAS F. ZENTZ<br>[signature] | 3/3/15 | 9 Support<br>0 Support with Concerns<br>0 Not Support<br>1 Abstain (SABBATICAL) |
| Department/School/Faculty Representative Vote ** | [signature]<br>John Schmidt | 3/19/15 | 5 Support<br>0 Support with Concerns<br>0 Not Support<br>1 Abstain (on travel) |
| Department/School - Administrator | [signature]<br>John Schmidt | 3/19/15 | X Support<br>___ Support with Concerns<br>___ Not Support |
| College Curriculum Committee/Faculty | CHUCK DRAKE | | 9 Support<br>Ø Support with Concerns<br>Ø Not Support<br>Ø Abstain |
| Dean | LARRY Schutt | | ___ Support<br>___ Support with Concerns<br>___ Not Support |
| University Curriculum Committee ** | | | ___ Support<br>___ Support with Concerns<br>___ Not Support<br>___ Abstain |
| Senate ** | | | ___ Support<br>___ Support with Concerns<br>___ Not Support<br>___ Abstain |
| Academic Affairs | | | ___ Support<br>___ Hold<br>___ Not Support |

* Support with Concerns or Not Support must include identification of specific concerns with appropriate rationale.
** Number count must be given for all members present and/or voting.

**To be completed by Academic Affairs** **Date/Term of Implementation:** __________

| President (Date Approved) | Board of Trustees (Date Approved) | Academic Officers of MI (Date Approved) |
|---|---|---|

**FORM A CONT.**

1. **Proposal Summary**

(Summary is generally less than one page. Briefly: state what is proposed with a summary of rationale and highlights.)

**MATH 116/126 have long offered advising challenges with the number of transfer students in HVACR. This proposes to delay the semester when the Math requirements are to be met, and modify the check sheets to reflect the change. As such, *this proposal affects only the timing of the math prerequisites.***

**Associate Degree: Currently, freshmen are required to complete MATH 116 by their second semester. This proposes to change this to their 200 level HVAC courses. This gives them an extra semester (and a summer) to fulfill the requirement in case they failed the course, or in case they could not fit it into their first semester schedule.**

**Baccalaureate Degree: Transfer students typically transfer in with only MATH 115 equivalent, and fulfill their math requirements with the 115/120/130 track. This means they take MATH 120 during fall semester and 130 during winter. Current BS check sheets require students to complete MATH 126 by their second semester. This works well for continuing Ferris students who completed MATH 116 during their AAS work, but is not possible for transfers. This is a double standard that requires continuing student to reach the 126/130 level (pre-calc) by winter of their junior year, while transfer students are given until fall of their senior year.**

**This proposes to change the MATH 126/130 completion from winter of junior year until fall of senior year (400 level classes). Similar to the associate degree rationale, this proposal grants students an extra semester (or two) to fulfill their math requirement.)**

**NOTE: 400 level HVAC courses already had MATH 126 listed as a prereq, so this proposal simply removes that prereq from existing 300 level courses.**

2. **Summary of Curricular Action (check all that apply to this proposal)**

☐ Degree ☐ Major ☒ Minor ☐ Concentration ☐ Certificate ☐ Course

☐ New ☐ Modification ☐ Deletion

Name of Degree, Major, etc. : ____________________

3. **Summary of All Course Action Required** Contact Senate Secretary or UCC Chair if additional spaces are required.

a. **Newly Created Courses to be Added to FSU Catalog:**

| Prefix | Number | Title |
|---|---|---|

b. **Courses to be Deleted from FSU Catalog:**

| Prefix | Number | Title |
|---|---|---|

c. **Existing Course(s) to be Modified:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 102 | Advanced Refrigeration & A/C |
| HVAC | 117 | Advanced Electricity-Circuits |
| HVAC | 132 | Fund of Heating & Mechanical Systems |

| | | |
|---|---|---|
| HVAC | 235 | Advanced Heating-Mechanical Systems |
| HVAC | 245 | HVAC Unitary System Design |
| HVAC | 207 | Commercial Refrigeration Systems |
| HVAC | 208 | Air Conditioning Applications |
| HVAC | 312 | Control Theory & Application |
| HVAC | 325 | HVAC Hydronic Systm Slct-Dsgn |
| HVAC | 350 | Contracting Issues in HVACR |

d. **Addition of existing FSU courses to program**

| Prefix | Number | Title |
|---|---|---|

e. **Removal of existing FSU courses from program**

| Prefix | Number | Title |
|---|---|---|

4. **Summary of All Consultations**

| **Form Sent (B or C)** | **Date Sent** | **Responding Dept.** | **Date Received & by Whom** |
|---|---|---|---|

5. **Will External Accreditation be sought? (For new programs or certificates only)**

☐ **Yes** ☐ **No**

**If yes, name the organization involved with accreditation for this program.**

6. **Is a PCAF required? ______ Yes ___x___No Is the PCAF approved? ______ Yes _______No**

**(If yes, supply link from Academic Affairs website where PCAF is posted.**

7. **Program Checksheets affected by this proposal** **(check all that apply to this proposal)**

☐ Add Course ☐ Delete Course ☐ Modify Course ☒ Change Prerequisite ☐ Move from required to elective
☐ Move from elective to required ☐ Change Outcomes and Assessment Plan ☐ Change credit hours

8. **List all Checksheets affected by this proposal:**

| College | Department | Program |
|---|---|---|
| CET | HVAC | AAS |
| CET | HVAC | BS |

**FORM D – Current**

FERRIS STATE UNIVERSITY
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Associate in Applied Science

# HVACR Technology

## Program Academic Requirements

| | | | | | |
|---|---|---|---|---|---|
| Student: | | | Code | Location | Crs |
| email: | | ID: | | Ferris | |
| Advisor: | | Ph: | 1 | Transfer | |

| | | | Cr | Gr | Pts | S | Yr | Code | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | **MAJOR** | | | | | | | |
| HVAC | 101 | Intro to Refrig & A/C Systems (co-req MATH 116) | 4 | | | | | | |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | | | | | | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | | | | | | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111, MATH 116) | 4 | | | | | | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | | | | | | |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | | | | | | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102,117) | 5 | | | | | | |
| HVAC | 235 | Advanced Heating-Mech System (C- or better in HVAC 117, 132) | 5 | | | | | | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | |
| ISYS | 105 | Microcomputer Applications | 3 | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | |
| ENGL | 150 | English 1 | 3 | | | | | | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | | | | | | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | |
| MATH | 116 | Interm. Algebra & Numerical Trig (ACT 19 or MATH 110) | 4 | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, BIOL 111. Course must have a lab) | 4 | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | |
| | | **FRESHMEN SEMINAR** | | | | | | | |
| FSUS | 100 | FSU Seminar | 1 | | | | | | |

**Unofficial Statistics**

| | |
|---|---|
| Major: Total Crs / Earned Crs / Honor Points | 40 |
| Degree: Total Crs / Earned Crs / Honor Points | 67 |
| GPA Major: | - |
| GPA Degree: | - |

AAS Minimum General Education Requirements:
Cultural Enrichment (CE) – 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3/4 credits
Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

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Associate in Applied Science

# HVACR Technology

## Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 1 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 101 | Introduction to Refrigeration & A/C Systems (co-req MATH 116) | 4 | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | |
| MATH | 116 | Intermediate Algebra & Numerical Trigonometry (C- in MATH 110 or 19 ACT) | 4 | |
| ENGL | 150 | English 1 | 3 | |
| FSUS | 100 | FSU Seminar | 1 | |
| | | **Total** | **16** | |

| YEAR 1 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111 and MATH 116) | 4 | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, or BIOL 111. Must Include a Lab Section) | 4 | |
| | | **Total** | **17** | |

| YEAR 2 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 235 | Advanced Heating-Mechanical Systems (C- or better in HVAC 117, 132) | 5 | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | |
| ISYS | 105 | Microcomputer Applications | 3 | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | **Total** | **18** | |

| YEAR 2 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117) | 5 | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | |
| | | Social Awareness Elective | 3 | |
| | | **Total** | **16** | |

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential/light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems.

# Form D – Current Program Academic Requirements for Bachelor Degree

FERRIS STATE UNIVERSITY
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**Bachelor of Science Degree**

## HVACR Engineering Technology and Energy Management

**Program Academic Requirements**

| | | | | |
|---|---|---|---|---|
| Student: | | | | |
| email: | | | ID: | |
| Advisor: | | | Ph: | |
| | | **MAJOR** | **Cr** | **Gr** |
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 321, HVAC 342 & MATH 126) | 4 | |
| HVAC | 321 | HVAC Air Side System Select-Design (Admission to BS in HVACR Engineering Tech & Energy Mgt) | 4 | |
| HVAC | 325 | HVAC Hydronic System Select-Design (C- or better in HVAC 321, HVAC 342, & MATH 126) | 4 | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to BS in HVACR Engineering Tech & Energy Mgt) | 4 | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321, HVAC 342 & MATH 126) | 4 | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, HVAC 325 & HVAC 350) | 4 | |
| HVAC | 415 | Direct Digital Control (C- or better in HVAC 393 & MATH 126) | 4 | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in HVAC 393 & MATH 126) | 4 | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in HVAC 393 & MATH 126) | 4 | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, HVAC 451 & HVAC 462) | 4 | |
| | | **TECHNICAL RELATED** | | |
| ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | 2 | |
| | | **COMMUNICATIONS COMPETENCE** | | |
| ENGL | 311 | Advanced Technical Writing | 3 | |
| | | **QUANTITATIVE SKILLS** | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | |
| | | **SCIENTIFIC UNDERSTANDING** | | |
| | | Scientific Understanding Elective | 4 | |
| | | **CULTURAL ENRICHMENT** | | |
| | | Cultural Enrichment Elective | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | **SOCIAL AWARENESS** | | |
| | | Social Awareness Elective | 3 | |
| ECON | 221 | Principles of Economics 1 | 3 | |
| | | **Unofficial Statistics** | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 65 | |
| | | GPA Major: | - | |
| | | GPA Degree: | - | |

Bachelor of Science General Education Requirements:
One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr)
Multiple requirements may be satisfied by a single course.
Cultural Enrichment - 9 credits (3 credits in course > 200 level), Social Awareness - 9credits (3 credits in course > 200 level)
Students must complete 40 credits at or above the 300 level.
[Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

Form D – Current check Sheet for Bachelor Degree

FERRIS STATE UNIVERSITY
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Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 3 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 321 | HVAC Air Side System Select-Design (Admission to BS in HVACR Engineering Tech & | 4 | |
| HVAC | 342 | Load Analysis & Energy Modeling (Admission to BS in HVACR Engineering Tech & Energy Mgt) | 4 | |
| ARCH | 110 | Intro to Computer Graphics in ARCH for HVACR Students | 2 | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116)(Students who took MATH 115 shall take MATH 120) | 4 | |
| ENGL | 311 | Advanced Technical Writing | 3 | |
| | | **Total** | **17** | |

| YEAR 3 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 321, HVAC 342 & MATH 126) | 4 | |
| HVAC | 325 | HVAC Hydronic System Select-Design (C- or better in HVAC 321, HVAC 342 & MATH 126) | 4 | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321, HVAC 342 & MATH 126) | 4 | |
| | | Scientific Understanding Elective | 4 | |
| MATH | | Students who took MATH 115 & 120 in Fall shall take MATH 130 | | |
| | | **Total** | **16** | |

| YEAR 3 - SUMMER SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, HVAC 325 & HVAC 350) | 4 | |
| | | **Total** | **4** | |

**Submit Application for Graduation.**

| YEAR 4 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 415 | Direct Digital Control (C- or better in HVAC 393 & MATH 126) | 4 | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in HVAC 393 & MATH 126) | 4 | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in HVAC 393 & MATH 126) | 4 | |
| | | Cultural Enrichment Elective | 3 | |
| | | **Total** | **15** | |

| YEAR 4 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, HVAC 451 & HVAC 462) | 4 | |
| ECON | 221 | Principles of Economics 1 | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Social Awareness Elective | 3 | |
| | | **Total** | **13** | |

Learning Outcomes Include:
1) analyze & select commercial/industrial HVAC systems for specific applications,
2) design commercial/industrial HVAC systems, given design parameters, building type, & geographic location,
3) select secondary equipment for specific commercial/industrial ducting & piping systems,
4) select primary equipment for specific commercial/industrial ducting & piping systems,
5) commission a commercial or industrial HVAC system,
6) perform an energy audit of an actual facility & analyze utilities for proper applications; Operation & Maintenance & Energy Conservation Measures for potential energy savings; & implementation feasibility using payback calculations,
7) understand, utilize & develop estimates, specs, economic costs, & analysis codes & standards,
8) program control sequences for specific commercial & industrial HVAC systems & equipment

# Form D - Proposed Program Academic Requirements for Associate Degree

**FORM D – Proposed**

FERRIS STATE UNIVERSITY
Imagine More

Associate in Applied Science

## HVACR Technology

**Program Academic Requirements**

| Student: | | | | | | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| email: | | | ID: | | | | | | | Ferris | |
| Advisor: | | | Ph: | | | | | | 1 | Transfer | |
| | | **MAJOR** | Cr | Gr | Pts | S | Yr | | Code | Notes | |
| HVAC | 101 | Intro to Refrig & A/C Systems | 4 | | | | | | | | |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111) | 4 | | | | | | | | |
| HVAC | 111 | Electricity-Blueprints-Fabrication | 4 | | | | | | | | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111) | 4 | | | | | | | | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111) | 5 | | | | | | | | |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117 & MATH 116) | 5 | | | | | | | | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117, & MATH 116) | 5 | | | | | | | | |
| HVAC | 235 | Advanced Heating-Mech System (C- or better in HVAC 117, 132 & MATH 116) | 5 | | | | | | | | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132 & MATH 116) | 4 | | | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | | | |
| ISYS | 105 | Microcomputer Applications | 3 | | | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | | | |
| ENGL | 150 | English 1 | 3 | | | | | | | | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | | | | | | | | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | | | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | | | |
| MATH | 116 | Interm. Algebra & Numerical Trig (ACT 19 or MATH 110) | 4 | | | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | | | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, BIOL 111. Course must have a lab) | 4 | | | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | | | |
| | | **FRESHMEN SEMINAR** | | | | | | | | | |
| FSUS | 100 | FSU Seminar | 1 | | | | | | | | |
| | | **Unofficial Statistics** | | | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | | | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 67 | | | | | | | | |
| | | GPA Major: | - | | | | | | | | |
| | | GPA Degree: | - | | | | | | | | |

AAS Minimum General Education Requirements:

Cultural Enrichment (CE) – 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3/4 credits

Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Form D - Proposed Check Sheet for Associate Degree

FERRIS STATE UNIVERSITY
Imagine More

Associate in Applied Science

# HVACR Technology

Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 1 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 101 | Introduction to Refrigeration & A/C Systems (co-req MATH 116) | 4 | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | |
| MATH | 116 | Intermediate Algebra & Numerical Trigonometry (C- in MATH 110 or 19 ACT) | 4 | |
| ENGL | 150 | English 1 | 3 | |
| FSUS | 100 | FSU Seminar | 1 | |
| | | Total | 16 | |
| **YEAR 1 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111) | 4 | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111) | 4 | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111) | 5 | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, or BIOL 111. Must Include a Lab Section) | 4 | |
| | | Total | 17 | |
| **YEAR 2 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 235 | Advanced Heating-Mechanical Systems (C- or better in HVAC 117, 132 & MATH 116) | 5 | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132 & MATH 116) | 4 | |
| ISYS | 105 | Microcomputer Applications | 3 | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Total | 18 | |
| **YEAR 2 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117 & MATH 116) | 5 | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117 & MATH 116) | 5 | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | |
| | | Social Awareness Elective | 3 | |
| | | Total | 16 | |

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential/light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems.

# Form D - Proposed Program Academic Requirements for Bachelor Degree

Ferris State University
Imagine More

Bachelor of Science Degree

## HVACR Engineering Technology and Energy Management

Program Academic Requirements

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Student: | | | | | | | | Code | Location | Crs |
| email: | | | ID: | | | | | | Ferris | |
| Advisor: | | | Ph: | | | | | 1 | Transfer | |
| | | MAJOR | Cr | Gr | Pts | S | Yr | Code | Notes | |
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 321 & HVAC 342) | 4 | | | | | | | |
| HVAC | 321 | HVAC Air Side System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | | |
| HVAC | 325 | HVAC Hydronic System Select-Design (C- or better in HVAC 321 & HVAC 342) | 4 | | | | | | | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321 & HVAC 342) | 4 | | | | | | | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 325 & 350) | 4 | | | | | | | |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 & HVAC 393) | 4 | | | | | | | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in MATH 126 & HVAC 393) | 4 | | | | | | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 & HVAC 393) | 4 | | | | | | | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, HVAC 451 & HVAC 462) | 4 | | | | | | | |
| | | TECHNICAL RELATED | | | | | | | | |
| ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | 2 | | | | | | | |
| | | COMMUNICATIONS COMPETENCE | | | | | | | | |
| ENGL | 331 | Advanced Technical Writing | 3 | | | | | | | |
| | | QUANTITATIVE SKILLS | | | | | | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | | | | | | |
| | | SCIENTIFIC UNDERSTANDING | | | | | | | | |
| | | Scientific Understanding Elective | 4 | | | | | | | |
| | | CULTURAL ENRICHMENT | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | |
| | | SOCIAL AWARENESS | | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | | |
| ECON | 221 | Principles of Economics 1 | 3 | | | | | | | |
| | | Unofficial Statistics | | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 65 | | | | | | | |
| | | GPA Major: | - | | | | | | | |
| | | GPA Degree: | - | | | | | | | |

Bachelor of Science General Education Requirements:
One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr)
Multiple requirements may be satisfied by a single course.
Cultural Enrichment – 9 credits (3 credits in course > 200 level), Social Awareness - 9credits (3 credits in course > 200 level)
[Reference: http://www.ferris.edu/htmls/academics/gened/gen edspecific.html ]

Form D - Proposed Check Sheet for Bachelor Degree

Ferris State University
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

Course Sequence Guide

| Student: | | ID: | |
|---|---|---|---|

| | | | Crs | Gr |
|---|---|---|---|---|
| **YEAR 3 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 321 | HVAC Air Side System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | |
| HVAC | 342 | Load Analysis & Energy Modeling (Admission to BS in HVACR Engineering Technology) | 4 | |
| ARCH | 110 | Intro to Computer Graphics in ARCH for HVACR Students | 2 | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116)- (Students who took MATH115 shall take MATH120) | 4 | |
| ENGL | 311 | Advanced Technical Writing | 3 | |
| | | **Total** | 17 | |
| **YEAR 3 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 321 & HVAC 342) | 4 | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321 & HVAC 342) | 4 | |
| HVAC | 325 | HVAC Hydronic System Select-Design (C- or better in HVAC 321 & HVAC 342) | 4 | |
| | | Scientific Understanding Elective | 4 | |
| MATH | | Students who took MATH 115 and MATH 120 shall take MATH 130 | | |
| | | **Total** | 16 | |
| **YEAR 3 - SUMMER SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 325 & 350) | 4 | |
| | | **Total** | 4 | |
| **YEAR 4 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 & HVAC 393) | 4 | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 & HVAC 393) | 4 | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in HVAC 393 & MATH 126) | 4 | |
| | | Cultural Enrichment Elective | 3 | |
| | | **Total** | 15 | |
| **YEAR 4 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, HVAC 451 & HVAC 462) | 4 | |
| ECON | 221 | Principles of Economics 1 | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Social Awareness Elective | 3 | |
| | | **Total** | 13 | |

Learning Outcomes Include: 1) analyze & select commercial/industrial HVAC systems for specific applications, 2) design commercial/industrial HVAC systems, given design parameters, building type, & geographic location, 3) select secondary equipment for specific commercial/industrial ducting & piping systems, 4) select primary equipment for specific commercial/industrial ducting & piping systems, 5) commission a commercial or industrial HVAC system, 6) perform an energy audit of an actual facility & analyze utilities for proper applications; Operation & Maintenance & Energy Conservation Measures for potential energy savings; & implementation feasibility using payback calculations, 7) understand, utilize & develop estimates, specs, economic costs, & analysis codes & standards, 8) program control sequences for specific commercial & industrial HVAC systems & equipment.

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

**Prefix ☒ (current)** HVAC ☐ **Number (current) 102** ☐ **LEC _3_ LAB _3_ SEM ___ (current)**

(proposed) **No Change** (proposed) **No Change** (Enter Contact Hours per week)

LEC ___ LAB ___ SEM ___(proposed):

**Title ☐ (current) Advanced Refrigeration and AC**

(proposed) **No Change**

| ☐ Credit Hours (current) 4 | ☒ | Prerequisites (current) | Co-requisite (current) |
|---|---|---|---|
| | | Prerequisites: HVAC 101, HVAC 111 and MATH 116all with a grade of C- or better. | |
| (proposed) | | (proposed) | (proposed) |
| | | Prerequisites: HVAC 101 & HVAC 111 all with a grade of C- or better. | |

☒ **Course Description (current): (125 words maximum)**

A continuation of the basic refrigeration cycle and application of the Mollier diagram and thermodynamics, including theoretical and actual refrigeration capacities, along with a study of refrigerants, oils, systems, metering devices and compressors. Emphasis on instrumentation, testing, system troubleshooting and problem solving. Students will study for EPA Section 608 certification. Prerequisites: HVAC 101, HVAC 111 and MATH 116all with a grade of C- or better. Typically Offered Fall, Spring

(proposed):

A continuation of the basic refrigeration cycle and application of the Mollier diagram and thermodynamics, including theoretical and actual refrigeration capacities, along with a study of refrigerants, oils, systems, metering devices and compressors. Emphasis on instrumentation, testing, system troubleshooting and problem solving. Students will study for EPA Section 608 certification. Prerequisites: HVAC 101 & HVAC 111 all with a grade of C- or better. Typically Offered Fall, Spring

**Course ☐ Outcomes and Assessment Plan (current)**

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction, Orientation, and Safety.<br>A. Apply all safety procedures required in this course. |
| II. | Application of Pressure-Heat Diagram (Mollier) into the use of the Thermodynamic tables.<br>A. Collect data for refrigeration analysis.<br>B. Relate test data to Mollier diagram.<br>C. Compare the Mollier diagram to thermodynamic tables.<br>D. Utilize thermodynamic tables for analysis purposes.<br>E. Make conclusions from thermodynamic analysis. |
| III. | Physical and chemical properties of refrigerants and refrigerant blends.<br>A. Define the various common types of refrigerants.<br>B. Define temperature glide and fractionation.<br>C. Define the dew point, bubble point, sub cooling and superheat of the various common refrigerants. |
| IV. | Refrigerant Oils.<br>A. Understand the application of the proper oil with refrigerant.<br>B. Understand the properties of the following oils:<br>a. Mineral<br>b. Alkylbenzine<br>c. Esters<br>d. Glycols |
| V. | Theoretical and actual refrigeration capacities with power requirements. |

| | |
|---|---|
| | A. Use the formula necessary to prove changes in capacity due to fluctuating operating conditions.<br>B. Use the formula necessary to prove changes in required power to satisfy requirements of capacity.<br>C. Understand the compression process and performance of reciprocating compressions including:<br>    a. The compression cycle<br>    b. The compressor displacement<br>    c. Pressure/volume relationship<br>    d. Clearance volume<br>    e. Volumetric efficiency and compression ratio<br>    f. Suction pressure and discharge pressure effect on compressor capacity<br>    g. Liquid slugging |
| VI. | Pressure drop due to frictional line loss in low side of system.<br>A. Define the effects on capacity and required power due to pressure drops.<br>B. Define effect on system performance due to changes in compression ratio. |
| VII. | Automated metering devices.<br>A. Explain the construction and operation of a Thermostatic expansion valve (TXV).<br>    a. Liquid, crossed and gas charged elements<br>    b. Externally and internally equalized<br>    c. Externally and internally adjustable<br>    d. Selection of valves<br>    e. Superheat adjustment ranges<br>B. Explain the construction and operation of an Automatic expansion valve.<br>    a. Application and operation<br>    b. Adjustment method<br>    c. Safety precautions (low limit thermostat and back-pressure setting)<br>C. Explain the construction and operation of high and low side floats<br>    a. Function and construction of each<br>    b. Applications |
| VIII. | Compressors<br>A. Explain the different types of compressors<br>    a. Reciprocating<br>    b. Scroll<br>    c. Rotary<br>    d. Screw<br>    e. Centrifugal<br>B. Explain the various types of configurations<br>    a. Hermetic<br>    b. Semi-hermetic<br>    c. Open drive<br>C. Explain the compressor capacity relative to demand of the system<br>    a. Increase in suction pressure<br>    b. Decrease in suction pressure<br>    c. Increase in evaporator air flow<br>    d. Decrease in evaporator air flow<br>    e. Increase in evaporator coil surface<br>    f. Decrease in evaporator coil surface<br>    g. Increase in condensing temperature<br>    h. Decrease in condensing temperature<br>D. Understand and apply the correct type of lubrication<br>    a. Splash lubrication, scoop<br>        i. Importance of proper rotation<br>        ii. Oil level requirements<br>        iii. Oil check valve application and purpose<br>    b. Forced-feed, oil pump<br>        i. Pump location and construction (gear type or similar)<br>        ii. Galleries and internal oil lines<br>    c. Centrifugal-type |

| | |
|---|---|
| | d. Determining oil pressure<br>e. Determining SSV rating and application of oils<br>i. Viscosity, floc-point, cloud point, pour-point<br>ii. Servicing compressor; checking oil level and adding oil<br>E. Define and understand compressor shaft seals; open compressors including:<br>a. Rotary bellows<br>b. Stationary bellows<br>c. Packing gland<br>d. Diaphragm<br>F. Understand and explain compressor valve plates<br>a. Types of valves employed<br>b. Method of servicing and precautions<br>c. Determining of a faulty valve plate<br>d. Causes of valve failure<br>G. Understand and explain compressor drives<br>a. V-belts<br>i. V-belt construction, sizing, application<br>ii. Pulley alignment<br>iii. Belt tensioning specs<br>iv. Determination of driven speed by ratio<br>b. Direct drive with solid couplers<br>i. Introduction to dial indicators<br>ii. Construction features<br>iii. Installation<br>iv. Alignment, using dial indicators applied to manufacturers specification.<br>c. Gear drive<br>H. Understand and accomplish a compressor disassembling process<br>a. Care exercised and method<br>b. Reference to manufacturers' illustrations and specs<br>c. Care in cleanliness and the use of oil<br>d. Use of a torque wrench<br>e. Compressor relief valves |
| IX. | Determination, cause and cleanup of compressor burnout.<br>A. Use a Megger to determine winding condition<br>B. Test oils for acid<br>C. Perform system cleanup procedure after burnout<br>D. Determine cause and prevention of compressor burnout |
| X. | System analysis and system troubleshooting.<br>A. Analysis and troubleshoot TXV systems<br>a. System analysis of restrictions, improper charge (sight glass), compressor efficiency.<br>b. System analysis of improper air flows<br>B. Develop methods of trouble-shooting |
| XI. | EPA section 608 certification.<br>A. Understand and explain all of the material required for EPA section 608 Type I and Type II certification. |

(proposed): **No Changes**

**Course Outline including Time Allocation (current)**

Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week) Percentages
(100 percent)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction, Orientation, and Safety | 1 | 0 |
| II. | Application of Pressure-Heat Diagram (Mollier) into the use of the Thermodynamic tables. | 6 | 6 |
| III. | Physical and chemical properties of refrigerants and refrigerant blends (CFC, HCFC, HFC, Zeotropic and Azeotropic blends). | 3 | 0 |
| IV. | Refrigerant oils. | 6 | 0 |
| V. | Theoretical and Actual Refrigeration Capacities with Power Requirements. | 8 | 3 |
| VI. | Pressure Drop Due to Frictional Line Loss in Low Side of System. | 2 | 3 |
| VII. | Automated metering Devices. | 5 | 3 |
| VIII. | Compressors | 5 | 6 |
| IX. | Determination, Cause and Cleanup of Compressor Burnout. | 3 | 6 |
| X. | System analysis and system troubleshooting. | 0 | 15 |
| XI. | EPA Section 608 Certification. | 6 | 3 |
| | Total Hours | 45 | 45 |

(proposed) **No Change**

9/28/05

## COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC** 117 ☐ **Number (current) 117** ☐ LEC 3 LAB 3 SEM ___ (current)

(proposed) **No Change** (proposed) **No Change** (Enter Contact Hours per week)
LEC ___ LAB ___ SEM ___(proposed):

☐ **Title (current) Advanced Electricity-Circuits**

(proposed) **No Change**

☐ **Credit Hours (current) 4**

(proposed)

☒ **Prerequisites (current)**
**HVAC 111 and MATH 116, both with a grade of C- or better.**

**(proposed)**
**HVAC 111 with a grade of C- or better**

**Co-requisite (current)**

(proposed)

☒ **Course Description (current): (125 words maximum)**

AC electrical theory and application, concentrating on the operation, installation and analysis of HVACR components and control circuits. The components include single and polyphase transformer and motors, heating and air conditioning controls, commercial timers, motor starters, contactors, relays and other control devices. Lab exercises focus on developing wiring diagrams; wiring, troubleshooting and analyzing circuits based on lecture material. Prerequisites: HVAC 111 and MATH 116, both with a grade of C- or better. Typically Offered Fall, Spring

(proposed):

AC electrical theory and application, concentrating on the operation, installation and analysis of HVACR components and control circuits. The components include single and polyphase transformer and motors, heating and air conditioning controls, commercial timers, motor starters, contactors, relays and other control devices. Lab exercises focus on developing wiring diagrams; wiring, troubleshooting and analyzing circuits based on lecture material. Prerequisites: HVAC 111 with a grade of C- or better. Typically Offered Fall, Spring

☐ **Course Outcomes and Assessment Plan (current)**

### Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction, Orientation, and Safety.<br>B. Apply all safety procedures required in this course. |
| II. | Alternating current.<br>F. Define the characteristics of AC run and start capacitors with respect to: construction, operating and troubleshooting characteristics, phase shifts and CEMF.<br>G. Define the characteristics of AC induction motors with respect to: construction, operating and troubleshooting characteristics, CEMF and resulting phase shifts. |
| III. | AC Capacitor applications.<br>D. Describe the use of capacitors in AC applications, such as starting and running of single phase motors and power factor correction. |
| IV. | Single phase transformers.<br>C. Describe the operation and use of single phase transformers for controls, ignition circuits and voltage correction. |
| V. | Three Phase Transformers.<br>D. Describe the operation and use of delta and wye three phase transformers for power distribution and voltage correction |
| VI. | AC induction motors. |

| | |
|---|---|
| | C. Define the characteristics of AC run and start capacitors.<br>D. Define the starting and running characteristics, construction, CEMF and resulting phase shifts of the following motor types: CSIR, CSCR, SP, PSC, Synchronous, Shaded pole and Universal. |
| VII. | Single phase motor characteristics.<br>D. Define the starting, running and other operating characteristics of AC induction motor starting relays; potential, solid state and centrifugal switches.<br>E. Identify the correct starting relay to use with a specific single phase motor. |
| VIII. | Three phase motors.<br>I. Explain the purpose, operation and application of wye-delta starting schemes. |
| IX. | Motor starters.<br>E. Explain the different types and troubleshooting techniques for motor starters. |
| X. | Wiring diagrams.<br>C. Explain the use of a wiring diagram for troubleshooting.<br>D. Explain how to develop a wiring diagram for a piece of equipment. |
| XI. | Low voltage thermostats.<br>B. Explain how a heat/cool thermostat operates and is properly wired. |
| XII. | Defrost timer.<br>A. Describe the sequence of operation and application of various types of defrost timers and circuits. |
| XIII. | Conductor sizing and over current protection.<br>A. Use NEC to properly size wire and describe the problems associated with improperly sized and misapplied conductors.<br>B. Describe operation of various types of circuit breaker, fuses and circuit protectors. |
| XIV. | Measuring devices.<br>A. Identify and describe the application of thermistors, RTD's, humidity sensors and static pressure sensors.<br>B. Demonstrate knowledge of the operating characteristics and circuits using solid state transducers in HVAC applications.<br>C. Demonstrate knowledge of the proper procedure for troubleshooting solid state control boards by accurately answering homework and test questions.<br>D. Demonstrate knowledge of the proper procedure for troubleshooting solid state control boards by accurately answering homework and test questions. |
| XV. | Modulating control loops.<br>A. Describe temperature control loop terminology components and operation. |

(proposed): **No Changes**

**Course Outline including Time Allocation (current)**

Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week) Percentages
(100 percent)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction, Orientation, and Safety | 1 | 0 |
| II. | Alternating current | 1 | 3 |
| III. | AC Capacitor applications | 3 | 3 |
| IV. | Single phase transformers | 6 | 3 |
| V. | Three phase transformers | 3 | 3 |
| VI. | AC induction motors | 3 | 6 |

| | | | |
|---|---|---|---|
| VII. | Single phase motor characteristics | 3 | 3 |
| VIII. | Three phase motors | 3 | 3 |
| IX. | Motor starters | 6 | 3 |
| X. | Wiring diagrams | 3 | 3 |
| XI. | Low voltage thermostats | 3 | 3 |
| XII. | Defrost timers | 3 | 3 |
| XIII. | Conductor sizing and over current protection | 3 | 3 |
| XIV. | Measuring Devices | 1 | 3 |
| XV. | Modulating Control Loops | 3 | 3 |
| | Total Hours | 45 | 45 |

(proposed) **No Changes**

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## COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current** HVAC ☐ **Number (current) 132** ☐ **LEC** 3 **LAB** 6 **SEM** ___ **(current)**

(proposed) **No Change** (proposed) **No Change** (Enter Contact Hours per week)

LEC ___ LAB ___ SEM ___(proposed):

☐ **Title (current)** **Fund of Heating & Mechanical Systems**

(proposed) **No Change**

☐ **Credit Hours (current) 5**

(proposed)

☒ **Prerequisites (current)**

**HVAC 111 and MATH 116, both with a grade of C- or better or a minimum score of 24 on ACT or 560 on SAT..**

**(proposed)**

**HVAC 111 with a grade of C- or better**

**Co-requisite (current)**

(proposed)

☒ **Course Description (current): (125 words maximum)**

A study of combustion in conventional and high-efficiency units. Mechanical and building blueprints, symbols, drawing & sketching, and views will be covered. Laboratory work on heating, components, system identification, and the analysis of fuel consumption rates and cycles. Pre-Requisites: HVAC 111 and MATH 116, both with a grade of C- or better or a minimum score of 24 on ACT or 560 on SAT. Typically Offered Fall, Spring

(proposed):

A study of combustion in conventional and high-efficiency units. Mechanical and building blueprints, symbols, drawing & sketching, and views will be covered. Laboratory work on heating, components, system identification, and the analysis of fuel consumption rates and cycles. Pre-Requisites: HVAC 111 with a grade of C- or better. Typically Offered Fall, Spring

☐ **Course Outcomes and Assessment Plan (current)**

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction, Orientation, and Safety.<br>C. Demonstrate proper attitude and compliance with all safety policies and procedures required in this course. |
| II. | Combustion.<br>H. Describe the requirements and the process of combustion.<br>I. List the products of complete and incomplete combustion.<br>J. List the heating values of common fuels used in the heating industry (natural gas, propane)<br>K. Explain the purpose of combustion testing<br>L. Explain the results of improper fuel and air mixture<br>M. Explain the outcome of a properly tuned burner, including acceptable combustion testing results.<br>N. Explain the three elements that determine combustion efficiency |

| | |
|---|---|
| | O. Explain excess air is and why it is necessary<br>P. Explain and determine combustion air requirements<br>Q. Demonstrate knowledge of carbon monoxide sources, health effects, testing devices and methods, and acceptable exposure limits. |
| IV. | Forced-air furnace.<br>D. Identify and describe various gas valve types and their operation.<br>E. Identify and describe flame proving devices and their operation, including standing pilots, thermocouple and millivolt systems, liquid-filled, bimetal switch, and electronic flame rectification.<br>F. List common manifold pressures for gas heating devices.<br>G. Describe various heat exchanger types used in forced air furnaces.<br>H. Describe the difference between an atmospheric burner and a power burner.<br>I. Describe the function and operation of a simple thermostat.<br>J. Describe the function and operation of the fan control.<br>K. Describe the function and operation of the fuel control.<br>L. Describe the function, sequence of operation and application of the standing pilot (aerated and non-aerated).<br>M. Describe the function, sequence of operation and application of various ignited pilot systems, including the electric spark, glow coil and hot surface ignition.<br>N. Describe the function, sequence of operation and application of various direct ignition systems, including the direct spark ignition (DSI) and hot surface ignition.<br>O. Describe the function, sequence of operation and application of various flame-proving devices, including thermocouples, thermopiles, bimetallic strips, mercury bulbs and flame rectifiers.<br>P. Determine the correct orifice size for a gas burner.<br>Q. Describe the function for all safety controls including the high limit, auxiliary limits, the flame rollout, the airflow switch and door switch.<br>R. Describe the function and operation of the main blower. Including various types (constant speed, multi-speed and variable speed).<br>S. Describe the function of the manifold, orifice, and burner.<br>T. Describe the basic electrical operation of a forced air furnace to include call for heat, ignition, safeties and satisfied condition. List the controllers, actuators, and safety devices used in the sequence of operation, and describe the function of each.<br>U. Describe the venting requirements for the various models of furnaces.<br>V. Explain the requirements to modify a gas fired heating device to burn a different gas fuel type, i.e. convert from natural gas to propane. |
| V. | Combustion air.<br>E. Describe the code requirements, design and sizing of proper combustion air. |
| VI. | Airflow and air pressures.<br>E. Describe external static pressure and air volume measurements.<br>F. Describe air volume and pressure testing tools.<br>G. Describe the basic fan laws.<br>H. Use the fan law equations to solve related problems. |
| VII. | Make-up air units.<br>F. Define system types and air side configurations including: 100% outside air, constant volume, recirculation, variable air volume, direct fired and indirect fired.<br>G. Describe various application: direct fired and indirect fired.<br>H. List all electrical, mechanical and gas burner components.<br>I. Describe fan and blower types: forward curved, backward incline and backward incline airfoil.<br>J. Define sequence of operations for typical winter and summer operations.<br>K. List common problems and troubleshooting steps.<br>L. Describe energy conservation modification and recommendations: air balance |

| | |
|---|---|
| | investigation, code compliance, recirculation and control system upgrades. |
| VIII. | Larger burner gas train assemblies.<br>J. Define electrical and mechanical components.<br>K. Define the sequence of operation.<br>L. Explain approval agency requirements. |
| IX. | Flame safeguard control systems.<br>F. Define types, functions, sequence of operations.<br>G. List flame detector types: ultraviolet, infrared, and flame rectification.<br>H. Describe wiring diagrams and troubleshooting steps. |
| X. | Customer relations and conflict management.<br>E. Define the importance of image, and verbal communications<br>F. Explain conflict resolution methods. |

(proposed): **No changes**

**Course Outline including Time Allocation (current)**

Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week) Percentages
(100 percent)

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## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction, Orientation, and Safety | 1 | 1 |
| II. | Combustion | 4 | 9 |
| IV. | Forced-air furnace | 22 | 50 |
| VI. | Air flow and air pressures | 4 | 6 |
| VII. | Make up air systems | 3 | 3 |
| VIII. | Large burner gas train assemblies | 3 | 3 |
| IX. | Flame safeguard control systems | 4 | 6 |
| X. | Customer relations, conflict management | 2 | 0 |

(proposed) **No changes**

# COURSE INFORMATION FORM FORM E

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

**Prefix (current) HVAC** ☐ **Number (current) 235** ☐ **LEC 3 LAB 6 SEM ___ (current)**

(proposed) **No Change** (proposed) **No Change** (Enter Contact Hours per week)
LEC ___ LAB ___ SEM ___(proposed):
**Title (current) Advanced Heating-Mechanical Systems**

(proposed) **No Change**

☐ **Credit Hours (current) 5**

(proposed)

☒ **Prerequisites (current)**

HVAC 132 and HVAC 117, both with a grade of C- or better.

(proposed)

HVAC 132, HVAC 117 & MATH 116, all with a grade of C- or better

**Co-requisite (current)**

(proposed)

☒ **Course Description (current): (125 words maximum)**

| |
|---|
| A continuation of the study of gas and oil fired heating appliances for residential and commercial applications. Includes the operating sequence of forced air and hydronic systems for safe, efficient combustion and flame safety. Application includes troubleshooting faulty electrical/electronic control systems, safety systems, mechanical systems and hydronic systems. Pre-Requisites: HVAC 132 and HVAC 117, both with a grade of C- or better. Typically Offered Fall, Spring |

(proposed):

| |
|---|
| A continuation of the study of gas and oil fired heating appliances for residential and commercial applications. Includes the operating sequence of forced air and hydronic systems for safe, efficient combustion and flame safety. Application includes troubleshooting faulty electrical/electronic control systems, safety systems, mechanical systems and hydronic systems. Pre-Requisites: HVAC 132, HVAC 117 & MATH 116, all with a grade of C- or better. Typically Offered Fall, Spring |

**Course Outcomes and Assessment Plan (current)**

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction, Orientation, and Safety.<br>D. Apply all safety procedures required in this course. |
| II. | Operation of high pressure gun type oil burner.<br>R. Explain the parts of a high pressure gun type oil burner and the function of each.<br>S. Describe the sequence of operation of an oil burner, listing each component and its function. |
| III. | Fuel pumps.<br>E. Explain the functions of the fuel pump used in high pressure gun type fuel oil burners.<br>F. Explain the function of the parts: cleaning section, pumping section and regulating system.<br>G. Explain the operation, differences and applications of one and two stage fuel pumps.<br>H. Explain the advantages and disadvantages of one and two line fuel systems. |
| IV. | Nozzles.<br>W. Describe the functions of the fuel oil nozzle.<br>X. Determine the firing rate of a nozzle based on GPH rating.<br>Y. List common spray angles produced by fuel oil nozzles and explain the advantages and disadvantages for the various angles.<br>Z. List common spray patterns produced by fuel oil nozzles and explain the advantages and disadvantages for the various patterns.<br>AA. Select a nozzle with correct GPH, spray angle and spray pattern for a specific unit. |
| V. | Primary controls.<br>F. Explain the function of a primary control.<br>G. Explain the proper sequence of operation for stack control.<br>H. Explain the proper sequence of operation of a CAD cell. |
| VI. | Operation and troubleshooting complete unit.<br>I. Describe the step of systematically troubleshooting a malfunctioning fuel oil unit. |
| VII. | Combustion chambers.<br>M. Describe the purpose of the combustion chamber.<br>N. List the types of combustion chambers and list the applications of each type.<br>O. Describe the method of sizing a combustion chamber. |
| VIII. | Combustion testing and efficiency.<br>M. List testing measurements commonly used on fuel oil devices. |

| | |
|---|---|
| | N. Explain the adjustments that can be made to improve efficiency.<br>O. Explain the function, operation and application of the barometric damper. |
| IX. | Hydronics.<br>I. Describe and list the advantages, disadvantages and applications of series loop, one pipe, two pipe direct return and two pipe reverse return piping systems.<br>J. List piping system components, their function, placement and specifications and settings.<br>K. Describe the total system operation of the series loop, one pipe, tow pipe direct return and two pipe reverse return piping system.<br>L. Properly size a specified type of hydronic system, given total load, a list of terminal devices, a list of fittings and components and a heat source (boiler).<br>M. Determine the piping configuration (series loop, (monoflo), two pipe direct return, two pipe reverse return, or a combination of any of the four) of an existing hydronic system. |
| X. | Steam.<br>G. Given a specific gauge or absolute pressure, use a steam table to find the corresponding latent heat of vaporization, total heat of steam, specific volume of liquid and steam.<br>H. Identify the different components found in a steam system including various types of steam traps and piping configurations specific to steam. |

(proposed): **No Changes**

**Course Outline including Time Allocation (current)**

Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week) Percentages
(100 percent)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction, orientation and safety | 1 | 0 |
| II. | Operation of High Pressure Gun Type Oil Burner | 2 | 1 |
| III. | Fuel Pumps | 2 | 3 |
| IV. | Nozzles | 1 | 2 |
| V. | Primary Controls | 1 | 2 |
| VI. | Operation & Troubleshooting Complete Unit | 3 | 9 |
| VII. | Combustion Chambers | 1 | 1 |
| VIII. | Combustion Testing and Efficiency | 1 | 6 |
| IX. | Hydronics | 27 | 54 |
| X. | Steam | 6 | 12 |
| | Total Hours | 45 | 90 |

(proposed) **No Changes**

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# COURSE INFORMATION FORM

# FORM E

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

**Prefix ☒ (current)** HVAC ☐ **Number (current )245** ☐ **LEC 3 LAB 3 SEM ___ (current)**

(proposed) **No Change** (proposed) **No Change** (Enter Contact Hours per week)
LEC ___ LAB ___ SEM ___(proposed):

**Title ☐ (current)**

(proposed)

☐ **Credit Hours (current) 4**

(proposed)

☒ **Prerequisites (current)**
HVAC 101 and HVAC 132, both with a grade of C- or better.

(proposed)
HVAC 101, HVAC 132 & MATH 116, all with a grade of C- or better

**Co-requisite (current)**

(proposed)

☒ **Course Description (current): (125 words maximum)**

| |
|---|
| The study of residential and light commercial HVACR system design including load calculations and psychrometrics. Includes heat recovery methods, restaurant ventilations requirements, humidification, insulation, sound and measurement techniques and applicable codes. Pre-Requisites: HVAC 101 and HVAC 132, both with a grade of C- or better. Typically Offered Fall, Spring |

(proposed):

| |
|---|
| The study of residential and light commercial HVACR system design including load calculations and psychrometrics. Includes heat recovery methods, restaurant ventilations requirements, humidification, insulation, sound and measurement techniques and applicable codes. Pre-Requisites: HVAC 101, HVAC 132 & MATH 116, all with a grade of C- or better. Typically Offered Fall, Spring |

**Course Outcomes and Assessment Plan (current)**

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction, Orientation<br>E. Syllabus |
| II. | Psychrometrics<br>a. Explain the listed terms and given an example air condition, determine the appropriate value for the following:<br>i. Dry bulb, wet bulb, relative humidity, dew point, humidity ratio, specific volume, enthalpy<br>b. Apply the Psychrometric chart to:<br>i. Determining air flow rate (corrected for density)<br>ii. Determining heating capacity<br>iii. Determining total, sensible, and latent cooling capacity, and sensible heat ratio |

| | |
|---|---|
| | iv. Determining mixed air properties |
| III. | Heat transfer<br>a. Define the three methods of heat transfer.<br>b. List the elements of heat loss and heat gain.<br>c. Define "R" and "U" values.<br>d. Convert from R value to U value.<br>e. Apply the basic equation for calculating heat transfer thru building sections.<br>f. Calculate the average U value for a building section with parallel heat flow paths. |
| IV. | Residential Load Calculations and related energy codes<br>a. Define basic terms related to load calculations<br>b. Explain indoor and outdoor air design conditions and apply weather data<br>c. Complete building envelope heat loss and heat gain load calculations<br>d. Explain ventilation codes, calculations and affects of energy recovery<br>e. Explain infiltration issues, estimation, and measurement methods<br>f. Affects of distribution system on equipment loads<br>g. Complete a manual J load calculation for a residential structure |
| V. | Residential equipment selection<br>a. Determine airflow requirements<br>b. Explain sizing (capacity) limitations<br>c. Analyze manufacturers detailed capacity ratings<br>d. Explain secondary equipment options for improved indoor air quality<br>e. Complete an equipment selection project |
| VI. | Residential duct system design<br>a. Explain distribution system classifications and applications for each<br>b. Explain the purpose of manual D procedures<br>c. Explain fan performance tables or fan curves and how they are used in duct system design<br>d. Explain friction rate and how friction rate is applied in duct system design<br>e. Explain Total Equivalent Length (TEL) and how TEL is calculated<br>f. Explain the term, Available Static Pressure (ASP) and how ASP is calculated<br>g. Calculate space airflows<br>h. Complete a residential duct system design project |
| VII. | Commercial Load Calculations<br>a. Explain the differences between commercial and residential load calculations<br>b. Describe internal loads and their affects on commercial buildings<br>c. Explain infiltration for commercial buildings<br>d. Explain ventilation codes and calculations<br>e. Complete a Manual N load calculation project |
| VIIII. | Hydronic system design<br>a. Know the formula used to calculate heat flow in hydronic systems and be able to arrange the formula to solve for any unknown.<br>b. Explain the purpose of an expansion tank<br>c. Know the typical operating temperature and pressure range for residential and light commercial systems<br>d. Know the eight common piping arrangements |

| | |
|---|---|
| | e. Explain primary- secondary pumping arrangements and be able to determine flow thru primary-secondary "tees"<br>f. Explain outdoor reset controls and their purpose<br>g. Determine system head pressure<br>h. Explain pump curves and be able to determine pump performance based on operating pressures<br>i. Be able select a pump based on system requirements<br>j. Complete a hydronic design project |

(proposed): **No Change**

**Course Outline including Time Allocation (current)**

Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week) Percentages
(100 percent)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction, orientation | 1 | 0 |
| II. | Psychrometrics | 4 | 6 |
| III. | Heat transfer | 2 | 3 |
| IV. | Residential load calculations | 9 | 9 |
| V. | Residential equipment selection | 3 | 3 |
| VI. | Residential duct system design | 9 | 9 |
| VII. | Commercial load calculations | 6 | 9 |
| VIIII. | Hydronic system design | 8 | 6 |
| | Total Hours | 45 | 45 |

(proposed) **No Change**

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9/28/15

# COURSE INFORMATION FORM FORM E

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC** ☐ **Number (current) 207** ☐ **LEC 3 LAB 6 SEM ___ (current)**

(proposed) **No Change** (proposed) **No Change** (Enter Contact Hours per week)
LEC ___ LAB ___ SEM ___(proposed):

☐ **Title (current) Commercial Refrigeration Systems**

(proposed)

☐ **Credit Hours (current) 5**

(proposed)

☒ **Prerequisites (current)**
HVAC 102 and 117, both with a grade of C- or better.

(proposed)
HVAC 102, HVAC 117, & MATH 116, all with a grade of C- or better.

**Co-requisite (current)**

(proposed)

☒ **Course Description (current): (125 words maximum)**

A study of commercial and industrial refrigeration systems associated with supermarkets, restaurants and storage facilities. Topics include electrical and mechanical refrigeration systems found in today's applications. Laboratories will cover testing, adjusting and troubleshooting electrical and mechanical systems.Prerequisites: HVAC 102 and 117, both with a grade of C- or better.Typically Offered Fall and Spring.

(proposed):

A study of commercial and industrial refrigeration systems associated with supermarkets, restaurants and storage facilities. Topics include electrical and mechanical refrigeration systems found in today's applications. Laboratories will cover testing, adjusting and troubleshooting electrical and mechanical systems. Prerequisites: HVAC 102, HVAC 117, & MATH 116, all with a grade of C- or better. Typically Offered Fall and Spring.

☐ **Course Outcomes and Assessment Plan (current)**

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction, Orientation, and Safety.<br>F. Apply all safety procedures required in this course. |
| II. | Review of food preservation issues.<br>T. Relate the temperature, humidity, $CO_2$, and air velocity to the longevity of food preservation. |
| III. | Review of compressor types and application in commercial refrigeration.<br>I. Identify and describe commercial refrigeration compressors. |
| IV. | Compressor safety controls and components.<br>BB. Describe types of oil separators, their application and operation.<br>CC. Describe the operation of the oil pump and oil safety control, calculate and read net oil pressure. |
| V. | System cycling and defrosting controls.<br>I. Describe commercial refrigeration system cycling and defrost controls. |
| VI. | Water cooled condensers and related components.<br>J. Describe the operation, water requirements, fouling factors, and service of water cooled condensers and water regulating valves.<br>K. Calculate required water volume for specific capacities of refrigeration. |

| | |
|---|---|
| VII. | Low ambient controllers.<br>P. Describe the operation and application of low ambient control systems. |
| VIII. | Heat reclaim systems.<br>P. Describe energy conserving systems that are used in supermarkets and other commercial applications. |
| IX. | Commercial ice machines.<br>N. Describe the operation and application of various types of ice machines, including electrical and mechanical sequences. |
| X. | Low, medium and ultra-low temp systems, floating head, intercoolers, compound compression, liquid injection and applicable ammonia systems and refrigerants.<br>I. Indentify the types and characteristics of refrigerants used in commercial applications.<br>J. Describe the application and operation of ultra-low temperature series (multi-stage) and cascade system. |
| XI. | Multiple temperature application including suction line control sizing, servicing and maintenance.<br>C. Describe various suction line controllers, their operation and application. |
| XII. | Equipment performance testing troubleshooting, maintenance and adjustment of electrical and mechanical problems relating to ice makers, walk-ins, aisle cases and reach-ins.<br>A. Describe appropriate steps in troubleshooting of the various refrigeration units mentioned above. |
| XIII. | Parallel systems and related components.<br>A. Describe operation of various parallel system components. |
| XIV. | Piping procedures and equipment selection.<br>A. Describe proper piping procedures and equipment selection for various refrigeration units. |

(proposed): **No Change**

**Course Outline including Time Allocation (current)**

Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week) Percentages
(100 percent)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction, orientation and safety | 1 | 8 |
| II. | Review of food preservation issues | 1 | 0 |
| III. | Review of compressor types and applications in commercial refrigeration. | 1 | 0 |
| IV. | Compressor safety controls and components (function, sizing, and servicing.) | 4 | 10 |
| V. | System cycling and defrosting controls | 4 | 10 |
| VI. | Water cooled condensers and related components | 4 | 3 |
| VII. | Low ambient controllers | 3 | 1 |
| VIII. | Heat reclaim systems | 3 | 1 |
| IX. | Commercial ice machines | 6 | 20 |
| X. | Low, Medium, and Ultra-Low temp systems, floating head, intercoolers, compound compression, liquid injection and applicable ammonia systems and refrigerants. | 3 | 0 |
| XI. | Multiple Temperature Application including suction line control | 5 | 7 |

| | | | |
|---|---|---|---|
| | sizing, servicing and maintenance. | | |
| XII. | Equipment Performance Testing Troubleshooting, Maintenance and Adjustment of Electrical and Mechanical Problems relating to ice makers, walk-ins, aisle cases and reach-ins. | 0 | 20 |
| XIII. | Parallel Systems and Related Components | 5 | 5 |
| XIV. | Piping Procedures and Equipment Selection | 5 | 5 |
| | Total Hours | 45 | 90 |

(proposed) **No Change**

9/28/15

# COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

**Prefix (current)** HVAC ☐ **Number (current) 208** ☐ LEC 3 LAB 6 SEM ___ (current)

(proposed) **No Change** (proposed) **No Change** (Enter Contact Hours per week)
LEC ___ LAB ___ SEM ___(proposed):
**Title (current) Air Conditioning Applications**

(proposed)

☐ **Credit Hours (current) 5** ☒ **Prerequisites (current)** **Co-requisite (current)**
HVAC 102 and HVAC 117, both with a grade of C- or better.

(proposed) (proposed) (proposed)
HVAC 102, HVAC 117, & MATH 116, all with a grade of C- or better.

☒ **Course Description (current): (125 words maximum)**

A study of mechanical air conditioning equipment including heat pump, chiller, absorption refrigeration, cooling tower and evaporative cooling applications. Compressor types and capacity control systems are included. Hands on laboratories cover electrical systems, capacity testing and troubleshooting of residential and light commercial mechanical and electrical systems. Pre-Requisites: HVAC 102 and HVAC 117, both with a grade of C- or better. Typically Offered Fall, Spring

(proposed):

A study of mechanical air conditioning equipment including heat pump, chiller, absorption refrigeration, cooling tower and evaporative cooling applications. Compressor types and capacity control systems are included. Hands on laboratories cover electrical systems, capacity testing and troubleshooting of residential and light commercial mechanical and electrical systems. Pre-Requisites: HVAC 102, HVAC 117, & MATH 116, all with a grade of C- or better. Typically Offered Fall, Spring

**Course Outcomes and Assessment Plan (current)**

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction, Orientation, and Safety.<br>G. Apply all safety procedures required in this course. |
| II. | System classification.<br>U. Identify different system classifications of air conditioning equipment and systems. |
| III. | Psychrometrics.<br>J. Understand the use of a psychrometric chart to analyze the performance of a air conditioning cooling coil and other cooling equipment. |
| IV. | Air conditioning systems.<br>DD. Describe the various components, sequence of operation and troubleshooting steps for air conditioning units. |
| V. | Heat pump systems.<br>J. Explain in dull detail the mechanical and electrical sequence of operation in both the heating and cooling modes of air and water cource heat pumps using flow charts and I/O devices.<br>K. Identify the type of defrost control system and auxiliary heat on air-to-air heat pumps, |

| | |
|---|---|
| | explain operation and test for correct operation. |
| VI. | Chillers.<br>L. Describe the application, advantages and disadvantages of chillers.<br>M. Describe the sequence of operation for a chiller.<br>N. Explain chiller safety controls.<br>O. Describe operation and maintenance of a 2-way and 3-way water regulating valve. |
| VII. | Cooling towers.<br>Q. Describe and demonstrate the operation and maintenance of cooling towers and evaporative condensers.<br>R. Describe the problems and preventative treatment systems involved with scale, corrosion, slime and algae in water cooled equipment. |
| VIII. | Capacity control.<br>Q. Describe operation, advantages and disadvantages of various air conditioning capacity control.<br>R. Describe problems caused by short cycling, compressor capacity control devices and hot gas bypass systems. |
| IX. | Overload devices.<br>O. Describe the operation, the troubleshooting sequence and the repair/replacement of overload devices such as:<br>a. Solid state time-delay devices.<br>b. Current sensing overload protection devices.<br>c. Thermal overload sensing devices.<br>d. Microprocessor and their input/output devices.<br>e. Identify overload devices on lab equipment. |
| X. | Centrifugal compressors.<br>K. Describe operation and application and capacity control of centrifugal compressors to include the following in preparation for the EPA Section 608 type III certification: speeds, pressure, reliability, maintenance, capacities and air purge units. |
| XI. | Screw type compressors.<br>D. Describe operation, application and capacity control of screw compressors. |
| XII. | Absorption refrigeration.<br>B. Describe operation, application and capacity control of an absorption system. |
| XIII. | Tubing and installation procedures.<br>B. Describe the installation considerations, wiring, air volume requirements and customer relations required to add a split system to a conventional forced air furnace. |

(proposed): **No Change**

**Course Outline including Time Allocation (current)**

Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week) Percentages
(100 percent)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction, orientation and safety | 1 | 1 |
| II. | System classifications | 2 | 0 |
| III. | Psychrometrics | 9 | 3 |
| IV. | Air Conditioning Systems | 6 | 39 |
| V. | Heat pump systems | 8 | 23 |
| VI. | Chillers | 3 | 6 |

| | | | |
|---|---|---|---|
| VII. | Cooling towers and evaporative condensers | 3 | 6 |
| VIII. | Capacity control systems | 2 | 0 |
| IX. | Overload devices | 2 | 3 |
| X. | Centrifugal compressors | 1 | 3 |
| XI. | Screw type compressors | 1 | 6 |
| XII. | Absorption refrigeration | 2 | 0 |
| XIII. | Tubing and installation procedures | 2 | 0 |
| | Total Hours | 45 | 90 |

(proposed) **No Change**

9/28/15

## COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

**Prefix (current)** HVAC ☐ **Number (current)** 312 ☐ **LEC** 3 **LAB** 3 **SEM** ___ **(current)**

(proposed) **No Change** (proposed) **No Change** (Enter Contact Hours per week)
LEC ___ LAB ___ SEM ___(proposed):
**Title (current) Control Theory & Application**

(proposed) **No Change**

**Credit Hours (current) 4** ☐

(proposed)

☒ **Prerequisites (current)**
C- or better in HVAC 321 and HVAC 342 and MATH 126

(proposed)
C- or better in HVAC 321 and HVAC 342

**Co-requisite (current)**

(proposed)

☒ **Course Description (current): (125 words maximum)**

The study of control loop theory related to commercial and industrial comfort, process and safety applications. The course focuses on analog electronic and pneumatic control components and their systems used in new and existing installations. Lab exercises concentrate on system operation and analysis. Pre-requisite: C- or better in HVAC 321 and HVAC 342 and MATH 126 Typically Offered Spring Only

(proposed):

The study of control loop theory related to commercial and industrial comfort, process and safety applications. The course focuses on analog electronic and pneumatic control components and their systems used in new and existing installations. Lab exercises concentrate on system operation and analysis. Pre-requisite: C- or better in HVAC 321 and HVAC 342. Typically Offered Spring Only

**Course Outcomes and Assessment Plan (current)**

## Learning Outcomes

## Topics

1. Terminology
    1.1. Student will be able to identify control system components by name.
2. Loop Components
    2.1. Student will be able to identify low volume and high volume pneumatic systems. Student will also demonstrate the ability to identify the process variable and final control device for a loop. Student will demonstrate identify loops by function (open / closed / safety / feedback)
3. Elements of Transfer Function
    3.1. Student will define and calculate sample values for the following:
        3.1.1. Throttling Range
        3.1.2. Proportional Gain
        3.1.3. Proportional Band
        3.1.4. Gain
        3.1.5. Error
        3.1.6. Bias
4. Application of Transfer Function
    4.1. Student will demonstrate the ability to calibrate a sensor by calculating its transfer function. Students will predict signal values for controllers and positions of final control devices by applying the transfer function for each component. Student will apply setpoint reset to multiple applications.
5. Application of Transfer Function
    5.1. Assemble and calibrate a pneumatic loop. Student will graph loop output for the pneumatic loop as well as several electronic sensors.
6. Sensors
    6.1. Students will examine current sensor literature and will plot sensor response in a computer application. Students will create a spreadsheet for calculation and graphing of the linear transfer function.
7. Controllers
    7.1. Given a controller operating in unstable mode, the student will follow a tuning process for returning the process to steady state error. Students will examine linear response and response over time and will demonstrate the ability to identify loop responses.
8. Process Characteristics
    8.1. Students will select controller outputs based upon calculated thermal characteristics of sample spaces.
9. Modulating Final Control Devices
        9.1.1. As a component of the documentation process, students will size and select control valves for a sample project.
10. Documentation
    10.1. Using plans and specifications, the student will generate the following Control Documentation for a sample project:
        10.1.1. Flow Diagram
        10.1.2. Point Schedule
        10.1.3. Wiring Detail

(proposed): **No Change**

**Course Outline including Time Allocation (current)**

Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week) Percentages
(100 percent)

**COURSE OUTLINE HVAC312**

TOPICS

1. Terminology
    - 1.1. Introduction
    - 1.2. Control Background and Terminology
    - 1.3. Background and Terminology
2. Loop Components
    - 2.1. Background and Terminology
    - 2.2. Loop Components and Configuration
        - 2.2.1. Pneumatic
            - 2.2.1.1. Examine different Process Variables
            - 2.2.1.2. Define the purpose and function of the Controller
            - 2.2.1.3. Examine different Final Control Devices
        - 2.2.2. Electronic
            - 2.2.2.1. Examine different Process Variables
            - 2.2.2.2. Define the purpose and function of the Controller
            - 2.2.2.3. Examine different Final Control Devices
    - 2.3. Loop Components and Configuration
        - 2.3.1. Examine uses for Open / Closed Loops
        - 2.3.2. Graph Feedback / Feed Forward Loops
3. Elements of Transfer Function
    - 3.1. Loop Components and Configuration
        - 3.1.1. Calculate Setpoint / Error
        - 3.1.2. Study various Signal Paths
        - 3.1.3. Define common Signal Types and Terminations
    - 3.2. Loop Components and Configuration
        - 3.2.1. Define and calculate:
        - 3.2.2. Throttling Range
        - 3.2.3. Proportional Gain
        - 3.2.4. Proportional Band
    - 3.3. Transfer Functions – Elements
        - 3.3.1. Calculate the Process Variable Transfer Function
            - 3.3.1.1. Gain
            - 3.3.1.2. Error
            - 3.3.1.3. Bias
4. Application of Transfer Function
    - 4.1. Transfer Functions – Elements
        - 4.1.1. Calculate the Loop Transfer Function
            - 4.1.1.1. Gain
            - 4.1.1.2. Error
            - 4.1.1.3. Bias
        - 4.1.2. Setpoint Reset
    - 4.2. Transfer Functions – Elements
        - 4.2.1. Calculate the Final Control Device Transfer Function
            - 4.2.1.1. Gain
            - 4.2.1.2. Error
            - 4.2.1.3. Bias
    - 4.3. Transfer Functions – Application
        - 4.3.1. Room Control
        - 4.3.2. Supply Control

4.3.3. Damper Applications
4.3.4. Valve Applications
4.4. Exam 1
4.5. Sensors
4.5.1. Pneumatic
4.5.1.1. Low Volume
4.5.1.2. High Volume

5. <u>Sensors</u>
5.1. Sensors
5.1.1. Pneumatic
5.1.1.1. Limits
5.1.1.2. Thermostats / Controllers
5.2. Sensors
5.2.1. Electronic
5.2.1.1. RTD
5.2.1.2. Semiconductor
5.2.1.3. Frequency
5.2.1.4. Current
5.2.1.5. Specialty
5.3. Sensors
5.3.1. Application
5.3.1.1. Installation
5.3.1.2. Best Practices
5.3.1.3. Calibration
5.3.1.4. Handling
5.3.1.5. Termination

6. <u>Controllers</u>
6.1. Controllers
6.1.1. Electronic
6.1.2. Pneumatic
6.1.3. Digital
6.2. Controllers
6.2.1. Control Modes
6.2.1.1. P
6.2.1.2. PI
6.2.1.3. PID
6.2.1.4. PD
6.2.1.5. Two-Position
6.2.1.6. Timed Two Position
6.2.1.7. Incremental
6.3. Controllers
6.3.1. Loop Responses
6.3.1.1. Underdamped
6.3.1.2. Overdamped
6.3.1.3. Critically Damped
6.3.1.4. Unstable with Increasing Amplitude
6.3.1.5. Unstable with Constant Amplitude

7. <u>Process Characteristics</u>
7.1. Process Characteristics
7.1.1. Heat Transfer

        7.1.2. Process Time Lags
    7.2. Process Characteristics
        7.2.1. Time Constant
        7.2.2. Thermal Capacitance
        7.2.3. Thermal Resistance
    7.3. Process Characteristics
        7.3.1. Affects of Time Constant on controller modes
        7.3.2. Affects of Thermal Capacitance on controller modes
        7.3.3. Affects of Thermal Resistance on controller modes

8. <u>Modulating Final Control Devices</u>
    8.1. Valves
        8.1.1. Components
        8.1.2. Type
        8.1.3. Connection
        8.1.4. Application
    8.2. Dampers
        8.2.1. Components
        8.2.2. Type
        8.2.3. Connection
        8.2.4. Application
    8.3. Engineering
        8.3.1. Sizing
        8.3.2. Authority
        8.3.3. Cv
        8.3.4. Specialty Applications

9. <u>Documentation</u>
    9.1. Construction Documentation
        9.1.1. Specifications
        9.1.2. Plans
    9.2. Control Documentation
        9.2.1. Flow Diagram
        9.2.2. Point Schedule
        9.2.3. Wiring Detail
        9.2.4. Bill of Material
    9.3. Changes
        9.3.1. Request for Information
        9.3.2. Bulletin

(proposed) **No Change**

9/28/15

# COURSE INFORMATION FORM FORM E

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

**Prefix ☒ (current)** HVAC ☐ **Number (current) 325** ☐ **LEC 3 LAB 3 SEM ___ (current)**

(proposed) **No Change** (proposed) **No Change** (Enter Contact Hours per week)
LEC ___ LAB ___ SEM ___(proposed):
**Title ☐ (current) HVAC Hydronic Systm Slct-Dsgn**

(proposed) **No Change**

☐ **Credit Hours (current) 4** ☒ **Prerequisites (current)** HVAC 321 and HVAC 342 and MATH 126 — **Co-requisite (current)**

(proposed) — (proposed) C- or better in HVAC 321 and HVAC 342 — (proposed)

☒ **Course Description (current): (125 words maximum)**

A study of water systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort. Prerequisites: HVAC 321 and HVAC 342 and MATH 126. Typically offered Spring.

(proposed):

A study of water systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort. Prerequisites: C- or better in HVAC 321 and HVAC 342. Typically offered Spring.

**Course ☐ Outcomes and Assessment Plan (current)**

## Learning Outcomes and Assessment for Each Instructional Unit

Assessment Code:
1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | Assessment |
|---|---|---|
| I. | Introduction | |
| II. | Hydronic System Definition and Classification<br>V. Classify hydronic systems based upon flow generation, temperature, pressure, piping and pumping arrangement.<br>W. Explain the advantages and disadvantages of various piping and pumping arrangements.<br>X. Calculate primary and secondary flowrates and temperatures in primary-secondary pumping arrangements. | 1.<br>2. |
| III. | Terminal Devices<br>A. Determine type, size and location of finned tube radiation units.<br>B. Determine type, size and location of hot water convector units. | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | C. Determine type, size and location of cabinet unit heaters.<br>D. Determine type, size and location of unit heaters. | |
| IV. | Hydronic System Design Procedure<br>A. Select terminal devices based on load requirements and calculate the required flow of water for each temperature control zone.<br>B. Determine pipe size required to carry desired water flowrate based upon friction loss and velocity.<br>C. Calculate equivalent length of pipe fittings in piping network.<br>D. Calculate friction loss of piping circuits.<br>E. Determine pressure losses of equipment and terminal units from manufacturer's data.<br>F. Calculate total head loss in closed loop piping systems.<br>G. Use pump affinity laws to plot system curve on pump performance curve for closed loop piping system.<br>H. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>I. Calculate total head loss in open piping systems.<br>J. Use pump affinity laws to plot system curve on pump performance curve for open loop piping system.<br>K. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>L. Select proper motor horsepower for circulating pump from manufacturer's performance data.<br>M. Develop parallel pump performance curves and identify operating points.<br>N. Develop series pump performance curves and identify operating points.<br>O. Analyze the effects of glycol on pump performance.<br>P. Determine the type, size and location of the system expansion tank.<br>Q. Utilize manufacturer's computer software to calculate piping system friction loss.<br>R. Utilize manufacturer's computer software to select proper circulating pump.<br>S. Utilize manufacturer's computer software to select proper expansion tank size. | 1.<br>2.<br>3. |
| V. | Flow Control Devices<br>EE. Explain the application of various service valves in hydronic systems.<br>FF. Explain the relationship between heat transfer, temperature differential and flow through a terminal convection element.<br>GG. Explain the relationship between valve port configuration and stem travel.<br>HH. Explain the relationship between energy transfer and valve stem travel for various valve types.<br>II. Define the control flow coefficient (Cv).<br>JJ. Select two-way modulating and three-way mixing and diverting valves using the flow coefficient (Cv). | 1.<br>2.<br>3. |
| VI. | Pumps<br>K. Identify the components and summarize the operation of a centrifugal pump.<br>L. Explain the relationship between flowrate and total dynamic head in a closed hydronic system.<br>M. Explain the difference between open and closed hydronic | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | systems. | |
| VII. | Balancing Hydronic Systems<br>P. Identify and summarize the function of instruments used to balance hydronic systems.<br>Q. Determine circulating pump impeller size.<br>R. Determine actual operating characteristics of circulating pump.<br>S. Determine flow rates of hydronic circuits using various flow measuring devices.<br>T. Calculate resistance necessary to pre-balance hydronic circuit.<br>U. Determine new impeller size to produce required flowrate. | 1.<br>2.<br>3. |

(proposed): **No Change**

**Course Outline including Time Allocation (current)**

Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week) Percentages
(100 percent)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Hydronic System Definition and Classification | 2 | 3 |
| III. | Terminal Devices | 6 | 3 |
| VI. | Hydronic System Design Procedure | 12 | 15 |
| V. | Flow Control Devices | 9 | 6 |
| VI. | Pumps | 9 | 6 |
| VII. | Balancing Hydronic Systems | 3 | 6 |
| VIII. | Exams | 3 | 6 |
| | Total Hours | 45 | 45 |

(proposed) **No Change**

9/28/15

# COURSE INFORMATION FORM FORM E

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

**Prefix (current)** HVAC ☐ **Number (current) 350** ☐ **LEC 3 LAB 3 SEM ___ (current)**

(proposed) **No Change** (proposed) **No Change** (Enter Contact Hours per week)

LEC ___ LAB ___ SEM ___(proposed):

**Title (current) Contracting Issues in HVACR**

(proposed) **No Change**

☐ **Credit Hours (current) 4**

(proposed)

☒ **Prerequisites (current)**

C- or better in HVAC 321 and HVAC 342 and MATH 126

(proposed)

C- or better in HVAC 321 and HVAC 342

**Co-requisite (current)**

(proposed)

☒ **Course Description (current): (125 words maximum)**

The study of contracting issues as related to the HVACR industry. The course focuses on plans and specifications, estimating, budget issues, project management, economic cost analysis and codes and standards, all from the perspective of an HVACR professional. Lab exercises focus on application of contracting issues to a sample project. Prerequisites: C- or better in HVAC 321 and HVAC 342 and MATH 126. Typically Offered Fall and Spring

(proposed):

The study of contracting issues as related to the HVACR industry. The course focuses on plans and specifications, estimating, budget issues, project management, economic cost analysis and codes and standards, all from the perspective of an HVACR professional. Lab exercises focus on application of contracting issues to a sample project. Prerequisites: C- or better in HVAC 321 and HVAC 342. Typically Offered Fall and Spring.

**Course Outcomes and Assessment Plan (current)**

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Specifications<br>H. Define the divisions and numbering system used in specification.<br>I. Predictably locate specific information using the above system.<br>J. Identify all new industry specification formats<br>K. Define the role of the Construction Specification Institute in construction documentation.<br>L. Define terms and conditions<br>M. Define cost impact from terms and conditions<br>N. Complete sample documentation including: (method of procedure, AIA billing, approved change orders, insurance needs for material not on site, schedule of values, bulletin, addendum) |
| II. | Plans<br>Y. Locate and understand abbreviations.<br>Z. Locate and understand symbols.<br>AA. Utilize abbreviations and symbols in a sample project.<br>BB. Identify types of details and their links to other drawings. |

| | |
|---|---|
| | CC. Define the use of Mechanical schedules.<br>DD. Use schedules to locate specific mechanical information.<br>EE. Develop a mechanical schedule for a sample project.<br>FF. Locate discrepancies between plans and specs.<br>GG. Identify the cost impact of discrepancies between plans and specs.<br>HH. Define what an addendum is and how it impacts bid form format.<br>II. Define what a bulletin is and identify situations for use.<br>JJ. Identify and complete documentation for discrepancy resolution, including: RFI, Bulletin and Addendum. |
| III. | Estimating<br>N. Define the different estimating methods: (manual and software).<br>O. Define scope of work for mechanical trades and identify issues.<br>P. Complete a scope of work for a sample project.<br>Q. Define a Bid / negotiated job including: bid documents, customer relations, spec. reference to owners authority, issues related to negotiated work.<br>R. Define a Design / build job including: advantages / disadvantages, customer relations, code compliance and plan review.<br>S. Define a Bid / specification job including: sources of opportunity (builders exchange), public vs. private bid, bid requirements (bonding, insurance), bid documents, specific issues relative to bid and spec. jobs.<br>T. Identify issues regarding material, including: billing, shipping, storage, insurance, incorrect, schedule of value and unit pricing.<br>U. Define what targeted work is and issues including: union vs. private, long term benefits, actual cost of work.<br>V. Identify equipment needed for job.<br>W. Identify equipment issues including: responsibility, operating implications, temporary heating, enclosures, unit pricing, warranty start, shipping and availability (job schedule).<br>X. Perform a mechanical take-off including: piping, duct, controls, primary and secondary equipment<br>Y. Identify labor concerns and issues including: union vs. non-union, prevailing wage, job site foreman, skills needed vs. skill available, per diem.<br>Z. Define the term burden<br>AA. Define the term Risk and items associated with the following: designer, mechanical contractor, piping contractor, sheet metal contractor, control contractor, sub-contracted work.<br>BB. Perform a risk analysis for a sample job.<br>CC. Define terms and conditions and their implications.<br>DD. Define warranty and the following issues: jobsite specifics, early equipment start-up, start date, owner acceptance, certificate of occupancy, significant completion and contract requirements.<br>EE. Identify the roles of general and sub contractors on a job.<br>FF. Develop a flow chart of job site hierarchy.<br>GG. Define the risk of sub-contracting.<br>HH. Identify sub-contactors cost methods including: unit pricing, detailed bid, time and material, single line bid.<br>II. Identify site specific requirements including: rough in, minority contracting, scheduling, general terms and conditions, parking, trash removal, after hour work, staging areas, special equipment.<br>JJ. Identify and define other misc. estimated areas including: drug testing, background checks, safety training, customer training, set up and tear down, trade coordination, weather issues, etc. |
| IV. | Budget Issues<br>E. Define the process of discovery including customer interview. |

| | |
|---|---|
| | F. Develop a quick budget.<br>G. Define risk analysis and thresh hold of risk. |
| V. | Project Management<br>A. Define the post award of bid steps.<br>B. Define the Project Management Professional (PMP)<br>C. Identify the PMP certificate process<br>D. Develop a project management plan for a sample project.<br>E. Define scope review and identify duplication of responsibility.<br>F. Define scheduling including the following topics: gant schedule, project contractor meeting, manpower, delivery, equipment and critical path.<br>G. Identify and define job documents including: change orders, submittals, bulletin, addendum, bid alternate, RFI, pencil copy, RFP, RFQ, job close out, payment app.<br>H. Identify equipment rental needs.<br>I. Identify security and safety issues including compliance and documentation.<br>J. Identify coordination issues with other trades.<br>K. Identify sub-contractor issues and scheduling.<br>L. Define quality control issues.<br>M. Identify personnel issues including: safety, drug screening, job site etiquette. |
| VI. | Codes and Standards<br>T. Identify and define the following code and standard organizations: ASHRAE, SMACNA, IESNA, ANSI, OSHA, ISO.<br>U. Determine the applicable code from local, state, federal, international.<br>V. Correctly use and interpret a code book.<br>W. Identify what an inspector wants.<br>X. Define the term standards of care. |
| VII. | Economic Analysis<br>V. Define the following financial terms:<br>a. Net present value<br>b. Discount rate<br>c. Rate-of-Return (ROR)<br>d. Return-on-investment (ROI)<br>e. Inflation<br>f. Depreciation<br>g. Taxes<br>h. Fuel Cost Escalation<br>W. Define methods of cash flow analysis including: simple payback, life cycle cash flow analysis (present worth method & annual cash flow method).<br>X. Utilize available software to perform cash flow analysis. |

(proposed): **No Change**

**Course Outline including Time Allocation (current)**

Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week) Percentages
(100 percent)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Specifications | 3 | 3 |
| II. | Plans | 3 | 3 |
| III. | Estimating | 12 | 12 |
| IV. | Budget Issues | 3 | 3 |
| V. | Project Management | 6 | 6 |
| VI. | Codes and Standards | 6 | 6 |
| VII. | Economic Analysis | 10 | 12 |
| VIII. | Evaluation | 2 | 0 |
| | Total Hours | 45 | 45 |

(proposed) **No Change**

9/28/15

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

I. **ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (201601): Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

II. **COURSE TO BE MODIFIED:**

| a. Course Prefix | b. Number | c. Title |
|---|---|---|
| **HVAC** | **102** | **Advanced Refrigeration and AC** |

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW.** **P & S**
**See Appendix E Instructions for Completing Forms.**

III. **MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix   b. Number   c. Contact hours   LECture   LAB   Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code:   g. Department Code:   h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box:   Minimum Credit Hours j.   Maximum Credit Hours .

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times   or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix   Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

**A continuation of the basic refrigeration cycle and application of the Mollier diagram and thermodynamics, including theoretical and actual refrigeration capacities, along with a study of refrigerants, oils, systems, metering devices and compressors. Emphasis on instrumentation, testing, system troubleshooting and problem solving. Students will study for EPA Section 608 certification. Prerequisites: HVAC 101 & HVAC 111 all with a grade of C- or better. Typically Offered Fall, Spring**

q. Term(s) Offered:   r. Max Section Enrollment:   Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.)

**HVAC 101 & HVAC 111 all with a grade of C- or better.**

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
Basic Skill ☐ (BS)   ☐ General Education (GE)   ☐ Occupational Education (OC)   ☐ G.E. Codes

**UCC Chair Signature/Date:** 9/10/15

**Academic Affairs Approval Signature/Date:** 9/18/15

Office of the Registrar use ONLY
**Date Rec'd:** ________ **Date Completed:** _____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** _______

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

I. **ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (201601): Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

II. **COURSE TO BE MODIFIED:**

| a. Course Prefix | b. Number | c. Title |
|---|---|---|
| **HVAC** | **117** | **Advanced Electricity-Circuits** |

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW.** **P & S**
**See Appendix E Instructions for Completing Forms.**

III. **MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix   b. Number   c. Contact hours   LECture   LAB   Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code:   g. Department Code:   h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box:   Minimum Credit Hours   j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times   or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix   Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

**AC electrical theory and application, concentrating on the operation, installation and analysis of HVACR components and control circuits. The components include single and polyphase transformer and motors, heating and air conditioning controls, commercial timers, motor starters, contactors, relays and other control devices. Lab exercises focus on developing wiring diagrams; wiring, troubleshooting and analyzing circuits based on lecture material. Prerequisites: HVAC 111 with a grade of C- or better. Typically Offered Fall, Spring**

q. Term(s) Offered:   r. Max Section Enrollment:   Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.)

**HVAC 111 with a grade of C- or better.**

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
Basic Skill ☐ (BS)   ☐ General Education (GE)   ☐ Occupational Education (OC)   ☐ G.E. Codes

**UCC Chair Signature/Date:** 9/10/15

**Academic Affairs Approval Signature/Date:** 9/18/15

**Office of the Registrar use ONLY**

**Date Rec'd:** ________ **Date Completed:** _____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** ______

# MODIFY A COURSE

**Course Data Entry Form**

**FORM F**

Rev. September 2012

I. **ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (201601): Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

II. **COURSE TO BE MODIFIED:**

| a. Course Prefix | b. Number | c. Title |
|---|---|---|
| HVAC | 132 | Fund of Heating & Mechanical Systems |

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW.** P & S
**See Appendix E Instructions for Completing Forms.**

III. **MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

**A study of combustion in conventional and high-efficiency units. Mechanical and building blueprints, symbols, drawing & sketching, and views will be covered. Laboratory work on heating, components, system identification, and the analysis of fuel consumption rates and cycles. Pre-Requisites: HVAC 111 with a grade of C- or better. Typically Offered Fall, Spring**

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.)

**HVAC 111 with a grade of C- or better.**

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
Basic Skill ☐ (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** 9/10/15

**Academic Affairs Approval Signature/Date:** 9/28/15

**Office of the Registrar use ONLY**

**Date Rec'd:** ________ **Date Completed:** _____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** _______

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

I. ACTION TO BE TAKEN: MODIFY A COURSE

**Desired Term Effective** (201601): Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

II. COURSE TO BE MODIFIED:

| a. Course Prefix | b. Number | c. Title |
|---|---|---|
| HVAC | 235 | Advanced Heating-Mechanical Systems |

LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. P & S
**See Appendix E Instructions for Completing Forms.**

III. **MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐Yes ☐No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

**A continuation of the study of gas and oil fired heating appliances for residential and commercial applications. Includes the operating sequence of forced air and hydronic systems for safe, efficient combustion and flame safety. Application includes troubleshooting faulty electrical/electronic control systems, safety systems, mechanical systems and hydronic systems. Pre-Requisites: HVAC 132, HVAC 117 & MATH 116, all with a grade of C- or better. Typically Offered Fall, Spring**

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.)

**HVAC 132, HVAC 117 & MATH 116, all with a grade of C- or better.**

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
Basic Skil☐BS) ☐General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** 9/10/15

**Academic Affairs Approval Signature/Date:** 9/25

Office of the Registrar use ONLY
Date Rec'd: ________ Date Completed: _____ Entered: SCACRSE __ SCADETL __ SCARRES __ SCAPREQ _______

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

I. **ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (201601): Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

II. **COURSE TO BE MODIFIED:**

| a. Course Prefix | b. Number | c. Title |
|---|---|---|
| **HVAC** | **245** | **HVAC Unitary System Design** |

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW.** **P & S**
**See Appendix E Instructions for Completing Forms.**

III. **MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours .

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

**The study of residential and light commercial HVACR system design including load calculations and psychrometrics. Includes heat recovery methods, restaurant ventilations requirements, humidification, insulation, sound and measurement techniques and applicable codes. Pre-Requisites: HVAC 101, HVAC 132 & MATH 116, all with a grade of C- or better. Typically Offered Fall, Spring**

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.)

**HVAC 101, HVAC 132 & MATH 116, all with a grade of C- or better.**

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
Basic Skill ☐ (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:**
9/10/15

**Academic Affairs Approval Signature/Date:**
9/28/15

**Office of the Registrar use ONLY**
**Date Rec'd:** ________ **Date Completed:** _____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** _______

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

I. ACTION TO BE TAKEN: MODIFY A COURSE

**Desired Term Effective** (201601): Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

II. COURSE TO BE MODIFIED:

| a. Course Prefix | b. Number | c. Title |
|---|---|---|
| HVAC | 207 | Commercial Refrigeration Systems |

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW.** P & S
**See Appendix E Instructions for Completing Forms.**

III. **MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours .

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. CATALOG DESCRIPTION – Limit to 125 words – PLEASE BE CONCISE.

**A study of commercial and industrial refrigeration systems associated with supermarkets, restaurants and storage facilities. Topics include electrical and mechanical refrigeration systems found in today's applications. Laboratories will cover testing, adjusting and troubleshooting electrical and mechanical systems. Prerequisites: HVAC 102, HVAC 117, & MATH 116, all with a grade of C- or better. Typically Offered Fall and Spring.**

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.)

**HVAC 102, HVAC 117, & MATH 116, all with a grade of C- or better.**

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
Basic Skill ☐ (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** 9/10/15

**Academic Affairs Approval Signature/Date:** 9/28/15

Office of the Registrar use ONLY
Date Rec'd: ________ Date Completed: _____ Entered: SCACRSE __ SCADETL __ SCARRES __ SCAPREQ _______

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

I. **ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (201601): Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

II. **COURSE TO BE MODIFIED:**

| a. Course Prefix | b. Number | c. Title |
|---|---|---|
| HVAC | 208 | Air Conditioning Applications |

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW.** P & S
**See Appendix E Instructions for Completing Forms.**

III. **MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix  b. Number  c. Contact hours  LECture  LAB  Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

**A study of mechanical air conditioning equipment including heat pump, chiller, absorption refrigeration, cooling tower and evaporative cooling applications. Compressor types and capacity control systems are included. Hands on laboratories cover electrical systems, capacity testing and troubleshooting of residential and light commercial mechanical and electrical systems. Pre-Requisites: HVAC 102, HVAC 117, & MATH 116, all with a grade of C- or better. Typically Offered Fall, Spring**

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.)

**HVAC 102, HVAC 117, & MATH 116, all with a grade of C- or better.**

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
Basic Skill ☐ (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** 9/10/15

**Academic Affairs Approval Signature/Date:** 9/28/15

**Office of the Registrar use ONLY**
**Date Rec'd:** ________ **Date Completed:** _____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** ______

# MODIFY A COURSE

**Course Data Entry Form**

# FORM F

Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (201601): Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**

| a. Course Prefix | b. Number | c. Title |
|---|---|---|
| **HVAC** | **312** | **Control Theory & Application** |

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW.** **P & S**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

**The study of control loop theory related to commercial and industrial comfort, process and safety applications. The course focuses on analog electronic and pneumatic control components and their systems used in new and existing installations. Lab exercises concentrate on system operation and analysis.Pre-requisite: C- or better in HVAC 321 and HVAC 342. Typically Offered Spring Only**

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.)

**C- or better in HVAC 321 and HVAC 342.**

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** 9/10/15

**Academic Affairs Approval Signature/Date:** 9/28/15

**Office of the Registrar use ONLY**
**Date Rec'd:** ________ **Date Completed:** _____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** _______

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (201601): Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**

| a. Course Prefix | b. Number | c. Title |
|---|---|---|
| **HVAC** | **325** | **HVAC Hydronic Systm Slct-Dsgn** |

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW.** **P & S**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

**A study of water systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort. Prerequisites: C- or better in HVAC 321 and HVAC 342. Typically offered Spring.**

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.)

**C- or better in HVAC 321 and HVAC 342.**

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
Basic Skil(BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** 9/10/15

**Academic Affairs Approval Signature/Date:** 9/8/15

**Office of the Registrar use ONLY**

**Date Rec'd:** _________ **Date Completed:** _____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** _______

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

I. **ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (201601): Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

II. **COURSE TO BE MODIFIED:**

| a. Course Prefix | b. Number | c. Title |
|---|---|---|
| HVAC | 350 | Contracting Issues in HVACR |

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW.** **P & S**
**See Appendix E Instructions for Completing Forms.**

III. **MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours .

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

**The study of contracting issues as related to the HVACR industry. The course focuses on plans and specifications, estimating, budget issues, project management, economic cost analysis and codes and standards, all from the perspective of an HVACR professional. Lab exercises focus on application of contracting issues to a sample project. Prerequisites: C- or better in HVAC 321 and HVAC 342. Typically Offered Fall and Spring.**

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.)

**C- or better in HVAC 321 and HVAC 342.**

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** 9/10/15

**Academic Affairs Approval Signature/Date:** 9/18/15

**Office of the Registrar use ONLY**
**Date Rec'd:** ________ **Date Completed:** _____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** _______

## Paula L Hadley-Kennedy

| | |
|---|---|
| **From:** | Brian Holton |
| **Sent:** | Thursday, August 27, 2015 9:26 AM |
| **To:** | Olukemi O Fadayomi; Paula L Hadley-Kennedy |
| **Subject:** | FW: Proposal #15-079 |
| **Attachments:** | Complete proposal HVACR change to MATH prerequisite timing.doc |

I need to discuss a past proposal with one or both of you. Possibly today after our meeting our we could schedule a meeting.
Mike Feutz gave up on a proposal and during the summer I addressed the problems and added the missing documentation. Not sure if this would have to start all over. Seems like that would be a waste of peoples time and effort since the proposal already had made it to the UCC level and nothing changed except the missing documentation requested by Kemi.
I attached the updated proposal. The form A does not have signatures but I included a form A to update the summery. I tried to make the intent of the proposal more clear.

Brian Holton
Ferris State University

**From:** Brian Holton
**Sent:** Tuesday, April 21, 2015 9:19 AM
**To:** Olukemi O Fadayomi <OlukemiFadayomi@ferris.edu>
**Subject:** RE: Proposal #15-079

Thank you.

Brian Holton

**From:** Olukemi O Fadayomi
**Sent:** Tuesday, April 21, 2015 8:22 AM
**To:** Brian Holton
**Subject:** FW: Proposal #15-079

FYI!

*Kemi*
Olukemi Fadayomi, Ph. D
Professor
Department of Biological Sciences
Ferris State University
ASC 2009, 820 Campus Drive
Big Rapids, MI 49307-2225

fadayok@ferris.edu
Phone: (231) 591-5628
Fax: (231) 591-2540

**From:** Olukemi O Fadayomi
**Sent:** Friday, April 17, 2015 3:59 PM
**To:** Mike J Feutz
**Subject:** RE: Proposal #15-079

Hi Mike,

The form requires that you include current and new information on Form E. You have the proposed changes but not the existing information. Hope this is helpful.

**COURSE INFORMATION FORM** **FORM E**

Rev. May 2013

**Complete all items below (New or Current).**

*Kemi*

Olukemi Fadayomi, Ph. D
Professor
Department of Biological Sciences
Ferris State University
ASC 2009, 820 Campus Drive
Big Rapids, MI 49307-2225

fadayok@ferris.edu
Phone: (231) 591-5628
Fax: (231) 591-2540

**From:** Mike J Feutz
**Sent:** Friday, April 17, 2015 6:34 AM
**To:** Olukemi O Fadayomi
**Subject:** RE: Proposal #15-079

Good morning,

I wonder if you could help me. What is incomplete in the Form Es? The instructions direct the proposer to **Check all boxes where modifications are being made. Enter the modification to be made (Proposed).**

The proposal affects the prerequisites and course descriptions, and those areas are completed. What is missing?

Thank you,

Michael J. Feutz, Ph.D., LEED AP
Professor, HVAC Engineering Technology and Energy Management
Ferris State University

**From:** Olukemi O Fadayomi
**Sent:** Thursday, April 16, 2015 10:19 PM
**To:** Mike J Feutz
**Cc:** Victor I Piercey; Kristy L Motz; David M Marion; Adnan Dakkuri; Mark A Hutchinson; Brian Holton; John Scott S Gray;

Elise M Gramza; Paul Blake; Tracey D Boncher; Paula L Hadley-Kennedy; Olukemi O Fadayomi
**Subject:** Proposal #15-079

Hi Mike,

Your proposal to change math prerequisite timing in HVACR curriculum, Proposal #15-079 was reviewed and we are holding it pending come corrections.

We noticed that many of the Form Es in your proposal are incomplete. To assist UCC in the evaluation process we require that all relevant Form Es (current and modified) be included in a proposal. We therefore ask that you forward complete current Form Es to Paula Hadley in the Senate Office.

We also recommend that you change the effective date for your proposal to Spring 2016 since most students have already registered for Fall 2015 before the prerequisites are in effect.

These changes must be in place before we can move your proposal to the next level. As always, do not hesitate to contact me if I can be of further assistance.

*Kemi*

Olukemi Fadayomi, Ph. D
Professor of Biology
Chair, University Curriculum Committee
Ferris State University
ASC 2009, 820 Campus Drive
Big Rapids, MI 49307-2225

fadayok@ferris.edu
Phone: (231) 591-5628
Fax: (231) 591-2540

**Paula L Hadley-Kennedy**

| | |
|---|---|
| **From:** | Olukemi O Fadayomi |
| **Sent:** | Wednesday, April 22, 2015 4:20 PM |
| **To:** | Paula L Hadley-Kennedy |
| **Subject:** | FW: Proposal #15-079 |

*Kemi*
Olukemi Fadayomi, Ph. D
Professor
Department of Biological Sciences
Chair, University Curriculum committee
Ferris State University
ASC 2009, 820 Campus Drive
Big Rapids, MI 49307-2225

fadayok@ferris.edu
Phone: (231) 591-5628
Fax: (231) 591-2540

---

**From:** Mike J Feutz
**Sent:** Wednesday, April 22, 2015 3:17 PM
**To:** Olukemi O Fadayomi
**Subject:** RE: Proposal #15-079

Please withdraw this proposal.

Thank you!

Michael J. Feutz, Ph.D., LEED AP
Professor, HVAC Engineering Technology and Energy Management
Ferris State University

---

**From:** Olukemi O Fadayomi
**Sent:** Wednesday, April 22, 2015 2:14 PM
**To:** Mike J Feutz
**Subject:** RE: Proposal #15-079

Hi Mike,

Form E goes to Academic Affairs, hence the requirement to put everything relevant to the course. It checks for duplication and redundancy. It also drives assessment.

Form F is for the registrar's office and requires information for gradebook and course catalog.

Hope this is helpful.

*Kemi*
Olukemi Fadayomi, Ph. D
Professor
Department of Biological Sciences
Ferris State University
ASC 2009, 820 Campus Drive
Big Rapids, MI 49307-2225

fadayok@ferris.edu
Phone: (231) 591-5628
Fax: (231) 591-2540

**From:** Mike J Feutz
**Sent:** Friday, April 17, 2015 8:55 PM
**To:** Olukemi O Fadayomi
**Subject:** RE: Proposal #15-079

Thanks,

No problem. Question for you. Can you explain why Form F asks for only changes while Form E requires current and proposed? Seems a silly requirement as it introduces great opportunity for human error while filling in redundant information.

Michael J. Feutz, Ph.D., LEED AP
Professor, HVAC Engineering Technology and Energy Management
Ferris State University

**From:** Olukemi O Fadayomi
**Sent:** Friday, April 17, 2015 3:59 PM
**To:** Mike J Feutz
**Subject:** RE: Proposal #15-079

Hi Mike,

The form requires that you include current and new information on Form E. You have the proposed changes but not the existing information. Hope this is helpful.

**COURSE INFORMATION FORM** **FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

*Kemi*
Olukemi Fadayomi, Ph. D
Professor
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Ferris State University
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Big Rapids, MI 49307-2225

fadayok@ferris.edu

Phone: (231) 591-5628
Fax: (231) 591-2540

**From:** Mike J Feutz
**Sent:** Friday, April 17, 2015 6:34 AM
**To:** Olukemi O Fadayomi
**Subject:** RE: Proposal #15-079

Good morning,

I wonder if you could help me. What is incomplete in the Form Es? The instructions direct the proposer to **Check all boxes where modifications are being made. Enter the modification to be made (Proposed).**

The proposal affects the prerequisites and course descriptions, and those areas are completed. What is missing?

Thank you,

Michael J. Feutz, Ph.D., LEED AP
Professor, HVAC Engineering Technology and Energy Management
Ferris State University

**From:** Olukemi O Fadayomi
**Sent:** Thursday, April 16, 2015 10:19 PM
**To:** Mike J Feutz
**Cc:** Victor I Piercey; Kristy L Motz; David M Marion; Adnan Dakkuri; Mark A Hutchinson; Brian Holton; John Scott S Gray; Elise M Gramza; Paul Blake; Tracey D Boncher; Paula L Hadley-Kennedy; Olukemi O Fadayomi
**Subject:** Proposal #15-079

Hi Mike,

Your proposal to change math prerequisite timing in HVACR curriculum, Proposal #15-079 was reviewed and we are holding it pending come corrections.

We noticed that many of the Form Es in your proposal are incomplete. To assist UCC in the evaluation process we require that all relevant Form Es (current and modified) be included in a proposal. We therefore ask that you forward complete current Form Es to Paula Hadley in the Senate Office.

We also recommend that you change the effective date for your proposal to Spring 2016 since most students have already registered for Fall 2015 before the prerequisites are in effect.

These changes must be in place before we can move your proposal to the next level. As always, do not hesitate to contact me if I can be of further assistance.

*Kemi*
Olukemi Fadayomi, Ph. D
Professor of Biology
Chair, University Curriculum Committee
Ferris State University

ASC 2009, 820 Campus Drive
Big Rapids, MI 49307-2225

fadayok@ferris.edu
Phone: (231) 591-5628
Fax: (231) 591-2540

**Paula L Hadley-Kennedy**

| | |
|---|---|
| **From:** | Olukemi O Fadayomi |
| **Sent:** | Thursday, April 16, 2015 10:25 PM |
| **To:** | Mike J Feutz |
| **Cc:** | Paula L Hadley-Kennedy |
| **Subject:** | Fw: Proposal #15-079 |

Mike,

We also ask that you send a consultation form, Form B to Mathematics Department so that they are aware of the changes and can schedule sections accordingly. Consultation form turnaround is about 10 days but you might be able to expedite it by contacting Kirk Weller in the mathematics Department.

Kemi

---

**From:** Olukemi O Fadayomi
**Sent:** Thursday, April 16, 2015 10:18 PM
**To:** Mike J Feutz
**Cc:** Victor I Piercey; Kristy L Motz; David M Marion; Adnan Dakkuri; Mark A Hutchinson; Brian Holton; John Scott S Gray; Elise M Gramza; Paul Blake; Tracey D Boncher; Paula L Hadley-Kennedy; Olukemi O Fadayomi
**Subject:** Proposal #15-079

Hi Mike,

Your proposal to change math prerequisite timing in HVACR curriculum, Proposal #15-079 was reviewed and we are holding it pending come corrections.

We noticed that many of the Form Es in your proposal are incomplete. To assist UCC in the evaluation process we require that all relevant Form Es (current and modified) be included in a proposal. We therefore ask that you forward complete current Form Es to Paula Hadley in the Senate Office.

We also recommend that you change the effective date for your proposal to Spring 2016 since most students have already registered for Fall 2015 before the prerequisites are in effect.

These changes must be in place before we can move your proposal to the next level. As always, do not hesitate to contact me if I can be of further assistance.

*Kemi*
Olukemi Fadayomi, Ph. D
Professor of Biology
Chair, University Curriculum Committee
Ferris State University
ASC 2009, 820 Campus Drive
Big Rapids, MI 49307-2225

fadayok@ferris.edu

## Paula L Hadley-Kennedy

**From:** Olukemi O Fadayomi
**Sent:** Thursday, September 10, 2015 11:17 PM
**To:** Mike J Feutz
**Cc:** Adnan Dakkuri; Brian Holton; David M Marion; Elise M Gramza; John Scott S Gray; Kirk E Weller; Kristy L Motz; Mark A Hutchinson; Olukemi O Fadayomi; Paula L Hadley-Kennedy; Paul Blake; Tracey D Boncher; Victor I Piercey
**Subject:** Proposal #15-079

Hi Mike,

Your proposal to change the timing of math prerequisite in the HVACR program, Proposal # 15-079 was approved by the UCC at our meeting Thursday, September 10 and has been forwarded to Academic Affairs for their approval. Congratulations!

*Kemi*
Olukemi Fadayomi, Ph. D
Professor of Biology
Chair, University Curriculum Committee
Ferris State University
ASC 2009, 820 Campus Drive
Big Rapids, MI 49307-2225

fadayok@ferris.edu
Phone: (231) 591-5628
Fax: (231) 591-2540

**FORM A**

Revised September 2012

# PROPOSAL SUMMARY AND ROUTING FORM

## Proposal Title: HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325

**Initiating Individual:** Doug Zentz **Initiating Department or Unit:** HVACR
**Contact Person's Name:** Doug Zentz **e-mail:** zentzd@ferris.edu **phone:** 3083

- ☐ Group I - A – New degree, major, concentration, minor, or redirection of a current offering
- ☐ Group I - B – Deletion of a degree, major, concentration, or minor
- ☒ Group II - A – New Course, modification of a course, deletion of a course
- ☒ Group II - B – Minor curriculum clean-up
- ☐ Group III – Certificates (☐ College Credit ☐ Non-Credit)
- ☐ Group IV – Other Site Locations (☐ College Credit ☐ Non-Credit)

| | Signature | Date | Vote/Action * Number count ** |
|---|---|---|---|
| Program Representative ** | [signature] | 11/19/13 | 8 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| Department/School/Faculty Representative Vote **<br>School Curriculum Comm | John Schmitt | 01/02/14 | 6 Support<br>– Support with Concerns<br>– Not Support<br>– Abstain |
| Department/School Administrator<br>Director, SBE | John Schmitt | 01/02/14 | 1 Support<br>– Support with Concerns<br>– Not Support |
| College Curriculum Committee/Faculty | [signature] | 2/20/14 | 10 Support<br>0 Support with Concerns<br>0 Not Support<br>0 Abstain |
| Dean | [signature] | 2/27/14 | 1 Support<br>0 Support with Concerns<br>0 Not Support |
| University Curriculum Committee ** | Sandy Alspach-Jensen | 3/24/14 | ✓ Support 9-0<br>Support with Concerns<br>Not Support<br>Abstain |
| Senate ** | K. Thompson | 3/24/14 | ✓ Support<br>Support with Concerns<br>Not Support<br>Abstain |
| Academic Affairs | Paul Blake | 4/1/14 | ✓ Support<br>Hold<br>Not Support |

* Support with Concerns or Not Support must include identification of specific concerns with appropriate rationale.
** Number count must be given for all members present and/or voting.

| To be completed by Academic Affairs | | Date/Term of Implementation: Fall 2014 |
|---|---|---|
| President (Date Approved) | Board of Trustees (Date Approved) | Academic Officers of MI (Date Approved) |

VPAA
MAR 3 1 2014
PROVOST

# FORM A CONT.

## 1. Proposal Summary

(Summary is generally less than one page. Briefly: state what is proposed with a summary of rationale and highlights.)

**BACKGROUND**

The HVAC Bachelor degree began in the mid 1980's when Ferris was on quarters, and during this time period the HVAC Bachelor degree had two junior level "*secondary system select-design*" courses; one was centered on air side systems and the other one was centered on water (hydronic) side systems. When Ferris moved to semester based courses, these two "*secondary system select-design*" courses were blended together to a 5 credit "*HVAC Secondary System Select-Design*" class (known as HVAC 331). Although manageable, the amount of course content within this course is beyond the normal junior level class and in some semesters it was difficult to cover all learning outcomes. In 2009, it was determined through advisory board input that another course, HVAC 350 – Contracting Issues in HVAC, should be created and to provide the needed credits for this new class it was determined that HVAC 331 should be reduced to 4 credits by reducing some of the learning outcomes (moving them to another HVAC course). It has been 4 years now and the result of this change, along with Advisory Board input, has concluded there is a strong need to return to two separate "*secondary system select-design*" courses (one air side and the other water (hydronic) side); thus, the HVAC department wants to create HVAC 321, "*HVAC Air Side System Select-Design*" and HVAC 325, "*HVAC Hydronic System Select-Design*".

**CREATION OF HVAC 321 & HVAC 325**: HVAC 321 will be in fall semester of the junior year replacing HVAC 331 (the credits remain the same - 4). HVAC 325 (4 credits) will be in the spring semester of junior year as a new course and to accommodate this creation two things will occur. The needed 4 credits will come from the elimination of our "Directed (3 credit) Elective" course which is on our current check sheet and one credit from the reduction of the HVAC Capstone Experience Class, HVAC 499 (outlined below). Thus the overall credits for graduation remain the same. The splitting of HVAC 331 into HVAC 321 and HVAC 325 will allow a deeper learning experience for students in the learning outcomes including advanced computer system design (using BIM software) per our advisory board input and to satisfy requirements our industry expects from our graduates (this was a direct outcome from our last program APR).

**HVAC CAPSTONE EXPERIENCE MODIFICATION**: This proposal includes the modification of HVAC 499 from a 5 credit class to a 4 credit class by eliminating one of the weekly lab sessions. Currently, this class has two lecture hours per week and nine lab hours (three 3-hour sessions). This proposes to reduce lab to six hours per week (two 3-hour sessions).

Six hours of lab per week provides ample time for faculty to assist students. The reduction eliminates a lab session that experience has shown to be "supervised homework." The credit made available through this reduction is added to the three credits made available by eliminating the directed elective, providing four credits for HVAC 325 (shown above). Note; this change in credit hours will be phased in to reflect some current students working from existing check sheets.

This also proposes to correct a typographical (spelling) error in the title of the course, from *Commerical* HVAC System Design, to *Commercial* HVAC System Design

**CHANGE HVAC 362 to HVAC 462**: This proposes to move HVAC 362 from spring semester junior year to fall semester senior year. This move reverses a move that was made when HVAC 350 was introduced into the curriculum beginning in the 2010 academic year. At that time, the class was called HVAC 462 because it was held during senior year and was changed to HVAC 362 when it was moved to spring of junior year. It is arbitrary whether the course is held spring semester junior year or fall semester senior year, so this proposal simply changes the number to reflect where it is being offered in the curriculum. This transfer of HVAC 362 back to HVAC 462 will occur over a 2-year time period as to allow students which have started on the old check sheet to continue as we have other HVAC students in the On-line format as well.

**GENERAL EDUCATION MODIFICATION**: The HVAC Bachelor degree contains two WIC courses (HVAC 451 & HVAC 499); thus, the degree only has one class beyond the Associate level of two English classes and one Communication class. This current class is COMM 221, and has been a requirement for graduation with the HVAC Bachelor degree for many years. However, since the HVAC program created the On-line version of this degree it has been difficult for some students to either enroll in the Ferris offering of COMM 221 or to find a transferable equal to COMM 221. Additionally, our last APR indicated that our Bachelor degree graduates could use a higher level of technical writing skills to be more successful in industry. Thus, the HVAC department determined it is in the student's best interest to take ENGL 311 (Advanced Technical Writing) instead of COMM 221. This substitution follows the guidelines of the University and will allow our students easier access for graduation and better prepare them for success.

**PREREQUISITE CHANGES**: Due to the addition of 2 new HVAC courses (HVAC 321 & HVAC 325), deletion of HVAC 331, and the moving of HVAC 362 to HVAC 462, there is a need for changes in many of the HVAC 300 & 400 level course prerequisites. This proposal includes these minor changes within the enclosed Form F sheet for HVAC 312, HVAC 350, HVAC 393, HVAC 415, HVAC 451, HVAC 462 & HVAC 499. Note; these changes in prerequisites will be phased in to reflect some current students working from existing check sheets.

**SUMMARY:** Under this proposal:

- No changes are proposed for AAS students.
- Overall SCH for BS students remain the same.
- HVAC 499 drops from five credits to four, making one credit available.
- The directed elective is eliminated, making three credits available.
- HVAC 331 is replaced with HVAC 321, a four-credit course, to fall semester, junior year.
- HVAC 325, a four-credit course (using the four credits available from above), is added to spring semester, junior year.
- Move HVAC362 back to the senior year by changing it to HVAC462
- Removal of COMM 221 from the graduation requirement by the addition of ENGL 311 in its place
- Modification of prerequisites for 300 & 400 level HVAC courses to reflect the above changes

## 2. Summary of Curricular Action (check all that apply to this proposal)

☐ Degree ☒ Major ☐ Minor ☐ Concentration ☐ Certificate ☒ Course

☒ New ☒ Modification ☒ Deletion

**Name of Degree, Major, etc. :** <u>HVACR Engineering Technology and Energy Management</u>

## 3. Summary of All Course Action Required **Contact Senate Secretary or UCC Chair if additional spaces are required.**

**a. Newly Created Courses to be Added to FSU Catalog:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 321 | HVAC Air Side System Select-Design |
| HVAC | 325 | HVAC Hydronic System Select-Design |
| HVAC | 462 | HVAC Primary Equipment Selection |

**b. Courses to be Deleted from FSU Catalog:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 331 | HVAC Secondary System Select-Design |

**c. Existing Course(s) to be Modified:**

| Prefix | Number | Title |
|---|---|---|
| HVAC | 312 | Control Theory & Application |
| HVAC | 350 | Contracting Issues in HVACR |
| HVAC | 393 | Summer Internship |
| HVAC | 415 | Direct Digital Control |
| HVAC | 451 | Energy Audit and Analysis |
| HVAC | 499 | Commercial HVAC System Design |

**d. Addition of existing FSU courses to program**

| Prefix | Number | Title |
|---|---|---|
| ENGL | 311 | Advanced Technical Writing |

**e. Removal of existing FSU courses from program**

| Prefix | Number | Title |
|---|---|---|
| COMM | 221 | Small Group Decision Making |

## 4. Summary of All Consultations

| Form Sent (B or C) | Date Sent | Responding Dept. | Date Received & by Whom |
|---|---|---|---|
| Form B | 2/7/14 | Humanities | |
| Form B | 2/7/14 | Language and Literature | |
| Form C | 2/7/14 | FLITE | |

## 5. Will External Accreditation be sought? (For new programs or certificates only)

☐ **Yes** ☒ **No**

**If yes, name the organization involved with accreditation for this program.**

**6. Program Checksheets affected by this proposal (check all that apply to this proposal)**

☒ Add Course ☒ Delete Course ☒ Modify Course ☐ Change Prerequisite ☐ Move from required to elective
☐ Move from elective to required ☐ Change Outcomes and Assessment Plan ☒ Change credit hours

List all Checksheets affected by this proposal:

| College | Department | Program |
|---|---|---|
| CET | HVACR | HVACR Engineering Technology and Energy Management |

**FORM B**
Rev. September 2012

# CURRICULUM CONSULTATION FORM

To be completed by each department affected by the proposed change, addition, or deletion. Potential duplication of coursework is reason for consultation.

1. This completed form must be forwarded with the proposal to the administrator of the department to be consulted.

2. The department must respond within 10 business days of receipt of this form to insure inclusion in the final proposal. The completed original is returned to the Academic Senate office to be inserted into the proposal and a copy is returned to the initiator.

   The department must acknowledge receipt of this form and the proposal in writing to the initiator.

   **Failure to respond by 10 business days of receipt of this form is interpreted as support for the proposal.**

3. The Proposing Department must address any concerns raised by the consulted department. This response must be in writing and will be included in the proposal following the original consultation form.

**RE: Proposal Title** HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325

**Initiator(s):** Doug Zentz

**Proposal Contact**: Doug Zentz **Date Sent**: ~~2/11/14~~ 2/11/14

**Department:** HVAC Engineering Technology **Campus Address:** GRN-227
(Please type)

**Responding Department: Humanities – JOH-117**

Administrator: Trinidy Williams Date Received: 2/11/14 Date Returned: 2/25/14

Based upon department faculty review on 2/21/14 (date), we

- ☐ Support the above proposal.
- ☒ Support the above proposal with the modifications and concerns listed below.
- ☐ Do not support the proposal for the reasons listed below.

Comment regarding the impact this proposal has on current curriculum including prerequisites, scheduling, room assignments, and/or faculty load for your department. Use additional pages, if necessary.

Humanities Department Communications area: Our response is a support with recommendations that students who have not taken their communication general education requirement be steered to take COMM 221.

**FORM B**
Rev. September 2012

# CURRICULUM CONSULTATION FORM

To be completed by each department affected by the proposed change, addition, or deletion. Potential duplication of coursework is reason for consultation.

1. This completed form must be forwarded with the proposal to the administrator of the department to be consulted.
2. The department must respond within 10 business days of receipt of this form to insure inclusion in the final proposal. The completed original is returned to the Academic Senate office to be inserted into the proposal and a copy is returned to the initiator.

   The department must acknowledge receipt of this form and the proposal in writing to the initiator.

   **Failure to respond by 10 business days of receipt of this form is interpreted as support for the proposal.**
3. The Proposing Department must address any concerns raised by the consulted department. This response must be in writing and will be included in the proposal following the original consultation form.

**RE: Proposal Title** HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325

**Initiator(s):** Doug Zentz

**Proposal Contact**: Doug Zentz **Date Sent**: 2/7/14

**Department:** HVAC Engineering Technology **Campus Address:** GRN-227
(Please type)

**Responding Department: Languages & Literature – ASC-3080**

Administrator: Andy Karafa Date Received: _____ Date Returned: _____

Based upon department faculty review on _____(date), we

- ☐ Support the above proposal.
- ☐ Support the above proposal with the modifications and concerns listed below.
- ☐ Do not support the proposal for the reasons listed below.

Comment regarding the impact this proposal has on current curriculum including prerequisites, scheduling, room assignments, and/or faculty load for your department. Use additional pages, if necessary.

**FORM C**
Rev. September 2012

# FLITE SERVICES CONSULTATION FORM

To be completed by the liaison librarian and approved by the Dean of FLITE. FLITE must return the original form to the Academic Senate office to be inserted in the proposal and a copy to the initiator. FLITE must respond within 10 business days of receipt of this form to insure that the form is included in the final proposal.

**Failure to respond by 10 business days of receipt of this form is interpreted as support for the proposal.**

## RE: Proposal Title: HVACR Curriculum Modification and Creation of HVAC 321 & HVAC 325

**Projected number of students per year affected by proposed change: 75**

**Initiator(s):** Doug Zentz
**Proposal Contact**: Doug Zentz Date Sent: **2/7/14**

**Department:** HVAC Engineering Technology **Address:** GRN-227
(Please type)

**Liaison Librarian Signature:** Fran Rosen **Date Received:** 2/11/14
**Dean of FLITE Signature:** [signature] **Date Returned:** 2/12/14

Based upon our review on 2/12/14 (date), FLITE concludes that:

☒ Library resources to support the proposed curriculum change are currently available.

☐ Additional Library resources are needed but can be obtained from current funds.

☐ Support, but significant additional Library funds/resources are required in the amount of $__________.

☐ Does not support the proposal for reasons listed below.

**Comment regarding the impact this proposal will have on library resources, collection development, or other FLITE programs. Use additional pages if necessary.**

**FORM D – Current**

Ferris State University

*Imagine More*

### Associate in Applied Science

# HVACR Technology

### Program Academic Requirements

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Student: | | | | | | | | Code | Location | Crs |
| email: | | | ID: | | | | | | Ferris | |
| Advisor: | | | Ph: | | | | | 1 | Transfer | |
| | | **MAJOR** | Cr | Gr | Pts | S | Yr | Code | Notes | |
| HVAC | 101 | Intro to Refrig & A/C Systems (co-req MATH 116) | 4 | | | | | | | |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | | | | | | | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | | | | | | | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111, MATH 116) | 4 | | | | | | | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | | | | | | | |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | | | | | | | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102,117) | 5 | | | | | | | |
| HVAC | 235 | Advanced Heating-Mech System (C- or better in HVAC 117, 132) | 5 | | | | | | | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | | |
| ISYS | 105 | Microcomputer Applications | 3 | | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | | |
| ENGL | 150 | English 1 | 3 | | | | | | | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | | | | | | | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | | |
| MATH | 116 | Interm. Algebra & Numerical Trig (ACT 19 or MATH 110) | 4 | | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, BIOL 111. Course must have a lab) | 4 | | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | | |
| | | **FRESHMEN SEMINAR** | | | | | | | | |
| FSUS | 100 | FSU Seminar | 1 | | | | | | | |
| | | **Unofficial Statistics** | | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 67 | | | | | | | |
| | | GPA Major: | - | | | | | | | |
| | | GPA Degree: | - | | | | | | | |

AAS Minimum General Education Requirements:
Cultural Enrichment (CE) – 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3/4 credits
Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Ferris State University
Imagine More

Associate in Applied Science

# HVACR Technology

## Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 1 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 101 | Introduction to Refrigeration & A/C Systems (co-req MATH 116) | 4 | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | |
| MATH | 116 | Intermediate Algebra & Numerical Trigonometry (C- in MATH 110 or 19 ACT) | 4 | |
| ENGL | 150 | English 1 | 3 | |
| FSUS | 100 | FSU Seminar | 1 | |
| | | Total | 16 | |
| **YEAR 1 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111 and MATH 116) | 4 | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, or BIOL 111. Must Include a Lab Section) | 4 | |
| | | Total | 17 | |
| **YEAR 2 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 235 | Advanced Heating-Mechanical Systems (C- or better in HVAC 117, 132) | 5 | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | |
| ISYS | 105 | Microcomputer Applications | 3 | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Total | 18 | |
| **YEAR 2 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117) | 5 | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | |
| | | Social Awareness Elective | 3 | |
| | | Total | 16 | |

AAS Minimum General Education Requirements

Cultural Enrichment (CE) - 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3-4 credits

Reference: gttp://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

FERRIS STATE UNIVERSITY
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Program Academic Requirements

| Student: | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|
| email: | | ID: | | | Ferris | |
| Advisor: | | Ph: | | 1 | Transfer | |

| | | MAJOR | Cr | Gr | Pts | S | Yr | Code | Notes | |
|---|---|---|---|---|---|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 331, HVAC342, and MATH 116 or 120) | 4 | | | | | | | |
| HVAC | 331 | Secondary System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | | | | | | | |
| HVAC | 362 | Primary HVAC Equipment Selection (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | | | | | | | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 350 & 362) | 4 | | | | | | | |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 or 130, and HVAC 393) | 4 | | | | | | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 or 130, and HVAC 393) | 4 | | | | | | | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, and 451) | 5 | | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | | |
| ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | 2 | | | | | | | |
| | | Directed Elective (See Your Advisor) | 3 | | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | | |
| COMM | 221 | Small Group Decision Making | 3 | | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | | |
| | | Scientific Understanding Elective | 4 | | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | | |
| ECON | 221 | Principles of Economics 1 | 3 | | | | | | | |
| | | **Unofficial Statistics** | | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 37 | | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 65 | | | | | | | |
| | | GPA Major: | - | | | | | | | |
| | | GPA Degree: | - | | | | | | | |

Bachelor of Science General Education Requirements:
One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr)
Multiple requirements may be satisfied by a single course.
Cultural Enrichment – 9 credits (3 credits in course > 200 level), Social Awareness - 9credits (3 credits in course > 200 level)
Students must complete 40 credits at or above the 300 level. [Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

Ferris State University
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

## Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 3 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 331 | Secondary System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | |
| HVAC | 342 | Load Analysis & Energy Modeling (Admission to BS in HVACR Engineering Technology) | 4 | |
| ARCH | 110 | Intro to Computer Graphics in ARCH for HVACR Students | 2 | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116)- (Students who took MATH115 shall take MATH120) | 4 | |
| | | Social Awareness Elective | 3 | |
| | | Total | 17 | |

| YEAR 3 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | |
| HVAC | 362 | Primary Equipment Selection (C- or better in HVAC 331, HVAC 342, and MATH 116 or 120) | 4 | |
| | | Scientific Understanding Elective | 4 | |
| MATH | | Students who took MATH 115 and MATH 120 shall take MATH 130 | | |
| | | Total | 16 | |

| YEAR 3 - SUMMER SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 350 & 362) | 4 | |
| | | Total | 4 | |

Submit Application for Graduation.

| YEAR 4 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 415 | Direct Digital Control (C- in MATH 126 or 130, and HVAC 393) | 4 | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- in MATH 126 or 130, and HVAC 393) | 4 | |
| COMM | 221 | Small Group Decision Making | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Total | 14 | |

| YEAR 4 - SPRING SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415 and 451) | 5 | |
| ECON | 221 | Principles of Economics 1 | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | Directed Elective | 3 | |
| | | Total | 14 | |

Students must complete 40 credits at or above the 300 level in the bachelor program. Three credits of 300 level coursework must be taken in the social awareness and/or cultural enrichment courses to meet this requirement. From among the cultural enrichment and social awareness coursework, at least one global consciousness course and one REG course must be taken.

**FORM D – Proposed**

Ferris State University
Imagine More

## Associate in Applied Science

# HVACR Technology

## Program Academic Requirements

| Student: | | | | | | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| email: | | | ID: | | | | | | | Ferris | |
| Advisor: | | | Ph: | | | | | | 1 | Transfer | |
| | | **MAJOR** | Cr | Gr | Pts | S | Yr | | Code | Notes | |
| HVAC | 101 | Intro to Refrig & A/C Systems (co-req MATH 116) | 4 | | | | | | | | |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | | | | | | | | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | | | | | | | | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111, MATH 116) | 4 | | | | | | | | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | | | | | | | | |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | | | | | | | | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102,117) | 5 | | | | | | | | |
| HVAC | 235 | Advanced Heating-Mech System (C- or better in HVAC 117, 132) | 5 | | | | | | | | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | | | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | | | |
| ISYS | 105 | Microcomputer Applications | 3 | | | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | | | |
| ENGL | 150 | English 1 | 3 | | | | | | | | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | | | | | | | | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | | | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | | | |
| MATH | 116 | Interm. Algebra & Numerical Trig (ACT 19 or MATH 110) | 4 | | | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | | | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, BIOL 111. Course must have a lab) | 4 | | | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | | | |
| | | **FRESHMEN SEMINAR** | | | | | | | | | |
| FSUS | 100 | FSU Seminar | 1 | | | | | | | | |
| | | **Unofficial Statistics** | | | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | | | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 67 | | | | | | | | |
| | | GPA Major: | - | | | | | | | | |
| | | GPA Degree: | - | | | | | | | | |

AAS Minimum General Education Requirements:
Cultural Enrichment (CE) – 3 credits, Social Awareness (SA) - 3 credits, Communications - 6 credits, Scientific Understanding - 3/4 credits
Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.htm

Ferris State University
Imagine More

Associate in Applied Science

# HVACR Technology

## Course Sequence Guide

| | | | |
|---|---|---|---|
| Student: | | | |
| Email: | | ID: | |
| Advisor: | | Ph: | |

| YEAR 1 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 101 | Introduction to Refrigeration & A/C Systems (co-req MATH 116) | 4 | |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 | |
| MATH | 116 | Intermediate Algebra & Numerical Trigonometry (C- in MATH 110 or 19 ACT) | 4 | |
| ENGL | 150 | English 1 | 3 | |
| FSUS | 100 | FSU Seminar | 1 | |
| | | **Total** | **16** | |
| **YEAR 1 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 102 | Advanced Refrigeration & A/C (C- or better in HVAC 101, 111 and MATH 116) | 4 | |
| HVAC | 117 | Advanced Electricity-Circuits (C- or better in HVAC 111 and MATH 116) | 4 | |
| HVAC | 132 | Fund of Heating & Mechanical Systems (C- or better in HVAC 111, MATH 116) | 5 | |
| | | Scientific Understanding Elective (PHYS 130 or 211, CHEM 103, 114 or 121, or BIOL 111. Must Include a Lab Section) | 4 | |
| | | **Total** | **17** | |
| **YEAR 2 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 235 | Advanced Heating-Mechanical Systems (C- or better in HVAC 117, 132) | 5 | |
| HVAC | 245 | HVAC Unitary System Design (C- or better in HVAC 101, 132) | 4 | |
| ISYS | 105 | Microcomputer Applications | 3 | |
| ENGL | 211 | Industrial and Career Writing (ENGL 150) | 3 | |
| | | Cultural Enrichment Elective | 3 | |
| | | **Total** | **18** | |
| **YEAR 2 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 207 | Commercial Refrigeration Systems (C- or better in HVAC 102, 117) | 5 | |
| HVAC | 208 | Air Conditioning Applications (C- or better in HVAC 102, 117) | 5 | |
| COMM | 121 | Fundamentals of Public Speaking | 3 | |
| | | Social Awareness Elective | 3 | |
| | | **Total** | **16** | |

Learning Outcomes include: 1) demonstrate installation techniques for residential/light commercial HVAC systems, 2) service residential/light commercial HVAC equipment, 3) service commercial refrigeration equipment, 4) systematically troubleshoot and repair commercial refrigeration equipment, 5) systematically troubleshoot and repair residential/light commercial HVAC equipment, 6) design residential/light commercial HVAC systems.

Ferris State University

Imagine More

**Bachelor of Science Degree**

# HVACR Engineering Technology and Energy Management

**Program Academic Requirements**

| Student: | | | | | | | | | Code | Location | Crs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| email: | | | ID: | | | | | | | Ferris | |
| Advisor: | | | Ph: | | | | | | 1 | Transfer | |
| | | **MAJOR** | Cr | Gr | Pts | S | Yr | | Code | Notes | |
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 321, HVAC342, and MATH 126) | 4 | | | | | | | | |
| HVAC | 321 | HVAC Air Side System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | | | |
| HVAC | 325 | HVAC Hydronic System Select-Design (C- or better in HVAC 321, HVAC342, and MATH 126) | 4 | | | | | | | | |
| HVAC | 342 | Load Calculation & Energy Code (Admission to BS in HVACR Engineering Technology) | 4 | | | | | | | | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321, HVAC 342, and MATH 126) | 4 | | | | | | | | |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 325 & 350) | 4 | | | | | | | | |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 and HVAC 393) | 4 | | | | | | | | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in HVAC 393 and MATH 126) | 4 | | | | | | | | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 and HVAC 393) | 4 | | | | | | | | |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, HVAC 451 and HVAC 462) | 4 | | | | | | | | |
| | | **TECHNICAL RELATED** | | | | | | | | | |
| ARCH | 110 | Intro to Cmptr Graphics in ARCH for HVACR Students | 2 | | | | | | | | |
| | | **COMMUNICATIONS COMPETENCE** | | | | | | | | | |
| ENGL | 311 | Advanced Technical Writing | 3 | | | | | | | | |
| | | **QUANTITATIVE SKILLS** | | | | | | | | | |
| MATH | 126 | Algebra & Analytical Trig. (C- or better in MATH 116) | 4 | | | | | | | | |
| | | **SCIENTIFIC UNDERSTANDING** | | | | | | | | | |
| | | Scientific Understanding Elective | 4 | | | | | | | | |
| | | **CULTURAL ENRICHMENT** | | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | | |
| | | Cultural Enrichment Elective | 3 | | | | | | | | |
| | | **SOCIAL AWARENESS** | | | | | | | | | |
| | | Social Awareness Elective | 3 | | | | | | | | |
| ECON | 221 | Principles of Economics 1 | 3 | | | | | | | | |
| | | Unofficial Statistics | | | | | | | | | |
| | | Major: Total Crs / Earned Crs / Honor Points | 40 | | | | | | | | |
| | | Degree: Total Crs / Earned Crs / Honor Points | 65 | | | | | | | | |
| | | GPA Major: | - | | | | | | | | |
| | | GPA Degree: | - | | | | | | | | |

Bachelor of Science General Education Requirements:
One Global Consciousness Course (3cr), One Race - Ethnicity - Gender (REG) Course (3cr), and One Foundation Course (3cr)
Multiple requirements may be satisfied by a single course.
Cultural Enrichment – 9 credits (3 credits in course > 200 level), Social Awareness - 9credits (3 credits in course > 200 level)
[Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

FERRIS STATE UNIVERSITY
Imagine More

Bachelor of Science Degree

# HVACR Engineering Technology and Energy Management

Course Sequence Guide

| Student: | | ID: | |
|---|---|---|---|

| YEAR 3 - FALL SEMESTER | | | Crs | Gr |
|---|---|---|---|---|
| HVAC | 321 | HVAC Air Side System Select-Design (Admission to BS in HVACR Engineering Technology) | 4 | |
| HVAC | 342 | Load Analysis & Energy Modeling (Admission to BS in HVACR Engineering Technology) | 4 | |
| ARCH | 110 | Intro to Computer Graphics in ARCH for HVACR Students | 2 | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116)- (Students who took MATH115 shall take MATH120) | 4 | |
| ENGL | 311 | Advanced Technical Writing | 3 | |
| | | Total | 17 | |
| **YEAR 3 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 312 | Control Theory & Application (C- or better in HVAC 321, HVAC342, and MATH 126) | 4 | |
| HVAC | 350 | Contracting Issues in HVACR (C- or better in HVAC 321, HVAC 342, and MATH 126) | 4 | |
| HVAC | 325 | HVAC Hydronic System Select-Design (C- or better in HVAC 321, HVAC342, and MATH 126) | 4 | |
| | | Scientific Understanding Elective | 4 | |
| MATH | | Students who took MATH 115 and MATH 120 shall take MATH 130 | | |
| | | Total | 16 | |
| **YEAR 3 - SUMMER SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 393 | Summer Internship (C- or better in HVAC 312, 325 & 350) | 4 | |
| | | Total | 4 | |
| **YEAR 4 - FALL SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 415 | Direct Digital Control (C- or better in MATH 126 and HVAC 393) | 4 | |
| HVAC | 451 | Energy Audit and Analysis [WIC] (C- or better in MATH 126 and HVAC 393) | 4 | |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (C- or better in HVAC 393 and MATH 126) | 4 | |
| | | Cultural Enrichment Elective | 3 | #REF! |
| | | Total | 15 | |
| **YEAR 4 - SPRING SEMESTER** | | | **Crs** | **Gr** |
| HVAC | 499 | Commercial HVAC System Design [WIC] (C- or better in HVAC 415, HVAC 451 and HVAC 462) | 4 | |
| ECON | 221 | Principles of Economics 1 | 3 | |
| | | Cultural Enrichment Elective | 3 | #REF! |
| | | Social Awareness Elective | 3 | |
| | | Total | 13 | |

Learning Outcomes Include: 1) analyze & select commercial/industrial HVAC systems for specific applications, 2) design commercial/industrial HVAC systems, given design parameters, building type, & geographic location, 3) select secondary equipment for specific commercial/industrial ducting & piping systems, 4) select primary equipment for specific commercial/industrial ducting & piping systems, 5) commission a commercial or industrial HVAC system, 6) perform an energy audit of an actual facility & analyze utilities for proper applications; Operation & Maintenance & Energy Conservation Measures for potential energy savings; & Implementation feasibility using payback calculations, 7) understand, utilize & develop estimates, specs, economic costs, & analysis codes & standards, 8) program control sequences for specific commercial & industrial HVAC systems & equipment.

# COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)**

(proposed) **HVAC**

☐ **Number (current)**

(proposed) **312**

☐ **LEC ___ LAB ___ SEM ___ (current)**

(Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current) Control Theory & Application**

(proposed) **Control Theory & Application**

☒ **Credit Hours (current)** 4

(proposed) 4

☒ **Prerequisites (current)**

(proposed) C- (or better) in MATH 126, HVAC321 & HVAC342

**Co-requisite (current)**

☒ **Course Description (current): (125 words maximum)**

(current & proposed): The study of control loop theory related to commercial and industrial comfort, process and safety applications. The course focuses on analog electronic and pneumatic control components and their systems used in new and existing installations. Lab exercises concentrate on control system operation and analysis.

☒ **Course Outcomes and Assessment Plan (current & proposed)**

## (current & proposed): Learning Outcomes and Assessment for Each Instructional Unit

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding of control terminology, equipment and documentation
2. Describing loop components and configurations
3. Understanding and applying transfer functions
4. Performing control valve and damper sizing and selection
5. Understanding and application of control modes and process characteristics
6. Performing modulating control loop calibration

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Terminology | 3 | 3 |
| II. | Loop Components | 6 | 6 |
| III. | Elements of a Transfer Function | 6 | 6 |
| IV. | Application of a Transfer Function | 6 | 3 |
| V. | Sensors | 6 | 3 |

| | | | |
|---|---|---|---|
| VI. | Controllers | 3 | 6 |
| VII. | Process Characteristics | 3 | 3 |
| VIII. | Modulating Final Control Devices | 3 | 3 |
| IX. | Documentation | 12 | 12 |
| | Total Hours | 45 | 45 |

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Terminology<br>A. Understand and apply control terminology.<br>B. Identify control system components by name. |
| II. | Loop Components<br>A. Identify low and high volume pneumatic control systems.<br>B. Identify process variable and final control device for a specific control loop.<br>C. Identify a open or closed control loop.<br>D. Identify a control loop used for safety.<br>E. Identify the feedback utilized in a control loop.<br>F. Define the purpose and function of different controllers (pneumatic, electronic) |
| III. | Elements of a Transfer Function<br>A. Define, apply and calculate the following terms:<br>a. Throttling range<br>b. Proportional gain<br>c. Proportional band<br>d. Gain<br>e. Error<br>f. Bias<br>g. Setpoint<br>h. Signal path, type and terminations |
| IV. | Application of a Transfer Function<br>A. Calculate a transfer function for a sensor and then utilize to calibrate the sensor.<br>B. Utilize transfer functions to predict signal values for controllers and final control device positions.<br>C. Apply setpoint reset to multiple applications |
| V. | Sensors<br>A. Understand the various types of sensors by point type (analog / digital).<br>B. Understand the various types of sensors by output signal (mA, V, ohm, pneumatic, semiconductor)<br>C. Understand the proper installation, best practice, calibration, handling and termination of sensors of all types.<br>D. Understand current sensor manufacturer literature.<br>E. Plot a sensor response in a computer application.<br>F. Create a spreadsheet for calculating and graphing a linear transfer function. |
| VI. | Controllers<br>A. Understand the types of controllers (electronic, pneumatic, digital).<br>B. Understand the different modes of control (2 position, timed two position, incremental, Proportional (P), Proportional + Integral (PI), Proportional + Integral + Derivative (PID), Proportional + Derivative (PD).<br>C. Utilize a tuning process to return a process with an unstable controller to a steady state error.<br>D. Identify different loop responses (underdamped, overdamped, critically |

| | |
|---|---|
| | damped, unstable with increasing amplitude, unstable with constant amplitude)<br>E. Examine linear response and response over time of a control loop. |
| VII. | Process Characteristics<br>A. Understand process characteristics and terms, such as heat transfer, process time lags, time constant, thermal capacitance and thermal resistance.<br>B. Understand the affects of time constant on control modes.<br>C. Understand the affects of thermal capacitance on control modes.<br>D. Understand the affects of thermal resistance on control modes.<br>E. Select a controller output based on calculated thermal characteristics of sample spaces. |
| VIII. | Modulating Final Control Devices<br>A. Understand the various components that make up a control valve.<br>B. Understand the various types of control valves.<br>C. Understand the various ways to connect valves to a system.<br>D. Understand how various control valves are applied.<br>E. Understand the following control valve engineering terms: (size, authority, CV).<br>F. Understand the various components that make up a damper.<br>G. Understand the various types of dampers.<br>H. Understand the various ways to connect dampers.<br>I. Understand how various dampers are applied.<br>J. Size and select control valves for a sample project. |
| IX. | Documentation<br>A. Understand control plans and specifications.<br>B. Understand, generate and utilize flow charts, point schedules, wiring details and bill of materials.<br>C. Understand changes made to control documentation, including: RFI, bulletin, addendum.<br>D. Generate control documentation for a sample project using plans and specs., includes the following documents:<br>a. Flow diagram<br>b. Point schedule<br>c. Wiring detail<br>d. Bill of material |

**Minimum Required Student Laboratory Activities**

| | |
|---|---|
| I. | Identify commercial control components for Air Handling, Hot and Chilled Water systems. |
| II. | Student will diagram basic control loops for commercial heating, cooling, and ventilation strategies. |
| III. | Student will perform point verification for Air Handling Unit controls. |
| IV. | Student will calculate transfer function for several system components. |
| V. | Student will examine current control literature and graph sensor functions. |
| VI. | Student will perform point verification for multiple HVAC systems. |
| VII. | Student will Commission multiple HVAC systems. Student will use Question and Answer programming to create an Application Specific program. Student will examine Proportional and Integral response in a functional loop. |
| VIII. | Student will assemble and calibrate a pneumatic control loop. Student will examine loop operation and correct mal-functioning loop. |
| IX. | Student will extract job information from control specifications create a bill of materials, flow diagram with sequence of operation, and point schedule for a control project. Student will then assemble control submittals from previous lab work. |

**Associate Provost's Signature:** ___Paul Blake___ Date 4/1/14

# COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)** ☒ **Number (current)** ☐ **LEC ___ LAB ___ SEM ___ (current)**

(proposed) **HVAC** (proposed) **321** (Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current)**

(proposed) **HVAC Air System Select-Design**

☒ **Credit Hours (current)** ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) **4** (proposed) Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management (proposed)

☒ **Course Description (current): (125 words maximum)**

(proposed): A study of air systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.

☒ **Course Outcomes and Assessment Plan (current)**

**(proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Assessment Code:
1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | Assessment |
|---|---|---|
| | | |
| I. | Introduction | |
| II. | Applied Psychrometrics<br>A. Review basic psychrometrics.<br>B. Apply psychrometrics to the air system design process | 1.<br>2.<br>3. |
| III. | Air Diffusion<br>A. Determine type, size and location of diffusers and grilles.<br>B. Determine location and size of ventilation air intake.<br>C. Determine location and size of exhaust air grille. | 1.<br>2.<br>3. |
| IV. | Ductwork<br>A. Calculate cross-sectional area of a duct.<br>B. Calculate velocity of air in a duct.<br>C. Calculate volume of air in a duct.<br>D. Determine space air flow requirements.<br>E. Determine type, size and routing of duct system (including | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | ventilation air intake and exhaust ducts). | |
| V. | Air System Pressure Loss Calculations<br>A. Find fitting loss coefficients from tabular data.<br>B. Calculate friction loss in a duct system.<br>C. Utilize manufacturer's computer software to calculate duct system friction loss. | 1.<br>2.<br>3. |
| VI. | Air System Configuration<br>A. Describe the components and operating characteristics of a(n)<br>a. single zone air system.<br>b. terminal reheat air system.<br>c. dual-duct air system.<br>d. Multizone air system.<br>e. variable air volume system.<br>f. variable volume, variable temperature (VVT) system.<br>g. induction air system. | 1.<br>2. |
| VII. | Fan Selection and Performance<br>A. Identify two main categories of fans.<br>a. forward curve fans.<br>b. backward inclined and air foil fans.<br>c. radial blade fans.<br>d. propeller fans.<br>e. vane-axial fans.<br>f. tube-axial fans.<br>B. Select a fan from manufacturer's performance data.<br>C. Use fan laws to plot system curve on fan performance curve.<br>D. Select proper motor horsepower for circulating fan.<br>E. Describe effects of varying fan volume on fan performance curve. | 1.<br>2.<br>3. |
| VIII. | Duct System Design Procedure<br>A. Utilizing all available information design an air system in its entirety (diffuser to fan). | 1.<br>2.<br>3. |
| IX. | Air System Testing and Balancing<br>A. Identify and summarize the function of instruments used to balance air systems.<br>B. Determine actual operating characteristics of fans.<br>C. Determine flow rates of air systems using various flow measuring devices.<br>D. Calculate the resistance in a ductwork system. | 1.<br>2.<br>3. |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
**(proposed)**

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Applied Psychrometrics | 6 | 6 |
| III. | Air Diffusion | 6 | 3 |

| | | | |
|---|---|---|---|
| IV. | Ductwork | 5 | 3 |
| V. | Air System Pressure Loss Calculations | 3 | 6 |
| VI. | Air System Configurations | 6 | 3 |
| VII. | Fan Selection and Performance | 6 | 6 |
| VIII. | Duct System Design Procedure | 6 | 6 |
| IX. | Air System Testing and Balancing | 3 | 6 |
| X. | Exams | 3 | 6 |
| | | | |
| | Total Hours | 45 | 45 |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

**COURSE INFORMATION FORM** **FORM E**

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)** ☐ **Number (current)** ☐ **LEC ___ LAB ___ SEM ___ (current)**

(proposed) **HVAC** (proposed) **325** (Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current)**

(proposed) **HVAC Hydronic System Select-Design**

☒ **Credit Hours (current)** ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) **4** (proposed) C- (or better) in HVAC 321, HVAC 342 and MATH126 (proposed)

☒ **Course Description (current): (125 words maximum)**

(proposed): A study of water systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.

☒ **Course Outcomes and Assessment Plan (current)**

**(proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Assessment Code:

1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | Assessment |
|---|---|---|
| I. | Introduction | |
| II. | Hydronic System Definition and Classification<br>A. Classify hydronic systems based upon flow generation, temperature, pressure, piping and pumping arrangement.<br>B. Explain the advantages and disadvantages of various piping and pumping arrangements.<br>C. Calculate primary and secondary flowrates and temperatures in primary-secondary pumping arrangements. | 1.<br>2. |
| III. | Terminal Devices<br>A. Determine type, size and location of finned tube radiation units.<br>B. Determine type, size and location of hot water convector units.<br>C. Determine type, size and location of cabinet unit heaters.<br>D. Determine type, size and location of unit heaters. | 1.<br>2.<br>3. |
| IV. | Hydronic System Design Procedure<br>A. Select terminal devices based on load requirements and calculate the required flow of water for each temperature control zone. | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | B. Determine pipe size required to carry desired water flowrate based upon friction loss and velocity.<br>C. Calculate equivalent length of pipe fittings in piping network.<br>D. Calculate friction loss of piping circuits.<br>E. Determine pressure losses of equipment and terminal units from manufacturer's data.<br>F. Calculate total head loss in closed loop piping systems.<br>G. Use pump affinity laws to plot system curve on pump performance curve for closed loop piping system.<br>H. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>I. Calculate total head loss in open piping systems.<br>J. Use pump affinity laws to plot system curve on pump performance curve for open loop piping system.<br>K. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>L. Select proper motor horsepower for circulating pump from manufacturer's performance data.<br>M. Develop parallel pump performance curves and identify operating points.<br>N. Develop series pump performance curves and identify operating points.<br>O. Analyze the effects of glycol on pump performance.<br>P. Determine the type, size and location of the system expansion tank.<br>Q. Utilize manufacturer's computer software to calculate piping system friction loss.<br>R. Utilize manufacturer's computer software to select proper circulating pump.<br>S. Utilize manufacturer's computer software to select proper expansion tank size. | |
| V. | Flow Control Devices<br>A. Explain the application of various service valves in hydronic systems.<br>B. Explain the relationship between heat transfer, temperature differential and flow through a terminal convection element.<br>C. Explain the relationship between valve port configuration and stem travel.<br>D. Explain the relationship between energy transfer and valve stem travel for various valve types.<br>E. Define the control flow coefficient (Cv).<br>F. Select two-way modulating and three-way mixing and diverting valves using the flow coefficient (Cv). | 1.<br>2.<br>3. |
| VI. | Pumps<br>A. Identify the components and summarize the operation of a centrifugal pump.<br>B. Explain the relationship between flowrate and total dynamic head in a closed hydronic system.<br>C. Explain the difference between open and closed hydronic systems. | 1.<br>2.<br>3. |
| VII. | Balancing Hydronic Systems<br>A. Identify and summarize the function of instruments used to balance hydronic systems.<br>B. Determine circulating pump impeller size.<br>C. Determine actual operating characteristics of circulating pump.<br>D. Determine flow rates of hydronic circuits using various flow | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| | measuring devices.<br>E. Calculate resistance necessary to pre-balance hydronic circuit.<br>F. Determine new impeller size to produce required flowrate. | |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
**(proposed)**

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Hydronic System Definition and Classification | 2 | 3 |
| III. | Terminal Devices | 6 | 3 |
| VI. | Hydronic System Design Procedure | 12 | 15 |
| V. | Flow Control Devices | 9 | 6 |
| VI. | Pumps | 9 | 6 |
| VII. | Balancing Hydronic Systems | 3 | 6 |
| VIII. | Exams | 3 | 6 |
| | Total Hours | 45 | 45 |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

# COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC** ☐ **Number (current) 350** ☐ **LEC ___ LAB ___ SEM ___ (current)**

(proposed) **HVAC** (proposed) **350** (Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current) Contracting Issues in HVACR**

(proposed) **Contracting Issues in HVACR**

☒ **Credit Hours (current)** 4 ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) 4 (proposed) C- (or better) in MATH 126, HVAC321 & HVAC342

☒ **Course Description (current): (125 words maximum)**

(current & proposed): The study of contracting issues as related to the HVACR industry. The course focuses on plans and specifications, estimating, budget issues, project management, economic cost analysis and codes and standards, all from the perspective of an HVACR professional. Lab exercises focus on application of contracting issues to a sample project.

☒ **Course Outcomes and Assessment Plan (current & proposed)**

**(current & proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding and utilization of plans and specifications
2. Understanding and developing an HVACR estimate
3. Identifying and handling budgetary issues
4. Understanding and performing key duties of Project Management
5. Understanding and utilization of appropriate codes and standards
6. Performing an economic cost analysis

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Specifications | 3 | 3 |
| II. | Plans | 3 | 3 |
| III. | Estimating | 12 | 12 |
| IV. | Budget Issues | 3 | 3 |
| V. | Project Management | 6 | 6 |

| | | | |
|---|---|---|---|
| VI. | Codes and Standards | 6 | 6 |
| VII. | Economic Analysis | 10 | 12 |
| VIII. | Evaluation | 2 | 0 |
| | Total Hours | 45 | 45 |

**Learning Outcomes for Each Instructional Unit**

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Specifications<br>A. Define the divisions and numbering system used in specification.<br>B. Predictably locate specific information using the above system.<br>C. Identify all new industry specification formats<br>D. Define the role of the Construction Specification Institute in construction documentation.<br>E. Define terms and conditions<br>F. Define cost impact from terms and conditions<br>G. Complete sample documentation including: (method of procedure, AIA billing, approved change orders, insurance needs for material not on site, schedule of values, bulletin, addendum) |
| II. | Plans<br>A. Locate and understand abbreviations.<br>B. Locate and understand symbols.<br>C. Utilize abbreviations and symbols in a sample project.<br>D. Identify types of details and their links to other drawings.<br>E. Define the use of Mechanical schedules.<br>F. Use schedules to locate specific mechanical information.<br>G. Develop a mechanical schedule for a sample project.<br>H. Locate discrepancies between plans and specs.<br>I. Identify the cost impact of discrepancies between plans and specs.<br>J. Define what an addendum is and how it impacts bid form format.<br>K. Define what a bulletin is and identify situations for use.<br>L. Identify and complete documentation for discrepancy resolution, including: RFI, Bulletin and Addendum. |
| III. | Estimating<br>A. Define the different estimating methods: (manual and software).<br>B. Define scope of work for mechanical trades and identify issues.<br>C. Complete a scope of work for a sample project.<br>D. Define a Bid / negotiated job including: bid documents, customer relations, spec. reference to owners authority, issues related to negotiated work.<br>E. Define a Design / build job including: advantages / disadvantages, customer relations, code compliance and plan review.<br>F. Define a Bid / specification job including: sources of opportunity (builders exchange), public vs. private bid, bid requirements (bonding, insurance), bid documents, specific issues relative to bid and spec. jobs.<br>G. Identify issues regarding material, including: billing, shipping, storage, insurance, incorrect, schedule of value and unit pricing.<br>H. Define what targeted work is and issues including: union vs. private, long term benefits, actual cost of work.<br>I. Identify equipment needed for job.<br>J. Identify equipment issues including: responsibility, operating implications, temporary heating, enclosures, unit pricing, warranty start, shipping and availability (job schedule).<br>K. Perform a mechanical take-off including: piping, duct, controls, primary and |

| | |
|---|---|
| | secondary equipment<br>L. Identify labor concerns and issues including: union vs. non-union, prevailing wage, job site foreman, skills needed vs. skill available, per diem.<br>M. Define the term burden<br>N. Define the term Risk and items associated with the following: designer, mechanical contractor, piping contractor, sheet metal contractor, control contractor, sub-contracted work.<br>O. Perform a risk analysis for a sample job.<br>P. Define terms and conditions and their implications.<br>Q. Define warranty and the following issues: jobsite specifics, early equipment start-up, start date, owner acceptance, certificate of occupancy, significant completion and contract requirements.<br>R. Identify the roles of general and sub contractors on a job.<br>S. Develop a flow chart of job site hierarchy.<br>T. Define the risk of sub-contracting.<br>U. Identify sub-contactors cost methods including: unit pricing, detailed bid, time and material, single line bid.<br>V. Identify site specific requirements including: rough in, minority contracting, scheduling, general terms and conditions, parking, trash removal, after hour work, staging areas, special equipment.<br>W. Identify and define other misc. estimated areas including: drug testing, background checks, safety training, customer training, set up and tear down, trade coordination, weather issues, etc. |
| IV. | Budget Issues<br>A. Define the process of discovery including customer interview.<br>B. Develop a quick budget.<br>C. Define risk analysis and thresh hold of risk. |
| V. | Project Management<br>A. Define the post award of bid steps.<br>B. Define the Project Management Professional (PMP)<br>C. Identify the PMP certificate process<br>D. Develop a project management plan for a sample project.<br>E. Define scope review and identify duplication of responsibility.<br>F. Define scheduling including the following topics: gant schedule, project contractor meeting, manpower, delivery, equipment and critical path.<br>G. Identify and define job documents including: change orders, submittals, bulletin, addendum, bid alternate, RFI, pencil copy, RFP, RFQ, job close out, payment app.<br>H. Identify equipment rental needs.<br>I. Identify security and safety issues including compliance and documentation.<br>J. Identify coordination issues with other trades.<br>K. Identify sub-contractor issues and scheduling.<br>L. Define quality control issues.<br>M. Identify personnel issues including: safety, drug screening, job site etiquette. |
| VI. | Codes and Standards<br>A. Identify and define the following code and standard organizations: ASHRAE, SMACNA, IESNA, ANSI, OSHA, ISO.<br>B. Determine the applicable code from local, state, federal, international.<br>C. Correctly use and interpret a code book.<br>D. Identify what an inspector wants.<br>E. Define the term standards of care. |
| VII. | Economic Analysis<br>A. Define the following financial terms:<br>a. Net present value<br>b. Discount rate<br>c. Rate-of-Return (ROR) |

| | |
|---|---|
| | d. Return-on-investment (ROI)<br>e. Inflation<br>f. Depreciation<br>g. Taxes<br>h. Fuel Cost Escalation<br>B. Define methods of cash flow analysis including: simple payback, life cycle cash flow analysis (present worth method & annual cash flow method).<br>C. Utilize available software to perform cash flow analysis. |

**Minimum Required Student Laboratory Activities**

| | |
|---|---|
| I. | Identify pertinent areas within a specification regarding a specific job. |
| II. | Student will existing plans to answer job specific question. Student will develop a mechanical equipment schedule. |
| III. | Student will complete a scope of work, mechanical take-off, risk analysis, develop a and flow chart as key components in an estimate. |
| IV. | Student will develop a quick budget for a sample job. |
| V. | Student will layout basic information and concerns for a sample job, including scheduling. |
| VI. | Student will utilize a variety of codes to comply with a sample job. |
| VII. | Student will do a manual economic cost analysis on a sample job. |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

## COURSE INFORMATION FORM

**FORM E**
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)** HVAC ☐ **Number (current)** 393 ☐ **LEC** ___ **LAB** ___ **SEM** ___ **(current)**

(proposed) HVAC (proposed) 393 (Enter Contact Hours per week)
LEC _4__ LAB ___ SEM ___(proposed):

☒ **Title (current)** Summer Internship

(proposed) Summer Internship

☒ **Credit Hours (current)** 4 ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) 4 (proposed) C- or better in HVAC 312, 325 & 350

☒ **Course Description (current): (125 words maximum)**

(current & proposed): Ten week minimum work experience. Students will gain a variety of commercial and industrial system and energy related experiences to include in part or in whole: new and retrofit system selection and design (including CAD); load calculation and system analysis or problem solving; system balance (testing, adjusting & balancing); system commissioning; control balancing and control work; energy related experience (e.g. energy auditing and payback calculation); estimating, bidding and proposal development; project management.

☒ **Course Outcomes and Assessment Plan (current & proposed)**

**(current & proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Students satisfactorily completing this course will gain a variety of commercial and industrial system and energy related experiences to include in part or in whole: new and retrofit system selection and design (including CAD); load calculation and system analysis or problem solving; system balance (testing, adjusting & balancing); system commissioning; control balancing and control work; energy related experience (e.g. energy auditing and payback calculation); estimating, bidding and proposal development; project management.

**Associate Provost's Signature:** Paul Blake Date 4/1/14

**COURSE INFORMATION FORM** **FORM E**

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC** ☐ **Number (current) 415** ☐ **LEC ___ LAB ___ SEM ___ (current)**

(proposed) **HVAC** (proposed) **415** (Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current) Direct Digital Control**

(proposed) **Direct Digital Control**

☒ **Credit Hours (current) 4** ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) **4** (proposed) C- or better in MATH 126 and HVAC 393

☒ **Course Description (current): (125 words maximum)**

(proposed): The study of digital electronic control of HVAC mechanical systems to maximize their operating efficiency in commercial and industrial applications. The layout, programming and operation of the building management system will be emphasized.

☒ **Course Outcomes and Assessment Plan (current & proposed)**

**(current & proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Students satisfactorily completing this course will achieve proficiency in:

1. Application of numbering systems and binary logic
2. Recognition, application and troubleshooting of DDC systems
3. Programming DDC systems
4. Development and understanding of DDC documentation
5. Performing DDC loop tuning

**Instructional Unit Topic Descriptions and Time Allocations**

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction to Course, DDC | 1 | 0 |
| II. | Numbering Systems | 2 | 3 |
| III. | Binary Logic | 3 | 3 |
| IV. | Microcomputers / DDC Systems | 3 | 3 |
| V. | Specifications and Hardware | 3 | 3 |
| VI. | DDC Database Information | 5 | 6 |
| VII. | Program Statements | 5 | 3 |

| | | | |
|---|---|---|---|
| VIII. | Writing DDC Programs | 7 | 9 |
| IX. | Load Management Functions | 4 | 3 |
| X. | Downloading Programs | 2 | 3 |
| XI. | Loop Editing and Tuning | 2 | 3 |
| XII. | Archiving Data | 4 | 3 |
| | Total Hours | 45 | 45 |

**Learning Outcomes for Each Instructional Unit**

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction and DDC Background<br>A. Understand course policy and requirements.<br>B. Describe the differences, advantages and disadvantages of digital control systen when compared to analog control systems. |
| II. | Numbering Systems<br>A. Demonstrate an understanding of the characteristics and applications of binary numbering systems.<br>B. Demonstrate an understanding of the characteristics and applications of octal numbering systems.<br>C. Demonstrate an understanding of the characteristics and applications of hexadecimal numbering systems. |
| III. | Binary Logic<br>A. Demonstrate an understanding of the characteristics and applications of binary logic and logic gates.<br>B. Demonstrate an understanding of the characteristics and applications of truth tables. |
| IV. | Microcomputers / DDC Systems<br>A. Demonstrate an understanding of the characteristics and applications of the following Microcomputer and DDC system components:<br>a. Power supply<br>b. Microprocessor<br>c. Registers<br>d. Memory (RAM and ROM)<br>e. I/O Interfaces (D/A and A/D converters) |
| V. | Specification and Hardware<br>A. Demonstrate an understanding of the process of developing the following:<br>a. Proposal<br>b. Job Prints<br>c. Hardware specifications (cut sheets)<br>d. Description of Operation<br>e. DDC control program<br>B. Identify and explain the purpose of various components which make up a DDC system.<br>C. Analyze DDC system hardware, software, point operation and field wiring to ensure the lab system is completely operable.<br>D. Identify the different field I/O devices and know the correct way to terminate those devices at the termination board of the DDC system and at the field locations. |
| VI. | DDC Database Information<br>A. Describe a DDC database.<br>B. Develop a DDC database.<br>C. Program a DDC database. |

| | |
|---|---|
| VII. | Program Statements<br>A. Understand programming syntax and error resolution.<br>B. Develop and test software strategies to control various HVAC processes. |
| VIII. | Writing DDC Programs<br>A. Develop flowcharts and convert into computer program instruction statements.<br>B. Develop a DDC operating program from a description of operation, using correct statements, sequences and syntax. |
| IX. | Load Management Functions<br>A. Demonstrate an understanding of the theory, application and software associated with the different energy management strategies, including:<br>a. TOD<br>b. OSS<br>c. DLC<br>d. DC |
| X. | Downloading Programs<br>A. Download, upload, enable, disable, edit and monitor a DDC program to operate the equipment. |
| XI. | Loop Editing and Tuning<br>A. Demonstrate the ability to correctly troubleshoot hardware and software problems within a digital control system.<br>B. Tune DDC loops for proper operation |
| XII. | Archiving Data<br>A. Demonstrate the ability to archive information, set up point monitors and access point to override program control. |

**Minimum Required Student Laboratory Activities**

| | |
|---|---|
| II. | Student will apply different numbering systems including binary, octal and hexadecimal. |
| III. | Student will apply binary logic using truth tables and logic gates. |
| IV. | Student will apply knowledge to various components which make up a microcomputer including the power supply, microprocessor, registers, memory (RAM and ROM), I/O interfaces (D/A and A/D converters). |
| V. | Student will analyze DDC system hardware, software, point operation and field wiring to ensure the lab system is completely operable. |
| VI. | Student will identify the different field I/O devices and know the correct way to terminate those devices at the termination board of the DDC system and at the field.<br>Student will accurately program a DDC database. |
| VII. | Student will develop and test software strategies to control various HVAC processes. |
| VIII. | Student will develop flow charts and convert the chart into computer program instruction statements.<br>Student will develop a DDC operating program from a description of operation, using correct statements, sequences and syntax. |
| IX. | Student will apply the theory, application and software associated with the different energy management strategies, TOD, OSS, DLC, and DC. |
| X. | Student will download, upload, enable, disable, edit and monitor a DDC program to operate the equipment in the lab. |
| XI. | Student will correctly troubleshoot hardware and software problems within a digital control system.<br>Student will tune DDC loops for proper operation. |
| XII. | Student will archive information, set up point monitors and access point to override program control. |

**Associate Provost's Signature:** ___Paul Blake___ Date 4/1/14

# COURSE INFORMATION FORM

# FORM E
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current)**

(proposed) **HVAC**

☐ **Number (current)**

(proposed) **462**

☐ **LEC ___ LAB ___ SEM ___ (current)**

(Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current)**

(proposed) **HVAC Primary Equipment Selection**

☒ **Credit Hours (current)**

(proposed) **4**

☒ **Prerequisites (current)**

(proposed) C- (or better) in MATH 126 & HVAC393

**Co-requisite (current)**

(proposed)

☒ **Course Description (current): (125 words maximum)**

(proposed): The selection, application and layout of state-of-the-art equipment and systems for commercial and industrial buildings. Emphasis will be placed upon the energy efficiency, integration of equipment into a complete system, and sequence of operation.

☒ **Course Outcomes and Assessment Plan (current)**

**(proposed): Learning Outcomes and Assessment for Each Instructional Unit**

**Assessment Code (AC):**

1. Student learning will be evaluated through written and/or electronic homework assessments.
2. Student knowledge will be evaluated through written and/or electronic examinations.
3. Student design projects will be evaluated by comparing them to design criteria and specifications.

Upon completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome | AC |
|---|---|---|
| I. | Introduction and Primary System Overview<br>A. Understand course policy and requirements.<br>B. Define the various categories of primary HVAC equipment, design and selection process and document development. | |
| II. | Chiller Systems<br>A. Define all the types of chiller systems and support components.<br>B. Apply and design a chiller system.<br>C. Select a chiller system from available vendors.<br>D. Develop all documentation for chiller design: piping schematics, chiller schedule, submittal documentation. | 1.<br>2.<br>3. |
| III. | Cooling Tower Systems<br>A. Define all the types of cooling tower systems and support components.<br>B. Apply and design a cooling tower system.<br>C. Select a cooling tower system from available vendors.<br>D. Develop all documentation for a cooling tower design: piping schematics, cooling tower schedule, submittal documentation. | 1.<br>2.<br>3. |

| | | |
|---|---|---|
| IV. | Boiler Systems<br>A. Define all the types of boiler systems and support components.<br>B. Apply and design a boiler system.<br>C. Select a boiler system from available vendors.<br>D. Develop all documentation for a boiler design: piping schematics, boiler tower schedule, submittal documentation. | 1.<br>2.<br>3. |
| V. | Air Handling Units<br>A. Define all the types of air handling units and support components.<br>B. Apply and design an air handling unit.<br>C. Select an air handling unit from available vendors.<br>D. Develop all documentation for an AHU design: piping schematics, AHU schedule, submittal documentation. | 1.<br>2.<br>3. |
| VI. | Heat Exchangers<br>A. Define all the types of heat exchangers and support components.<br>B. Apply and design a heat exchanger.<br>C. Select a heat exchanger from available vendors.<br>D. Develop all documentation for a heat exchanger design: piping schematics, heat exchanger schedule, submittal documentation. | 1.<br>2.<br>3. |
| VII. | Thermal Storage<br>A. Define all the types of thermal storage and support components.<br>B. Apply and design a thermal storage system.<br>C. Select a thermal storage system from available vendor.<br>D. Develop all documentation for a thermal storage system design: piping schematics, thermal storage schedule, submittal documentation. | 1.<br>2. |
| VIII. | Dehumidification<br>A. Define all the types of dehumidification and support components.<br>B. Apply and design a dehumidification system.<br>C. Select a dehumidification system from an available vendor.<br>D. Develop all documentation for a dehumidification system: dehumidification schedule, submittal documentation. | 1.<br>2.<br>3. |
| IX. | Heat Pumps<br>A. Define all the types of heat pumps and support components.<br>B. Apply and design a heat pump system.<br>C. Select a heat pump system from an available vendor.<br>D. Develop all documentation for a heat pump system: piping schematics, heat pump schedule, submittal documentation. | 1.<br>2.<br>3. |
| X. | Class Project<br>A. Given a set of building specification: Apply, design, select and develop all documentation for a complete project building HVAC system.<br>B. Illustrate the full load energy consumption of the HVAC system<br>C. Illustrate a sequence of operation for the HVAC system | 1.<br>2.<br>3. |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
(proposed)

**Instructional Unit Topic Descriptions and Time Allocations**

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|

| | | | |
|---|---|---|---|
| I. | Introduction to Course, Overview of HVAC Primary Systems | 1 | 0 |
| II. | Chiller systems | 9 | 6 |
| III. | Cooling tower systems | 6 | 3 |
| IV. | Boiler systems | 6 | 6 |
| V. | Air Handling Units | 9 | 6 |
| VI. | Heat Exchangers | 3 | 3 |
| VII. | Thermal storage | 2 | 3 |
| VIII. | Dehumidification | 2 | 3 |
| IX. | Heat pumps | 3 | 3 |
| X. | Course Project | 2 | 12 |
| XI. | Exams | 2 | 0 |
| | Total Hours | 45 | 45 |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

## COURSE INFORMATION FORM

## FORM E

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC** ☒ **Number (current) 499** ☐ **LEC 2 LAB 9 SEM ___ (current)**

(proposed) **HVAC** (proposed) **499** (Enter Contact Hours per week)
LEC _2__ LAB _6__ SEM ___(proposed):

☐ **Title (current) Commerical HVAC System Design**

(proposed) **Commercial HVAC System Design**

☒ **Credit Hours (current) 5** ☒ **Prerequisites (current) HVAC 415 and HAVC 451 with a C- or better** **Co-requisite (current)**

(proposed) **4** (proposed) HVAC 415, HVAC 451, and HVAC 462 with a grade of C- or better.
(proposed)

☒ **Course Description (current): (125 words maximum)**

Given building architectural plans, appropriate software, codes and standards and owner's requirements, students will select appropriate HVAC system, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation. This course meets General Education Requirements: Writing Intensive.

(proposed): Given building architectural plans, appropriate software, codes and standards and owner's requirements, students will select appropriate HVAC system, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation. This course meets General Education Requirements: Writing Intensive.

☒ **Course Outcomes and Assessment Plan (current)**

### Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding the overall HVAC system design procedure.
2. Analyzing owner & building requirements for proper equipment selection.
3. Computerized load calculation and building simulation related to the HVAC design process.
4. Developing system layouts, working drawings, specification and control sequence of operation.

### (proposed): Learning Outcomes and Assessment for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

Note: Each Learning unit has written assignments which build toward the final class project as this is a Capstone class, continual feedback is given to individual students as well as student groups as the final project is a group based learning project.

| | |
|---|---|
| I. | Introduction and Project Overview<br>A. Understand the purpose and course objectives |

| | |
|---|---|
| | B. Understand the project timeline |
| II. | Design Procedure<br>A. Identify the processes of HVAC design |
| III. | System Analysis and Selection<br>A. Apply factors affecting zoning decisions to system selection.<br>B. Evaluate architectural considerations and its affect upon system selection.<br>C. Evaluate system configuration and performance in relationship to building and zoning considerations.<br>D. Evaluate economics in relationship to budgetary considerations (first cost and operating costs).<br>E. Summarize system performance.<br>F. Identify potential systems to meet performance requirements. |
| IV. | Base Load Information<br>A. Indentify indoor design requirements based upon occupancy and applicable codes.<br>B. Identify indoor air quality requirements. |
| V. | Miscellaneous Base Load<br>A. Describe ventilation characteristics of various systems. |
| VI. | Initial Design Load<br>A. Assemble building base load information.<br>B. Calculate building base load.<br>C. Assemble building miscellaneous base load information.<br>D. Calculate miscellaneous base load.<br>E. Calculate building load. |
| VII. | Applied Load Analysis<br>A. Understand load analysis terminology.<br>B. Calculate equipment sizing loads.<br>C. Determine ventilation requirements for indoor air quality, economizer and building pressurization.<br>D. Perform load line analysis based upon design load.<br>E. Identify preliminary control strategies and modes.<br>F. Identify methods to control humidity.<br>G. Apply psychrometric analysis. |
| VIII. | Equipment Selection<br>A. Identify critical conditions for cooling coil selection.<br>B. Select cooling coil.<br>C. Identify miscellaneous accessories.<br>D. Select air handling equipment.<br>E. Select chiller.<br>F. Select heat rejection equipment.<br>G. Identify critical conditions for heating coil selection.<br>H. Select heating coil.<br>I. Identify miscellaneous heating accessories.<br>J. Select boiler.<br>K. Identify availability and verify electrical rate structure.<br>L. Identify availability and verify fossil fuel rate structure.<br>M. Analyze applicability of energy enhancing systems. |
| IX. | Building Simulation<br>A. Input utility data.<br>B. Input building data.<br>C. Input plant data.<br>D. Generate component and annual energy costs. |
| X. | System Sizing and Layout<br>A. Select size and layout air distribution system.<br>B. Calculate air pressure losses and select fan.<br>C. Select size and layout water distribution system. |

| | |
|---|---|
| | D. Calculate water pressure losses and select circulating pump. |
| XI. | Working Drawings<br>A. Identify standards and drawing arrangement.<br>B. Develop working drawings for piping, ductwork, details, schematics and control diagrams and schedules. |
| XII. | Specifications<br>A. Understand the purpose and format for mechanical specifications.<br>B. Understand the purpose and format for control specifications. |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
(proposed)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction and Project Overview | 1 | 0 |
| II. | Design Procedure | 1 | 0 |
| III. | System Analysis and Selection | 2 | 6 |
| IV. | Base Load Information | 2 | 12 |
| V. | Miscellaneous Base Load | 2 | 6 |
| VI. | Initial Design Load | 2 | 6 |
| VII. | Applied Load Analysis | 2 | 6 |
| VIII. | Equipment Selection | 4 | 6 |
| IX. | Building Simulation | 2 | 6 |
| X. | System Sizing and Layout | 3 | 12 |
| XI. | Working Drawings | 2 | 18 |
| XI. | Specifications | 2 | 6 |
| XII. | Project Report | 2 | 6 |
| XIII. | Exams | 3 | 0 |
| | Total Hours | 30 | 90 |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

**COURSE INFORMATION FORM** **FORM E**

Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC** ☐ **Number (current) 451** ☐ **LEC ___ LAB ___ SEM ___ (current)**

(proposed) **HVAC** (proposed) **451** (Enter Contact Hours per week)
LEC _3__ LAB _3__ SEM ___(proposed):

☒ **Title (current)** Energy Audit and Analysis

(proposed) Energy Audit and Analysis

☒ **Credit Hours (current) 4** ☒ **Prerequisites (current)** **Co-requisite (current)**

(proposed) **4** (proposed) C- or better in MATH 126 and HVAC 393

☒ **Course Description (current): (125 words maximum)**

(proposed): The survey of utility rate structures, billing energy consumption and energy profiling of commercial and industrial buildings. On-site audit projects will report on recommendations to building envelopes, HVACR systems and control systems with regard to payback. Oral and written presentations are a requirement of this senior project course. This course meets General Education Requirements: Writing Intensive.

☒ **Course Outcomes and Assessment Plan (current & proposed)**

**(current & proposed): Learning Outcomes and Assessment for Each Instructional Unit**

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding and evaluating various utility tariffs.
2. Understanding the history and politics of energy.
3. Conducting all forms of energy audit.
4. Building envelope evaluation and O&M/ECM recommendation.
5. HVAC system evaluation and O&M/ECM recommendation.
6. Lighting & Other electrical evaluation and O&M/ECM recommendation.
7. Application of energy estimating methods.

**Instructional Unit Topic Descriptions and Time Allocations**

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Units of Energy | 1 | 0 |
| II. | Energy History / Energy Audit Types / Energy code / Standards | 9 | 3 |
| III. | Utility Bill Analysis | 8 | 6 |
| IV. | Energy Estimating Methods | 3 | 3 |

| | | | |
|---|---|---|---|
| V. | Envelope, HVAC, Lighting & Other Electric Improvements | 12 | 12 |
| VI. | Steam systems | 6 | 3 |
| VII. | Technical Assistance Audit and Class Project | 3 | 18 |
| VIII. | Evaluation | 3 | 0 |
| | Total Hours | 45 | 45 |

**Learning Outcomes for Each Instructional Unit**

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Units of Energy<br>A. Define the units of energy for various energy sources.<br>B. Apply the appropriate energy unit in energy calculations. |
| II. | Energy History / Energy Audit Types / Energy Code / Standards<br>A. Explain the recent history of energy conservation<br>B. Differentiate between the three types of energy audits (walk thru, mini-audit and technical assistance audit.<br>C. Apply the correct energy audit type for a given situation.<br>D. Perform all steps in all forms of energy audits.<br>E. Utilize current energy codes and standards during the course of an energy audit.<br>F. Make recommendations utilizing current energy codes and standards. |
| III. | Utility Bill Analysis<br>A. Define the various rate structures for electricity.<br>B. Calculate an electric bill at various rate structures.<br>C. Define the terms demand, kW, capacity and power.<br>D. Define the terms electrical use, consumption, kWh and energy.<br>E. Define cost recovery factor.<br>F. Define electrical surcharges.<br>G. Define and calculate power factor.<br>H. Accurately read electrical meters.<br>I. Make recommendations on local vs. de-regulated electrical purchase.<br>J. Calculate the correct tax exemption status for manufacturing buildings.<br>K. Define the various rate structures for gas (natural and propane).<br>L. Define the various rate structures for other energy sources.<br>M. Use computer spreadsheets to assist in utility bill analysis.<br>N. Use utility billing history to establish a utility use baseline.<br>O. Use utility billing for building comparison to other similar buildings. |
| IV. | Energy Estimating Methods<br>A. Define, calculate and utilize the degree day method of energy estimating method.<br>B. Define, calculate and utilize the bin energy estimating method.<br>C. Define, calculate and utilize the correlation energy estimating method.<br>D. Define and utilize complex computer energy estimating methods.<br>E. Explain the strengths and limitations of each method. |
| V. | Envelope, HVAC, Lighting & Other Electric Improvements<br>A. Evaluate a building's envelope and make energy recommendations.<br>B. Evaluate a building's HVAC systems and make energy recommendations.<br>C. Evaluate a building's Lighting and other electrical and make energy recommendations.<br>D. Use various hand calculations to determine energy savings in all the above areas.<br>E. Use computer design and load programs to determine complex energy savings situations for all of the above areas. |

| | |
|---|---|
| | F. Establish a ranked order of Operation and Maintenance recommendations according to simple payback.<br>G. Establish a ranked order of Energy Conservation Measures according to simple payback. |
| VI. | Steam Systems<br>A. Define basic steam principles.<br>B. Utilize the appropriate steam charts.<br>C. Recognize and describe various steam systems and components.<br>D. Evaluate a buildings steam system and make energy recommendations. |
| VII. | Technical Assist Audit and Class Project<br>A. Collect on-site data for a technical assist audit.<br>B. Analyze utility billing for project building.<br>C. Establish a energy usage history for project building.<br>D. Place all collected data into a load calculation and computer simulation program.<br>E. Evaluate building envelope, HVAC systems, Lighting and other electrical systems, Control systems for optimal energy efficiency and building performance.<br>F. Calculate energy savings for operational and maintenance issues.<br>G. Calculate energy savings for energy conservation measures.<br>H. Develop a detailed, professional energy audit report.<br>I. Deliver the energy audit results in a formal presentation. |

**Minimum Required Student Laboratory Activities**

| | |
|---|---|
| I. | Student will collect accurate information on a project building, including: envelope data, HVAC data, lighting data, control data, other electrical data, utility data. |
| II. | Student will use above data, blueprints and building specifications to develop a building simulation. |
| III. | Student will use various hand calculations to validate the outcome of the computer simulation. |
| IV. | Student will use the building simulation program to test complex "what if" energy savings measures to determine rank order of payback. |
| V. | Student will write up a professional energy audit report including the following sections: Building history, Utility history, Computer profile, Mechanical system information, Control information, Lighting & other electrical information, Operational and Maintenance Recommendations, Energy conservation measure recommendations. |
| VI. | Student will deliver an oral presentation to Ferris staff and students on energy audit findings. |
| VII. | Student will deliver an oral presentation to the building owner and representatives. |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

# COURSE INFORMATION FORM

# FORM E
Rev. May 2013

**Complete all items below (New or Current).**

**Check all boxes where modifications are being made.**
**Enter the modification to be made (Proposed).**

**Course Identification**

☒ **Prefix (current) HVAC** ☒ **Number (current) 499** ☐ **LEC 2 LAB 9 SEM ___ (current)**

(proposed) **HVAC** (proposed) **499** (Enter Contact Hours per week)
LEC _2__ LAB _6__ SEM ___(proposed):

☐ **Title (current) Commerical HVAC System Design**

(proposed) **Commercial HVAC System Design**

☒ **Credit Hours (current) 5** ☒ **Prerequisites (current) HVAC 415 and HAVC 451 with a C- or better** **Co-requisite (current)**

(proposed) **4** (proposed) HVAC 415, HVAC 451, and HVAC 462 with a grade of C- or better.
(proposed)

☒ **Course Description (current): (125 words maximum)**
Given building architectural plans, appropriate software, codes and standards and owner's requirements, students will select appropriate HVAC system, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation. This course meets General Education Requirements: Writing Intensive.
(proposed): Given building architectural plans, appropriate software, codes and standards and owner's requirements, students will select appropriate HVAC system, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation. This course meets General Education Requirements: Writing Intensive.

☒ **Course Outcomes and Assessment Plan (current)**

## Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding the overall HVAC system design procedure.
2. Analyzing owner & building requirements for proper equipment selection.
3. Computerized load calculation and building simulation related to the HVAC design process.
4. Developing system layouts, working drawings, specification and control sequence of operation.

## (proposed): Learning Outcomes and Assessment for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

Note: Each Learning unit has written assignments which build toward the final class project as this is a Capstone class, continual feedback is given to individual students as well as student groups as the final project is a group based learning project.

| | |
|---|---|
| I. | Introduction and Project Overview<br>A. Understand the purpose and course objectives |

| | |
|---|---|
| | B. Understand the project timeline |
| II. | Design Procedure<br>A. Identify the processes of HVAC design |
| III. | System Analysis and Selection<br>A. Apply factors affecting zoning decisions to system selection.<br>B. Evaluate architectural considerations and its affect upon system selection.<br>C. Evaluate system configuration and performance in relationship to building and zoning considerations.<br>D. Evaluate economics in relationship to budgetary considerations (first cost and operating costs).<br>E. Summarize system performance.<br>F. Identify potential systems to meet performance requirements. |
| IV. | Base Load Information<br>A. Indentify indoor design requirements based upon occupancy and applicable codes.<br>B. Identify indoor air quality requirements. |
| V. | Miscellaneous Base Load<br>A. Describe ventilation characteristics of various systems. |
| VI. | Initial Design Load<br>A. Assemble building base load information.<br>B. Calculate building base load.<br>C. Assemble building miscellaneous base load information.<br>D. Calculate miscellaneous base load.<br>E. Calculate building load. |
| VII. | Applied Load Analysis<br>A. Understand load analysis terminology.<br>B. Calculate equipment sizing loads.<br>C. Determine ventilation requirements for indoor air quality, economizer and building pressurization.<br>D. Perform load line analysis based upon design load.<br>E. Identify preliminary control strategies and modes.<br>F. Identify methods to control humidity.<br>G. Apply psychrometric analysis. |
| VIII. | Equipment Selection<br>A. Identify critical conditions for cooling coil selection.<br>B. Select cooling coil.<br>C. Identify miscellaneous accessories.<br>D. Select air handling equipment.<br>E. Select chiller.<br>F. Select heat rejection equipment.<br>G. Identify critical conditions for heating coil selection.<br>H. Select heating coil.<br>I. Identify miscellaneous heating accessories.<br>J. Select boiler.<br>K. Identify availability and verify electrical rate structure.<br>L. Identify availability and verify fossil fuel rate structure.<br>M. Analyze applicability of energy enhancing systems. |
| IX. | Building Simulation<br>A. Input utility data.<br>B. Input building data.<br>C. Input plant data.<br>D. Generate component and annual energy costs. |
| X. | System Sizing and Layout<br>A. Select size and layout air distribution system.<br>B. Calculate air pressure losses and select fan.<br>C. Select size and layout water distribution system. |

| | |
|---|---|
| | D. Calculate water pressure losses and select circulating pump. |
| XI. | Working Drawings<br>A. Identify standards and drawing arrangement.<br>B. Develop working drawings for piping, ductwork, details, schematics and control diagrams and schedules. |
| XII. | Specifications<br>A. Understand the purpose and format for mechanical specifications.<br>B. Understand the purpose and format for control specifications. |

☒ **Course Outline including Time Allocation (current)**
Express Time Allocation in one of the following formats for a 3 credit hour course; adjust accordingly:
Weeks (15 weeks)
Hours (45 hours; assuming 3 contact hours per week)
Percentages (100 percent)
(proposed)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction and Project Overview | 1 | 0 |
| II. | Design Procedure | 1 | 0 |
| III. | System Analysis and Selection | 2 | 6 |
| IV. | Base Load Information | 2 | 12 |
| V. | Miscellaneous Base Load | 2 | 6 |
| VI. | Initial Design Load | 2 | 6 |
| VII. | Applied Load Analysis | 2 | 6 |
| VIII. | Equipment Selection | 4 | 6 |
| IX. | Building Simulation | 2 | 6 |
| X. | System Sizing and Layout | 3 | 12 |
| XI. | Working Drawings | 2 | 18 |
| XI. | Specifications | 2 | 6 |
| XII. | Project Report | 2 | 6 |
| XIII. | Exams | 3 | 0 |
| | Total Hours | 30 | 90 |

**Associate Provost's Signature:** Paul Blake Date 4/1/14

# MODIFY A COURSE
**Course Data Entry Form**

# FORM F
Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**
a. Course Prefix **HVAC** b. Number **312** c. Title **Control Theory & Application**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in HVAC 321, HVAC342, and MATH 126

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# CREATE NEW COURSE

**Course Data Entry Form**

# FORM F

Rev. September 2012

**COMPLETE ALL SECTIONS BELOW. If this course is to be used as a prerequisite for other university courses, Form F's that reflect the prerequisite change must be submitted for those courses as well. See Appendix E Instructions for Completing Forms.**

**I. ACTION TO BE TAKEN: CREATE A NEW COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. NEW COURSE ATTRIBUTES:**

a. Course Prefix **HVAC** b. Number **321** c. Contact Hours **3** LECture **3** LAB ☐Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

**d.** ☐ Practicum ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

**e.** Course Title: **HVAC Air System Select-Design** (Limit to 30 characters including punctuation and spaces.)

**f.** College Code: **CET** **g.** Department Code: **HVAC** **h.** Credit Hours: Check (x) type ☐ Variable ☒ Fixed

**i.** Enter number in box: **4** Minimum Credit Hours **j. 4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☒ Yes ☐ No
If yes, Max Times **3** or Max Credits Awarded **3 times**

**l.** Levels: Check (x) ☒ Undergraduate ☐ Graduate ☐ Professional

**m.** Grade Method: Check (x) ☒ Normal Grading ☐ Credit/No Credit (Pass/Fail)

**n.** Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☒ No

**o.** Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

A study of air systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.

**q.** Term(s) Offered: **Fall** **r.** Max Section Enrollment: **16** **s.** Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management

**t.** Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# CREATE NEW COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**COMPLETE ALL SECTIONS BELOW. If this course is to be used as a prerequisite for other university courses, Form F's that reflect the prerequisite change must be submitted for those courses as well. See Appendix E Instructions for Completing Forms.**

**I. ACTION TO BE TAKEN: CREATE A NEW COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. NEW COURSE ATTRIBUTES:**

a. Course Prefix **HVAC** b. Number **325** c. Contact Hours **3** LECture **3** LAB ☐Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: **HVAC Hydronic System Select-Design** (Limit to 30 characters including punctuation and spaces.)

f. College Code: **CET** g. Department Code: **HVAC** h. Credit Hours: Check (x) type ☐ Variable ☒ Fixed

i. Enter number in box: **4** Minimum Credit Hours j. **4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☒ Yes ☐ No
If yes, Max Times **3** or Max Credits Awarded **3 times**

l. Levels: Check (x) ☒ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☒ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☒ No

o. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.
A study of water systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.

q. Term(s) Offered: **Spring** r. Max Section Enrollment: **16** s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- (or better) in HVAC 321, HVAC 342 and MATH126

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# MODIFY A COURSE
**Course Data Entry Form**

# FORM F
Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**
a. Course Prefix **HVAC** b. Number **350** c. Title **Contracting Issues in HVACR**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in HVAC 321, HVAC 342, and MATH 126

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# MODIFY A COURSE
**Course Data Entry Form**

# FORM F
Rev. September 2012

I. **ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

II. **COURSE TO BE MODIFIED:**
a. Course Prefix **HVAC** b. Number **393** c. Title **Summer Internship**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

III. **MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in HVAC 312, 325 & 350

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**

a. Course Prefix **HVAC** b. Number **415** c. Title **Direct Digital Control**

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in MATH 126 and HVAC 393

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# MODIFY A COURSE
**Course Data Entry Form**

# FORM F
Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**

a. Course Prefix **HVAC** b. Number **451** c. Title Energy Audit and Analysis

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours LECture LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☐ Fixed

i. Enter number in box: Minimum Credit Hours j. Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☐ Yes ☐ No
If yes, Max Times or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

p. **CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in MATH 126 and HVAC 393

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:**
Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:**
Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# CREATE NEW COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**COMPLETE ALL SECTIONS BELOW. If this course is to be used as a prerequisite for other university courses, Form F's that reflect the prerequisite change must be submitted for those courses as well. See Appendix E Instructions for Completing Forms.**

**I. ACTION TO BE TAKEN: CREATE A NEW COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. NEW COURSE ATTRIBUTES:**

a. Course Prefix **HVAC** b. Number **462** c. Contact Hours **3** LECture **3** LAB ☐Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: **HVAC Primary Equipment Selection** (Limit to 30 characters including punctuation and spaces.)

f. College Code: **CET** g. Department Code: **HVAC** h. Credit Hours: Check (x) type ☐ Variable ☒ Fixed

i. Enter number in box: **4** Minimum Credit Hours j. **4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) (es ☐ No
If yes, Max Times **3** or Max Credits Awarded **3 times**

l. Levels: Check (x) ☒ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☒ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☒ No

o. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

The selection, application and layout of state-of-the-art equipment and systems for commercial and industrial buildings. Emphasis will be placed upon the energy efficiency, integration of equipment into a complete system, and sequence of operation.

q. Term(s) Offered: **Fall/Spring/Summer** r. Max Section Enrollment: **16** s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- (or better) in MATH 126 & HVAC393

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/26/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# MODIFY A COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**I. ACTION TO BE TAKEN: MODIFY A COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. COURSE TO BE MODIFIED:**

a. Course Prefix **HVAC** b. Number **499** c. Title Commercial HVAC System Design

**LIST THE LETTER(S) OF ALL CHANGES FROM SECTION III BELOW. h, i, j, k, s**
**See Appendix E Instructions for Completing Forms.**

**III. MODIFICATIONS:** Enter ONLY the modification(s) proposed.

a. Course Prefix b. Number c. Contact hours **2** LECture **6** LAB Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum - ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: (Limit to 30 characters including punctuation and spaces.)

f. College Code: g. Department Code: h. Credit Hours: Check (x) type ☐ Variable ☒ Fixed

i. Enter number in box: **4** Minimum Credit Hours j. **4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☒ Yes ☐ No
If yes, Max Times **3** or Max Credits Awarded
l. Levels: Check (x) ☐ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☐ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☐ No

o. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

q. Term(s) Offered: r. Max Section Enrollment: Section(s) Affected:

s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- or better in HVAC 415, HVAC 451 and HVAC 462

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# CREATE NEW COURSE

**FORM F**

**Course Data Entry Form**

Rev. September 2012

**COMPLETE ALL SECTIONS BELOW. If this course is to be used as a prerequisite for other university courses, Form F's that reflect the prerequisite change must be submitted for those courses as well. See Appendix E Instructions for Completing Forms.**

**I. ACTION TO BE TAKEN: CREATE A NEW COURSE**

**Desired Term Effective** (6 digit code only): **201408** Examples: 201301(Spring), 201305(Summer), 201308(Fall)
Note: The first four digits indicate year, the next two digits indicate month in which term begins.

**II. NEW COURSE ATTRIBUTES:**

a. Course Prefix **HVAC** b. Number **462** c. Contact Hours **3** LECture **3** LAB ☐ Seminar
[Enter hours per week in box. See formula for contact hours to credit hours in Appendix E.]

d. ☐ Practicum ☐ INDependent Study
[Check (x) box as appropriate. See definitions in Appendix E.]

e. Course Title: **HVAC Primary Equipment Selection** (Limit to 30 characters including punctuation and spaces.)

f. College Code: **CET** g. Department Code: **HVAC** h. Credit Hours: Check (x) type ☐ Variable ☒ Fixed

i. Enter number in box: **4** Minimum Credit Hours j. **4** Maximum Credit Hours

k. May Be Repeated for Added Credit: Check (x) ☒ Yes ☐ No
If yes, Max Times **3** or Max Credits Awarded **3 times**

l. Levels: Check (x) ☒ Undergraduate ☐ Graduate ☐ Professional

m. Grade Method: Check (x) ☒ Normal Grading ☐ Credit/No Credit (Pass/Fail)

n. Does proposed new course replace an equivalent course? Check (x) ☐ Yes ☒ No

o. Equivalent course: Prefix Number

**p. CATALOG DESCRIPTION** – Limit to 125 words – PLEASE BE CONCISE.

The selection, application and layout of state-of-the-art equipment and systems for commercial and industrial buildings. Emphasis will be placed upon the energy efficiency, integration of equipment into a complete system, and sequence of operation.

q. Term(s) Offered: **Fall/Spring/Summer** r. Max Section Enrollment: **16** s. Prerequisites or Restrictions: (If none, leave blank. Limit to 100 characters including punctuation and spaces.) C- (or better) in MATH 126 & HVAC393

t. Co-requisites: courses must be taken concurrently (if none, leave blank. Limit to 100 characters including punctuation and spaces.)

*To be completed by Academic Affairs Office:* - Standard & Measures Coding and General Education Code
☐ Basic Skill (BS) ☐ General Education (GE) ☐ Occupational Education (OC) ☐ G.E. Codes

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd:** ____ **Date Completed:** ____ **Entered: SCACRSE** __ **SCADETL** __ **SCARRES** __ **SCAPREQ** __

# Delete a Course
**Course Data Entry Form**

**FORM F**
Rev. September 2012

**I. ACTION TO BE TAKEN: DELETE COURSE FROM CATALOG.**

The course listed below will be removed from the Ferris State University Catalog.
(See Appendix E Instructions for Completing Forms.)

**a**. Desired Term Effective: Term Fall Year 2014

**II. CURRENT COURSE TO BE DELETED FROM CATALOG:**

**a**. Course Prefix **HVAC**
**b**. Number **331**
**c**. Enter Contact Hours per week in boxes. LECture 3 LAB 3 Seminar
**d**. INDependent Study ☐ Practicum: [Check (x) box as appropriate. See definitions in Appendix E.)

**e**. Full Course Title: **Secondary System Select-Design**

**UCC Chair Signature/Date:** Sandy Alspach 3/24/14

**Academic Affairs Approval Signature/Date:** Paul Blake 4/1/14

**Office of the Registrar use ONLY**

**Date Rec'd: ____ Date Completed: ____ Entered: SCACRSE __ SCADETL __SCARRES __ SCAPREQ __**

**Paula L Hadley-Kennedy**

---

| | |
|---|---|
| **From:** | Sandy L Alspach <SandyAlspach@ferris.edu> |
| **Sent:** | Friday, March 21, 2014 11:47 AM |
| **To:** | Douglas F Zentz; John R Schmidt |
| **Cc:** | Chrystal R Roach; Elise M Gramza; Paul Blake; Paula Hadley-Kennedy; Douglas F Zentz; Victor I Piercey; David M Marion; Kristy L Motz; Steven Karnes; Olukemi O Fadayomi; Adnan Dakkuri; Tracey D Boncher |
| **Subject:** | HVACR Curriculum Modification and new courses proposal |

Gentlemen,

UCC is holding your proposal, pending receipt of the following:

Form Es for all modifications and reinstitution of HVAC 462
This "new and improved" Form E is now signed and dated by the Associate Provost for Academic Affairs and becomes the "course of record" going forward.

Form Fs:
- HVAC 321, 325, 462: if the intent is that these courses are repeatable, Records will need to know how many times and/or maximum credits that can be earned
- HVAC 499: a LEC/LAB course cannot be variable credit. You could accomplish this option by changing the course to Practicum
- Form F Delete for HVAC 331

We meet at noon on Monday; send corrected forms directly to Paula Hadley in the Academic Senate office.

**Paula L Hadley-Kennedy**

---

**From:** Douglas F Zentz
**Sent:** Friday, March 21, 2014 3:13 PM
**To:** Paula L Hadley-Kennedy
**Cc:** Sandy L Alspach; Donna J Schmidt; John R Schmidt
**Attachments:** Form F - HVAC331 - Delete Course.pdf; Form F - HVAC321 - HVAC 2013 Proposal.pdf; Form F - HVAC325 - HVAC 2013 Proposal.pdf; Form F - HVAC462 - HVAC 2013 Proposal.pdf; Form F - HVAC499 - HVAC 2013 Proposal.pdf

Paula,

Pere the direction of the UCC, here are the required forms with minor modifications as requested. Please note there is zero need for a modified Form E on HVAC462 as the course is not changing (only the course number is changing) and the original packet has a Form E for HVAC462.

Doug Zentz
Associate Professor/HVACR Department Coordinator
School of Built Environment
College of Engineering Technology
Ferris State University
Office Ph: (231) 591-3083
Cell: (231) 250-4394

# HVACR Mission Statement
# 2011

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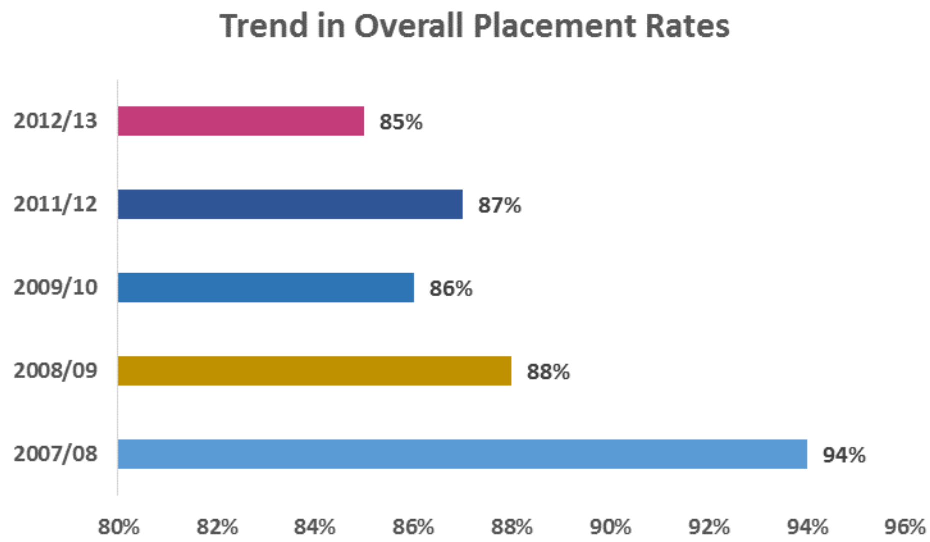
' (153+512&; +2<&16, & (- ' 1(- .&38 - &30, - 638) &16124: - <&4638 - .+: - <&
16, &) 2* - &() =2 9 .>&28+: &+: &155) 9 ' 2: 8 - , &6&313 - @) AB38 - B1(3&
A15+23+. &C+38&+7824&/012A+ , &6.3(053) (.>

11/1997

# Graduate Follow-Up
## Survey Report
## 2012-2013

INSTITUTIONAL RESEARCH & TESTING
FERRIS STATE UNIVERSITY

# 2012/2013 Graduate Follow Up Survey - Overall Results




**<u>Notes</u>**

**Respondents included here are those who are employed, continuing their education full-time, or who are employed and continuing their education.**

**Salary information is provided when there are 2 or more respondents indicating a salary for the listed program.**

**Graduates are counted in the Respondents column for all programs (degree and certificate) they graduated in during 2012-2013.**

**Graduates are counted in the Employed/Continuing Education and Salary columns only for the highest degree awarded to them; in the case of multiple Bachelor's degrees, the first one listed alphabetically was counted.**

**The overall response rate for the 2012-2013 report was 27%, an increase of five percent from last year's survey and a good indicator that Michigan's economy is starting to recover.**

# 2012/2013 Graduate Follow Up Survey Summary

## College: Arts & Sciences

| | Degrees | | | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ARTS & SCIENCES** | **AA** | **AAS** | **AS** | **BA** | **BIS** | **BS** | **BSW** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Plcmt Rate** | **Ave Salary** |
| **BIOLOGY** | | | | | | | | | | | | | |
| Biology | | | | 1 | | 36 | | 37 | 9 | 24% | 7 | 78% | $ 30,480 |
| Biology/Environmental | | | | | | 1 | | 1 | 1 | 100% | 1 | 100% | NA |
| Biology/Forensic | | | | | | 10 | | 10 | 6 | 60% | 4 | 67% | NA |
| Biology/Pre-Dentistry | | | | | | 1 | | 1 | 0 | 0% | 0 | | NA |
| Biology/Pre-Medicine | | | | | | 4 | | 4 | 0 | 0% | 0 | | NA |
| Biology/Pre-Optometry | | | | | | 14 | | 14 | 3 | 21% | 3 | 100% | NA |
| Biology/Pre-Phys Therapy | | | | | | 1 | | 1 | 0 | 0% | 0 | | NA |
| Biotechnology | | | | | | 5 | | 5 | 1 | 20% | 0 | 0% | NA |
| Pre-Science | | | 70 | | | | | 70 | 15 | 21% | 15 | 100% | NA |
| **COLLEGE OF ARTS & SCIENCES** | | | | | | | | | | | | | |
| Integrative Studies | | | | | 53 | | | 53 | 13 | 25% | 10 | 77% | $ 36,171 |
| **HUMANITIES** | | | | | | | | | | | | | |
| Applied Speech Communication | 3 | | | | | | | 3 | 0 | 0% | 0 | | NA |
| Applied Speech Communication | | | | | | 8 | | 8 | 3 | 38% | 3 | 100% | $ 27,850 |
| Communication | | | | 3 | | | | 3 | 1 | 33% | 1 | 100% | NA |
| History | | | | 9 | | | | 9 | 3 | 33% | 2 | 67% | NA |
| **LANGUAGE & LITERATURE** | | | | | | | | | | | | | |
| English | | | | 9 | | | | 9 | 4 | 44% | 4 | 100% | $ 24,750 |
| Journalism & Tech Comm | | | | | | 3 | | 3 | 0 | 0% | 0 | | NA |
| Liberal Arts | 16 | | | | | | | 16 | 0 | 0% | 0 | | NA |
| Tech-Prof Communication | | | | | | 6 | | 6 | 3 | 50% | 3 | 100% | $ 32,403 |
| **MATHEMATICS** | | | | | | | | | | | | | |
| Applied Math/Actuarial Science | | | | | | 7 | | 7 | 5 | 71% | 4 | 80% | $ 50,000 |
| Applied Math/Computer Science | | | | | | 2 | | 2 | 0 | 0% | 0 | | NA |
| Applied Mathematics | | | | | | 4 | | 4 | 2 | 50% | 2 | 100% | NA |
| Mathematics | | | | 1 | | | | 1 | 1 | 100% | 1 | 100% | NA |
| **PHYSICAL SCIENCES** | | | | | | | | | | | | | |
| Biochemistry | | | | 5 | | | | 5 | 1 | 20% | 1 | 100% | NA |
| Chemistry | | | | 6 | | | | 6 | 3 | 50% | 3 | 100% | $ 31,700 |
| Industrial Chemistry Technology | | 4 | | | | | | 4 | 1 | 25% | 0 | 0% | NA |
| **SOCIAL SCIENCES** | | | | | | | | | | | | | |
| Political Science | | | | | | 4 | | 4 | 1 | 25% | 1 | 100% | NA |
| Psychology | | | | | | 35 | | 35 | 8 | 23% | 5 | 63% | $ 22,480 |
| Social Work - BSW | | | | | | | 52 | 52 | 19 | 37% | 17 | 89% | $ 33,000 |
| Sociology | | | | 1 | | | | 1 | 1 | 100% | 1 | 100% | NA |
| **Arts & Sciences TOTAL** | **19** | **4** | **70** | **35** | **53** | **141** | **52** | **374** | **104** | **28%** | **88** | **85%** | **Not Calculated** |

# 2012/2013 Graduate Follow Up Survey Summary

## College: Business

| | Degrees | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **BUSINESS** | **CERT** | **AAS** | **BB/BS** | **MBA** | **MISM** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **ACCOUNTING, FINANCE, INFO SYSTEMS** | | | | | | | | | | | |
| Accountancy | | 4 | | | | 4 | 1 | 25% | 1 | 100% | NA |
| Accountancy | | | 21 | | | 21 | 5 | 24% | 5 | 100% | $ 28,680 |
| Accountancy/Finance | | | 7 | | | 7 | 3 | 43% | 3 | 100% | $ 38,520 |
| Accountancy/Prof Directed Conc | | | 3 | | | 3 | 1 | 33% | 1 | 100% | NA |
| Accountancy/Public Accounting | | | 30 | | | 30 | 10 | 33% | 8 | 80% | $ 32,663 |
| Adv Studies Bus Intel & Infmts | 5 | | | | | 5 | 3 | 60% | 2 | 67% | NA |
| Adv Studies Info Sec/Net Mgmt | 9 | | | | | 9 | 3 | 33% | 0 | 0% | NA |
| Adv Studies Project Mgmt | 8 | | | | | 8 | 2 | 25% | 0 | 0% | NA |
| Adv Studies Systems Integration | 2 | | | | | 2 | 0 | 0% | 0 | | NA |
| Computer Information Systems | | 3 | | | | 3 | 0 | 0% | 0 | | NA |
| Computer Information Systems | | | 28 | | | 28 | 10 | 36% | 10 | 100% | $ 40,117 |
| Computer Information Technology | | | 2 | | | 2 | 1 | 50% | 1 | 100% | NA |
| Finance | | | 8 | | | 8 | 1 | 13% | 1 | 100% | NA |
| Finance Corp Acct Conc | | | 2 | | | 2 | 2 | 100% | 1 | 50% | NA |
| Finance Investment Conc | | | 4 | | | 4 | 2 | 50% | 2 | 100% | $ 35,000 |
| Finance Real Estate Conc | | | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Homeland Sec Dig Sec/Forensics (LE) | 1 | | | | | 1 | 1 | 100% | 0 | 0% | NA |
| Homeland Sec Dig Sec/Forensics (TECH) | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Info Security and Intelligence | | | 12 | | | 12 | 1 | 8% | 1 | 100% | NA |
| Masters of Information Systems Management | | | | | 11 | 11 | 5 | 45% | 4 | 80% | $ 95,000 |
| Project Management | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| **MANAGEMENT** | | | | | | | | | | | |
| Adv Studies Design/Innovation | 9 | | | | | 9 | 3 | 33% | 2 | 67% | NA |
| Adv Studies Global Logistics | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Adv Studies Mgt Tools/Concepts | 18 | | | | | 18 | 8 | 44% | 0 | 0% | NA |
| Adv Studies Outsourcing Mgmt | 1 | | | | | 1 | 1 | 100% | 0 | 0% | NA |
| Business Administration (all inclusive) | | | 183 | | | 183 | 35 | 19% | 31 | 89% | $ 42,866 |
| General Business | | 8 | | | | 8 | 2 | 25% | 1 | 50% | NA |
| Human Resource Management | 20 | | | | | 20 | 3 | 15% | 2 | 67% | $ 35,000 |
| Human Resource Management | | | 12 | | | 12 | 3 | 25% | 3 | 100% | NA |
| International Business | 8 | | | | | 8 | 1 | 13% | 0 | 0% | NA |
| Leadership & Supervision | 4 | | | | | 4 | 2 | 50% | 0 | 0% | NA |
| Lean Systems | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Legal Studies | | 10 | | | | 10 | 4 | 40% | 0 | 0% | NA |
| Management | | | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Masters of Business Administration | | | | 26 | | 26 | 12 | 46% | 12 | 100% | $ 46,427 |
| Operations/Supply Management | | | 3 | | | 3 | 0 | 0% | 0 | | NA |
| Small Business Mgmt | 2 | | | | | 2 | 0 | 0% | 0 | | NA |
| Supervision | 6 | | | | | 6 | 2 | 33% | 0 | 0% | NA |
| **MARKETING** | | | | | | | | | | | |
| Advertising | | | 2 | | | 2 | 0 | 0% | 0 | | NA |
| Advertising/Integrated Mktg Comm | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Advertising/Integrated Mktg Comm | | | 12 | | | 12 | 3 | 25% | 3 | 100% | NA |
| Business to Business Marketing | 4 | | | | | 4 | 1 | 25% | 0 | 0% | NA |
| Data Mining | 1 | | | | | 1 | 1 | 100% | 1 | 100% | NA |
| Direct Marketing | 7 | | | | | 7 | 2 | 29% | 0 | 0% | NA |
| E-Commerce Marketing | 3 | | | | | 3 | 0 | 0% | 0 | | NA |
| Graphic Design | | 37 | | | | 37 | 5 | 14% | 3 | 60% | NA |
| Graphic Design | | | 16 | | | 16 | 4 | 25% | 4 | 100% | $ 41,500 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Graphic Media Mgmt | | | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Marketing | 2 | | | | | 2 | 0 | 0% | 0 | | NA |
| Marketing | | | 47 | | | 47 | 9 | 19% | 8 | 89% | $ 41,386 |
| Public Relations | 2 | | | | | 2 | 0 | 0% | 0 | | NA |
| Public Relations | | | 19 | | | 19 | 5 | 26% | 4 | 80% | NA |
| Retailing | 1 | | | | | 1 | 1 | 100% | 0 | 0% | NA |
| **SPORT, ENTERTAINMENT, & HOSPITALITY** | | | | | | | | | | | |
| Club Management | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Culinary Management | 1 | | | | | 1 | 1 | 100% | 0 | 0% | NA |
| Dietary & Food Svc Mgmt | | 2 | | | | 2 | 1 | 50% | 1 | 100% | NA |
| Hotel Management | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Hotel Management | | | 8 | | | 8 | 2 | 25% | 1 | 50% | NA |
| Hotel/Rest/Food Industry Mgmt | | | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Mktg/Professional Golf Mgmt | | | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Mktg/Professional Tennis Mgmt | | | 12 | | | 12 | 6 | 50% | 6 | 100% | $ 36,250 |
| Music Industry Management | | | 33 | | | 33 | 5 | 15% | 4 | 80% | $ 25,000 |
| Professional Golf Management | | | 33 | | | 33 | 2 | 6% | 2 | 100% | $ 33,500 |
| Professional Tennis Management | | | 4 | | | 4 | 2 | 50% | 2 | 100% | NA |
| Resort Management | | | 21 | | | 21 | 4 | 19% | 2 | 50% | NA |
| Restaurant and Food Ind Mgmt | | 11 | | | | 11 | 2 | 18% | 0 | 0% | NA |
| Ski Resort Mgmt | 3 | | | | | 3 | 1 | 33% | 0 | 0% | NA |
| Special Event/Meeting Planning | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Sport/Spa/Entertain Operations | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| **Business TOTAL** | **126** | **75** | **527** | **26** | **11** | **765** | **184** | **24%** | **132** | **72%** | **Not Calculated** |

# 2012/2013 Graduate Follow Up Survey Summary

## College: Education and Human Services

| | Degrees | | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **EDUCATION & HUMAN SERVICES** | **CERT** | **AA/AS** | **BS** | **MED** | **MSCJ** | **MTE** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **CRIMINAL JUSTICE** | | | | | | | | | | | | |
| Criminal Justice Admin | | | | | 25 | | 25 | 10 | 40% | 9 | 90% | $ 37,949 |
| Criminal Justice (all tracks) | | | 352 | | | | 352 | 81 | 23% | 70 | 86% | $ 33,650 |
| Pre-Criminal Justice | | 72 | | | | | 72 | 12 | 17% | 3 | 25% | NA |
| **LEISURE STUDIES & WELLNESS** | | | | | | | | | | | | |
| Recreation Leadership and Mgt | | | 16 | | | | 16 | 3 | 19% | 2 | 67% | NA |
| **SCHOOL OF EDUCATION** | | | | | | | | | | | | |
| Biology Education | | | 2 | | | | 2 | 2 | 100% | 2 | 100% | $ 27,400 |
| Career & Technical Education (all tracks) | | | | | | 12 | 12 | 5 | 42% | 5 | 100% | $ 60,000 |
| Curriculum & Instruction (all tracks) | | | | 19 | | | 19 | 7 | 37% | 7 | 100% | $ 47,067 |
| Early Childhood Education | | 10 | | | | | 10 | 1 | 10% | 1 | 100% | NA |
| Early Childhood Education | | | 23 | | | | 23 | 5 | 22% | 5 | 100% | $ 30,000 |
| Elementary Education | | | 49 | | | | 49 | 11 | 22% | 10 | 91% | $ 27,511 |
| English Education | | | 4 | | | | 4 | 0 | 0% | 0 | | NA |
| History Education | | | 6 | | | | 6 | 1 | 17% | 1 | 100% | NA |
| Mathematics Education | | | 4 | | | | 4 | 2 | 50% | 1 | 50% | NA |
| Political Science Education | | | 1 | | | | 1 | 1 | 100% | 0 | 0% | NA |
| Pre-Teaching Elementary | | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Pre-Teaching Secondary | | 4 | | | | | 4 | 0 | 0% | 0 | | NA |
| Pro-Mo-TEd Technical Education | | | 9 | | | | 9 | 4 | 44% | 4 | 100% | $ 56,750 |
| Social Studies Education | | | 6 | | | | 6 | 2 | 33% | 2 | 100% | $ 25,000 |
| Technical Education | | | 1 | | | | 1 | 0 | 0% | 0 | | NA |
| Total Quality Mgmt in Education | 1 | | | | | | 1 | 0 | 0% | 0 | | NA |
| **TELEVISION PRODUCTION** | | | | | | | | | | | | |
| Television/Digital Media Prod | | | 18 | | | | 18 | 7 | 39% | 7 | 100% | $ 20,667 |
| **Education and Human Svcs TOTAL** | **1** | **87** | **491** | **19** | **25** | **12** | **635** | **154** | **24%** | **129** | **84%** | **Not Calculated** |

# 2012/2013 Graduate Follow Up Survey Summary

## College: Engineering Technology

| | Degrees | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ENGINEERING TECHNOLOGY** | **CERT** | **AAS** | **BS** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **ARCHITECURAL TECH & FACILITIES MGMT** | | | | | | | | | |
| Architectural Technology | | 35 | | 35 | 3 | 9% | 2 | 67% | NA |
| Architecture & Sustainability | | | 10 | 10 | 3 | 30% | 3 | 100% | $ 28,173 |
| Facility Management | 9 | | | 9 | 0 | 0% | 0 | | NA |
| Facility Management | | | 22 | 22 | 8 | 36% | 7 | 88% | $ 44,097 |
| **AUTOMOTIVE** | | | | | | | | | |
| Automotive Engineering Tech | | | 34 | 34 | 5 | 15% | 3 | 60% | $ 49,400 |
| Automotive Management | | | 13 | 13 | 5 | 38% | 4 | 80% | $ 73,500 |
| Automotive Management (2+2) | | | 6 | 6 | 0 | 0% | 0 | | NA |
| Automotive Service Technology | | 20 | | 20 | 3 | 15% | 3 | 100% | NA |
| Automotive/Heavy Equipment Mgt | | | 1 | 1 | 0 | 0% | 0 | | NA |
| Performance Machining | 10 | | | 10 | 1 | 10% | 0 | 0% | NA |
| Performance Motorsports | 39 | | | 39 | 6 | 15% | 1 | 17% | NA |
| **CONSTRUCTION TECHNOLOGY & MGMT** | | | | | | | | | |
| Advanced Construction Mgmt | 2 | | | 2 | 0 | 0% | 0 | | NA |
| Building Construction Tech | | 40 | | 40 | 9 | 23% | 3 | 33% | $ 58,500 |
| Civil Engineering Technology | | 12 | | 12 | 3 | 25% | 0 | 0% | NA |
| Construction Administration | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Construction Management (all inclusive) | | | 71 | 71 | 19 | 27% | 17 | 89% | $ 42,507 |
| **ELECTRONICS/CNS** | | | | | | | | | |
| Computers Networks and Systems | | | 9 | 9 | 2 | 22% | 2 | 100% | $ 57,750 |
| Electrical/Electronic Eng Tech | | | 12 | 12 | 6 | 50% | 2 | 33% | NA |
| Industrial Electronics Tech | | 9 | | 9 | 3 | 33% | 2 | 67% | NA |
| **ENERGY SYSTEMS ENGINEERING** | | | | | | | | | |
| Energy Systems Engineering | | | 1 | 1 | 0 | 0% | 0 | | NA |
| **HEAVY EQUIPMENT** | | | | | | | | | |
| Electrical Power Generation | 2 | | | 2 | 0 | 0% | 0 | | NA |
| Heavy Equip Service Eng Tech | | | 19 | 19 | 5 | 26% | 5 | 100% | $ 54,960 |
| Heavy Equipment Technology | | 41 | | 41 | 11 | 27% | 7 | 64% | $ 19,333 |
| **HVACR** | | | | | | | | | |
| HVACR Engineering Technology | | | 46 | 46 | 14 | 30% | 12 | 86% | $ 59,667 |
| HVACR Technology | | 27 | | 27 | 4 | 15% | 3 | 75% | $ 45,682 |
| **MANUFACTURING ENGINEERING TECH** | | | | | | | | | |
| Manufacturing Engineering Tech | | | 22 | 22 | 12 | 55% | 12 | 100% | $ 60,615 |
| Manufacturing Technology | | 2 | | 2 | 0 | 0% | 0 | | NA |
| Manufacturing Tooling Tech | | 4 | | 4 | 0 | 0% | 0 | | NA |
| Product Design | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Quality Engineering Technology | | | 2 | 2 | 1 | 50% | 1 | 100% | NA |
| Quality Technology | 49 | | | 49 | 14 | 29% | 0 | 0% | NA |
| **MECHANICAL DESIGN** | | | | | | | | | |
| CAD Drafting/Tool Design Tech | | 19 | | 19 | 1 | 5% | 1 | 100% | NA |
| Mechanical Engineering Tech | | 31 | | 31 | 5 | 16% | 2 | 40% | NA |
| Mechanical Engineering Tech | | | 19 | 19 | 4 | 21% | 4 | 100% | $ 52,000 |
| Product Design Engineering Tech | | | 22 | 22 | 3 | 14% | 3 | 100% | $ 49,167 |
| **PLASTICS & RUBBER** | | | | | | | | | |
| Plastics Engineering Tech | | | 26 | 26 | 4 | 15% | 4 | 100% | $ 56,434 |
| Plastics Technology | | 7 | | 7 | 0 | 0% | 0 | | NA |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Plastics/Polymer Engineering Technology | | 11 | | 11 | 1 | 9% | 1 | 100% | NA |
| Rubber Engineering Technology | | | 3 | 3 | 0 | 0% | 0 | | NA |
| **PRINTING & IMAGING TECHNOLOGY MGMT** | | | | | | | | | |
| New Media Printing and Publishing | | | 3 | 3 | 0 | 0% | 0 | | NA |
| Print/Digital Graphic Img Tech | | 10 | | 10 | 1 | 10% | 1 | 100% | NA |
| Printing Management | | | 9 | 9 | 3 | 33% | 3 | 100% | $ 33,067 |
| **SURVEYING** | | | | | | | | | |
| Positioning for Hydrographic Surveying | 1 | | | 1 | 1 | 100% | 1 | 100% | NA |
| Surveying Engineering | | | 13 | 13 | 0 | 0% | 0 | | NA |
| Surveying Technology | | 4 | | 4 | 0 | 0% | 0 | | NA |
| **WELDING ENGINEERING TECHNOLOGY** | | | | | | | | | |
| Welding Engineering Technology | | | 33 | 33 | 32 | 97% | 32 | 100% | $ 63,405 |
| Welding Technology | | 39 | | 39 | 8 | 21% | 7 | 88% | $ 42,000 |
| **Eng. Tech TOTAL** | **114** | **311** | **396** | **821** | **200** | **24%** | **148** | **74%** | **Not Calculated** |

# 2012/2013 Graduate Follow Up Survey Summary

## College: Health Professions

| | Degrees | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **HEALTH PROFESSIONS** | **CERT** | **AAS** | **BS** | **BSN** | **MSN** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **CLIN LAB, RESP CARE & HEALTH ADM.** | | | | | | | | | | | |
| Gerontology | 5 | | | | | 5 | 1 | 20% | 0 | 0% | NA |
| Health Care Systems Admin | | | 88 | | | 88 | 32 | 36% | 30 | 94% | $ 30,630 |
| Health Information Management | | | 15 | | | 15 | 5 | 33% | 5 | 100% | $ 52,500 |
| Health Information Technology | | 64 | | | | 64 | 22 | 34% | 20 | 91% | $ 29,979 |
| Medical Laboratory Technology | | 1 | | | | 1 | 1 | 100% | 1 | 100% | NA |
| Medical Technology | | | 20 | | | 20 | 5 | 25% | 5 | 100% | $ 34,598 |
| Phlebotomy | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Respiratory Care | | 42 | | | | 42 | 7 | 17% | 7 | 100% | $ 39,817 |
| **DENTAL HYGIENE & MEDICAL IMAGING** | | | | | | | | | | | |
| Allied Health Science | | 17 | | | | 17 | 2 | 12% | 2 | 100% | NA |
| Allied Health Science | | | 19 | | | 19 | 6 | 32% | 6 | 100% | $ 37,388 |
| Dental Hygiene | | 40 | | | | 40 | 12 | 30% | 10 | 83% | $ 26,600 |
| Dental Hygiene | | | 19 | | | 19 | 15 | 79% | 15 | 100% | $ 43,214 |
| Diagnostic Medical Sonography | | 22 | | | | 22 | 7 | 32% | 3 | 43% | NA |
| Nuclear Medicine Technology | | | 48 | | | 48 | 11 | 23% | 9 | 82% | $ 52,000 |
| Radiography | | 38 | | | | 38 | 10 | 26% | 6 | 60% | $ 26,480 |
| **SCHOOL OF NURSING** | | | | | | | | | | | |
| Master of Science in Nursing | | | | | 20 | 20 | 7 | 35% | 7 | 100% | $ 76,143 |
| Nursing | | | 126 | | | 126 | 40 | 32% | 38 | 95% | $ 61,849 |
| Nursing - B.S.N. | | | | 62 | | 62 | 15 | 24% | 15 | 100% | $ 44,607 |
| Nursing (accelerated track) | | | 24 | | | 24 | 8 | 33% | 8 | 100% | $ 44,000 |
| Nursing Education | 2 | | | | | 2 | 2 | 100% | 0 | 0% | NA |
| **Health Professions TOTAL** | **8** | **224** | **359** | **62** | **20** | **673** | **208** | **31%** | **187** | **90%** | **Not Calculated** |

## 2012/2013 Graduate Follow Up Survey Summary

## College: Kendall College of Art and Design

| | Degrees | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **KENDALL** | **BFA** | **BS** | **MA/MFA** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **DESIGN STUDIES** | | | | | | | | | |
| Digital Media | 23 | | | 23 | 3 | 13% | 2 | 67% | $ 29,000 |
| Digital Media Dig Illustration | 2 | | | 2 | 0 | 0% | 0 | | NA |
| Furniture Design | 6 | | | 6 | 1 | 17% | 1 | 100% | NA |
| Graphic Design | 48 | | | 48 | 13 | 27% | 12 | 92% | $ 27,530 |
| Illustration | 31 | | | 31 | 4 | 13% | 4 | 100% | $ 29,000 |
| Industrial Design | 15 | | | 15 | 9 | 60% | 7 | 78% | $ 33,317 |
| Interior Design | 27 | | | 27 | 4 | 15% | 3 | 75% | $ 26,250 |
| Metals/Jewelry Design | 1 | | | 1 | 0 | 0% | 0 | | NA |
| **FINE ARTS/FOUNDATION** | | | | | | | | | |
| Art Education | 8 | | | 8 | 2 | 25% | 2 | 100% | $ 23,000 |
| Drawing | 9 | | | 9 | 1 | 11% | 1 | 100% | NA |
| Drawing with Printmaking Focus | 4 | | | 4 | 0 | 0% | 0 | | NA |
| Fine Arts Drawing | | | 2 | 2 | 1 | 50% | 1 | 100% | NA |
| Fine Arts Painting | | | 7 | 7 | 3 | 43% | 2 | 67% | NA |
| Fine Arts Photography | | | 3 | 3 | 1 | 33% | 0 | 0% | NA |
| Fine Arts Printmaking | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Fine Arts Printmaking | | | 1 | 1 | 1 | 100% | 1 | 100% | NA |
| Painting | 6 | | | 6 | 2 | 33% | 1 | 50% | NA |
| Photography | 14 | | | 14 | 6 | 43% | 4 | 67% | NA |
| Sculpture/Functional Art | 3 | | | 3 | 1 | 33% | 1 | 100% | NA |
| **LIBERAL ARTS/SCIENCE/ART HISTORY** | | | | | | | | | |
| Art History Academic Option | | 2 | | 2 | 0 | 0% | 0 | | NA |
| Art History Studio Option | | 3 | | 3 | 1 | 33% | 1 | 100% | NA |
| Master of Art Education | | | 1 | 1 | 0 | 0% | 0 | | NA |
| **Kendall TOTAL** | **198** | **5** | **14** | **217** | **53** | **24%** | **43** | **81%** | **Not Calculated** |

# 2012/2013 Graduate Follow Up Survey Summary

## Colleges: Optometry and Pharmacy

| | Degrees | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|
| **MICHIGAN COLLEGE OF OPTOMETRY** | **BS** | **OD** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **OPTOMETRY** | | | | | | | | |
| Optometry | 0 | 34 | 34 | 15 | 44% | 14 | 93% | $ 84,545 |
| **Optometry TOTAL** | **0** | **34** | **34** | **15** | **44%** | **14** | **93%** | |
| **COLLEGE OF PHARMACY** | **BS** | **PD** | | | | | | |
| **PHARMACY** | | | | | | | | |
| Pharmacy | 0 | 116 | 116 | 47 | 41% | 44 | 94% | $ 98,379 |
| **Pharmacy TOTAL** | **0** | **116** | **116** | **47** | **41%** | **44** | **94%** | **Not Calculated** |

# 2012/2013 Graduate Follow Up Survey Summary

## College: Professional & Technological Studies

| | Degree | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|
| **PROFESSIONAL & TECH STUDIES** | **BAS** | **EDD** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **CPT** | | | | | | | | |
| Community College Leadership | | 5 | 5 | 3 | 60% | 3 | 100% | NA |
| Digital Animation/Game Design | 12 | | 12 | 3 | 25% | 2 | 67% | $ 34,000 |
| Industrial Technology and Mgmt | 20 | | 20 | 6 | 30% | 6 | 100% | $ 69,667 |
| **Prof & Tech Studies TOTAL** | **32** | **5** | **37** | **12** | **32%** | **11** | **92%** | **Not Calculated** |

| Institution attended after graduating from Ferris State University | Earning Master's degree | Earning PhD or other terminal degree |
|---|---|---|
| (Blank) | 11 | 15 |
| Arcadia University | 1 | |
| Arizona State University | 1 | |
| Auburn University | 1 | |
| Baker College | 1 | |
| Bowling Green State University | 1 | |
| Cancious | | 1 |
| CMU | 4 | |
| Davenport University | 2 | |
| Florida State University | 1 | |
| GVSU | 5 | |
| Idaho State University | 1 | |
| LCC | 1 | |
| Liberty University | 1 | |
| Maryville University | 1 | |
| Michigan Tech | 1 | |
| MSU | 4 | 2 |
| Northern Illinois University | 1 | |
| Spring Arbor | 1 | |
| Springfield College | 1 | |
| SVSU | 1 | |
| University of Illinois-Chicago | 1 | |
| U-M | 1 | 1 |
| U-M Flint | | 2 |
| University of Cincinnati | 2 | |
| University of Detroit Mercy | 1 | |
| University of Florida | 1 | |
| Vermont College of Fine Arts | | 1 |
| Virginia Tech | 1 | |
| Walden University | 1 | |
| Wayne State | 1 | |
| WMU | 6 | |

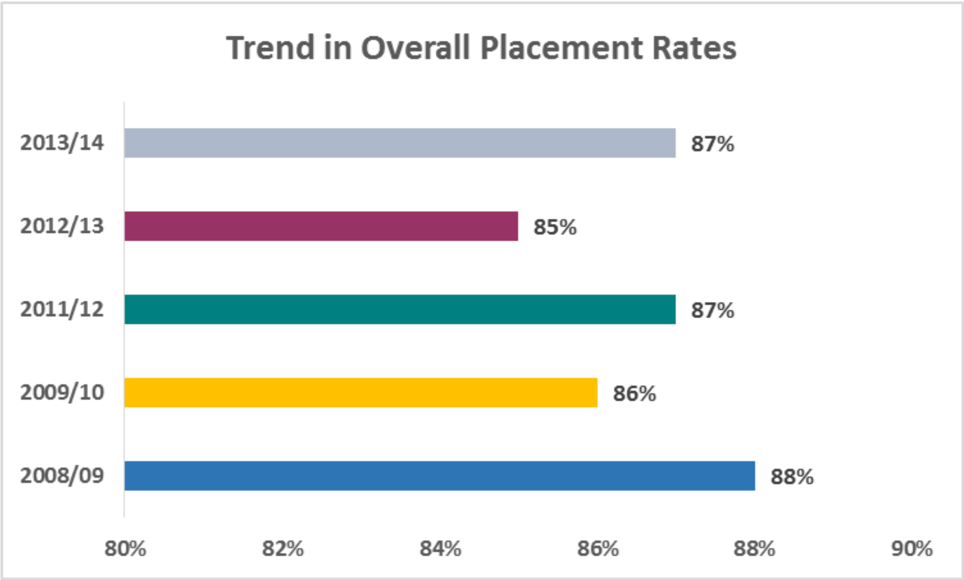


# GRADUATE FOLLOW-UP SURVEY REPORT

## 2013-2014

INSTITUTIONAL RESEARCH & TESTING
FERRIS STATE UNIVERSITY

# 2013/2014 Graduate Follow Up Survey - Overall Results




**<u>Notes</u>**

**Respondents included here are those who are employed, continuing their education full-time, or who are employed and continuing their education.**

**Salary information is provided when there are 2 or more respondents indicating a salary for the listed program.**

**Graduates are counted in the Respondents column for all programs (degree and certificate) they graduated in during 2013-2014.**

**Graduates are counted in the Employed/Continuing Education and Salary columns only for the highest degree awarded to them; in the case of multiple Bachelor's degrees, the first one listed alphabetically was counted.**

**The overall response rate for the 2013-2014 report was 27%, steady from last year's survey.**

# 2013/2014 Graduate Follow Up Survey Summary

## College: Arts & Sciences

| | Degrees | | | | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ARTS & SCIENCES** | **CERT** | **AA** | **AAS** | **AS** | **BA** | **BIS** | **BS** | **BSW** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Plcmt Rate** | **Ave Salary** |
| **BIOLOGY** | | | | | | | | | | | | | | |
| Biology | | | | | 1 | | 37 | | 38 | 13 | 34% | 12 | 92% | $ 26,700 |
| Biology/Environmental | | | | | | | 4 | | 4 | 1 | 25% | 1 | 100% | NA |
| Biology/Forensic | | | | | | | 18 | | 18 | 7 | 39% | 7 | 100% | $ 21,520 |
| Biology/Pre-Dentistry | | | | | | | 2 | | 2 | 0 | 0% | 0 | | NA |
| Biology/Pre-Medicine | | | | | | | 11 | | 11 | 3 | 27% | 2 | 67% | NA |
| Biology/Pre-Optometry | | | | | | | 9 | | 9 | 4 | 44% | 4 | 100% | NA |
| Biology/Pre-Phys Therapy | | | | | | | 9 | | 9 | 1 | 11% | 1 | 100% | NA |
| Biology/Pre-Veterinary | | | | | | | 2 | | 2 | 1 | 50% | 1 | 100% | NA |
| Biotechnology | | | | | | | 10 | | 10 | 5 | 50% | 3 | 60% | $ 31,500 |
| Ornamental Horticulture Tech | | | 2 | | | | | | 2 | 1 | 50% | 1 | 100% | NA |
| Pre-Science | | | | 56 | | | | | 56 | 14 | 25% | 12 | 86% | NA |
| **COLLEGE OF ARTS & SCIENCES** | | | | | | | | | | | | | | |
| Integrative Studies | | | | | | 58 | | | 58 | 12 | 21% | 9 | 75% | $ 35,133 |
| **HUMANITIES** | | | | | | | | | | | | | | |
| Applied Speech Communication | | 3 | | | | | | | 3 | 2 | 67% | 2 | 100% | NA |
| Applied Speech Communication | | | | | | | 7 | | 7 | 1 | 14% | 1 | 100% | NA |
| Communication | | | | | 2 | | | | 2 | 1 | 50% | 1 | 100% | NA |
| History | | | | | 5 | | | | 5 | 2 | 40% | 0 | 0% | NA |
| Sports Communication | 3 | | | | | | | | 3 | 0 | 0% | 0 | | NA |
| **LANGUAGE & LITERATURE** | | | | | | | | | | | | | | |
| English | | | | | 7 | | | | 7 | 1 | 14% | 1 | 100% | NA |
| Journalism | 1 | | | | | | | | 1 | 1 | 100% | 0 | 0% | NA |
| Journalism & Tech Comm | | | | | | | 2 | | 2 | 1 | 50% | 1 | 100% | NA |
| Liberal Arts | | 10 | | | | | | | 10 | 1 | 10% | 0 | 0% | NA |
| Tech-Prof Communication | | | | | | | 5 | | 5 | 0 | 0% | 0 | | NA |
| **MATHEMATICS** | | | | | | | | | | | | | | |
| Applied Math/Actuarial Science | | | | | | | 6 | | 6 | 0 | 0% | 0 | | NA |
| Applied Math/Computer Science | | | | | | | 3 | | 3 | 1 | 33% | 1 | 100% | NA |
| Applied Math/Industrial | | | | | | | 1 | | 1 | 0 | 0% | 0 | | NA |
| Applied Math/Operations Resch | | | | | | | 2 | | 2 | 0 | 0% | 0 | | NA |
| Applied Math/Statistics | | | | | | | 1 | | 1 | 0 | 0% | 0 | | NA |
| Applied Mathematics | | | | | | | 1 | | 1 | 1 | 100% | 1 | 100% | NA |
| **PHYSICAL SCIENCES** | | | | | | | | | | | | | | |
| Biochemistry | | | | | 3 | | | | 3 | 0 | 0% | 0 | | NA |
| Chemistry | | | | | 12 | | | | 12 | 3 | 25% | 2 | 67% | NA |
| Industrial Chemistry Technology | | | 11 | | | | | | 11 | 3 | 27% | 1 | 33% | NA |
| **SOCIAL SCIENCES** | | | | | | | | | | | | | | |
| Political Science | | | | | | | 3 | | 3 | 1 | 33% | 1 | 100% | NA |
| Psychology | | | | | | | 28 | | 28 | 10 | 36% | 10 | 100% | $ 19,625 |
| Social Work - BSW | | | | | | | | 56 | 56 | 16 | 29% | 15 | 94% | $ 26,021 |
| Sociology | | | | | 1 | | | | 1 | 0 | 0% | 0 | | NA |
| **Arts & Sciences TOTAL** | **4** | **13** | **13** | **56** | **31** | **58** | **161** | **56** | **392** | **107** | **27%** | **90** | **84%** | **Not Calculated** |

# 2013/2014 Graduate Follow Up Survey Summary

## College: Business

| | Degrees | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **BUSINESS** | **CERT** | **AAS** | **BB/BS** | **MBA** | **MISI/MISM** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **ACCOUNTING, FINANCE, INFO SYSTEMS** | | | | | | | | | | | |
| Accountancy | | 5 | | | | 5 | 1 | 20% | 1 | 100% | NA |
| Accountancy | | | 5 | | | 5 | 1 | 20% | 1 | 100% | NA |
| Accountancy/Computer Info Systems | | | 2 | | | 2 | 1 | 50% | 1 | 100% | NA |
| Accountancy/Finance | | | 3 | | | 3 | 1 | 33% | 1 | 100% | NA |
| Accountancy/Prof Directed Conc | | | 4 | | | 4 | 2 | 50% | 1 | 50% | NA |
| Accountancy/Public Accounting | | | 41 | | | 41 | 14 | 34% | 12 | 86% | $ 34,080 |
| Adv Studies Bus Intel & Infmts | 2 | | | | | 2 | 1 | 50% | 0 | 0% | NA |
| Adv Studies Business Intelligence | 3 | | | | | 3 | 3 | 100% | 0 | 0% | NA |
| Adv Studies Info Sec/Net Mgmt | 1 | | | | | 1 | 1 | 100% | 0 | 0% | NA |
| Adv Studies Project Mgmt | 14 | | | | | 14 | 7 | 50% | 0 | 0% | NA |
| Computer Information Systems | | | 24 | | | 24 | 8 | 33% | 8 | 100% | $ 54,694 |
| Computer Information Technology | | | 10 | | | 10 | 7 | 70% | 6 | 86% | $ 44,000 |
| Finance | | | 7 | | | 7 | 2 | 29% | 2 | 100% | $ 52,500 |
| Finance Corp Acct Conc | | | 1 | | | 1 | 1 | 100% | 0 | 0% | NA |
| Finance Investment Conc | | | 2 | | | 2 | 2 | 100% | 2 | 100% | $ 23,500 |
| Finance Real Estate Conc | | | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Homeland Sec Dig Sec/Forensics (LE) | 1 | | | | | 1 | 1 | 100% | 1 | 100% | NA |
| Homeland Sec Dig Sec/Forensics (TECH) | 2 | | | | | 2 | 0 | 0% | 0 | | NA |
| Info Security and Intelligence | | | 29 | | | 29 | 9 | 31% | 5 | 56% | $ 37,375 |
| Info Security and Intelligence | | | | | 12 | 12 | 7 | 58% | 7 | 100% | $ 57,983 |
| Masters of Information Systems Management | | | | | 1 | 1 | 1 | 100% | 0 | 0% | NA |
| Project Management | 2 | | | | | 2 | 1 | 50% | 0 | 0% | NA |
| **MANAGEMENT** | | | | | | | | | | | |
| Adv Studies Design/Innovation | 6 | | | | | 6 | 3 | 50% | 3 | 100% | $ 70,067 |
| Adv Studies Global Logistics | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Adv Studies Incident Response | 9 | | | | | 9 | 5 | 56% | 0 | 0% | NA |
| Adv Studies Mgt Tools/Concepts | 19 | | | | | 19 | 12 | 63% | 0 | 0% | NA |
| BUAD w/Professional Tracks | | | 47 | | | 47 | 18 | 38% | 16 | 89% | $ 41,665 |
| Business Administration | | | 127 | | | 127 | 28 | 22% | 26 | 93% | $ 34,961 |
| Business Administration-Aviation | | | 1 | | | 1 | 1 | 100% | 1 | 100% | NA |
| Business Administration-Maritime | | | 33 | | | 33 | 7 | 21% | 6 | 86% | $ 80,000 |
| Fleet Management | 2 | | | | | 2 | 1 | 50% | 0 | 0% | NA |
| General Business | | 13 | | | | 13 | 1 | 8% | 1 | 100% | NA |
| Human Resource Management | 10 | | | | | 10 | 4 | 40% | 1 | 25% | NA |
| Human Resource Management | | | 9 | | | 9 | 1 | 11% | 1 | 100% | NA |
| International Business | 3 | | | | | 3 | 2 | 67% | 0 | 0% | NA |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Leadership & Supervision | 11 | | | | | 11 | 5 | 45% | 0 | 0% | NA |
| Legal Studies | | 11 | | | | 11 | 4 | 36% | 1 | 25% | NA |
| Management | | | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Manufacturing Operations | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Masters of Business Administration | | | | 34 | | 34 | 21 | 62% | 20 | 95% | $ 64,511 |
| MBA-Pharm D | | | | 1 | | 1 | 0 | 0% | 0 | | NA |
| Operations/Supply Management | | | 4 | | | 4 | 1 | 25% | 1 | 100% | NA |
| Small Business Mgmt | 3 | | | | | 3 | 1 | 33% | 0 | 0% | NA |
| Supervision | 2 | | | | | 2 | 0 | 0% | 0 | | NA |
| **MARKETING** | | | | | | | | | | | |
| Advertising/Integrated Mktg Comm | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Advertising/Integrated Mktg Comm | | | 18 | | | 18 | 5 | 28% | 5 | 100% | $ 37,500 |
| Business to Business Marketing | 2 | | | | | 2 | 1 | 50% | 0 | 0% | NA |
| Data Mining | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Direct Marketing | 1 | | | | | 1 | 1 | 100% | 0 | 0% | NA |
| E-Commerce Marketing | 2 | | | | | 2 | 0 | 0% | 0 | | NA |
| Graphic Communication | | 2 | | | | 2 | 0 | 0% | 0 | | NA |
| Graphic Design | | 13 | | | | 13 | 1 | 8% | 0 | 0% | NA |
| Graphic Design | | | 14 | | | 14 | 5 | 36% | 5 | 100% | $ 44,750 |
| Graphic Media Mgmt | | | 7 | | | 7 | 3 | 43% | 3 | 100% | $ 32,435 |
| Marketing | 3 | | | | | 3 | 0 | 0% | 0 | | NA |
| Marketing | | | 32 | | | 32 | 4 | 13% | 4 | 100% | $ 41,888 |
| Public Relations | 2 | | | | | 2 | 0 | 0% | 0 | | NA |
| Public Relations | | | 9 | | | 9 | 1 | 11% | 1 | 100% | NA |
| **SPORT, ENTERTAINMENT, & HOSPITALITY** | | | | | | | | | | | |
| Club Management | 2 | | | | | 2 | 0 | 0% | 0 | | NA |
| Culinary Management | 4 | | | | | 4 | 0 | 0% | 0 | | NA |
| Dietary & Food Svc Mgmt | | 1 | | | | 1 | 0 | 0% | 0 | | NA |
| Hotel Management | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Hotel Management | | | 9 | | | 9 | 2 | 22% | 2 | 100% | $ 30,496 |
| Mktg/Professional Tennis Mgmt | | | 3 | | | 3 | 0 | 0% | 0 | | NA |
| Music Industry Management | | | 55 | | | 55 | 11 | 20% | 9 | 82% | $ 20,286 |
| Professional Golf Management | | | 36 | | | 36 | 8 | 22% | 8 | 100% | $ 30,714 |
| Professional Tennis Management | | | 7 | | | 7 | 2 | 29% | 2 | 100% | NA |
| Resort Management | | | 15 | | | 15 | 5 | 33% | 5 | 100% | $ 27,750 |
| Restaurant and Food Ind Mgmt | 3 | | | | | 3 | 1 | 33% | 0 | 0% | NA |
| Restaurant and Food Ind Mgmt | | 16 | | | | 16 | 2 | 13% | 2 | 100% | NA |
| Special Event/Meeting Planning | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Sport/Spa/Entertain Operations | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| **Business TOTAL** | **116** | **61** | **556** | **35** | **13** | **781** | **238** | **30%** | **171** | **72%** | **Not Calculated** |

# 2013/2014 Graduate Follow Up Survey Summary

## College: Education and Human Services

| | Degrees | | | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **EDUCATION & HUMAN SERVICES** | **CERT** | **AA/AS** | **BAS/BS** | **MED** | **MS** | **MSCJ** | **MTE** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **CRIMINAL JUSTICE** | | | | | | | | | | | | | |
| Criminal Justice Admin | | | | | | 25 | | 25 | 10 | 40% | 9 | 90% | $ 40,638 |
| Criminal Justice-Corrections | | | 16 | | | | | 16 | 5 | 31% | 3 | 60% | $ 37,000 |
| Criminal Justice-Generalist | | | 296 | | | | | 296 | 59 | 20% | 48 | 81% | $ 36,660 |
| Criminal Justice-Law Enforcement | | | 42 | | | | | 42 | 9 | 21% | 9 | 100% | $ 35,149 |
| Pre-Criminal Justice | | 52 | | | | | | 52 | 12 | 23% | 5 | 42% | NA |
| **LEISURE STUDIES & WELLNESS** | | | | | | | | | | | | | |
| Recreation Leadership and Mgt | | | 15 | | | | | 15 | 4 | 27% | 3 | 75% | NA |
| **SCHOOL OF EDUCATION** | | | | | | | | | | | | | |
| Art Education | 1 | | | | | | | 1 | 0 | 0% | 0 | | NA |
| Biology Education | | | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Career & Technical Education (all tracks) | | | | | | | 18 | 18 | 10 | 56% | 9 | 90% | $ 57,563 |
| Chemistry Education | | | 2 | | | | | 2 | 1 | 50% | 1 | 100% | NA |
| Curriculum & Instruction (all tracks) | | | | 31 | | | | 31 | 13 | 42% | 13 | 100% | $ 41,475 |
| Early Childhood Education | | 5 | | | | | | 5 | 0 | 0% | 0 | | NA |
| Early Childhood Education | | | 24 | | | | | 24 | 4 | 17% | 4 | 100% | $ 36,233 |
| Educational Leadership | | | | | 4 | | | 4 | 1 | 25% | 1 | 100% | NA |
| Elementary Education | | | 61 | | | | | 61 | 21 | 34% | 21 | 100% | $ 27,400 |
| English Education | | | 2 | | | | | 2 | 0 | 0% | 0 | | NA |
| History Education | | | 7 | | | | | 7 | 0 | 0% | 0 | | NA |
| Mathematics Education | | | 6 | | | | | 6 | 2 | 33% | 2 | 100% | $ 21,889 |
| Pre-Teaching Secondary | | 1 | | | | | | 1 | 0 | 0% | 0 | | NA |
| Pro-Mo-TEd Technical Education | | | 1 | | | | | 1 | 1 | 100% | 1 | 100% | NA |
| Social Studies & Elementary Education | | | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Social Studies Education | | | 7 | | | | | 7 | 2 | 29% | 2 | 100% | NA |
| Technical Education | | | 2 | | | | | 2 | 0 | 0% | 0 | | NA |
| Total Quality Mgmt in Education | 2 | | | | | | | 2 | 1 | 50% | 0 | 0% | NA |
| **TELEVISION & DIGITAL MEDIA PRODUCTION** | | | | | | | | | | | | | |
| Digital Animation/Game Design | | | 21 | | | | | 21 | 5 | 24% | 4 | 80% | $ 35,500 |
| Digital Media Software Engineering | | | 4 | | | | | 4 | 4 | 100% | 3 | 75% | $ 55,667 |
| Television/Digital Media Prod | | | 27 | | | | | 27 | 3 | 11% | 3 | 100% | $ 25,140 |
| **Education and Human Svcs TOTAL** | **3** | **58** | **535** | **31** | **4** | **25** | **18** | **674** | **167** | **25%** | **141** | **84%** | **Not Calculated** |

# 2013/2014 Graduate Follow Up Survey Summary

## College: Engineering Technology

| | Degrees | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ENGINEERING TECHNOLOGY** | **CERT** | **AAS** | **BAS/BS** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **ARCHITECURAL TECH & FACILITIES MGMT** | | | | | | | | | |
| Architectural Technology | | 24 | | 24 | 2 | 8% | 2 | 100% | NA |
| Architecture & Sustainability | | | 12 | 12 | 0 | 0% | 0 | | NA |
| Facility Management | 4 | | | 4 | 0 | 0% | 0 | | NA |
| Facility Management | | | 12 | 12 | 3 | 25% | 1 | 33% | NA |
| **AUTOMOTIVE** | | | | | | | | | |
| Automotive Engineering Tech | | | 30 | 30 | 5 | 17% | 5 | 100% | $ 53,400 |
| Automotive Management | | | 16 | 16 | 6 | 38% | 6 | 100% | $ 42,080 |
| Automotive Management (2+2) | | | 1 | 1 | 0 | 0% | 0 | | NA |
| Automotive Service Technology | | 14 | | 14 | 0 | 0% | 0 | | NA |
| Automotive/Heavy Equipment Mgt | | | 1 | 1 | 0 | 0% | 0 | | NA |
| Performance Machining | 16 | | | 16 | 2 | 13% | 0 | 0% | NA |
| Performance Motorsports | 40 | | | 40 | 6 | 15% | 1 | 17% | NA |
| **CONSTRUCTION TECHNOLOGY & MGMT** | | | | | | | | | |
| Building Construction Tech | | 27 | | 27 | 6 | 22% | 2 | 33% | $ 24,000 |
| Civil Engineering Technology | | 14 | | 14 | 3 | 21% | 0 | 0% | NA |
| Construction Management (all inclusive) | | | 43 | 43 | 13 | 30% | 12 | 92% | $ 43,187 |
| **ELECTRONICS/CNS** | | | | | | | | | |
| Computers Networks and Systems | | | 9 | 9 | 0 | 0% | 0 | | NA |
| Electrical/Electronic Eng Tech | | | 7 | 7 | 1 | 14% | 1 | 100% | NA |
| Industrial Electronics Tech | | 12 | | 12 | 0 | 0% | 0 | | NA |
| **ENERGY SYSTEMS ENGINEERING** | | | | | | | | | |
| Energy Systems Engineering | | | 3 | 3 | 0 | 0% | 0 | | NA |
| **HEAVY EQUIPMENT** | | | | | | | | | |
| Electrical Power Generation | 1 | | | 1 | 1 | 100% | 0 | 0% | NA |
| Heavy Equip Service Eng Tech | | | 10 | 10 | 2 | 20% | 2 | 100% | $ 52,500 |
| Heavy Equipment Technology | | 35 | | 35 | 8 | 23% | 7 | 88% | $ 36,920 |
| **HVACR** | | | | | | | | | |
| HVACR Eng Tech & Energy Mgmt | | | 14 | 14 | 7 | 50% | 7 | 100% | $ 57,357 |
| HVACR Engineering Technology | | | 25 | 25 | 6 | 24% | 6 | 100% | $ 62,109 |
| HVACR Technology | | 20 | | 20 | 2 | 10% | 2 | 100% | $ 42,500 |
| **MANUFACTURING ENGINEERING TECH** | | | | | | | | | |
| Basic CNC Prog & Machine Operations | 4 | | | 4 | 2 | 50% | 0 | 0% | NA |
| Industrial Practices | 3 | | | 3 | 1 | 33% | 0 | 0% | NA |
| Industrial Technology & Management | | | 9 | 9 | 3 | 33% | 3 | 100% | $ 86,000 |
| Manufacturing Engineering Tech | | | 20 | 20 | 5 | 25% | 5 | 100% | $ 69,075 |
| Manufacturing Technology | | 7 | | 7 | 4 | 57% | 4 | 100% | NA |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Manufacturing Tooling Tech | | 3 | | 3 | 0 | 0% | 0 | | | NA |
| Product Design | 7 | | | 7 | 0 | 0% | 0 | | | NA |
| Quality Engineering Technology | | | 8 | 8 | 4 | 50% | 4 | 100% | $ | 78,625 |
| Quality Technology | 68 | | | 68 | 14 | 21% | 3 | 21% | $ | 61,667 |
| **MECHANICAL DESIGN** | | | | | | | | | | |
| CAD Drafting/Tool Design Tech | | 12 | | 12 | 3 | 25% | 3 | 100% | | NA |
| Mechanical Engineering Tech | | 34 | | 34 | 3 | 9% | 1 | 33% | | NA |
| Mechanical Engineering Tech | | | 21 | 21 | 7 | 33% | 7 | 100% | $ | 53,660 |
| Product Design Engineering Tech | | | 14 | 14 | 5 | 36% | 4 | 80% | $ | 56,500 |
| **PLASTICS & RUBBER** | | | | | | | | | | |
| Plastics Engineering Tech | | | 21 | 21 | 4 | 19% | 4 | 100% | $ | 57,558 |
| Plastics Technology | | 5 | | 5 | 2 | 40% | 1 | 50% | | NA |
| Plastics/Polymer Engineering Technology | | 27 | | 27 | 4 | 15% | 4 | 100% | $ | 59,667 |
| Rubber Engineering Technology | | | 3 | 3 | 1 | 33% | 1 | 100% | | NA |
| Rubber Technology | | 1 | | 1 | 0 | 0% | 0 | | | NA |
| **PRINTING & IMAGING TECHNOLOGY MGMT** | | | | | | | | | | |
| New Media Printing and Publishing | | | 3 | 3 | 1 | 33% | 1 | 100% | | NA |
| Print/Digital Graphic Img Tech | | 5 | | 5 | 1 | 20% | 0 | 0% | | NA |
| Printing Management | | | 3 | 3 | 0 | 0% | 0 | | | NA |
| **SURVEYING** | | | | | | | | | | |
| Geographic Information Systems | 7 | | | 7 | 1 | 14% | 1 | 100% | | NA |
| Positioning for Hydrographic Surveying | 3 | | | 3 | 0 | 0% | 0 | | | NA |
| Surveying Engineering | 1 | | | 1 | 0 | 0% | 0 | | | NA |
| Surveying Engineering | | | 11 | 11 | 4 | 36% | 4 | 100% | $ | 37,867 |
| Surveying Technology | | 4 | | 4 | 2 | 50% | 0 | 0% | | NA |
| **WELDING ENGINEERING TECHNOLOGY** | | | | | | | | | | |
| Welding Engineering Technology | | | 40 | 40 | 39 | 98% | 38 | 97% | $ | 63,372 |
| Welding Technology | | 46 | | 46 | 7 | 15% | 7 | 100% | $ | 78,260 |
| **Eng. Tech TOTAL** | **154** | **290** | **336** | **780** | **190** | **24%** | **149** | **78%** | | **Not Calculated** |

# 2013/2014 Graduate Follow Up Survey Summary

## College: Health Professions

| | Degrees | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **HEALTH PROFESSIONS** | **CERT** | **AAS** | **BS** | **BSN** | **MSN** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **CLIN LAB, RESP CARE & HEALTH ADM.** | | | | | | | | | | | |
| Gerontology | 11 | | | | | 11 | 1 | 9% | 0 | 0% | NA |
| Health Care Systems Admin | | | 114 | | | 114 | 29 | 25% | 24 | 83% | $ 34,131 |
| Health Information Management | | | 19 | | | 19 | 9 | 47% | 8 | 89% | $ 36,543 |
| Health Information Technology | | 46 | | | | 46 | 12 | 26% | 8 | 67% | $ 24,000 |
| Medical Laboratory Science | | | 18 | | | 18 | 6 | 33% | 6 | 100% | $ 45,553 |
| Medical Laboratory Technology | | 5 | | | | 5 | 1 | 20% | 1 | 100% | NA |
| Medical Technology | | | 2 | | | 2 | 2 | 100% | 2 | 100% | $ 48,250 |
| Molecular Diagnostics | | | 5 | | | 5 | 1 | 20% | 1 | 100% | NA |
| Respiratory Care | | 24 | | | | 24 | 5 | 21% | 4 | 80% | NA |
| **DENTAL HYGIENE & MEDICAL IMAGING** | | | | | | | | | | | |
| Allied Health Science | | 16 | | | | 16 | 2 | 13% | 2 | 100% | NA |
| Allied Health Science | | | 28 | | | 28 | 10 | 36% | 9 | 90% | $ 45,429 |
| Dental Hygiene | | 38 | | | | 38 | 9 | 24% | 8 | 89% | $ 38,333 |
| Dental Hygiene | | | 15 | | | 15 | 5 | 33% | 5 | 100% | $ 34,000 |
| Diagnostic Medical Sonography | | 20 | | | | 20 | 8 | 40% | 3 | 38% | $ 42,000 |
| Nuclear Medicine Technology | | | 35 | | | 35 | 8 | 23% | 7 | 88% | $ 26,775 |
| Radiography | | 42 | | | | 42 | 11 | 26% | 9 | 82% | $ 34,083 |
| **SCHOOL OF NURSING** | | | | | | | | | | | |
| Master of Science in Nursing | | | | | 25 | 25 | 12 | 48% | 12 | 100% | $ 72,202 |
| Nursing | | | 131 | | | 131 | 49 | 37% | 47 | 96% | $ 58,463 |
| Nursing - B.S.N. | | | | 64 | | 64 | 23 | 36% | 21 | 91% | $ 46,259 |
| Nursing (accelerated track) | | | 23 | | | 23 | 10 | 43% | 10 | 100% | $ 44,200 |
| **Health Professions TOTAL** | **11** | **191** | **390** | **64** | **25** | **681** | **213** | **31%** | **187** | **88%** | **Not Calculated** |

# 2013/2014 Graduate Follow Up Survey Summary

## College: Kendall College of Art and Design

| | Degrees | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **KENDALL** | **BFA** | **BS** | **MA/MFA** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **DESIGN STUDIES** | | | | | | | | | |
| Digital Media | 30 | | | 30 | 9 | 30% | 7 | 78% | $ 26,603 |
| Furniture Design | 6 | | | 6 | 0 | 0% | 0 | | NA |
| Graphic Design | 52 | | | 52 | 12 | 23% | 10 | 83% | $ 42,667 |
| Illustration | 44 | | | 44 | 3 | 7% | 2 | 67% | NA |
| Industrial Design | 8 | | | 8 | 2 | 25% | 2 | 100% | NA |
| Interior Design | 23 | | | 23 | 6 | 26% | 5 | 83% | $ 27,627 |
| Medical Illustration | 3 | | | 3 | 1 | 33% | 1 | 100% | NA |
| **FINE ARTS/FOUNDATION** | | | | | | | | | |
| Art Education | 11 | | | 11 | 2 | 18% | 2 | 100% | $ 21,000 |
| Drawing | 7 | | | 7 | 1 | 14% | 1 | 100% | NA |
| Drawing with Printmaking Focus | 4 | | | 4 | 0 | 0% | 0 | | NA |
| Fine Arts Drawing | | | 3 | 3 | 1 | 33% | 1 | 100% | NA |
| Fine Arts Painting | | | 3 | 3 | 2 | 67% | 2 | 100% | NA |
| Fine Arts Photography | | | 3 | 3 | 1 | 33% | 1 | 100% | NA |
| Fine Arts Printmaking | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Fine Arts Printmaking | | | 1 | 1 | 1 | 100% | 1 | 100% | NA |
| Painting | 5 | | | 5 | 1 | 20% | 0 | 0% | NA |
| Photography | 12 | | | 12 | 3 | 25% | 3 | 100% | $ 25,333 |
| Printmaking | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Sculpture/Functional Art | 3 | | | 3 | 0 | 0% | 0 | | NA |
| **LIBERAL ARTS/SCIENCE/ART HISTORY** | | | | | | | | | |
| Art History Academic Option | | 1 | | 1 | 1 | 100% | 0 | 0% | NA |
| Art History Studio Option | | 4 | | 4 | 0 | 0% | 0 | | NA |
| Master of Art Education | | | 1 | 1 | 1 | 100% | 1 | 100% | NA |
| **Kendall TOTAL** | **210** | **5** | **11** | **226** | **47** | **21%** | **39** | **83%** | **Not Calculated** |

## 2013/2014 Graduate Follow Up Survey Summary

### Colleges: Optometry and Pharmacy

| | Degrees | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|
| **MICHIGAN COLLEGE OF OPTOMETRY** | **BS** | **OD** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **OPTOMETRY** | | | | | | | | |
| Optometry | | 39 | 39 | 15 | 38% | 14 | 93% | $ 76,333 |
| Vision Science | 6 | | 6 | 3 | 50% | 3 | 100% | NA |
| **Optometry TOTAL** | **6** | **39** | **45** | **3** | **7%** | **3** | **100%** | **Not Calculated** |
| **COLLEGE OF PHARMACY** | **BS** | **PD** | | | | | | |
| **PHARMACY** | | | | | | | | |
| Pharmacy | | 139 | 139 | 47 | 34% | 46 | 98% | $ 95,266 |
| **Pharmacy TOTAL** | **0** | **139** | **139** | **47** | **34%** | **46** | **98%** | **Not Calculated** |

# 2013/2014 Graduate Follow Up Survey Summary

## College: Professional & Technological Studies

| | Degree | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|
| **PROFESSIONAL & TECH STUDIES** | **BAS** | **EDD** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **CPT** | | | | | | | | |
| Community College Leadership | | 8 | 8 | 4 | 50% | 4 | 100% | $ 81,250 |
| Digital Animation/Game Design | 1 | | 1 | 0 | 0% | 0 | | NA |
| **Prof & Tech Studies TOTAL** | **1** | **8** | **9** | **4** | **44%** | **4** | **100%** | **Not Calculated** |

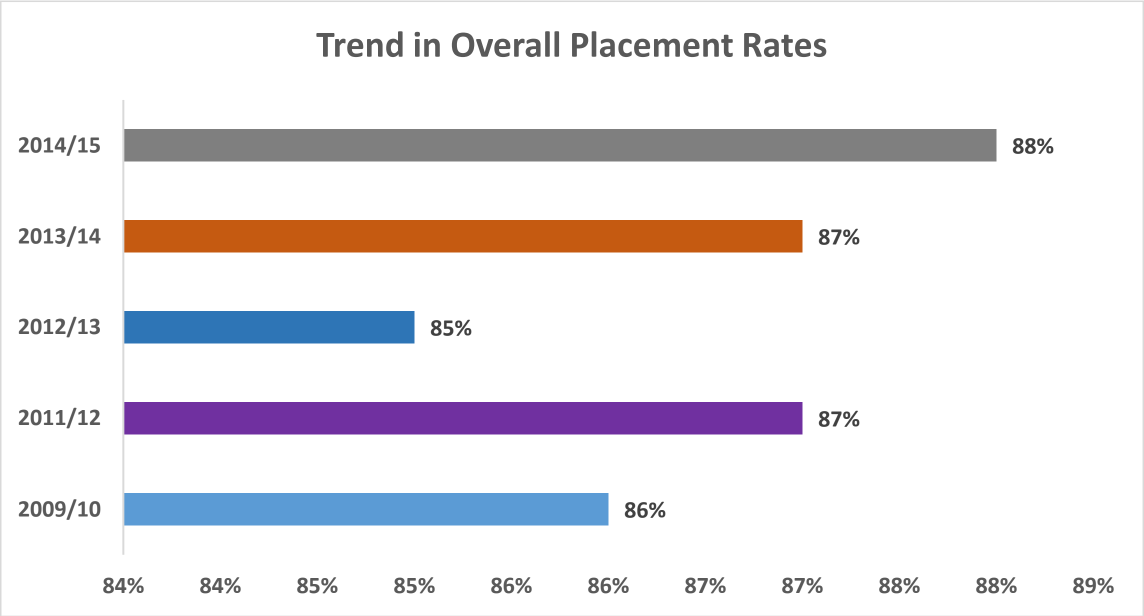
| Institution attended after graduating from Ferris State University | Earning Master's degree | Earning PhD or other terminal degree |
|---|---|---|
| (Blank) | 13 | 15 |
| American Sentinel University | 2 | |
| Arizona State University | 1 | |
| Baker Graduate School | 1 | |
| Central Michigan University | 9 | 2 |
| Davenport University | 2 | |
| Eastern Michigan University | 2 | |
| Grand Valley State University | 2 | |
| Illinois College of Optometry | | 1 |
| Indiana State University | 2 | |
| Indiana Wesleyan University | 1 | |
| iUSO | | 1 |
| Lawrence Technological University | 1 | |
| Lipscomb University | | 1 |
| Louisiana State University-Capella | 1 | |
| Massachusetts College of Pharmacy & Health Sciences | | 1 |
| Mott Community College | 1 | |
| Michigan State University | 4 | 1 |
| Northwood University | 1 | |
| Nova Southwestern | 1 | |
| Oakland Community College | 1 | |
| Oakland University | 2 | 1 |
| Pennsylvania State University | 1 | |
| Purdue University | 1 | |
| Southern New Hampshire University | 2 | |
| Texas A&M-Corpus Christi | 1 | |
| University of Alabama-Huntsville | 1 | |
| University of Barcelona | 1 | |
| University of California-Davis | 1 | |
| University of Detroit Mercy | 2 | |
| University of Findlay | 1 | |
| University of Louisiana-Monroe | 1 | |
| University of Michigan | 3 | 1 |
| University of Michigan Flint | 2 | |
| University of Notre Dame | 1 | |
| University of Phoenix | 1 | |
| Walden University | 3 | |
| Wayne State University | 1 | |
| Western Governors University | 1 | |
| Western Michigan University | | 1 |
| Wolford College | 1 | |


# GRADUATE FOLLOW-UP SURVEY REPORT

2014-2015

INSTITUTIONAL RESEARCH & TESTING
FERRIS STATE UNIVERSITY

## 2014/2015 Graduate Follow Up Survey - Overall Results




**<u>Notes</u>**

**Respondents included here are those who are employed, continuing their education full-time, or who are employed and continuing their education.**

**Salary information is provided when there are 2 or more respondents indicating a salary for the listed program.**

**Graduates are counted in the Respondents column for all programs (degree and certificate) they graduated in during 2013-2014.**

**Graduates are counted in the Employed/Continuing Education and Salary columns only for the highest degree awarded to them; in the case of multiple Bachelor's degrees, the first one listed alphabetically was counted.**

**The overall response rate for the 2014-2015 report was 24%.**

Institutional Research & Testing

07/01/2016

# 2014/2015 Graduate Follow Up Survey Summary

## College: Arts & Sciences

| | Degrees | | | | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ARTS & SCIENCES** | **CERT** | **AA** | **AAS** | **AS** | **BA** | **BIS** | **BS** | **BSW** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Plcmt Rate** | **Ave Salary** |
| **BIOLOGY** | | | | | | | | | | | | | | |
| Biology | | | | | | | 33 | | 33 | 8 | 24% | 5 | 63% | $ 28,000 |
| Biology/Environmental | | | | | | | 6 | | 6 | 3 | 50% | 3 | 100% | $ 15,423 |
| Biology/Forensic | | | | | | | 7 | | 7 | 2 | 29% | 2 | 100% | NA |
| Biology/Pre-Dentistry | | | | | | | 4 | | 4 | 1 | 25% | 1 | 100% | NA |
| Biology/Pre-Medicine | | | | | | | 7 | | 7 | 3 | 43% | 2 | 67% | NA |
| Biology/Pre-Optometry | | | | | | | 7 | | 7 | 2 | 29% | 1 | 50% | NA |
| Biology/Pre-Pharmacy | | | | | | | 16 | | 16 | 5 | 31% | 5 | 100% | $ 10,371 |
| Biology/Pre-Phys Therapy | | | | | | | 4 | | 4 | 2 | 50% | 2 | 100% | NA |
| Biology/Pre-Veterinary | | | | | | | 2 | | 2 | 0 | 0% | 0 | | NA |
| Biotechnology | | | | | | | 6 | | 6 | 1 | 17% | 1 | 100% | NA |
| Ornamental Horticulture Tech | | | 1 | | | | | | 1 | 2 | 200% | 0 | 0% | NA |
| Pre-Science | | | | 57 | | | | | 57 | 10 | 18% | 9 | 90% | $ 22,500 |
| **COLLEGE OF ARTS & SCIENCES** | | | | | | | | | | | | | | |
| Integrative Studies | | | | | | 57 | | | 57 | 15 | 26% | 13 | 87% | $ 41,311 |
| **HUMANITIES** | | | | | | | | | | | | | | |
| Applied Speech Communication | | 3 | | | | | | | 3 | 0 | 0% | 0 | | NA |
| Applied Speech Communication | | | | | | | 8 | | 8 | 2 | 25% | 2 | 100% | NA |
| Communication | | | | | 1 | | | | 1 | 0 | 0% | 0 | | NA |
| History | | | | | 7 | | | | 7 | 2 | 29% | 2 | 100% | $ 10,335 |
| **LANGUAGE & LITERATURE** | | | | | | | | | | | | | | |
| Creative Writing | 1 | | | | | | | | 1 | 0 | 0% | 0 | | NA |
| English | | | | | 4 | | | | 4 | 1 | 25% | 1 | 100% | NA |
| Journalism | 1 | | | | | | | | 1 | 0 | 0% | 0 | | NA |
| Liberal Arts | | 16 | | | | | | | 16 | 1 | 6% | 0 | 0% | NA |
| Tech-Prof Communication | | | | | | | 4 | | 4 | 1 | 25% | 1 | 100% | NA |
| Technical Writing | 1 | | | | | | | | 1 | 1 | 100% | 0 | 0% | NA |
| **MATHEMATICS** | | | | | | | | | | | | | | |
| Applied Math/Actuarial Science | | | | | | | 9 | | 9 | 3 | 33% | 3 | 100% | $ 50,000 |
| Applied Math/Computer Science | | | | | | | 2 | | 2 | 0 | 0% | 0 | | NA |
| Applied Mathematics | | | | | | | 5 | | 5 | 1 | 20% | 1 | 100% | NA |
| Computer Science | 4 | | | | | | | | 4 | 1 | 25% | 0 | 0% | NA |
| **PHYSICAL SCIENCES** | | | | | | | | | | | | | | |
| Biochemistry | | | | | 3 | | | | 3 | 1 | 33% | 1 | 100% | NA |
| Chemistry | | | | | 5 | | | | 5 | 2 | 40% | 2 | 100% | NA |
| Industrial Chemistry Technology | | | 4 | | | | | | 4 | 0 | 0% | 0 | | NA |
| **SOCIAL SCIENCES** | | | | | | | | | | | | | | |
| Political Science | | | | | | | 7 | | 7 | 1 | 14% | 1 | 100% | NA |
| Psychology | | | | | | | 39 | | 39 | 10 | 26% | 8 | 80% | $ 16,140 |
| Social Work - BSW | | | | | | | | 47 | 47 | 13 | 28% | 13 | 100% | $ 33,103 |
| Sociology | | | | | 2 | | | | 2 | 0 | 0% | 0 | | NA |
| **Arts & Sciences TOTAL** | **7** | **19** | **5** | **57** | **22** | **57** | **166** | **47** | **380** | **94** | **25%** | **79** | **84%** | **Not Calculated** |

# 2014/2015 Graduate Follow Up Survey Summary

## College: Business

| | Degrees | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BUSINESS | CERT | AAS | BB/BS | MBA | MISI | TOTAL | # Responded | % Responded | # Employed/CE | Placement Rate | Ave Salary |
| **ACCOUNTING, FINANCE, INFO SYSTEMS** | | | | | | | | | | | |
| Accountancy | | 3 | | | | 3 | 0 | 0% | 0 | | NA |
| Accountancy | | | 21 | | | 21 | 4 | 19% | 4 | 100% | $ 33,933 |
| Accountancy/Finance | | | 7 | | | 7 | 3 | 43% | 3 | 100% | $ 44,750 |
| Accountancy/Prof Directed Conc | | | 5 | | | 5 | 1 | 20% | 1 | 100% | NA |
| Accountancy/Public Accounting | | | 19 | | | 19 | 3 | 16% | 3 | 100% | $ 42,500 |
| Adv Studies Bus Intel & Infmts | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Adv Studies Busn Intelligence | 4 | | | | | 4 | 1 | 25% | 0 | 0% | NA |
| Adv Studies Project Mgmt | 15 | | | | | 15 | 6 | 40% | 2 | 33% | $ 42,000 |
| Computer Information Systems | | 2 | | | | 2 | 1 | 50% | 0 | | NA |
| Computer Information Systems | | | 30 | | | 30 | 11 | 37% | 11 | 100% | $ 60,307 |
| Computer Information Technology | | | 19 | | | 19 | 10 | 53% | 9 | 90% | $ 39,000 |
| Finance | | | 7 | | | 7 | 2 | 29% | 2 | 100% | NA |
| Finance Investment Conc | | | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Homeland Sec Dig Sec/Forensics (TECH) | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Info Security and Intelligence | | | 22 | | | 22 | 9 | 41% | 8 | 89% | $ 52,534 |
| Masters of Information Security & Intelligence | | | | | 19 | 19 | 2 | 11% | 1 | 50% | NA |
| Project Management | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| **MANAGEMENT** | | | | | | | | | | | |
| Adv Studies Design/Innovation | 20 | | | | | 20 | 5 | 25% | 3 | 60% | $ 72,500 |
| Adv Studies Global Logistics | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Adv Studies Incident Response | 11 | | | | | 11 | 1 | 9% | 0 | 0% | NA |
| Adv Studies Mgt Tools/Concepts | 8 | | | | | 8 | 3 | 38% | 0 | 0% | NA |
| BUAD w/Professional Tracks | | | 35 | | | 35 | 8 | 23% | 8 | 100% | $ 38,327 |
| Business Administration | | | 135 | | | 135 | 40 | 30% | 37 | 93% | $ 47,033 |
| Business Administration-Aviation | | | 2 | | | 2 | 0 | 0% | 0 | | NA |
| Business Administration-Maritime | | | 23 | | | 23 | 4 | 17% | 4 | 100% | $ 76,667 |
| Fleet Management | 5 | | | | | 5 | 1 | 20% | 0 | 0% | NA |
| General Business | | 14 | | | | 14 | 4 | 29% | 3 | 75% | NA |
| Human Resource Management | 16 | | | | | 16 | 6 | 38% | 4 | 67% | $ 34,250 |
| Human Resource Management | | | 8 | | | 8 | 4 | 50% | 4 | 100% | $ 51,644 |
| Insurance & Risk Management | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Insurance & Risk Management | | | 1 | | | 1 | 0 | 0% | 0 | | NA |
| International Business | 4 | | | | | 4 | 1 | 25% | 0 | 0% | NA |
| Leadership & Supervision | 19 | | | | | 19 | 5 | 26% | 0 | 0% | NA |
| Lean Systems | 2 | | | | | 2 | 1 | 50% | 1 | 100% | NA |
| Legal Studies | | 10 | | | | 10 | 1 | 10% | 0 | 0% | NA |
| Masters of Business Administration | | | | 23 | | 23 | 9 | 39% | 7 | 78% | $ 64,271 |
| Operations/Supply Management | | | 8 | | | 8 | 2 | 25% | 2 | 100% | |
| Small Business Mgmt | 3 | | | | | 3 | 4 | 133% | 0 | 0% | NA |
| **MARKETING** | | | | | | | | | | | |
| Advertising | | | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Advertising/Integrated Mktg Comm | | | 12 | | | 12 | 5 | 42% | 3 | 60% | $ 29,000 |
| Business to Business Marketing | 2 | | | | | 2 | 2 | 100% | 0 | 0% | NA |
| Data Mining | 5 | | | | | 5 | 4 | 80% | 1 | 25% | NA |
| Direct Marketing | 1 | | | | | 1 | 1 | 100% | 0 | 0% | NA |
| E-Commerce Marketing | 2 | | | | | 2 | 2 | 100% | 0 | 0% | NA |
| Graphic Communications | | 9 | | | | 9 | 0 | 0% | 0 | | NA |
| Graphic Design | | 31 | | | | 31 | 5 | 16% | 4 | 80% | NA |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Graphic Design | | | 10 | | | 10 | 3 | 30% | 2 | 67% | $ 59,500 |
| Graphic Media Mgmt | | | 13 | | | 13 | 4 | 31% | 3 | 75% | $ 31,513 |
| Marketing | | 4 | | | | 4 | 1 | 25% | 1 | 100% | NA |
| Marketing | | | 37 | | | 37 | 7 | 19% | 7 | 100% | $ 32,487 |
| Marketing Research | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Marketing Sales | 3 | | | | | 3 | 0 | 0% | 0 | | NA |
| Public Relations | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Public Relations | | | 8 | | | 8 | 2 | 25% | 2 | 100% | $ 26,500 |
| Real Estate | 3 | | | | | 3 | 0 | 0% | 0 | | NA |
| Retailing | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| **SPORT, ENTERTAINMENT, & HOSPITALITY** | | | | | | | | | | | |
| Club Management | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Culinary Management | 8 | | | | | 8 | 2 | 25% | 2 | 100% | $ 23,750 |
| Dietary & Food Svc Mgmt | | 4 | | | | 4 | 1 | 25% | 0 | 0% | NA |
| Hotel Management | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Hotel Management | | | 11 | | | 11 | 1 | 9% | 1 | 100% | NA |
| Mktg/Professional Tennis Mgmt | | | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Music Industry Management | | | 40 | | | 40 | 8 | 20% | 5 | 63% | $ 19,333 |
| Professional Golf Management | | | 28 | | | 28 | 3 | 11% | 2 | 67% | $ 28,000 |
| Professional Tennis Management | | | 17 | | | 17 | 5 | 29% | 4 | 80% | $ 34,667 |
| Resort Management | | | 16 | | | 16 | 3 | 19% | 3 | 100% | $ 24,500 |
| Restaurant and Food Ind Mgmt | 4 | | | | | 4 | 1 | 25% | 0 | 0% | NA |
| Restaurant and Food Ind Mgmt | | 9 | | | | 9 | 0 | 0% | 0 | | NA |
| Special Event/Meeting Planning | 3 | | | | | 3 | 1 | 33% | 0 | 0% | NA |
| **Business TOTAL** | **148** | **86** | **537** | **23** | **19** | **813** | **213** | **26%** | **157** | **74%** | **Not Calculated** |

# 2014/2015 Graduate Follow Up Survey Summary

## College: Education and Human Services

| | Degrees | | | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **EDUCATION & HUMAN SERVICES** | **CERT** | **AA/AS** | **BAS/BS** | **MED** | **MS** | **MSCJ** | **MTE** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **CRIMINAL JUSTICE** | | | | | | | | | | | | | |
| Criminal Justice Admin | | | | | | 19 | | 19 | 6 | 32% | 6 | 100% | $ 41,367 |
| Criminal Justice-Corrections | | | 16 | | | | | 16 | 2 | 13% | 2 | 100% | NA |
| Criminal Justice-Generalist | | | 299 | | | | | 299 | 61 | 20% | 55 | 90% | $ 35,089 |
| Criminal Justice-Law Enforcement | | | 43 | | | | | 43 | 7 | 16% | 7 | 100% | $ 42,857 |
| Pre-Criminal Justice | | 71 | | | | | | 71 | 9 | 13% | 4 | 44% | $ 17,989 |
| **LEISURE STUDIES & WELLNESS** | | | | | | | | | | | | | |
| Recreation Leadership and Mgt | | | 4 | | | | | 4 | 1 | 25% | 1 | 100% | NA |
| **SCHOOL OF EDUCATION** | | | | | | | | | | | | | |
| Biology Education | | | 4 | | | | | 4 | 1 | 25% | 1 | 100% | NA |
| Career & Technical Education (all tracks) | | | | | | | 13 | 13 | 3 | 23% | 3 | 100% | $ 58,233 |
| Curriculum & Instruction (all tracks) | | | | 27 | | | | 27 | 6 | 22% | 6 | 100% | $ 45,100 |
| Early Childhood Education | | 14 | | | | | | 14 | 2 | 14% | 1 | 50% | NA |
| Early Childhood Education | | | 27 | | | | | 27 | 11 | 41% | 11 | 100% | $ 32,460 |
| Educational Leadership | | | | | 6 | | | 6 | 1 | 17% | 1 | 100% | NA |
| Elementary Education | | | 38 | | | | | 38 | 13 | 34% | 13 | 100% | $ 33,861 |
| English Education | | | 4 | | | | | 4 | 2 | 50% | 1 | 50% | NA |
| History Education | | | 4 | | | | | 4 | 1 | 25% | 1 | 100% | NA |
| Mathematics Education | | | 3 | | | | | 3 | 1 | 33% | 1 | 100% | NA |
| Pre-Teaching Elementary | | 3 | | | | | | 3 | 0 | 0% | 0 | | NA |
| Pre-Teaching Secondary | | 1 | | | | | | 1 | 0 | 0% | 0 | | NA |
| Pro-Mo-TEd Technical Education | | | 6 | | | | | 6 | 3 | 50% | 3 | 100% | $ 59,662 |
| Social Studies Education | | | 14 | | | | | 14 | 2 | 14% | 2 | 100% | $ 34,017 |
| Technical Education | | | 1 | | | | | 1 | 0 | 0% | 0 | | NA |
| Total Quality Mgmt in Education | 1 | | | | | | | 1 | 1 | 100% | 1 | 100% | NA |
| **TELEVISION & DIGITAL MEDIA PRODUCTION** | | | | | | | | | | | | | |
| Digital Animation/Game Design | | | 20 | | | | | 20 | 2 | 10% | 1 | 50% | NA |
| Digital Media Software Engineering | | | 4 | | | | | 4 | 1 | 25% | 1 | 100% | NA |
| Television/Digital Media Prod | | | 21 | | | | | 21 | 7 | 33% | 5 | 71% | $ 22,417 |
| **Education and Human Svcs TOTAL** | **1** | **89** | **508** | **27** | **6** | **19** | **13** | **663** | **143** | **22%** | **127** | **89%** | **Not Calculated** |

# 2014/2015 Graduate Follow Up Survey Summary

## College: Engineering Technology

| | Degrees | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ENGINEERING TECHNOLOGY** | **CERT** | **AAS** | **BAS/BS** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **ARCHITECURAL TECH & FACILITIES MGMT** | | | | | | | | | |
| Architectural Technology | | 17 | | 17 | 6 | 35% | 2 | 33% | $ 29,500 |
| Architecture & Sustainability | | | 14 | 14 | 3 | 21% | 2 | 67% | $ 35,750 |
| Facility Management | 7 | | | 7 | 2 | 29% | 1 | 50% | NA |
| Facility Management | | | 16 | 16 | 10 | 63% | 10 | 100% | $ 42,453 |
| **AUTOMOTIVE** | | | | | | | | | |
| Automotive Engineering Tech | | | 43 | 43 | 9 | 21% | 9 | 100% | $ 53,011 |
| Automotive Management | | | 19 | 19 | 4 | 21% | 4 | 100% | $ 70,517 |
| Automotive Management (2+2) | | | 1 | 1 | 0 | 0% | 0 | | NA |
| Automotive Service Technology | | 13 | | 13 | 0 | 0% | 0 | | NA |
| Performance Machining | 12 | | | 12 | 1 | 8% | 1 | 100% | NA |
| Performance Motorsports | 42 | | | 42 | 9 | 21% | 1 | 11% | NA |
| **CONSTRUCTION TECHNOLOGY & MGMT** | | | | | | | | | |
| Advanced Construction Mgmt | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Building Construction Tech | | 33 | | 33 | 2 | 6% | 0 | 0% | NA |
| Civil Engineering Technology | | 12 | | 12 | 2 | 17% | 0 | 0% | NA |
| Construction Administration | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Construction Management (all inclusive) | | | 38 | 38 | 6 | 16% | 5 | 83% | $ 46,408 |
| **ELECTRONICS/CNS** | | | | | | | | | |
| Computer Networking | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Computers Networks and Systems | | | 6 | 6 | 0 | 0% | 0 | | NA |
| Electrical/Electronic Eng Tech | | | 18 | 18 | 2 | 11% | 2 | 100% | $ 47,500 |
| Industrial Electronics Tech | | 7 | | 7 | 1 | 14% | 0 | 0% | NA |
| **ENERGY SYSTEMS ENGINEERING** | | | | | | | | | |
| Energy Systems Engineering | | | 3 | 3 | 1 | 33% | 1 | 100% | NA |
| **HEAVY EQUIPMENT** | | | | | | | | | |
| Electrical Power Generation | 3 | | | 3 | 0 | 0% | 0 | | NA |
| Heavy Equip Service Eng Tech | | | 23 | 23 | 6 | 26% | 6 | 100% | $ 44,688 |
| Heavy Equipment Technology | | 25 | | 25 | 4 | 16% | 4 | 100% | $ 37,408 |
| **HVACR** | | | | | | | | | |
| HVACR Eng Tech & Enrgy Mgmt | | | 37 | 37 | 15 | 41% | 15 | 100% | $ 65,917 |
| HVACR Engineering Technology | | | 7 | 7 | 3 | 43% | 3 | 100% | $ 75,830 |
| HVACR Technology | | 25 | | 25 | 1 | 4% | 1 | 100% | NA |
| **MANUFACTURING ENGINEERING TECH** | | | | | | | | | |
| Industrial Practices | 5 | | | 5 | 2 | 40% | 0 | 0% | NA |
| Industrial Technology & Mgmt | | | 7 | 7 | 1 | 14% | 1 | 100% | NA |
| Manufacturing Engineering Tech | | | 22 | 22 | 9 | 41% | 9 | 100% | $ 61,756 |
| Manufacturing Technology | | 8 | | 8 | 2 | 25% | 2 | 100% | NA |
| Manufacturing Tooling Tech | | 1 | | 1 | 0 | 0% | 0 | | NA |
| Product Design | 10 | | | 10 | 1 | 10% | 0 | 0% | NA |
| Quality Engineering Technology | | | 4 | 4 | 1 | 25% | 1 | 100% | NA |
| Quality Technology | 66 | | | 66 | 19 | 29% | 2 | 11% | NA |
| **MECHANICAL DESIGN** | | | | | | | | | |
| Basic CNC Prog & Mchn Op | 28 | | | 28 | 7 | 25% | 2 | 29% | NA |
| CAD Drafting/Tool Design Tech | | 12 | | 12 | 0 | 0% | 0 | | NA |
| Mechanical Engineering Tech | | 22 | | 22 | 8 | 36% | 4 | 50% | $ 37,500 |
| Mechanical Engineering Tech | | | 32 | 32 | 6 | 19% | 6 | 100% | $ 55,000 |
| Product Design Engineering Tech | | | 25 | 25 | 10 | 40% | 9 | 90% | $ 60,668 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **PLASTICS & RUBBER** | | | | | | | | | |
| Plastics Engineering Tech | | | 20 | 20 | 3 | 15% | 3 | 100% | $ 65,000 |
| Plastics/Polymer Engineering Technology | | 33 | | 33 | 4 | 12% | 4 | 100% | $ 59,800 |
| Rubber Engineering Technology | | | 7 | 7 | 2 | 29% | 2 | 100% | NA |
| **PRINTING & IMAGING TECHNOLOGY MGMT** | | | | | | | | | |
| Printing Management | | | 1 | 1 | 0 | 0% | 0 | | NA |
| **SURVEYING** | | | | | | | | | |
| Geographic Info Systems (GIS) | 5 | | | 5 | 1 | 20% | 1 | 100% | NA |
| Surveying Engineering | | | 9 | 9 | 4 | 44% | 4 | 100% | $ 46,560 |
| Surveying Technology | | 8 | | 8 | 3 | 38% | 1 | 33% | NA |
| **WELDING ENGINEERING TECHNOLOGY** | | | | | | | | | |
| Welding Engineering Technology | | | 52 | 52 | 39 | 75% | 39 | 100% | $ 65,695 |
| Welding Technology | | 42 | | 42 | 4 | 10% | 4 | 100% | NA |
| **Eng. Tech TOTAL** | **181** | **258** | **404** | **843** | **213** | **25%** | **161** | **76%** | **Not Calculated** |

# 2014/2015 Graduate Follow Up Survey Summary

## College: Health Professions

| | Degrees | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **HEALTH PROFESSIONS** | **CERT** | **AAS** | **BS** | **BSN** | **MSN** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **CLIN LAB, RESP CARE & HEALTH ADM.** | | | | | | | | | | | |
| Gerontology | 29 | | | | | 29 | 8 | 28% | 3 | 38% | $ 37,464 |
| Health Care Systems Admin | | | 97 | | | 97 | 33 | 34% | 26 | 79% | $ 35,787 |
| Health Information Management | | | 27 | | | 27 | 8 | 30% | 8 | 100% | $ 38,434 |
| Health Information Technology | | 45 | | | | 45 | 10 | 22% | 4 | 40% | $ 27,550 |
| Medical Laboratory Science | | | 15 | | | 15 | 5 | 33% | 5 | 100% | $ 49,220 |
| Medical Laboratory Technology | | 1 | | | | 1 | 0 | 0% | 0 | | NA |
| Molecular Diagnostics | | | 16 | | | 16 | 3 | 19% | 2 | 67% | NA |
| Respiratory Care | | 32 | | | | 32 | 7 | 22% | 6 | 86% | $ 38,115 |
| **DENTAL HYGIENE & MEDICAL IMAGING** | | | | | | | | | | | |
| Allied Health Science | | 5 | | | | 5 | 1 | 20% | 1 | 100% | NA |
| Allied Health Science | | | 40 | | | 40 | 13 | 33% | 12 | 92% | $ 42,322 |
| Dental Hygiene | | 41 | | | | 41 | 9 | 22% | 9 | 100% | $ 47,071 |
| Dental Hygiene | | | 13 | | | 13 | 6 | 46% | 6 | 100% | $ 39,820 |
| Diagnostic Medical Sonography | | 21 | | | | 21 | 7 | 33% | 3 | 43% | $ 49,500 |
| Nuclear Medicine Technology | | | 32 | | | 32 | 10 | 31% | 9 | 90% | $ 32,333 |
| Radiography | | 36 | | | | 36 | 9 | 25% | 6 | 67% | $ 23,250 |
| **SCHOOL OF NURSING** | | | | | | | | | | | |
| Master of Science in Nursing | | | | | 18 | 18 | 4 | 22% | 4 | 100% | $ 96,313 |
| Nursing | | | 146 | | | 146 | 28 | 19% | 25 | 89% | $ 60,845 |
| Nursing - B.S.N. | | | | 58 | | 58 | 15 | 26% | 13 | 87% | $ 44,662 |
| Nursing (accelerated track) | | | 23 | | | 23 | 3 | 13% | 3 | 100% | $ 39,000 |
| **Health Professions TOTAL** | **29** | **181** | **409** | **58** | **18** | **695** | **179** | **26%** | **145** | **81%** | **Not Calculated** |

# 2014/2015 Graduate Follow Up Survey Summary

## College: Kendall College of Art and Design

| | Degrees | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **KENDALL** | **BFA** | **BS** | **MA/MFA** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **DESIGN STUDIES** | | | | | | | | | |
| Collaborative Design | 1 | | | 1 | 0 | 0% | 0 | | NA |
| Digital Media | 21 | | | 21 | 2 | 10% | 2 | **100%** | $ 31,500 |
| Fashion Studies | 2 | | | 2 | 0 | 0% | 0 | | NA |
| Furniture Design | 2 | | | 2 | 0 | 0% | 0 | | NA |
| Graphic Design | 41 | | | 41 | 6 | 15% | 6 | **100%** | $ 35,250 |
| Illustration | 36 | | | 36 | 5 | 14% | 4 | **80%** | NA |
| Industrial Design | 13 | | | 13 | 2 | 15% | 2 | **100%** | $ 54,000 |
| Interior Design | 18 | | | 18 | 6 | 33% | 5 | **83%** | $ 22,435 |
| Medical Illustration | 4 | | | 4 | 1 | 25% | 1 | **100%** | NA |
| Metals/Jewelry Design | 3 | | | 3 | 1 | 33% | 1 | **100%** | NA |
| **FINE ARTS/FOUNDATION** | | | | | | | | | |
| Art Education | 6 | | | 6 | 0 | 0% | 0 | | NA |
| Drawing | 3 | | | 3 | 1 | 33% | 1 | **100%** | NA |
| Fine Arts Painting | | | 12 | 12 | 2 | 17% | 1 | **50%** | NA |
| Fine Arts Photography | | | 2 | 2 | 0 | 0% | 0 | | NA |
| Fine Arts Printmaking | | | 2 | 2 | 0 | 0% | 0 | | NA |
| Painting | 8 | | | 8 | 0 | 0% | 0 | | NA |
| Photography | 12 | | | 12 | 2 | 17% | 2 | **100%** | NA |
| Printmaking | 3 | | | 3 | 0 | 0% | 0 | | NA |
| Sculpture/Functional Art | 9 | | | 9 | 1 | 11% | 1 | **100%** | NA |
| **LIBERAL ARTS/SCIENCE/ART HISTORY** | | | | | | | | | |
| Art History | | 2 | | 2 | 1 | 50% | 1 | **100%** | NA |
| Art History Studio Option | | 2 | | 2 | 0 | 0% | 0 | | NA |
| Master of Art Education | | | 2 | 2 | 0 | 0% | 0 | | NA |
| **Kendall TOTAL** | **182** | **4** | **18** | **204** | **30** | **15%** | **27** | **90%** | **Not Calculated** |

# 2014/2015 Graduate Follow Up Survey Summary

## Colleges: Optometry and Pharmacy

| | Degrees | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|
| **MICHIGAN COLLEGE OF OPTOMETRY** | **BS** | **OD** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **OPTOMETRY** | | | | | | | | |
| Optometry | | 37 | 37 | 7 | 19% | 7 | 100% | $ 89,000 |
| Vision Science | 6 | | 6 | 2 | 33% | 2 | 100% | NA |
| **Optometry TOTAL** | **6** | **37** | **43** | **2** | **5%** | **2** | **100%** | **Not Calculated** |
| **COLLEGE OF PHARMACY** | **BS** | **PD** | | | | | | |
| **PHARMACY** | | | | | | | | |
| Pharmacy | | 126 | 126 | 36 | 29% | 36 | 100% | $ 98,503 |
| **Pharmacy TOTAL** | **0** | **126** | **126** | **36** | **29%** | **36** | **100%** | **Not Calculated** |

# 2014/2015 Graduate Follow Up Survey Summary

## College: Professional & Technological Studies

| | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|
| **PROFESSIONAL & TECH STUDIES** | **EDD** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **CPT** | | | | | | | |
| Community College Leadership | 24 | 24 | 11 | 46% | 11 | **100%** | $ 99,800 |
| **Prof & Tech Studies TOTAL** | **24** | **24** | **11** | **46%** | **11** | **100%** | **Not Calculated** |

| Institution attended after graduating from Ferris State University | Earning Master's degree | Earning PhD or other terminal degree |
|---|---|---|
| | 16 | 11 |
| Aquinas College | 1 | |
| Argosy University | 1 | |
| Arizona State University | 1 | |
| Bethel University | 1 | |
| CMU | 3 | 1 |
| Columbia Southern University | 1 | |
| Cooley Law School | 1 | |
| Cornell University | 1 | |
| Detroit Mercy | 1 | |
| EMU | 1 | |
| GRCC | 1 | |
| GVSU | 1 | |
| Hillsoborough CC | 1 | |
| Illinois College of Optometry | | 1 |
| MSU | 2 | |
| Murray State University | 1 | |
| NMU | 1 | |
| Northwood University | 1 | |
| Oakland University | | 1 |
| Ohio State University | | 1 |
| Purdue University | 1 | |
| Quinnipiac | 1 | |
| San Francisco Academy of Art | 1 | |
| SUNY at Buffalo, Ross Eye Institute Orthoptic Program | 1 | |
| SVSU | 1 | |
| U-M | 1 | |
| UCLA | 1 | |
| University of Northern Colorado | | 1 |
| University of Indianapolis | 1 | |
| USC | 1 | |
| Virginia Commonwealth University | 1 | |
| Walsh College | 1 | |
| Wayne State University | 1 | |
| Western Carolina University | 1 | |
| WMU | 2 | |
| **Total** | **51** | **16** |

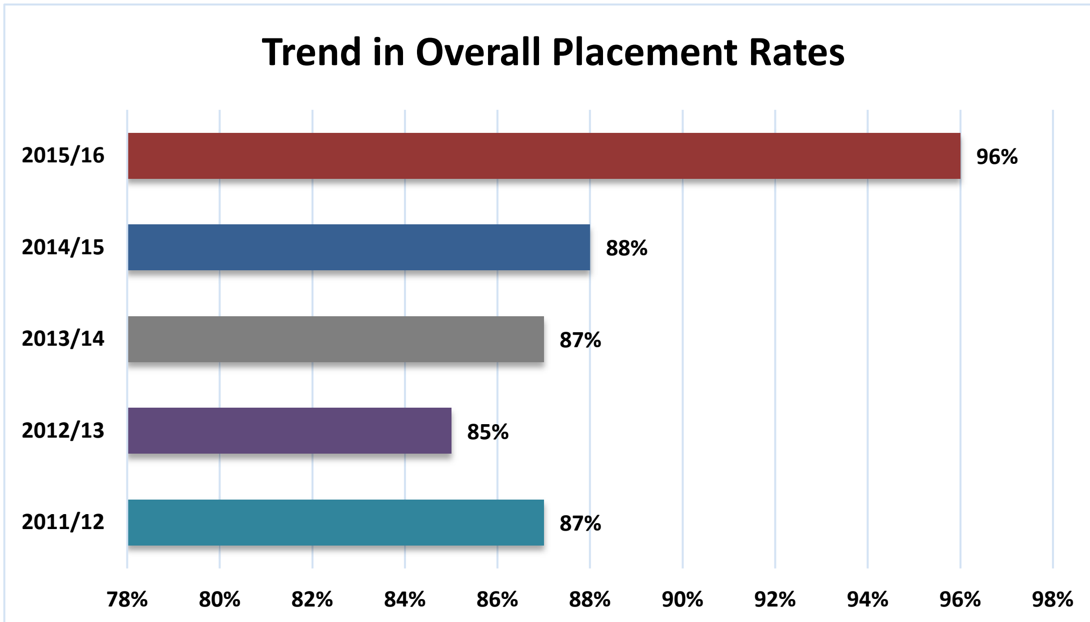



# GRADUATE FOLLOW-UP
# SURVEY REPORT

2015 - 2016

INSTITUTIONAL RESEARCH & TESTING
FERRIS STATE UNIVERSITY

# 2015/2016 Graduate Follow Up Survey - Overall Results




**Notes:**

**Respondents included here are those who are employed, continuing their education full-time, or who are employed and continuing their education.**

**Salary information is provided when there are 2 or more respondents indicating a salary for the listed program.**

**Graduates are counted in the Respondents column for all programs (degree and certificate) they graduated in during 2015-2016**

**Graduate are counted in the Employed/Continuing Education and Salary columns only for the highest degree awarded to them;**

**in the case of multiple Bachelor's degrees, the first one listed alphabetically was counted.**

**The overall response rate for the 2015-2016 report was 29%.**

Institutional Reseach & Testing

7/14/2017

# 2015/2016 Graduate Follow Up Survey Summary
# College: Arts & Sciences

| ARTS & SCIENCES | DEGREES | | | | | | | | | | PLACEMENT INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Program** | **CERT** | **AA** | **AAS** | **AS** | **BA** | **BIS** | **BS** | **BSW** | **MSW** | **Total** | **# Rspnd** | **% Rspnd** | **# Empld/CE** | **Plcmt Rate** | **Avg Salary** |
| **BIOLOGY** | | | | | | | | | | | | | | | |
| Biology | | | | | 1 | | 30 | | | 31 | 10 | 65% | 10 | 100% | $28,010 |
| Biology/Environmental | | | | | | | 7 | | | 7 | 3 | 43% | 3 | 100% | $41,167 |
| Biology/Forensic | | | | | | | 5 | | | 5 | 3 | 60% | 3 | 100% | $25,000 |
| Biology/Pre-Dentistry | | | | | | | 5 | | | 5 | 3 | 60% | 3 | 100% | NA |
| Biology/Pre-Medicine | | | | | | | 13 | | | 13 | 6 | 46% | 6 | 100% | $28,333 |
| Biology/Pre-Optometry | | | | | | | 10 | | | 10 | 3 | 30% | 3 | 100% | NA |
| Biology/Pre-Pharmacy | | | | | | | 14 | | | 14 | 5 | 36% | 4 | 80% | $5,000 |
| Biology/Pre-Physical Therapy | | | | | | | 8 | | | 8 | 1 | 13% | 1 | 100% | NA |
| Biology/Pre-Veterinary | | | | | | | 2 | | | 2 | 2 | 100% | 2 | 100% | NA |
| Biotechnology | | | | | | | 5 | | | 5 | 3 | 60% | 3 | 100% | $35,000 |
| Pre-Science | | | | 40 | | | | | | 40 | 9 | 23% | 8 | 89% | $16,500 |
| **COLLEGE OF ARTS & SCIENCES** | | | | | | | | | | | | | | | |
| Integrative Studies | | | | | | 19 | 43 | | | 62 | 8 | 14% | 6 | 80% | $52,600 |
| **HUMANITIES** | | | | | | | | | | | | | | | |
| Applied Speech Communication | | | | | | | 17 | | | 17 | 4 | 24% | 4 | 100% | $24,250 |
| Communication | | | | | 1 | | | | | 1 | 1 | 100% | 1 | 100% | NA |
| History | | | | | 7 | | | | | 7 | 4 | 57% | 4 | 100% | $14,267 |
| **LANGUAGE & LITERATURE** | | | | | | | | | | | | | | | |
| English | | | | | 4 | | | | | 4 | 4 | 100% | 3 | 75% | $18,333 |
| Journalism | 1 | | | | | | | | | 1 | 1 | 100% | 1 | 100% | NA |
| Liberal Arts | | 13 | | | | | | | | 13 | 2 | 15% | 1 | 50% | NA |
| Technical & Professional Comm | | | | | | | 4 | | | 4 | 3 | 75% | 3 | 100% | $22,653 |
| **MATHEMATICS** | | | | | | | | | | | | | | | |
| Actuarial Science | | | | | | | 4 | | | 4 | 2 | 50% | 2 | 100% | NA |
| Applied Math/Computer Science | | | | | | | 5 | | | 5 | 3 | 60% | 3 | 100% | $39,467 |
| Applied Math/Operations Research | | | | | | | 1 | | | 1 | 1 | 100% | 1 | 100% | NA |
| Applied Mathematics | | | | | | | 4 | | | 4 | 3 | 75% | 3 | 100% | $50,333 |
| **PHYSICAL SCIENCES** | | | | | | | | | | | | | | | |
| Chemistry | | | | | 8 | | | | | 8 | 3 | 38% | 3 | 100% | $52,250 |
| Industrial Chemistry Technology | | | 4 | | | | | | | 4 | 2 | 50% | 2 | 100% | NA |
| **SOCIAL SCIENCES** | | | | | | | | | | | | | | | |
| Political Science | | | | | | | 3 | | | 3 | 1 | 33% | 1 | 100% | NA |
| Psychology | | | | | | | 26 | | | 26 | 8 | 31% | 8 | 100% | $25,400 |
| Sociology | | | | | 3 | | | | | 3 | 2 | 67% | 2 | 100% | NA |
| **SOCIAL WORK** | | | | | | | | | | | | | | | |
| Social Work | | | | | | | | 69 | | 69 | 21 | 30% | 21 | 100% | $32,525 |
| Social Work | | | | | | | | | 19 | 19 | 3 | 23% | 3 | 100% | NA |
| **ARTS & SCIENCES TOTAL** | **1** | **13** | **4** | **40** | **24** | **19** | **206** | **69** | **19** | **395** | **124** | **31%** | **118** | **95%** | **Not Calculated** |

# 2015/2016 Graduate Follow Up Survey Summary
## College: Business

| BUSINESS | DEGREES | | | | | | PLACEMENT INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Program** | **CERT** | **AAS** | **BB/BS** | **MBA** | **MISI** | **Total** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Avg Salary** |
| **ACCOUNTING, FINANCE, INFORMATION SYSTEMS** | | | | | | | | | | | |
| Accountancy | | 3 | | | | 3 | 1 | 33% | 1 | 100% | NA |
| Accountancy | | | 48 | | | 48 | 14 | 29% | 12 | 86% | $42,137 |
| Accountancy/Finance | | | 3 | | | 3 | 2 | 67% | 2 | 100% | NA |
| Computer Information Systems | | | 31 | | | 31 | 14 | 45% | 14 | 100% | $43,642 |
| Computer Information Technology | | | 6 | | | 6 | 1 | 17% | 1 | 100% | NA |
| Finance | | | 10 | | | 10 | 4 | 40% | 4 | 100% | $55,000 |
| Information Security & Intelligence | | | 33 | | | 33 | 10 | 30% | 9 | 90% | $53,375 |
| Information Security & Intelligence | | | | | 64 | 64 | 13 | 20% | 9 | 69% | $55,000 |
| **MANAGEMENT** | | | | | | | | | | | |
| Adv Studies Design/Innovation Mgmt | 11 | | | | | 11 | 3 | 27% | 3 | 100% | $103,333 |
| BUAD w/ Professional Tracks | | | 48 | | | 48 | 16 | 33% | 16 | 100% | $44,108 |
| Business Administration | | | 117 | | | 117 | 32 | 27% | 28 | 88% | $37,990 |
| Business Administration-Legal Studies | | | 9 | | | 9 | 1 | 11% | 1 | 100% | NA |
| General Business | | 9 | | | | 9 | 4 | 44% | 4 | 100% | $39,500 |
| Human Resource Management | | | 7 | | | 7 | 3 | 43% | 3 | 100% | $33,107 |
| Leadership & Supervision | 9 | | | | | 9 | 2 | 22% | 2 | 100% | NA |
| Legal Studies | | 4 | | | | 4 | 1 | 25% | 1 | 100% | NA |
| Business Administration | | | | 29 | | 29 | 7 | 24% | 7 | 100% | $68,320 |
| Operations/Supply Management | | | 7 | | | 7 | 2 | 29% | 2 | 100% | NA |
| **MARKETING** | | | | | | | | | | | |
| Advertising/Integrated Marketing Comm | | | 15 | | | 15 | 4 | 27% | 4 | 100% | $39,500 |
| Business Data Analytics | | | 3 | | | 3 | 1 | 33% | 1 | 100% | NA |
| Graphic Design | | 21 | | | | 21 | 6 | 29% | 6 | 100% | $19,760 |
| Graphic Design | | | 12 | | | 12 | 5 | 42% | 4 | 80% | $39,333 |
| Graphic Media Management | | | 7 | | | 7 | 2 | 29% | 2 | 100% | NA |
| Marketing | | | 57 | | | 57 | 15 | 26% | 15 | 100% | $40,905 |
| Public Relations | | | 11 | | | 11 | 3 | 27% | 3 | 100% | $33,000 |
| **SPORTS, ENTERTAINMENT, HOSPITALITY MANAGEMENT** | | | | | | | | | | | |
| Hotel Management | | | 12 | | | 12 | 1 | 8% | 1 | 100% | NA |
| Hotel/Restaurant & Food Industry Mgmt | | | 11 | | | 11 | 2 | 18% | 2 | 100% | NA |
| Music Industry Management | | | 30 | | | 30 | 6 | 20% | 4 | 67% | $35,833 |
| PGA Golf Management | | | 24 | | | 24 | 2 | 8% | 2 | 100% | NA |
| Professional Golf Management | | | 9 | | | 9 | 1 | 11% | 1 | 100% | NA |
| Professional Tennis Management | | | 6 | | | 6 | 2 | 33% | 2 | 100% | NA |
| Resort Management | | | 12 | | | 12 | 4 | 33% | 4 | 100% | $38,500 |
| Restaurant and Food Industry Mgmt | | 7 | | | | 7 | 1 | 14% | 1 | 100% | NA |
| **BUSINESS TOTAL** | **20** | **44** | **528** | **29** | **64** | **685** | **185** | **27%** | **171** | **92%** | **Not Calculated** |

# 2015/2016 Graduate Follow Up Survey Summary
# College: Education & Human Services

| EDUCATION & HUMAN SERVICES | DEGREES | | | | | | | | PLACEMENT INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Program** | **CERT** | **AA/AAS** | **BAS/BS** | **MED** | **MS** | **MSCJ** | **MTE** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Avg Salary** |
| **CRIMINAL JUSTICE** | | | | | | | | | | | | | |
| Criminal Justice Administration | | | | | | 17 | | 17 | 4 | 24% | 4 | 100% | $43,200 |
| Criminal Justice-Corrections | | | 21 | | | | | 21 | 10 | 48% | 10 | 100% | $32,866 |
| Criminal Justice-Generalist | | | 310 | | | | | 310 | 69 | 22% | 62 | 90% | $34,452 |
| Criminal Justice-Law Enforcement | | | 45 | | | | | 45 | 10 | 22% | 10 | 100% | $40,495 |
| Pre-Criminal Justice | | 30 | | | | | | 30 | 5 | 17% | 3 | 60% | $15,000 |
| **RECREATION LEISURE SERVICES & WELLNESS** | | | | | | | | | | | | | |
| Recreation Leadership & Management | | | 3 | | | | | 3 | 1 | 33% | 1 | 100% | NA |
| **SCHOOL OF EDUCATION** | | | | | | | | | | | | | |
| Career & Technical Education (all tracks) | | | | | | | 9 | 9 | 3 | 33% | 3 | 100% | NA |
| Curriculum & Instruction (all tracks) | | | | 26 | | | | 26 | 6 | 23% | 6 | 100% | $39,000 |
| Early Childhood Education | | 10 | | | | | | 10 | 3 | 30% | 2 | 67% | NA |
| Early Childhood Education | | | 26 | | | | | 26 | 5 | 19% | 5 | 100% | $20,455 |
| Elementary Education | | | 50 | | | | | 50 | 14 | 28% | 14 | 100% | $31,008 |
| English Education | | | 4 | | | | | 4 | 1 | 25% | 1 | 100% | NA |
| Mathematics Education | | | 4 | | | | | 4 | 1 | 25% | 1 | 100% | NA |
| Pre-Teaching Secondary | | 3 | | | | | | 3 | 1 | 33% | 1 | 100% | NA |
| Pro-Mo-TEd Technical Education | | | 3 | | | | | 3 | 3 | 100% | 3 | 100% | $25,000 |
| Social Studies Elementary | | | 3 | | | | | 3 | 1 | 33% | 1 | 100% | NA |
| **SCHOOL OF DIGITAL MEDIA** | | | | | | | | | | | | | |
| Digital Animation/Game Design | | | 18 | | | | | 18 | 2 | 11% | 2 | 100% | NA |
| Television/Digital Media Production | | | 17 | | | | | 17 | 6 | 35% | 6 | 100% | $31,950 |
| **ED & HUMAN SERVICES TOTAL** | **0** | **43** | **504** | **26** | **0** | **17** | **9** | **599** | **145** | **24%** | **135** | **93%** | **Not Calculated** |

# 2015/2016 Graduate Follow Up Survey Summary
## College: Engineering Technology

| ENGINEERING TECHNOLOGY | DEGREES | | | | PLACEMENT INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Program** | **CERT** | **AAS** | **BAS/BS** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Avg Salary** |
| **ARCHITECURAL TECHNOLOGY & FACILITIES MANAGEMENT** | | | | | | | | | |
| Architectural Technology | | 19 | | 19 | 3 | 16% | 3 | 100% | $3,000 |
| Architecture Sustainability | | | 14 | 14 | 7 | 50% | 7 | 100% | $40,833 |
| Facility Management | | | 13 | 13 | 3 | 23% | 3 | 100% | $59,388 |
| Facility Management | 7 | | | 7 | 1 | 14% | 1 | 100% | NA |
| **AUTOMOTIVE** | | | | | | | | | |
| Automotive Engineering Technology | | | 44 | 44 | 11 | 25% | 10 | 91% | $56,686 |
| Automotive Management | | | 15 | 15 | 1 | 7% | 1 | 100% | NA |
| Automotive Service Technology | | 14 | | 14 | 2 | 14% | 2 | 100% | NA |
| Performance Motorsports | 7 | | | 7 | 1 | 14% | 1 | 100% | NA |
| **CONSTRUCTION TECHNOLOGY & MANAGEMENT** | | | | | | | | | |
| Building Construction Technology | | 18 | | 18 | 1 | 6% | 1 | 100% | NA |
| Civil Engineering Technology | | 6 | | 6 | 1 | 17% | 1 | 100% | NA |
| Construction Management | | | 44 | 44 | 6 | 14% | 6 | 100% | $59,280 |
| **ELECTRONICS/COMPUTER NETWORKS AND SYSTEMS** | | | | | | | | | |
| Computers Networks and Systems | | | 8 | 8 | 5 | 63% | 5 | 100% | $46,760 |
| Electrical/Electronic Engineering Technology | | | 20 | 20 | 4 | 20% | 4 | 100% | $61,000 |
| Industrial Electronics Technology | | 7 | | 7 | 1 | 14% | 1 | 100% | NA |
| **HEAVY EQUIPMENT** | | | | | | | | | |
| Heavy Equipment Service Engineering Tech | | | 13 | 13 | 5 | 38% | 5 | 100% | $55,010 |
| Heavy Equipment Technology | | 28 | | 28 | 2 | 7% | 2 | 100% | NA |
| **HVACR** | | | | | | | | | |
| HVACR Engineering Tech & Energy Mgmt | | | 28 | 28 | 12 | 43% | 12 | 100% | $66,717 |
| HVACR Engineering Technology | | | 8 | 8 | 2 | 25% | 2 | 100% | NA |
| HVACR Technology | | 24 | | 24 | 3 | 13% | 3 | 100% | $48,000 |

# 2015/2016 Graduate Follow Up Survey Summary
# College: Engineering Technology

| ENGINEERING TECHNOLOGY | DEGREES | | | | PLACEMENT INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Program** | **CERT** | **AAS** | **BAS/BS** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Avg Salary** |
| **MANUFACTURING ENGINEERING TECHNOLOGY** | | | | | | | | | |
| Industrial Technology & Management | | | 26 | 26 | 10 | 38% | 10 | 100% | $74,731 |
| Manufacturing Engineering Technology | | | 32 | 32 | 10 | 31% | 10 | 100% | $54,670 |
| Manufacturing Technology | | 7 | | 7 | 1 | 14% | 1 | 100% | NA |
| Product Design | 3 | | | 3 | 2 | 67% | 1 | 50% | NA |
| Quality Technology | 5 | | | 5 | 2 | 40% | 2 | 100% | NA |
| **MECHANICAL DESIGN** | | | | | | | | | |
| CAD Drafting/Tool Design Technology | | 7 | | 7 | 3 | 43% | 3 | 100% | $46,333 |
| Mechanical Engineering Technology | | 32 | | 32 | 3 | 9% | 3 | 100% | $34,000 |
| Mechanical Engineering Technology | | | 31 | 31 | 7 | 23% | 6 | 86% | $61,417 |
| Product Design Engineering Technology | | | 16 | 16 | 5 | 31% | 5 | 100% | $45,525 |
| **PLASTICS & RUBBER** | | | | | | | | | |
| Plastics Engineering Technology | | | 30 | 30 | 10 | 33% | 10 | 100% | $61,063 |
| Plastics/Polymer Engineering Technology | | 63 | | 63 | 7 | 11% | 7 | 100% | $50,712 |
| **PRINTING & IMAGING TECHNOLOGY MANAGEMENT** | | | | | | | | | |
| Print Digital Graphic Imaging Technology | | 1 | | 1 | 1 | 100% | 1 | 100% | NA |
| **SURVEYING** | | | | | | | | | |
| Geographic Information Systems (GIS) | 1 | | | 1 | 1 | 100% | 1 | 100% | NA |
| Surveying Engineering | | | 12 | 12 | 5 | 42% | 5 | 100% | $56,667 |
| Surveying Technology | | 1 | | 1 | 1 | 100% | 1 | 100% | NA |
| **WELDING ENGINEERING TECHNOLOGY** | | | | | | | | | |
| Welding Engineering Technology | | | 33 | 33 | 29 | 88% | 25 | 86% | $67,356 |
| Welding Technology | | 39 | | 39 | 3 | 8% | 3 | 100% | $80,000 |
| **ENGINEERING TECHNOLOGY TOTAL** | **23** | **266** | **387** | **676** | **171** | **33%** | **164** | **98%** | **Not calculated** |

# 2015/2016 Graduate Follow Up Survey Summary
## College: Health Professions

| HEALTH PROFESSIONS | DEGREES | | | | | | PLACEMENT INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Program** | **CERT** | **AAS** | **BS** | **BSN** | **MSN** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Avg Salary** |
| **CLIN LAB, RESP CARE & HEALTH ADM.** | | | | | | | | | | | |
| Gerontology | 23 | | | | | 23 | 9 | 39% | 8 | 89% | $35,808 |
| Health Care Systems Administration | | | 81 | | | 81 | 28 | 35% | 26 | 93% | $36,838 |
| Health Information Management | | | 15 | | | 15 | 4 | 27% | 4 | 100% | $65,947 |
| Health Information Technology | | 39 | | | | 39 | 14 | 36% | 12 | 86% | $30,026 |
| Medical Laboratory Science | | | 20 | | | 20 | 7 | 35% | 7 | 100% | $42,555 |
| Molecular Diagnostics | | | 13 | | | 13 | 5 | 38% | 5 | 100% | $39,780 |
| Respiratory Care | | 21 | | | | 21 | 5 | 24% | 4 | 80% | $50,333 |
| **DENTAL HYGIENE & MEDICAL IMAGING** | | | | | | | | | | | |
| Allied Health Science | | | 55 | | | 55 | 13 | 24% | 13 | 100% | $39,534 |
| Dental Hygiene | | 34 | | | | 34 | 5 | 15% | 5 | 100% | $50,000 |
| Dental Hygiene | | | 16 | | | 16 | 6 | 38% | 6 | 100% | $40,700 |
| Diagnostic Medical Sonography | | 14 | | | | 14 | 4 | 29% | 4 | 100% | $43,333 |
| Nuclear Medicine Technology | | | 37 | | | 37 | 9 | 24% | 9 | 100% | $53,000 |
| Radiography | | 24 | | | | 24 | 4 | 17% | 3 | 75% | $48,500 |
| **SCHOOL OF NURSING** | | | | | | | | | | | |
| Nursing | | | 178 | | | 178 | 58 | 33% | 57 | 98% | $63,421 |
| Nursing (accelerated track) | | | 20 | | | 20 | 6 | 30% | 6 | 100% | $49,250 |
| Nursing | | | | 64 | | 64 | 19 | 30% | 18 | 95% | $45,220 |
| Nursing | | | | | 27 | 27 | 9 | 33% | 9 | 100% | $72,000 |
| **HEALTH PROFESSIONS TOTAL** | **23** | **132** | **435** | **64** | **27** | **681** | **205** | **30%** | **196** | **95%** | **Not Calculated** |

# 2015/2016 Graduate Follow Up Survey Summary
# College: Kendall College of Art and Design

| KENDALL | DEGREE | | | | PLACEMENT INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Program** | **BFA** | **BS** | **MA/MFA** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Avg Salary** |
| **DESIGN STUDIES** | | | | | | | | | |
| Collaborative Design | 6 | | | 6 | 4 | 67% | 3 | 75% | $22,667 |
| Digital Media | 28 | | | 28 | 8 | 29% | 5 | 63% | $20,300 |
| Graphic Design | 66 | | | 66 | 22 | 33% | 22 | 100% | $37,360 |
| Illustration | 43 | | | 43 | 11 | 26% | 9 | 82% | $18,600 |
| Industrial Design | 24 | | | 24 | 7 | 29% | 7 | 100% | $42,237 |
| Interior Design | 26 | | | 26 | 4 | 15% | 3 | 75% | $26,111 |
| Arts in Design | | | 15 | 15 | 3 | 20% | 3 | 100% | $95,000 |
| Medical Illustration | 9 | | | 9 | 2 | 22% | 2 | 100% | NA |
| **FINE ARTS/FOUNDATION** | | | | | | | | | |
| Art Education | 5 | | | 5 | 4 | 80% | 4 | 100% | $33,900 |
| Drawing | 7 | | | 7 | 1 | 14% | 1 | 100% | NA |
| Fine Arts Drawing | | | 2 | 2 | 1 | 50% | 1 | 100% | NA |
| Fine Arts Painting | | | 7 | 7 | 3 | 43% | 2 | 67% | NA |
| Fine Arts Printmaking | | | 3 | 3 | 1 | 33% | 1 | 100% | NA |
| Photography | 11 | | | 11 | 2 | 18% | 2 | 100% | NA |
| Printmaking | 5 | | | 5 | 2 | 40% | 2 | 100% | NA |
| Sculpture/Functional Art | 4 | | | 4 | 1 | 25% | 1 | 100% | NA |
| **LIBERAL ARTS/SCIENCE/ART HISTORY** | | | | | | | | | |
| Art History Academic Option | | 2 | | 2 | 1 | 50% | 1 | 100% | NA |
| Art History Studio Option | | 3 | | 3 | 1 | 33% | 1 | 100% | NA |
| **KENDALL TOTAL** | **234** | **5** | **27** | **266** | **78** | **35%** | **70** | **92%** | **Not Calculated** |

## 2015/2016 Graduate Follow Up Survey Summary
## College: Michigan College of Optometry

| OPTOMETRY | DEGREES | | | PLACEMENT INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|
| **Program** | **BS** | **OD** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Avg Salary** |
| **OPTOMETRY** | | | | | | | | |
| Optometry | | 35 | 35 | 9 | 26% | 9 | 100% | $82,433 |
| Vision Science | 8 | | 8 | 1 | 13% | 1 | 100% | NA |
| **OPTOMETRY TOTAL** | **8** | **35** | **43** | **1** | **2%** | **1** | **100%** | **Not Calculated** |

## 2015/2016 Graduate Follow Up Survey Summary
## College: Pharmacy

| PHARMACY | DEGREES | | | PLACEMENT INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|
| **Program** | **BS** | **PD** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Avg Salary** |
| **PHARMACY** | | | | | | | | |
| Pharmacy | | 147 | 147 | 59 | 40% | 58 | 98% | $96,860 |
| **PHARMACY TOTAL** | **0** | **147** | **147** | **59** | **40%** | **58** | **98%** | **Not Calculated** |

## 2015/2016 Graduate Follow Up Survey Summary
## College: Professional and Technical Studies

| PROFESSIONAL & TECH STUDIES | DEGREES | | PLACEMENT INFORMATION | | | | |
|---|---|---|---|---|---|---|---|
| **Program** | **EDD** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Avg Salary** |
| **CPT** | | | | | | | |
| Community College Leadership | 11 | 11 | 4 | 36% | 4 | 100% | $111,000 |
| **PROF & TECH STUDIES TOTAL** | **0** | **11** | **4** | **36%** | **4** | **100%** | **Not Calculated** |

| Institution attended after graduating from Ferris State University | Earning Master's degree | Earning PhD or other terminal degree |
| --- | --- | --- |
| American Sentinel University | 1 | |
| Boston Architectural College | 1 | |
| Boston University | 1 | |
| Butler University | | 1 |
| California State University San Bernardino | 1 | |
| Campbell University School of Osteopathic Medicine | | 1 |
| Capella University | | 1 |
| Case Western Reserve University | | 1 |
| Central Michigan University | 2 | 1 |
| Chamberlain College of Nursing | 1 | |
| Chicago School of Professional Psychology | 1 | |
| Colorado State University | 1 | |
| Davenport University | 2 | |
| Delta Community College | 1 | |
| Eastern Michigan University | 3 | |
| Ferris State University | 3 | |
| Grand Valley State University | 1 | 1 |
| George Washington University | 1 | |
| Georgetown University | 1 | |
| Hawaii Pacific University | 2 | |
| Indiana University Maurer School of Law | | 2 |
| Kaplan University | 1 | |
| Lawrence Technological University | 2 | |
| Michigan State University | 2 | 1 |
| Northwestern University | 2 | |
| Olivet Nazarene University | 1 | |
| Quinnipiac University | 1 | |
| Rush University | | 1 |
| Saginaw Valley State University | 2 | |
| Simmons College | 1 | |
| South University | 1 | |
| Spring Arbor University | 2 | |
| Texas A&M University-Commerce | 1 | |
| Texas State University | 1 | |
| The University of Texas at Austin | 2 | |
| Tiffin University | 1 | |
| University of Cincinnati | 1 | |
| University of Glasgow | 1 | |
| University of Kansas | 1 | |
| University of Michigan | 4 | |
| University of New England College of Dental Medicine | | 1 |
| University of Saint Mary of the Lake, Mundelein Seminary | 1 | |
| University of Sussex, Institute of Development Studies | 1 | |
| Western Michigan University | 1 | |
| Wayne State University | 1 | |
| **Total** | **37** | **11** |

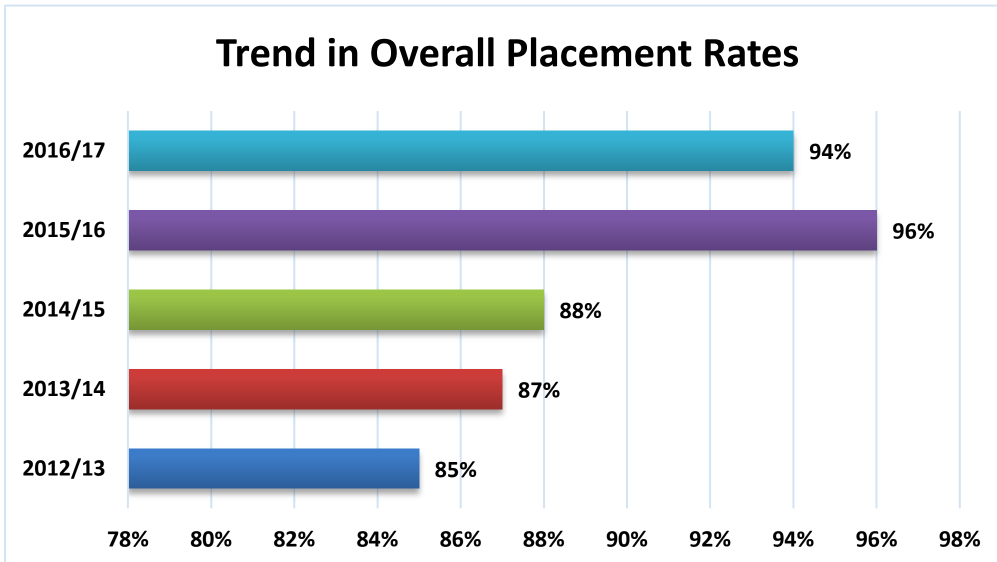

# GRADUATE FOLLOW-UP

# SURVEY REPORT

## 2016 - 2017

INSTITUTIONAL RESEARCH & TESTING
FERRIS STATE UNIVERSITY

# 2016/2017 Graduate Follow Up Survey - Overall Results




**Notes:**

**Respondents included here are those who are employed, continuing their education full-time, or who are employed and continuing**

**Salary information is provided when there are 2 or more respondents indicating a salary for the listed program.**

**Graduates are counted in the Respondents column for all programs (degree and certificate) they graduated in during 2016-2017**

**Graduates are counted in the Employed/Continuing Education and Salary columns only for the highest degree awarded to them; in the case of multiple Bachelor's degrees, the first one listed alphabetically was counted.**

**The overall response rate for the 2016-2017 report was 18%.**

Institutional Reseach & Testing

7/9/2018

# 2016-2017 Graduate Follow Up Survey Summary

## College: Arts & Sciences

| | Degrees | | | | | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ARTS & SCIENCES** | **CERT** | **AA** | **AAS** | **AS** | **BA** | **BIS** | **BS** | **BSW** | **MSW** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Plcmt Rate** | **Ave Salary** |
| **BIOLOGY** | | | | | | | | | | | | | | | |
| Biology | | | | | | | 28 | | | 28 | 3 | 11% | 2 | 67% | $20,000 |
| Biology/Environmental | | | | | | | 8 | | | 8 | 3 | 38% | 3 | 100% | $24,307 |
| Biology/Forensic | | | | | | | 7 | | | 7 | 4 | 57% | 4 | 100% | $25,333 |
| Biology/Pre-Dentistry | | | | | | | 1 | | | 1 | 1 | 100% | 1 | 100% | |
| Biology/Pre-Medicine | | | | | | | 14 | | | 14 | 4 | 29% | 4 | 100% | $23,000 |
| Biology/Pre-Optometry | | | | | | | 16 | | | 16 | 3 | 19% | 3 | 100% | $30,000 |
| Biology/Pre-Pharmacy | | | | | | | 21 | | | 21 | 5 | 24% | 5 | 100% | $10,000 |
| Biology/Pre-Phys Therapy | | | | | | | 3 | | | 3 | 0 | 0% | | | |
| Biology/Pre-Veterinary | | | | | | | 2 | | | 2 | 1 | 50% | 1 | 100% | $10,000 |
| Biotechnology | | | | | | | 12 | | | 12 | 5 | 42% | 5 | 100% | $28,375 |
| Pre-Science | | | | 39 | | | | | | 39 | 2 | 5% | 2 | 100% | $31,680 |
| **COLLEGE OF ARTS & SCIENCES** | | | | | | | | | | | | | | | |
| Integrative Studies | | | | | | 2 | | | | 2 | 0 | 0% | | | |
| Integrative Studies | | | | | | | 53 | | | 53 | 13 | 25% | 11 | 85% | $48,603 |
| **HUMANITIES** | | | | | | | | | | | | | | | |
| Applied Speech Communication | | 1 | | | | | | | | 1 | 0 | 0% | | | |
| Applied Speech Communication | | | | | | | 10 | | | 10 | 3 | 30% | 2 | 67% | $39,000 |
| Communication | | | | | 2 | | | | | 2 | 1 | 50% | 1 | 100% | $28,000 |
| History | | | | | 3 | | | | | 3 | 0 | 0% | | | |
| Sports Communication | | | | | | | 8 | | | 8 | 0 | 0% | | | |
| **LANGUAGE & LITERATURE** | | | | | | | | | | | | | | | |
| English | | | | | 6 | | | | | 6 | 1 | 17% | 1 | 100% | $9,620 |
| Journalism | 1 | | | | | | | | | 1 | 0 | 0% | | | |
| Journalism and Technical Communication | | | | | | | 2 | | | 2 | 1 | 50% | 1 | 100% | $55,000 |
| Liberal Arts | | 10 | | | | | | | | 10 | 1 | 10% | 1 | 100% | $9,600 |
| Tech-Prof Communication | | | | | | | 3 | | | 3 | 0 | 0% | | | |
| **MATHEMATICS** | | | | | | | | | | | | | | | |
| Actuarial Science | | | | | | | 2 | | | 2 | 0 | 0% | | | |
| Applied Math/Actuarial Science | | | | | | | 3 | | | 3 | 1 | 33% | 1 | 100% | |
| Applied Math/Computer Science | | | | | | | 2 | | | 2 | 1 | 50% | 1 | 100% | $34,000 |
| Applied Mathematics | | | | | | | 4 | | | 4 | 2 | 50% | 2 | 100% | $24,000 |
| **PHYSICAL SCIENCES** | | | | | | | | | | | | | | | |
| Chemistry | | | | | 3 | | | | | 3 | 0 | 0% | | | |
| Industrial Chemistry | | | | | | | 1 | | | 1 | 1 | 100% | 1 | 100% | $31,000 |
| Industrial Chemistry Technology | | | 4 | | | | | | | 4 | 0 | 0% | | | |
| Pre-Pharmacy | | | 12 | | | | | | | 12 | 2 | 17% | 2 | 100% | $12,500 |
| **SOCIAL SCIENCES** | | | | | | | | | | | | | | | |
| Political Science | | | | | | | 6 | | | 6 | 1 | 17% | 1 | 100% | $35,000 |
| Psychology | | | | 4 | | | | | | 4 | 1 | 25% | 1 | 100% | $4,600 |
| Psychology | | | | | | | 27 | | | 27 | 5 | 19% | 3 | 60% | $22,667 |
| Social Work | | 8 | | | | | | | | 8 | 1 | 13% | 1 | 100% | |
| Social Work | | | | | | | | 70 | | 70 | 13 | 19% | 11 | 85% | $34,826 |
| Social Work | | | | | | | | | 29 | 29 | 8 | 28% | 7 | 88% | $33,237 |
| Sociology | | | | | 3 | | | | | 3 | 1 | 33% | 1 | 100% | |
| **Arts & Sciences TOTAL** | **1** | **19** | **16** | **43** | **17** | **2** | **233** | **70** | **29** | **430** | **88** | **20%** | **79** | **90%** | **Not Calculated** |

# 2016-2017 Graduate Follow Up Survey Summary

## College: Business

| | Degrees | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **BUSINESS** | **CERT** | **AAS** | **BB/BS** | **MBA** | **MISI** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **ACCOUNTING, FINANCE, INFO SYSTEMS** | | | | | | | | | | | |
| Accountancy | | 1 | | | | 1 | | 0% | | | |
| Accountancy | | | 50 | | | 50 | 10 | 20% | 10 | 100% | $34,545 |
| Accountancy/Computer Information Systems | | | 2 | | | 2 | | 0% | | | |
| Accountancy/Finance | | | 3 | | | 3 | | 0% | | | |
| Adv Studies Busn Intelligence | 24 | | | | | 24 | 2 | 8% | 2 | 100% | $40,000 |
| Adv Studies Project Mgmt | 41 | | | | | 41 | 6 | 15% | 6 | 100% | $26,016 |
| Computer Information Systems | | 2 | | | | 2 | | 0% | | | |
| Computer Information Systems | | | 18 | | | 18 | 2 | 11% | 2 | 100% | $85,000 |
| Computer Information Technology | | | 18 | | | 18 | 2 | 11% | 2 | 100% | $60,650 |
| Finance | | | 15 | | | 15 | 4 | 27% | 4 | 100% | $58,000 |
| Homeland Sec Dig Sec/Forensics (TECH) | 2 | | | | | 2 | | 0% | | | |
| Info Security and Intelligence | | | 29 | | | 29 | 3 | 10% | 3 | 100% | $55,993 |
| Information Security & Intelligence | | | | | 1 | 1 | | 0% | | | |
| **MANAGEMENT** | | | | | | | | | | | |
| Adv Studies Design/Innovation | 12 | | | | | 12 | 4 | 33% | 4 | 100% | $56,000 |
| Adv Studies Incident Response | 21 | | | | | 21 | 7 | 33% | 6 | 86% | $55,836 |
| Adv Studies Mgt Tools/Concepts | 1 | | | | | 1 | | 0% | | | |
| BUAD w/Professional Tracks | | | 64 | | | 64 | 16 | 25% | 12 | 75% | $40,867 |
| Business Administration | | | 136 | | | 136 | 28 | 21% | 27 | 96% | $42,783 |
| Business Administration-Aviation | | | 2 | | | 2 | | 0% | | | |
| Business Admin Legal Studies | | | 7 | | | 7 | 3 | 43% | 3 | 100% | $24,000 |
| Business Administration-Maritime | | | 5 | | | 5 | | 0% | | | |
| Event Management | 2 | | | | | 2 | | 0% | | | |
| Fleet Management | 1 | | | | | 1 | 1 | 100% | 1 | 100% | $60,000 |
| General Business | | 19 | | | | 19 | | 0% | | | |
| Human Resource Management | 5 | | | | | 5 | 3 | 60% | 2 | 67% | $32,500 |
| Human Resource Management | | | 8 | | | 8 | 1 | 13% | 1 | 100% | $15,000 |
| Insurance & Risk Management | | | 4 | | | 4 | 1 | 25% | 1 | 100% | $50,000 |
| International Business | 2 | | | | | 2 | 1 | 50% | 1 | 100% | $61,000 |
| Leadership & Supervision | 8 | | | | | 8 | 1 | 13% | 1 | 100% | $44,000 |
| Legal Studies | | 2 | | | | 2 | 1 | 50% | 1 | 100% | $21,600 |
| Masters of Business Administration | | | | 11 | | 11 | 2 | 18% | 2 | 100% | $130,000 |
| Operations/Supply Management | | | 7 | | | 7 | | 0% | | | |

# 2016-2017 Graduate Follow Up Survey Summary

## College: Business (continued)

| | Degrees | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **BUSINESS** | **CERT** | **AAS** | **BB/BS** | **MBA** | **MISI** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **MARKETING** | | | | | | | | | | | |
| Advertising/Integrated Mktg Comm | | | 15 | | | 15 | 4 | 27% | 3 | 75% | $21,009 |
| Business Data Analytics | | | 2 | | | 2 | 2 | 100% | 2 | 100% | $62,000 |
| Business to Business Marketing | 1 | | | | | 1 | | 0% | | | |
| Data Mining | 1 | | | | | 1 | | 0% | | | |
| Direct Marketing | 1 | | | | | 1 | | 0% | | | |
| Graphic Communications | | 4 | | | | 4 | | 0% | | | |
| Graphic Design | | 29 | | | | 29 | 5 | 17% | 5 | 100% | $13,504 |
| Graphic Design | | | 12 | | | 12 | 1 | 8% | 1 | 100% | $35,500 |
| Graphic Media Mgmt | | | 12 | | | 12 | 1 | 8% | 1 | 100% | $38,000 |
| Healthcare Marketing | | | 2 | | | 2 | 2 | 100% | 2 | 100% | $42,500 |
| Marketing | | 16 | | | | 16 | 3 | 19% | 3 | 100% | $23,000 |
| Marketing | | | 49 | | | 49 | 9 | 18% | 8 | 89% | $23,416 |
| Public Relations | | | 15 | | | 15 | 5 | 33% | 5 | 100% | $39,667 |
| **SPORT, ENTERTAINMENT, & HOSPITALITY** | | | | | | | | | | | |
| Club Management | 1 | | | | | 1 | 1 | 100% | 1 | 100% | $36,000 |
| Culinary Management | 2 | | | | | 2 | | 0% | | | |
| Dietary & Food Svc Mgmt | | 3 | | | | 3 | | 0% | | | |
| Hospitality Management | | | 5 | | | 5 | 1 | 20% | 1 | 100% | $9,000 |
| Hotel Management | | | 10 | | | 10 | 4 | 40% | 4 | 100% | $43,500 |
| Hotel, Restaurant, & Food Industry Management | | | 12 | | | 12 | 1 | 8% | 1 | 100% | $20,000 |
| Music Industry Management | | | 33 | | | 33 | 6 | 18% | 6 | 100% | $26,660 |
| PGA Golf Management | | | 42 | | | 42 | 2 | 5% | 2 | 100% | $35,375 |
| Professional Tennis Management | | | 15 | | | 15 | | 0% | | | |
| Resort Management | | | 20 | | | 20 | 1 | 5% | 1 | 100% | $24,000 |
| Restaurant and Food Ind Mgmt | | | 5 | | | 5 | | 0% | | | |
| Restaurant and Food Ind Mgmt | | | 1 | | | 1 | | 0% | | | |
| **Business TOTAL** | **125** | **76** | **612** | **11** | **1** | **825** | **146** | **18%** | **137** | **94%** | **Not Calculated** |

# 2016-2017 Graduate Follow Up Survey Summary

## College: Education and Human Services

| | Degrees | | | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **EDUCATION & HUMAN SERVICES** | **CERT** | **AA/AS** | **BAS/BS** | **MED** | **MS** | **MSCJ** | **MTE** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **CRIMINAL JUSTICE** | | | | | | | | | | | | | |
| Criminal Justice Admin | | | | | | 33 | | 33 | 8 | 24% | 7 | 88% | $48,000 |
| Criminal Justice-Corrections | | | 20 | | | | | 20 | 3 | 15% | 3 | 100% | $17,000 |
| Criminal Justice-Generalist | | | 303 | | | | | 303 | 47 | 16% | 45 | 96% | $36,331 |
| Criminal Justice-Law Enforcement | | | 41 | | | | | 41 | 3 | 7% | 3 | 100% | $48,000 |
| Pre-Criminal Justice | | 71 | | | | | | 71 | 5 | 7% | 5 | 100% | $39,000 |
| **SCHOOL OF EDUCATION** | | | | | | | | | | | | | |
| Biology Education | | | 1 | | | | | 1 | | 0% | | | |
| Career & Technical Education- Admin | | | | | | | 1 | 1 | | 0% | | | |
| Career & Technical Education- Instructor | | | | | | | 6 | 6 | 4 | 67% | 4 | 100% | $60,000 |
| Career & Technical Education- Post Sec Admin | | | | | | | 1 | 1 | 1 | 100% | 1 | 100% | |
| Career & Technical Education- Train Dev | | | | | | | 1 | 1 | | 0% | | | |
| Curriculum & Instruction- Special Needs Ed | | | | 7 | | | | 7 | 1 | 14% | 1 | 100% | $42,878 |
| Curriculum & Instruction- Subject Area | | | | 7 | | | | 7 | | 0% | | | |
| Early Childhood Education | | 11 | | | | | | 11 | | 0% | | | |
| Early Childhood Education | | | 29 | | | | | 29 | 6 | 21% | 6 | 100% | $25,500 |
| Early Childhood Lead Teacher | | | 2 | | | | | 2 | 1 | 50% | 1 | 100% | $29,952 |
| Educational Leadership | | | | | 8 | | | 8 | | 0% | | | |
| Elementary Education | | | 44 | | | | | 44 | 10 | 23% | 10 | 100% | $33,136 |
| English Education | | | 4 | | | | | 4 | | 0% | | | |
| Mathematics Education | | | 3 | | | | | 3 | | 0% | | | |
| Pre-Teaching Elementary | | 1 | | | | | | 1 | | 0% | | | |
| Pre-Teaching Secondary | | 4 | | | | | | 4 | 1 | 25% | 1 | 100% | |
| Pro-Mo-TEd Technical Education | | 2 | | | | | | 2 | 1 | 50% | 1 | 100% | $56,000 |
| Social Studies & Elementary Education | | 1 | | | | | | 1 | | 0% | | | |
| Social Studies Education | | 6 | | | | | | 6 | 1 | 17% | 1 | 100% | $15,000 |
| **TELEVISION & DIGITAL MEDIA PRODUCTION** | | | | | | | | | | | | | |
| Digital Animation/Game Design | | | 14 | | | | | 14 | 3 | 21% | 3 | 100% | $31,087 |
| Digital Media Software Engineering | | | 3 | | | | | 3 | | 0% | | | |
| Pre-Digital Media | | 5 | | | | | | 5 | 1 | 20% | 1 | 100% | |
| Television/Digital Media Prod | | | 13 | | | | | 13 | 2 | 15% | 1 | 50% | $41,000 |
| **Education and Human Svcs TOTAL** | **0** | **101** | **477** | **14** | **8** | **33** | **9** | **642** | **98** | **15%** | **94** | **96%** | **Not Calculated** |

# 2016-2017 Graduate Follow Up Survey Summary

## College: Engineering Technology

| | Degrees | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ENGINEERING TECHNOLOGY** | **CERT** | **AAS** | **BAS/BS** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **ARCHITECURAL TECH & FACILITIES MGMT** | | | | | | | | | |
| Architectural Technology | | 19 | | 19 | 1 | 5% | 1 | 100% | |
| Architecture & Sustainability | | | 3 | 3 | | 0% | | | |
| Facility Management | | | 16 | 16 | 5 | 31% | 5 | 100% | $44,100 |
| Facility Management | 4 | | | 4 | | 0% | | | |
| **AUTOMOTIVE** | | | | | | | | | |
| Automotive Engineering Tech | | | 49 | 49 | 2 | 4% | 2 | 100% | $62,500 |
| Automotive Management | | | 24 | 24 | 5 | 21% | 5 | 100% | $59,250 |
| Automotive Service Technology | | 2 | | 2 | | 0% | | | |
| Performance Motorsports | 6 | | | 6 | | 0% | | | |
| **CONSTRUCTION TECHNOLOGY & MGMT** | | | | | | | | | |
| Building Construction Tech | | 38 | | 38 | 3 | 8% | 3 | 100% | $50,120 |
| Civil Engineering Technology | | 7 | | 7 | 1 | 14% | 1 | 100% | $45,000 |
| Construction Management (all inclusive) | | | 51 | 51 | 6 | 12% | 6 | 100% | $59,417 |
| **ELECTRONICS/CNS** | | | | | | | | | |
| Computers Networks and Systems | | | 9 | 9 | 5 | 56% | 4 | 80% | $72,000 |
| Electrical/Electronic Eng Tech | | | 16 | 16 | 5 | 31% | 5 | 100% | $53,292 |
| Industrial Electronics Tech | | 13 | | 13 | | 0% | | | |
| **ENERGY SYSTEMS ENGINEERING** | | | | | | | | | |
| Energy Systems Engineering | | | 4 | 4 | | 0% | | | |
| **HEAVY EQUIPMENT** | | | | | | | | | |
| Electrical Power Generation | 1 | | | 1 | | 0% | | | |
| Heavy Equip Service Eng Tech | | | 17 | 17 | 1 | 6% | 0 | 0% | |
| Heavy Equipment Technology | | 25 | | 25 | 1 | 4% | 1 | 100% | |
| **HVACR** | | | | | | | | | |
| HVACR Eng Tech & Enrgy Mgmt | | | 30 | 30 | 3 | 10% | 3 | 100% | $44,333 |
| HVACR Engineering Technology | | | 1 | 1 | | 0% | | | |
| HVACR Technology | | 27 | | 27 | 2 | 7% | 2 | 100% | |
| **MANUFACTURING ENGINEERING TECH** | | | | | | | | | |
| Basic CNC Prog & Machine Operations | 6 | | | 6 | 2 | 33% | 2 | 100% | $65,000 |
| Industrial Technology & Mgmt | | | 26 | 26 | 3 | 12% | 3 | 100% | $71,000 |
| Manufacturing Engineering Tech | | | 23 | 23 | 10 | 43% | 10 | 100% | $66,083 |
| Manufacturing Technology | | 25 | | 25 | 1 | 4% | 1 | 100% | $50,000 |
| Product Design | 2 | | | 2 | | 0% | | | |
| Quality Leadership | 1 | | | 1 | 1 | 100% | 1 | 100% | $42,500 |
| Quality Technology | 13 | | | 13 | | 0% | | | |

# 2016-2017 Graduate Follow Up Survey Summary

## College: Engineering Technology (continued)

| | Degrees | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ENGINEERING TECHNOLOGY** | **CERT** | **AAS** | **BAS/BS** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **MECHANICAL DESIGN** | | | | | | | | | |
| CAD Drafting/Tool Design Tech | | 21 | | 21 | 1 | 5% | 1 | 100% | $35,000 |
| Mechanical Engineering Tech | | 35 | | 35 | 3 | 9% | 3 | 100% | $13,015 |
| Mechanical Engineering Tech | | | 30 | 30 | 3 | 10% | 2 | 67% | $65,850 |
| Product Design Engineering Tech | | | 21 | 21 | 6 | 29% | 5 | 83% | $64,725 |
| **PLASTICS & RUBBER** | | | | | | | | | |
| Plastics Engineering Tech | | | 49 | 49 | 7 | 14% | 7 | 100% | $60,777 |
| Plastics/Polymer Engineering Technology | | 53 | | 53 | 6 | 11% | 5 | 83% | $49,600 |
| Rubber Engineering Technology | | | 2 | 2 | 0 | 0% | | | |
| **SURVEYING** | | | | | | | | | |
| Surveying Engineering | | | 13 | 13 | 4 | 31% | 4 | 100% | $51,215 |
| Surveying Technology | | 9 | | 9 | 3 | 33% | 3 | 100% | $50,500 |
| **WELDING ENGINEERING TECHNOLOGY** | | | | | | | | | |
| Welding Engineering Technology | | | 37 | 37 | 27 | 73% | 26 | 96% | $72,576 |
| Welding Technology | | 41 | | 41 | 2 | 5% | 2 | 100% | $37,000 |
| **Eng. Tech TOTAL** | **33** | **315** | **421** | **769** | **119** | **15%** | **113** | **95%** | **Not Calculated** |

# 2016-2017 Graduate Follow Up Survey Summary

## College: Health Professions

| | Degrees | | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **HEALTH PROFESSIONS** | **CERT** | **AAS** | **BS** | **BSN** | **MSN** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **CLIN LAB, RESP CARE & HEALTH ADM.** | | | | | | | | | | | |
| Gerontology | 15 | | | | | 15 | 6 | 40% | 6 | 100% | $44,453 |
| Health Care Systems Admin | | | 76 | | | 76 | 23 | 30% | 21 | 91% | $35,702 |
| Health Information Management | | | 27 | | | 27 | 4 | 15% | 4 | 100% | $34,550 |
| Health Information Technology | | 22 | | | | 22 | 7 | 32% | 5 | 71% | $30,048 |
| Lean Healthcare | 1 | | | | | 1 | 1 | 100% | 1 | 100% | $58,988 |
| Long Term Care | 15 | | | | | 15 | | 0% | | | |
| Medical Laboratory Science | | | 22 | | | 22 | 2 | 9% | 2 | 100% | $50,391 |
| Medical Laboratory Technology | | 2 | | | | 2 | | 0% | | | |
| Molecular Diagnostics | | | 4 | | | 4 | | 0% | | | |
| Public Health | | | 1 | | | 1 | 1 | 100% | 1 | 100% | $32,240 |
| Respiratory Care | | 12 | | | | 12 | 2 | 17% | 2 | 100% | $41,000 |
| **DENTAL HYGIENE & MEDICAL IMAGING** | | | | | | | | | | | |
| Allied Health Science | | 16 | | | | 16 | 1 | 6% | 1 | 100% | $46,600 |
| Allied Health Science | | | 55 | | | 55 | 12 | 22% | 12 | 100% | $45,200 |
| Dental Hygiene | | 27 | | | | 27 | 6 | 22% | 6 | 100% | $39,417 |
| Dental Hygiene | | | 13 | | | 13 | 1 | 8% | 1 | 100% | $50,000 |
| Diagnostic Medical Sonography | | 7 | | | | 7 | 1 | 14% | 1 | 100% | $63,000 |
| Nuclear Medicine Technology | | | 36 | | | 36 | 6 | 17% | 5 | 83% | $47,100 |
| Radiography | | 30 | | | | 30 | 5 | 17% | 5 | 100% | $34,399 |
| **SCHOOL OF NURSING** | | | | | | | | | | | |
| Master of Science in Nursing | | | | | 25 | 25 | 5 | 20% | 5 | 100% | $61,729 |
| Nursing | | | 27 | | | 27 | 7 | 26% | 7 | 100% | $54,912 |
| Nursing | | | | 125 | | 125 | 27 | 22% | 26 | 96% | $61,322 |
| Nursing | | | | 49 | | 49 | 13 | 27% | 13 | 100% | $44,392 |
| Nursing (accelerated track) | | | 1 | | | 1 | | 0% | | | |
| **Health Professions TOTAL** | **31** | **116** | **262** | **174** | **25** | **608** | **130** | **21%** | **124** | **95%** | **Not Calculated** |

# 2016-2017 Graduate Follow Up Survey Summary

## College: Kendall College of Art and Design

| | Degrees | | | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **KENDALL** | **BFA** | **BS** | **MA/MFA** | **MARCH** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **DESIGN STUDIES** | | | | | | | | | | |
| Architecture | | | | 8 | 8 | 4 | 50% | 4 | 100% | $47,500 |
| Collaborative Design | 8 | | | | 8 | 2 | 25% | 1 | 50% | $29,120 |
| Digital Media | 24 | | | | 24 | 7 | 29% | 6 | 86% | $46,496 |
| Fashion Studies | 13 | | | | 13 | 1 | 8% | 0 | 0% | |
| Furniture Design | 6 | | | | 6 | 3 | 50% | 2 | 67% | $45,000 |
| Graphic Design | 44 | | | | 44 | 8 | 18% | 8 | 100% | $38,014 |
| Illustration | 35 | | | | 35 | 5 | 14% | 5 | 100% | $22,400 |
| Industrial Design | 14 | | | | 14 | 3 | 21% | 2 | 67% | $62,500 |
| Interior Design | 20 | | | | 20 | 6 | 30% | 6 | 100% | $42,800 |
| Medical Illustration | 16 | | | | 16 | 1 | 6% | 1 | 100% | $24,000 |
| Metals/Jewelry Design | 3 | | | | 3 | | 0% | | | |
| **FINE ARTS/FOUNDATION** | | | | | | | | | | |
| Art Education | 8 | | | | 8 | | 0% | | | |
| Drawing | 9 | | | | 9 | 4 | 44% | 3 | 75% | $26,269 |
| Fine Arts Drawing | | | 3 | | 3 | 1 | 33% | 1 | 100% | $18,000 |
| Fine Arts Painting | | | 3 | | 3 | | 0% | | | |
| Fine Arts Printmaking | | | 2 | | 2 | 2 | 100% | 2 | 100% | $25,060 |
| Painting | | 3 | | | 3 | | 0% | | | |
| Photography | | 25 | | | 25 | 4 | 16% | 3 | 75% | $28,933 |
| Printmaking | | 7 | | | 7 | 3 | 43% | 3 | 100% | $24,500 |
| Sculpture/Functional Art | | 3 | | | 3 | 2 | 67% | 2 | 100% | $15,500 |
| **LIBERAL ARTS/SCIENCE/ART HISTORY** | | | | | | | | | | |
| Art History Academic Option | | 2 | | | 2 | 2 | 100% | 2 | 100% | $20,000 |
| Art History Studio Option | | 4 | | | 4 | 1 | 25% | 1 | 100% | |
| Master of Art Education | | 1 | | | 1 | | 0% | | | |
| **Kendall TOTAL** | **200** | **45** | **8** | | **261** | **59** | **23%** | **52** | **88%** | **Not Calculated** |

# 2016-2017 Graduate Follow Up Survey Summary

## Colleges: Optometry and Pharmacy

| | Degrees | | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|---|
| **MICHIGAN COLLEGE OF OPTOMETRY** | **BS** | **OD** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **OPTOMETRY** | | | | | | | | |
| Optometry | | 35 | 35 | 5 | 14% | 5 | 100% | $99,400 |
| Vision Science | 7 | | 7 | 2 | 29% | 2 | 100% | |
| **Optometry TOTAL** | **7** | **35** | **42** | **7** | **17%** | **2** | **29%** | |

| | Degrees | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|
| **COLLEGE OF PHARMACY** | **PD** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **PHARMACY** | | | | | | | |
| Pharmacy | 148 | 148 | 30 | 20% | 30 | 100% | $82,159 |
| **Pharmacy TOTAL** | | **148** | **30** | **20%** | **30** | **100%** | **Not Calculated** |

# 2016-2017 Graduate Follow Up Survey Summary

## College: Professional & Technological Studies

| | Degrees | | Placement Information | | | | |
|---|---|---|---|---|---|---|---|
| **PROFESSIONAL & TECH STUDIES** | **EDD** | **TOTAL** | **# Responded** | **% Responded** | **# Employed/CE** | **Placement Rate** | **Ave Salary** |
| **CPT** | | | | | | | |
| Community College Leadership | 16 | 16 | 8 | 50% | 8 | 100% | $85,160 |
| **Prof & Tech Studies TOTAL** | **16** | **16** | **8** | **50%** | **8** | **100%** | **Not Calculated** |

| Institution attended after Ferris State University | Earning Master's Degree | Earning PhD or other Terminal Degree |
| --- | --- | --- |
| American Sentinel University | 1 | |
| Aurora Community College- Online | | 1 |
| Boston University | 2 | |
| Concordia St. Paul | 1 | |
| Duke University | | 1 |
| Florida International University | 1 | |
| Grand Valley State University | 1 | |
| University of Detroit Mercy School of Law | | 1 |
| Indiana Wesleyan University | 1 | |
| Liberty University | 1 | |
| Michigan College of Optometry at Ferris State University | | 1 |
| Michigan State University | 1 | 1 |
| Michigan State University | 1 | |
| Michigan State University - Eli Broad College of Business | 1 | |
| Mott Community College | 1 | |
| Oakland University | 1 | |
| Ohio University | 1 | |
| Palo Alto University | | 1 |
| Penn State University | 1 | |
| Regent University Law School | 1 | |
| Simmons College | 1 | |
| Spring Arbor University | 1 | |
| St. Ambrose University | 1 | |
| Thomas M. Cooley Law School | | 1 |
| Univeristy of Michigan | | 1 |
| University of Detroit Mercy | 1 | |
| University of Michigan | | 1 |
| University of Minnesota - Twin Cities | | 1 |
| University of Pikeville Kentucky College of Optometry | | 1 |
| University of Sussex | 1 | |
| University of Texas Health and Science Center- San Antonio | 1 | |
| University of Toledo | | 1 |
| Wake Forest University | | 1 |
| Walden University | 1 | |
| Walden University Online | 1 | |
| Wayne State University | 1 | |
| Western Michigan University | 3 | |
| **Total** | **20** | **14** |

# HVACR Technology (HVAR) - 64 Credits

Associate in Applied Science (AAS) **_College of Engineering Technology_**

## ADMISSION REQUIREMENTS

New Students

- High school GPA of 2.7
- Minimum ACT score of 18 or SAT 16 or 950
- ACT math subscore of 19 or SAT 16 Math 500

Transfer Students

- College GPA of 2.0
- MATH 116 placement
- ENGL 150 placement

| UNIVERSITY GENERAL EDUCATION REQUIREMENTS | | | |
|---|---|---|---|
| Courses in this section are required to satisfy the university general education requirements for an AAS degree. | | | |
| Prefix | ### | Course Title (Prerequisites shown in parenthesis) | Crs |
| **TIER 1: FOUNDATION COMPETENCIES** | | | |
| COMMUNICATION COMPETENCY – 6 Written Communication Credits Required (or their equivalent) | | | |
| ENGL | 150 | English 1(ENGL 074 or ACT English 14 or SAT ERW 450 or pre2016 SAT Writing 370 or TOEFL Internet Total Score 61 or MSUELT Composite 73 or IELTS Overall 5.5) | 3 |
| ENGL | 250 | English 2 (ENGL 150 w/C- or higher) | 3 |
| QUANTITATIVE LITERACY COMPENTENCY – 3 Credits Required | | | |
| MATH | 116 | Intermediate Algebra and Numerical Trig. (MATH 109 or 110 w/C- or higher, or ACT Math 19 or SAT Math 500) | 3 |
| **TIER 2: DISTRIBUTION COMPETENCIES** | | | |
| NATURAL SCIENCES COMPETENCY – 1 course w/lab Required | | | |
| | | lab | 3-4 |
| CULTURE COMPETENCY – 1 course with a minimum of 3 Credits Required | | | |
| | | | 3 |
| SELF AND SOCIETY COMPETENCY – 1 course with a minimum of 3 Credits Required | | | |
| | | | 3 |
| ADDITIONAL GENERAL EDUCATION REQUIREMENTS | | | |
| The courses below are additional general education courses to meet the requirements for this specific program. | | | |
| COMM | 121 | Fundamentals of Public Speaking (None) | 3 |

| Freshman Seminar Requirement, FSUS 100, is satisfied by: | |
|---|---|

| Prefix | ### | Course Title (Prerequisites shown in parenthesis) | Crs |
|---|---|---|---|
| MAJOR REQUIREMENTS – 43 Credits Required (these courses ARE used to calculate the major 2.00 GPA requirement) | | | |
| HVAC | 101 | Intro to Refrigeration and A/C Systems (co-req MATH 116) | 4 |
| HVAC | 102 | Advanced Refrigeration and A/C (HVAC 101 and 111 w/C- or higher) | 4 |
| HVAC | 111 | Electricity-Blueprints-Fabrication (co-req MATH 116) | 4 |
| HVAC | 117 | Advanced Electricity-Circuits (None) | 4 |
| HVAC | 127 | Advanced HVACR Controls (HVAC 117 w/C- or higher) | 3 |
| HVAC | 132 | Fund of Heating and Mechanical Systems (HVAC 111 w/C- or higher) | 5 |
| HVAC | 207 | Commercial Refrigeration Systems (HVAC 102, 116, and 117 w/C- or higher) | 5 |
| HVAC | 208 | Air Conditioning Applications (HVAC 102, 116, and 117 w/C- or higher) | 5 |
| HVAC | 235 | Advanced Heating-Mech Systems (HVAC 116, 117 and 132 w/C- or higher) | 5 |
| HVAC | 245 | HVAC Unitary System Design (HVAC 101, 132 and MATH 116 w/C- or higher) | 4 |

Must have a C- or higher in the following HVAC 1st year classes: HVAC 101, 102, 111, 117, and 132 to meet 2nd year prerequisites.

## ADDITIONAL GRADUATION REQUIREMENTS

Students must

- maintain a 2.00 cumulative FSU GPA
- have 15 credits of Ferris classes (FSU Residency requirement)
- have a minimum 60 total credits to earn an associate degree
- maintain a 2.00 GPA in the major
- earn a C- or better in all HVAC coursework

**HVACR Technology – Associate of Applied Science - 64 Credits**

| DEGREE OUTCOMES | |
|---|---|
| 1. | Demonstrate installation techniques for residential/light commercial HVAC systems |
| 2. | Service residential/light commercial HVAC equipment |
| 3. | Service commercial refrigeration equipment |
| 4. | Systematically troubleshoot and repair commercial refrigeration equipment |
| 5. | Systematically troubleshoot and repair residential/light commercial HVAC equipment |
| 6. | Design residential/light commercial HVAC systems |
| 7. | Demonstrate ability to install, troubleshoot and repair HVACR controls |

Semester-by-Semester layout of classes

## FIRST YEAR

**Fall Semester**

| Class | Credits |
|---|---|
| HVAC 101 | 4 |
| HVAC 111 | 4 |
| HVAC 117 | 4 |
| MATH 116 | 4 |
| FSUS 100 | 1 |
| Total Credits | 17 |

**Spring Semester**

| Class | Credits |
|---|---|
| HVAC 102 | 4 |
| HVAC 127 | 3 |
| HVAC 132 | 5 |
| ENGL 150 | 3 |
| CULTURE | 3 |
| Total Credits | 18 |

**Summer Semester**

| Class | Credits |
|---|---|
| | |
| | |
| | |
| | |
| | |
| Total Credits | |

## SECOND YEAR

**Fall Semester**

| Class | Credits |
|---|---|
| HVAC 235 | 5 |
| HVAC 245 | 4 |
| ENGL 250 | 3 |
| SCIENCE ELECTIVE | 3-4 |
| | |
| Total Credits | 15-16 |

**Spring Semester**

| Class | Credits |
|---|---|
| HVAC 207 | 5 |
| HVAC 208 | 5 |
| COMM 121 | 3 |
| SELF AND SOCIETY | 3 |
| | |
| Total Credits | 16 |

**Summer Semester**

| Class | Credits |
|---|---|
| | |
| | |
| | |
| | |
| | |
| Total Credits | |

FERRIS STATE UNIVERSITY

# HVACR Engineering Technology and Energy Management (HVEM) - 124 Credits

Bachelor of Science (BS) ***College of Engineering Technology***

ADMISSION REQUIREMENTS

New Students

- Students must have completed the HVACR Technology program at Ferris or an equivalent AAS program at another institution with a minimum 2.5 GPA.
- Students should possess computer literary skills and completed college intermediate algebra and trigonometry and a natural sciences course.

Transfer Students

- Students must have completed the HVACR Technology program at Ferris or an equivalent AAS program at another institution with a minimum 2.5 GPA.
- Students should possess computer literary skills and completed college intermediate algebra and trigonometry and a natural sciences course.

| UNIVERSITY GENERAL EDUCATION REQUIREMENTS | | | |
|---|---|---|---|
| Courses in this section are required to satisfy the university general education requirements for a BS degree. | | | |
| Required | | Course Title (Prerequisites shown in parenthesis) | Crs |
| **TIER 1: FOUNDATION COMPETENCIES** | | | |
| COMMUNICATION COMPETENCY – 12 Credits Required | | | |
| COMM | 121 | Fundamentals of Public Speaking (None) | 3 |
| ENGL | 150 | English 1 (ENGL 074 or ACT English 14 or SAT ERW 450 or pre2016 SAT Writing 370 or TOEFL Internet Total Score 61 or MSUELT Composite 73 or IELTS Overall 5.5) | 3 |
| ENGL | 250 | English 2 (ENGL 150 w/C- or higher) | 3 |
| ENGL | 311 | Advanced Technical Writing (ENGL 250 or ENGL 211 w/C or higher) | 3 |
| QUANTITATIVE LITERACY COMPETENCY – 4 Credits Required | | | |
| MATH | 126 | Algebra & Analytical Trig. (MATH 116 w/C- or higher, or ACT Math 24 or SAT Math 580) | 4 |
| **TIER 2: DISTRIBUTION COMPETENCIES** | | | |
| NATURAL SCIENCES COMPETENCY – minimum 6 Credits Required; at least one must be a class with a lab | | | |
| ELEC | | Lab | |
| ELEC | | | |
| CULTURE COMPETENCY – 9 Credits Required *; Courses in this category must come from two different disciplines | | | |
| ELEC | | | |
| ELEC | | | |
| ELEC | | 200+ | |
| SELF AND SOCIETY COMPETENCY – 9 Credits Required *; Courses in this category must come from two different disciplines | | | |
| ELEC | | | |
| ELEC | | | |
| ECON | 221 | Principles of Macroeconomics (MATH 109 or 110 w/C- or higher, or MATH 114, 115, 116, 117, 118, 119, 120, 122, 126, or ACT Math 19 or SAT Math 580) Foundation, 200+ | 3 |
| **TIER 3: APPLICATION COMPETENCIES** | | | |
| COLLABORATION COMPETENCY – 2 courses Required ** | | | |
| | | Courses met in major. Look in Major/Core section for course prefix marked with ⊙ | |
| PROBLEM SOLVING COMPETENCY – 2 courses Required ** | | | |
| | | Courses met in major. Look in Major/Core section for course prefix marked with ⭘ | |

*General Education Requirements - |"Diversity (both Global and U.S. Diversity)"and "Self and Society Foundation" requirements must be met either through Culture or Self and Society or other courses | must have a 200 level course in both Culture and Self and Society Courses. | The Self and Society Foundation course can be your 200+ course.
**Some courses include both Collaboration and Problem Solving attributes

| | |
|---|---|
| First year Seminar Requirement, FSUS 100, is satisfied by: | |

**HVACR Engineering Technology & Energy Management - Bachelor of Science - 124 Credits**

| Prefix | ### | Course Title (Prerequisites shown in parenthesis) | Crs |
|---|---|---|---|
| MAJOR REQUIREMENTS – 84 Credits Required | | | |
| HVAC | 285 | HVAC System Design using BIM (departmental approval) | 2 |
| HVAC | 312 | Control Theory & Application (HVAC 285, 321 and 342 w/C- or higher) | 4 |
| HVAC | 321 | HVAC Air Side System Select Design (admission to BS in HVACR Engineering Tech & Energy Mgt) (co-requisite: HVAC 285) | 4 |
| HVAC | 325 | HVAC Hydronic System Select Design (HVAC 285, 321 and 342 w/C- or higher) | 4 |
| HVAC | 342 | Load Calculation and Energy Code (admission to BS in HVACR Engineering Tech & Energy Mgt) (co-requisite: HVAC 285) | 4 |
| HVAC | 350 | Contracting Issues in HVACR (HVAC 285, 342 and (HVAC 321 or 322) w/C- or higher) | 4 |
| HVAC | 393 | Summer Internship ((HVAC 312 or 313), (HVAC 325 or 326), and HVAC 350 w/C- or higher) | 4 |
| HVAC | 415 | Direct Digital Control (HVAC 393 and MATH 126 w/C- or higher) | 4 |
| ⭘⊙HVAC | 451 | Energy Audit and Analysis (HVAC 393 and MATH 126 w/C- or higher) | 4 |
| HVAC | 462 | HVAC Primary HVAC Equipment Selection (HVAC 393 and MATH 126 w/C- or higher) | 4 |
| ⭘⊙HVAC | 499 | Commercial HVAC System Design (HVAC 415, 451 and 462 w/C- or higher) | 4 |
| Associate's Degree | | Student must have an approved Associate's degree. | 42 |

⊙ - Class with Collaboration attribute
⭘ Class with Problem Solving attribute

**ADDITIONAL GRADUATION REQUIREMENTS**

Students must
- maintain a 2.00 cumulative FSU GPA
- have 40 credits at the 300/400 level
- have 30 credits of Ferris classes (FSU Residency requirement)
- have a minimum 120 total credits to earn a bachelor degree
- earn a "C-" or better in all HVAC coursework

| DEGREE OUTCOMES | |
|---|---|
| 1. | Analyze and select commercial/industrial HVAC systems for specific applications |
| 2. | Design commercial/industrial HVAC systems, given design parameters, building type & geographic location |
| 3. | Select secondary equipment for specific commercial/industrial ducting & piping systems |
| 4. | Select primary equipment for specific commercial/industrial ducting & piping systems |
| 5. | Commission a commercial or industrial HVAC system |
| 6. | Perform an energy audit of an actual facility; analyze utilities for proper applications of rate; analyze O&M and ECMs for potential energy savings; determine feasibility using payback calculations |
| 7. | Utilize & develop estimates, specifications, economic costs & analyze codes & standards |
| 8. | Program control sequences for specific commercial & industrial HVAC systems and equipment |

**HVACR Engineering Technology & Energy Management - Bachelor of Science - 124 Credits**

Semester-by-Semester layout of classes

## THIRD YEAR

**Fall Semester**

| Class | Credits |
|---|---|
| HVAC 285 | 2 |
| HVAC 321 | 4 |
| MATH 126 | 4 |
| HVAC 342 | 4 |
| ENGL 311 | 3 |
| Total Credits | 17 |

**Spring Semester**

| Class | Credits |
|---|---|
| HVAC 312 | 4 |
| HVAC 350 | 4 |
| HVAC 325 | 4 |
| MATH | 3-4 |
| | |
| Total Credits | 15-16 |

**Summer Semester**

| Class | Credits |
|---|---|
| HVAC 393 | 4 |
| | |
| | |
| | |
| | |
| Total Credits | 4 |

## FOURTH YEAR

**Fall Semester**

| Class | Credits |
|---|---|
| HVAC 415 | 4 |
| HVAC 451 | 4 |
| HVAC 462 | 4 |
| Culture | 3 |
| | |
| Total Credits | 15 |

**Spring Semester**

| Class | Credits |
|---|---|
| HVAC 499 | 4 |
| ECON 221 | 3 |
| Culture | 3 |
| Self and Society | 3 |
| | |
| Total Credits | 13 |

**Summer Semester**

| Class | Credits |
|---|---|
| | |
| | |
| | |
| | |
| | |
| Total Credits | |

## Course Name: HVAC 342

## HVAC Load Calculations and Energy Codes

## Course Description:

Complete heat loss and gain calculations for commercial and industrial buildings will be performed manually and utilizing currently available computer software packages. Student will perform load calculations with the expectations to understand minimum required and maximum energy efficiency.

Energy estimating methods will be studied and an analysis of a building using the Performance Rating Method as described in ASHRAE Standard 90.1 appendix G. Current federal, state and local codes and standards will be examined as they apply to HVAC systems.

## Semester Hours:

4

## Contact Hours:

Lectures M-W-F 08:00-08:50 AM

Labs: Section 211 8:00-10:50 Monday, Section 212: 8:00-10:50 Wednesday

## Prerequisites:

Admission to HVACR Engineering Technology Program

## Textbook and Required Materials:

**2009 ASHRAE Handbook of Fundamentals**

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. 2009 & CD, be sure to order the correct version (I/P (inch pounds) vs. S/I)

**Course Pack** Will be available at the on campus bookstore

**Safety glasses** please bring them to lectures and labs when asked so that we can be more expedient with the class.

## Reference Materials: (Not Required to Purchase)

### Principles of Heating Ventilating and Air Conditioning (not required)

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. 2005 &CD

### HVAC Systems and Equipment (not required to purchase)

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. Current
Typically required in other HVAC courses

HVAC Applications (not required to purchase)

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. Current
Typically required in other HVAC courses

### HVAC Systems and Components Handbook Second Edition (not required to purchase)

Niles R. Grimm & Robert C. Rosaler, McGraw Hill 1990

### ASHRAE Standards 15, 55, 62.1, 90.1 (not required to purchase)

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
They have various publication dates and are available electronically from the Flite Center and Blackboard.

### ACCA MANUAL N & CS (not required to purchase)

Air Conditioning Contractors of America, Commercial Load Calculation Manual, 5th Edition

### Trane Trace 700 & System Analyzer (not required to purchase)

Electronic load calculation program with LEED point generation assistance and operation cost analysis Created & distributed by the Ingersol Rand (Trane) Company. (Provided on HVAC Lab Computers)

### Carrier Hourly Analysis Program (not required to purchase)

Electronic load calculation program with LEED point generation assistance and operation cost analysis Created & distributed by the United Technologies (Carrier) Company. (Provided on HVAC Lab Computers)

### E-Quest (not required to purchase)

Electronic load calculation program with LEED point generation assistance and operation cost analysis Created & distributed by the USGBC **(Free Download see Blackboard)**

## Topical Unit Outline of Major Units of Instruction

**I. Introduction**

A. Course goals
B. Requirements for attendance and grading
C. HVACR Student Policy

**II. Psychrometric Processes For Equipment Selection**

A. Apparatus dew point method (aka effective coil temperature)
B. Calculations
- Air quantity
- Entering coil conditions
- Leaving coil conditions
- Coil load
- Coil sensible heat ratio

**III Heat Loss Calculations**

A. Summary of loads, equations and references
B. General procedure

1. Outdoor design conditions
2. Indoor design conditions
3. Temperature in adjacent unheated spaces
4. Heat transfer coefficients

5. Area calculations
6. Heat transmission losses
   A. Roof, ceilings, walls and glass
   B. Walls below grade
   C. Floors
      Above grade
      On grade
      Below grade
7. Infiltration
8. Ventilation
   A. Indoor air quality requirements
   B. Mechanical code requirements
9. Total losses
10. Internal gains
11. Pickup loads

C. Energy code compliance

**<u>IV Heat Gain Calculations</u>**

A. Heat flow rates
   1. Space heat gain
   2. Space cooling load
   3. Space heat extraction rate
   4. Cooling coil load

B. General procedure
   1. Characteristics of the building
   2. Location, orientation and external shading
   3. Outdoor design conditions
   4. Indoor design conditions
   5. Internal thermal loads
   6. Peak space cooling load determination

      A. External loads
         1. Roof walls and glass
            A. Conduction
            B. Solar Radiation
         2. Partitions, ceilings, and floors

      B. Internal loads
         1. Lights
         2. People
            Sensible & Latent
         3. Appliances
            Sensible & Latent
         4. Power utilizing equipment
         5. Ventilation and infiltration air
            Sensible, Latent & Total

C. Energy code compliance

**<u>V. Psychrometric Processes For Equipment Selection</u>**

A. Apparatus dew point method (aka effective coil temperature)
B. Calculations
   Air quantity
   Entering coil conditions
   Leaving coil conditions
   Coil load
   Coil sensible heat ratio

**VI. Energy Estimating Methods**

A. Single measure methods
B. Simplified multiple measure method
C. Detailed simulation methods
D. ASHRAE Standard 90.1

## HVACR Student Policy:

Will be read, endorsed and adhered to by each student. Keep in mind that you must pass every HVAC course in our curriculum with a C- or better to continue in your current enrollment tract in the HVAC Engineering Technology and Energy Management Program.

***Failure to meet this results in repeat of the course and you will not be allowed to take a course that have HVAC 342 in it's pre-requisite line*.**

## Attendance Policy:

Absences hinder technical development within the program or course of study. Attendance is required and punctuality expected. Leaving our lecture area or laboratory before classis dismissed shall count as an unexcused absence and will be reflected in your grade. You will have two freebies to use after the two there is a graduated scale for number of absences. It is worth 5% of your final grade.

Excused Absence: What would count as an excused absence?

Injuries, accidents, operations, immediate family deaths, communicable illnesses, etc. (check with me). Documentation is required to gain privilege of an excused absence. Consult with the instructor for arrangements to makeup missed work. I will do what I can to assist you in your situation provided you are honest & truthful thorough the process. I have an email address if you have an issue that requires you to miss class, send me an email prior to the class being missed. If you miss a lab without an excuse the lab grade will be 0 for the week.

This is a common courtesy that you are required to perform in the business world.

## Cell Phone Policy:

Make sure cell phones are off or set to the vibrate position.

Wait until the end of class or during a break in the lab to attend calls.

Any cell phone use during the middle of class is disruptive and unacceptable. You will be asked to leave the class for the day and could result in additional quizzes or assignments for the class.

## Personal Computer Usage Policy:

You can use personal computers during lecture and lab except during any examination. During examinations you will be instructed as to any peripheral devices that can be used. Headphones are not permitted during exams, lecture or labs.

## Course Issues:

Some students experience difficulty with courses, if you find this happening to you there are methods to assist you. I have posted office hours plus there are student tutoring services available. The bottom line is that this is something you must initiate and I will do what I can to assist.

## Student Representation of Ferris State University:

We will be visiting various facilities thru the semester and at those times I expect that you will treat our customers with respect. Remember you are a representative of our Ferris State University and as such I expect you to act as an HVACR professional.

If at any time you show any lack of professionalism you will be escorted from the class and will receive a letter grade of ***F*** for the course.

## Plagiarism or Cheating Policy:

The usage of any information from other students or prior classes is not acceptable. Every semester there are instances where information has been in possession of persons other than the Author.

I would recommend that you use a personal flash drive, email the documents to yourself or use the secure space of Ferris State's server (I will show you in Lab).

Please *do not* get in the habit of saving information on the hard drive of the lab computers, there are students that search for work left on machines.

Plagiarism from other sources will also not be acceptable.

If there is evidence that this has occurred, the resultant will be the receipt of a letter grade of **F** for the course plus the matter will be turned over to judicial services for potential expulsion from the University

## Laboratory Safety Policy:

Safety glasses will be worn when directed by Instructor. Proper attire and closed toed shoes will be worn at all times during excursions into the field. Failure to follow this rule will result in being escorted from the lab for the remainder of that period and a zero score for that lab.

Most of the times our labs are in the computer room (GRN-270), Instructor will notify students when we will be traveling for labs.

## Electronic Submissions Policy:

You will be using Blackboard for every course. I expect that your computer skills are to an average level for University caliber at the Junior Level. You will be responsible to use Microsoft Word, Excel, Visio for this class. You will be creating numerous spreadsheets and will have to manipulate your submissions so that there is only one file submitted per assignment.

This will require insertion of images etc. into your documents. I may suggest that you use Microsoft Word to compile your information. If you are having issues do not hesitate to contact me.

I will not grade any assignment that is turned in with multiple files unless prior approved and it will be considered late, applying late assignment point removal.

Assignments are going to be individual and group assignments, you will be assigned groups according to section numbers and only one submission will be required for grading purposes.

## Late Assignment Policy:

Unless directed, all assignments are to be completed and submitted via Blackboard. Handwritten assignments are not accepted unless prior approved is granted. If assignments are turned in late they will not be graded. It is your responsibility to communicate with me, I will work with students with personal issues, and communication must be clear and prompt. There are two drop boxes that can be used for late assignments or labs. They are located on the home page, please see the restrictions on them.

## Communication Policy:

Please ask questions prior to, in class or after class, if you need to discuss the course, use the Email available in Blackboard for course related issues. Use pacellj@ferris.edu email for course related issues.

## Grading Policy:

| PERCENT | H.P. | GRADE |
|---|---|---|
| 100 - 94 | 4 | A |
| 93 - 90 | 3.7 | A- |
| 89 – 87 | 3.3 | B+ |
| 86 – 84 | 3 | B |
| 83 – 81 | 2.7 | B- |
| 80 – 78 | 2.3 | C+ |
| 77 – 75 | 2 | C |
| 74 - 72 | 1.7 | C- |
| *71 – 70* | *1.3* | *D+* |
| *69 - 68* | *1* | *D* |
| *67-66* | *0.7* | *D-* |
| *65 - below* | *0* | *F* |

| Grading Components | Value |
|---|---|
| Exam #1 | 15% |
| Exam #2 | 15% |
| Exam #3 | 15% |
| Final Exam | 15% |
| Assignments | 7.5% |
| Quizzes | 7.5% |
| Labs | 20% |
| Attendance | 5% |
| | 100% |

## Instructor Contact Information:

Joseph R. Pacella
Associate Professor
LEED A.P.
Ferris State University
College of Engineering Technology
School of As Built Environment
HVACR Department
Granger Building
Room 209 (Office)
231-591-3586 (Office)
pacellj@ferris.edu

## Office Hours:

Can be found on Blackboard, office door or By Appointment

Note: Professor reserves the right to alter any of the contents found within this syllabus to meet unexpected class situations

HVAC Engineering Technology & Energy Management
Syllabus HVAC 350

**COURSE DESCRIPTION:**

HVAC-350 is the study of contracting issues as related to the HVACR industry. The course will focus on plans and specifications, estimating, budget issues, project management, economic cost analysis and codes and standards, all from the perspective of an HVACR professional. Assignments and Laboratory exercises focus on application of contracting issues.

**SEMESTER HOURS:** 4

**CONTACT HOURS:**

Spring 2018

Sec.211: Lectures. Tuesday & Thursday: 9:30-10:45, Lab Tuesday: 12:00-2:50

Sec.212: Lectures. Tuesday & Thursday: 9:30-10:45, Lab Thursday: 12:00-2:50

**PREREQUISITES:** HVAC 290, HVAC 325 & HVAC 342

**TEXTBOOK & REQUIRED MATERIAL:** RSMEANS Mechanical Cost Data 2018

ISBN 978-1-946872-13-5Edition: 41st (Amazon.com ~ $200.00)
Microsoft Office various programs, Excel & Word plus Microsoft Project (Provided in Lab for on-campus students)
On Center Takeoff Software (Provided in Lab and remote access codes for on-campus students)

**REFERENCES:**

***Referenced Materials*** **(Not required to purchase as they will be provided)**
**On Center Takeoff Software,** Free Download, requires access code from Professor
**The Project Resource Manual,** A CSI Manual of Practice 5th Edition 2005
**ASHRAE,** Standards 15, 55, 62.1 & 90.1
**International Code Council (ICC)**, International Mechanical Code 2012 -2018
**RS Means,** Building Construction Cost Data 66th Annual Edition, 2008
**MCAA Project Manager's Manual,** Mechanical Contractors Association of America & Plumbing Contractors of America,

**Topical Outline of Major Units of Instruction**

1. **Plans & Specifications**

a. Specifications
   i. Examine current specifications
   ii. Use specification division and numbering to predictably locate information
b. CSI
   i. Examine industry specification formats
   ii. Explore the Construction Specification Institute's role in construction documentation
c. Terms and conditions
   i. Examine terms and conditions from current jobs
   ii. Define cost impact from terms and conditions
   iii. Complete sample documentation
d. Abbreviations & Symbols
   i. Locate abbreviations in sample plans and specifications
   ii. Locate key symbols in sample plans and specifications
   iii. Demonstrate knowledge of current abbreviations and symbols through a sample project
e. Details
   i. Define pertinent detail types
   ii. Demonstrate ability to link details to construction pages
f. Mechanical Schedules
   i. Locate specific information through the use of schedules in a sample project
   ii. Identify different types of mechanical schedules – make sure all needed data there
   iii. Develop mechanical schedules for a sample project
g. Discrepancies between plans and specs
   i. Locate discrepancies in a sample project
   ii. Identify cost implications for discrepancies
   iii. Complete documentation for resolution of discrepancies.
h. Changes
   i. Addendums
   ii. Bulletins

2. **Codes & Standards**

a. ASHRAE/SMACNA/IESNA/ANSI/OSHA/ISO
b. Determine applicable local/state/federal/international mechanical/HVAC related electrical/gas/
c. Use of codebook
d. Interpretation of codebook
e. What the Inspector wants (Safety)

3. **Estimating**

a. Methods for estimating materials, tools, labor, etc.
   i. Manual method
   ii. Application Software method
b. Scope of work
   i. Define Scope of Work for Various Mechanical Trades
   ii. Complete a Scope of Work document from a sample project
c. Bid/Negotiated jobs
   i. Customer relations
   ii. Examine specifications for Owner's Authority
   iii. Examine relative Bid Documentation
   iv. Identify issues related to negotiated work

d. Design/Build
- i. Customer relations
- ii. Design Build advantages and disadvantages.
- iii. Code compliance and plan review: National, State, and Local. Also, what year code approved

e. Bid & Specification
- i. Sources for opportunities i.e. Builders Exchange
  1. Locate project from selected source
  2. Plot drawings and print specifications
- ii. Identify issues related to bid & specification
- iii. Public vs. private bids
- iv. Examine relative bid documentation
- v. Bid requirements i.e. bonding, insurance
- vi. Examine specifications for Owner

f. Material
- i. Material Billing
- ii. Material Shipping
- iii. Material Storage
- iv. Insured material
- v. Incorrect material
- vi. Schedule of Values
- vii. Unit Pricing

g. Equipment
- i. Identify responsibility
- ii. Examine implications from operation during construction
- iii. Temporary heat requirements and who supplies temp. enclosure and maintains it
- iv. Unit Pricing
- v. Warranty Start
- vi. Shipping
- vii. Availability vs. job schedule

h. Take off
- i. Perform mechanical take off for sample project

i. Labor
- i. Union/nonunion/prevailing wage
- ii. Skills required vs. available skilled labor
- iii. Roll of job site Forman
- iv. Per diem

j. Burden

k. Risk
- i. Examine risk items associated with mechanical work
- ii. Perform risk analysis for sample project Terms & conditions

l. Available software

m. Warranty
- i. Associated Jobsite Specifics
  1. Early equipment start-up
  2. Start-up during construction
  3. Warranty Start Date
  4. Contract requirements

n. General Contractor & Subcontractor
- i. Examine roles of contractors on projects
- ii. Complete a flowchart identifying hierarchy of a sample project
- iii. Identify subcontractor cost methods
- iv. Examine risk issues for subcontracting work

o. Site specific requirements
p. Set up and tear down (mobilization & demobilization)
q. Covered in site-specific requirements
r. Coordination with other trades
s. The influence of weather on productivity

4. **Project Management**

a. What is a PMP? (Project Management Professional)
b. Project management plan
c. Scheduling Gant schedule with weekly update and Project Contractor meetings
d. Job documents/AIA
e. Rental i.e. aerial work platforms, safety equipment, tools
f. Security compliance
g. Safety- on site supervision, compliance and documentation
h. Coordination with other trades
i. Sub-contractor performance issues & scheduling
j. Quality control
k. Personnel issues

5. **Economic Analysis**

a. Financial terms
b. Methods of cash flow analysis
    1. Simple payback
    2. Life cycle cash flow analysis
c. Application
    1. Utilize available software to perform cash flow analysis
    2. Given homework, and handouts calculate discounted cash flow analysis.
3. Utilize available software to perform cash flow analysis.

**HVACR Student Policy**:

Will be read, endorsed and adhered to by each student. Keep in mind that you must pass every HVACR course in our curriculum with a C- or better to continue in your current enrollment tract in the HVACR engineering program.

**Attendance**:

Absences hinder technical development within the program or course of study. Attendance is required and punctuality expected. Leaving our lecture area or laboratory before classis dismissed shall count as an unexcused absence and will be reflected in your grade. You will have three lecture freebies to use after the three, there is a graduated scale for number of absences. It is worth 5% of the final grade. There are no freebies for missing lab, labs will not be accepted unless prior arrangement is made with your Professor.

Excused Absence: What would count as an excused absence? Injuries, accidents, operations, immediate family deaths, communicable illnesses, etc. (check with your Professor) Documentation is required to gain privilege of an excused absence.

Consult with the Professor for arrangements to makeup missed work. I will do what I can to assist you in your situation provided you are honest & truthful thorough the process.

**Cell Phones**:

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Any phone use during class is disruptive to your classmates and is unacceptable.

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**Student Representation of Ferris State University:**

We may be visiting remote facilities thru the semester and at those times I expect that you will treat our customers with respect. Remember you are a representative of our Ferris State University and as such expects you to be a professional. <u>If at any time you show any lack of professionalism you will be escorted from the class and will receive a letter grade of F for the course.</u>

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The usage of any information from other students or prior classes is not acceptable. Plagiarism from other sources will also not be acceptable.

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**Electronic Submissions Policy**:

You will be using Blackboard for every course. Your computer skills are expected to be at an average level for a Junior attending a university. You will be responsible to use Microsoft Word, Excel, Visio for this class. You will be creating numerous spreadsheets and will have to manipulate your submissions so that there is only one file submitted per assignment. This will require insertion of images etc. into your documents. I may suggest that you use Microsoft Word to compile your information. If you are having issues do not hesitate to contact me.

I will *not grade* any assignment that is turned in with multiple files unless prior approved and it will be considered late, applying late assignment policy. Assignments are going to be individual and group assignments, you will be assigned groups according to section numbers and only one submission will be required for grading purposes.

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Assignments turned in late will not be graded. You have two late assignment or lab drop boxes, use them if needed but It is your responsibility to communicate with me prior to the assignment being due.
I will work with students with personal issues, communication must be clear and prompt.

**Laboratory Safety**:

Safety glasses will be worn when directed by Instructor. Proper attire and closed toed shoes will be worn at <u>all times</u> during excursions into the field. Failure to follow this rule will result in being escorted from the lab for the remainder of that period and a zero score for that lab.

**Grading Matrix**:

| PERCENT | H. P. | GRADE |
|---|---|---|
| 100 – 95 | 4 | A |
| 94 – 92 | 3.7 | A- |
| 91– 89 | 3.3 | B+ |
| 88 – 86 | 3 | B |
| 85 – 83 | 2.7 | B- |
| 82 – 80 | 2.3 | C+ |
| 79 – 77 | 2 | C |
| 76 - 73 | 1.7 | C- |
| *72 - 70* | *1.3* | *D+* |
| *69 - 67* | *1* | *D* |
| *66-64* | *0.7* | *D-* |
| *Below 64* | *0* | *F* |

| Grading Components | Value |
|---|---|
| Exam #1 | 15% |
| Exam #2 | 15% |
| Exam #3 | 15% |
| Final Exam | 15% |
| Assignments & Quizzes | 15% |
| Labs | 20% |
| Attendance | 5% |
| | 100% |

## Instructor Contact Information:

I am not on campus every day of the week and live approximately 45 miles North of Ferris State University's main campus. Occasionally I will not be "physically in" my office during office hours, I am normally in the Granger Building during those hours, but may be in a lab working with other instructors or students. If I am not in my office, please send mean email.

Joseph R. Pacella
LEED A.P.

Associate Professor
Granger Building, Room 209 (Office)
605 South Warren Avenue
Big Rapids, MI 49307

231-591-3586 (Office)
pacellaj@ferris.edu

**NOTE: Professor reserves the right to alter any of the contents found within this syllabus**

**FERRIS STATE UNIVERSITY**
COLLEGE OF TECHNOLOGY
CONSTRUCTION DEPARTMENT
HVACR PROGRAMS

# SYLLABUS

## COURSE TITLE:

HVAC 451, Energy Analysis and Audit

## COURSE DESCRIPTION:

The survey of utility rate structures, billing energy consumption and energy profiling of commercial and industrial buildings. On-site audit projects will report on recommendations to building envelopes, HVACR systems and control systems with regard to payback. Oral and written presentations are a requirement of this senior project.

## SEMESTER HOURS:

4

## CONTACT HOURS:

| | | | |
|---|---|---|---|
| Lecture: | 3 Hours / Week | Fall 2018: | Sec. 211 & 212; T, R; 9:30am - 10:45am |
| Lab: | 3 Hours / Week | Fall 2018: | Sec. 212; T; 12:00pm - 2:50pm |
| | | | Sec. 211; R; 12:00pm - 2:50pm |

## PREREQUISITES:

Math 126 or Math 130, HVAC 393 or Waiver, all HVAC courses with grade of C– or better.

## TEXTBOOK REQUIRED:

None

## REFERENCES & Course Pack:

*Capehart, Turner and Kennedy, ***Guide to Energy Management,*** The Fairmont Press, 8th Edition.
*Doty and Turner, ***Energy Management Handbook***, The Fairmont Press, 8th Edition.
*Thumann and Mehta, ***Handbook of Energy Engineering***, The Fairmont Press, 7th Edition.

Reiter, Sydney, ***The Financial Evaluation of Energy Costs and Projects,*** Van Nostrand Reinhold, 1985.

There is a required course pack at the campus bookstore.

* Suggested reference books to study for the CEM (Certified Energy Manager) exam.

## TOPICAL OUTLINE OF MAJOR UNITS (LECTURE):

I. Introduction

II. Units of Energy

III. Electrical Utility Rate Structures
   - A. Consumption based bills
   - B. Sales Tax
   - C. Hybrid based bills
   - D. Demand based bills
   - E. Power Factor

IV. Natural Gas Utility Rate Structures
   - A. Gas utility billing from distributor
   - B. Gas utility billing from broker

V. Utility Purchase

VI. Energy History

VII. National Energy Act

VIII. Energy Estimating Methods
   - A. Steady State Methods (Degree Day, BIN)
   - B. Correlation Methods
   - C. Computer Simulations

IX. Building Considerations
   - A. Envelope Insulation
   - B. Envelope Weather-stripping

X. Mechanical Considerations
   - A. Temperature setback
   - B. Piping insulation
   - C. Preheating water with waste hot water
   - D. Reducing equipment run time
   - E. Economizer (Less expensive cooling!)
   - F. Preheating Combustion Air

XI. Steam System Considerations
   - A. Background
   - B. Steam trap replacement
   - C. Steam from waste heat

## TOPICAL OUTLINE OF MAJOR UNITS (LECTURE):

XII. Lighting Considerations
- A. Terminology
- B. Incandescent Lighting
- C. Fluorescent Lighting
  1. Standard
  2. Compact
  3. HID
  4. Induction
- D. LED Lighting

XIII. Simple Economic Analysis
- A. Know present value find future value
- B. Know present value find annual value
- C. Know future value find annual value
- D. Know future value find present value
- E. Know annual value find future value
- F. Know annual value find present value
- G. Tax impact

## TOPICAL OUTLINE OF MAJOR UNITS (LAB):

LAB 1: Location: GRN Lab
Explanation of Energy Audits
Explanation of Sections of Technical Assistance Audit
Review of Data Collection and Space Input
Lab 1: Test Form on Blackboard (10 points)

LAB 2: Location: GRN Lab
Explanation of CBECS (Commercial Building Energy Consumption Survey)
EUI (Energy Utilization Index) Development
Lab 2: EUI Development Form & EUI Spreadsheet (10 points)

## TOPICAL OUTLINE OF MAJOR UNITS (LAB):

LAB 3: Location: GRN Lab
Utility Bill Analysis (10 points)

LAB 4: Location: GRN Lab
Report Section 2: Project (TAA) Utility Analysis (25 points)

LAB 5: Location: GRN Lab
Report Section 1: Project (TAA) Building Description (25 points)

LAB 6: Location: GRN Lab
Report Section 3: Project (TAA) HAP (25 points)

LAB 7: Location: GRN Lab
Report Section 4: Project (TAA) Mechanical /Control Description (25 points)

LAB 8: Location: GRN Lab
Report Section 5: Project (TAA) Lighting and Other Electrical (25 points)

LAB 9: Location: Project Site
Field Analysis & Final Data Collection (25 points)

LAB 10: Location: GRN Lab
Practice ECM Development (10 points)

LAB 11: Location: GRN Lab
Report: Section 6: Project (TAA) O&Ms and ECMs (25 points)

LAB 12: Location: GRN Lab
Report: Executive Summary (25 points)

LAB 13: Location: GRN Lab
PowerPoint Development
Presentation Practice (50 points)

LAB 14: Location: GRN Lab
Presentation Practice (50 points)

LAB 15: Location: Unknown
Presentation (100 points)

## INSTRUCTOR & OFFICE HOURS:

**INSTRUCTOR:** Michael J. Korcal, C.E.M., MT (ASCP), Associate Professor
**OFFICE: GRN 203** **PHONE: 231-591-2626**
**OFFICE HOURS:** Tues: 8:00am - 9:30am, 3:00pm - 3:30pm
Thur: 8:00am - 9:30am, 3:00pm - 3:30pm and by appointment.

NOTE: The professor reserves the right to make changes to this syllabus during the course of this class, including content and schedules of content.

## OTHER POLICIES:

**CELL PHONES**: Make sure cell phones are set to the vibrate position. Wait until the end of class or during a break in the lab to attend calls. Making and answering calls in the middle of class is disruptive and unacceptable.

**LABORATORY SITE VISITS**: During the semester the class must visit a customer site to collect data for the technical assistance audit. During these visits all students will follow all rules laid down by the instructor and the customer including conduct, safety, security and other rules. Failure to follow the given rules will result in penalties ranging from 1 full grade reduction for the course to course suspension.

## GRADES:

| | |
|---|---|
| EXAM 1 | 15% (150 points) |
| EXAM 2 | 15% (150 points) |
| EXAM 3 | 15% (150 points) |
| Quizzes | 11% (110 points) |
| Labs 1,2,3,9 | 4% (40 points) |
| Report (labs 4-8, 10-12) | 20% (200 points) |
| Presentation (labs 13-15) | 20% (200 points) |
| Total | 100% (1000 points) |

| PERCENT | HP | GRADE |
|---|---|---|
| 100 - 94 | 4.0 | A |
| 93 - 90 | 3.7 | A- |
| 89 - 87 | 3.3 | B+ |
| 86 - 84 | 3.0 | B |
| 83 - 81 | 2.7 | B- |
| 80 - 78 | 2.3 | C+ |
| 77 - 75 | 2.0 | C |
| 74 - 73 | 1.7 | C- |
| 72 - 71 | 1.3 | D+ |
| 70 - 69 | 1.0 | D |
| 68-67 | 0.7 | D- |
| 66 - below | 0.0 | F |

## Fall 2018, Tentative Class Schedule:

| Week | Day | Date | Class Topic for that Day (tentative, subject to change) | LABS |
|---|---|---|---|---|
| 1 | Tue | 8/28/2018 | Introduction, Syllabus, Overview, Energy Units | 1 - Audit Overview |
| | Thur | 8/30/2018 | Utility Rates | |
| 2 | Tue | 9/4/2018 | Utility Rates | 2 - EUI Development |
| | Thur | 9/6/2018 | Utility Rates | |
| 3 | Tue | 9/11/2018 | Power Factor, Natural Gas Billing | 3 - Utility Bill Analysis |
| | Thur | 9/13/2018 | Purchase of Utilities, Energy History | |
| 4 | Tue | 9/18/2018 | National Energy Act 1978 | 4 - TAA Utility Analysis |
| | Thur | 9/20/2018 | EXAM 1 | |
| 5 | Tue | 9/25/2018 | Energy Estimating Methods | 5 - TAA Building Desc. |
| | Thur | 9/27/2018 | Envelope Improvement | |
| 6 | Tue | 10/2/2018 | Envelope Improvement | 6 - TAA HAP |
| | Thur | 10/4/2018 | Envelope Improvement | |
| 7 | Tue | 10/9/2018 | HVAC Improvement | 7 - TAA Mech. / Control |
| | Thur | 10/11/2018 | HVAC Improvement | |
| 8 | Tue | 10/16/2018 | HVAC Improvement | 8 - TAA Lighting / Other |
| | Thur | 10/18/2018 | EXAM 2 | |
| 9 | Tue | 10/23/2018 | HVAC Improvement | 9 - Field Trip |
| | Thur | 10/25/2018 | HVAC Improvement | |
| 10 | Tue | 10/30/2018 | HVAC Improvement | 10 - ECM Practice |
| | Thur | 11/1/2018 | Lighting | |
| 11 | Tue | 11/6/2018 | Lighting | 11 - TAA ECM/OM |
| | Thur | 11/8/2018 | Lighting | |
| 12 | Tue | 11/13/2018 | Economic Analysis | 12 - TAA Ex. Summary |
| | Thur | 11/15/2018 | Economic Analysis | |
| 13 | Tue | 11/20/2018 | Project issues | 13 - PowerPoint Devel. |
| | Thur | 11/22/2018 | THANKSGIVING RECESS - NO CLASS | |
| 14 | Tue | 11/27/2018 | Project Issues | 14 - Present. Practice |
| | Thur | 11/29/2018 | Project Issues | |
| 15 | Tue | 12/4/2018 | Section 212 presentation practice | 15 - Presentation |
| | Thur | 12/6/2018 | Section 211 presentation practice | |
| 16 | Mon | 12/10/2018 | Final Exam - 10:00am—11:40am | |

**FERRIS STATE UNIVERSITY**
College of Engineering Technology
School of Built Environment
HVACR Programs

# Welcome

Welcome to HVAC337 for Fall of 2018. My name is Michael Korcal and I will be your professor for this course, this semester.

The course is being delivered through Blackboard, which you access through MyFSU. The steps are as follows:

1. Log into MyFSU
2. Click on Blackboard
3. When Blackboard opens, find your HVAC337 course and click on it.
4. It should take you to the Start Here page, which includes: my contact information and office hours and the current syllabus.

You will notice on the left side of the screen there are a row of buttons. At the top is the Start Here, this will take you back to start page if needed. The next button is Announcements button, I will post course announcements here, such as corrections to the course material. The next button is communications, this is what you should use to ask me questions. The next button is Tegrity classes, this is where you go to listen to lectures. The rest of the buttons are for each weeks course material. The course is delivered 1 week at a time starting on each Sunday. Each week you will do the following:

1. Open the appropriate week
2. Download the lecture notes for that week (or have the whole notes printed ahead of time)
3. Listen to the lectures for that week (usually 3 lectures, listed A, B, C)
4. Do an assessment or Exam (Exams are on week 4, 8 & 12)

Each week you follow the same steps.

There is a required textbook (see syllabus), There is not a course pack, even though the book store has an old one from when the course was an on campus course, you do not need this. On the course lecture notes: Each week, that weeks notes are available to download and print or I have included the full notes under Week 1, you can download and take somewhere and print.

Make sure you don't get behind in the course! Blackboard lets me know when you have last accessed the course. If it look like you are getting behind, you will hear from me! If you have questions, get a hold of me and we can work things out. I hope you have a great semester!!!

Sincerely,

Michael J. Korcal, C.E.M., MT(ASCP)

**FERRIS STATE UNIVERSITY**
College of Engineering Technology
School of Built Environment
HVACR Programs

# SYLLABUS

## COURSE TITLE:

HVAC 337, Mechanical and Electrical Systems for Buildings

## COURSE DESCRIPTION:

Awareness of heating, ventilating and air conditioning systems, water supply, sanitary and storm sewers, fire protection, electrical distribution, lighting and acoustical systems for buildings. Emphasis is placed upon systems integration, energy considerations and their effects upon building planning, detailing and construction. Discusses equipment, code requirements, and building applications.

## SEMESTER HOURS:

3

## CONTACT HOURS:

Fall 2018
Sec. VL1, VL2, VL3: On-Line

## PREREQUISITES:

None

## TEXTBOOK REQUIRED:

**Mechanical & Electrical Systems in Buildings,** 5rd Ed., by William K.Y. Tao and Richard R. Janis, (2013, 2009, 2005, 2001, 1997 Pearson Prentice Hall). ISBN-13: 978-0-13-801562-6 **OR**
**Mechanical & Electrical Systems in Buildings,** 4rd Ed., by William K.Y. Tao and Richard R. Janis, (2009, 2005, 2001, 1997 Pearson Prentice Hall). ISBN-13: 978-0-13-801562-6

***NOTE: You need one of the above editions, what ever is available.***

## COURSE DELIVERY:

Course is fully on-line. Material is delivered 1 week at a time. Every Sunday a new week's material is available. Every week will follow the same format:

1. Get notes for that week ready to take additional notes
2. Listen to the Tegrity Lectures for that week (Usually 3, labeled with letters A, B, C)
3. Do the assessment or exam for that week. Note: Week 4, 8 & 12 are exam weeks.
4. Repeat when the next weeks material is released.

All assessments and exams are open book / open note. All assessments and exams are self grading. Make sure you keep careful track of deadlines for assessments and exams. Read carefully!

## MAJOR UNITS OF INSTRUCTION BY WEEK:

Week 1:
- Lecture 1A - Basic Terminology - Mechanical
- Lecture 1B - Building Operation Plan
- Lecture 1C - Psychrometrics

Week 2:
- Lecture 2A - Load Calculation Basics
- Lecture 2B - Conduction (Gains / Losses)
- Lecture 2C - Conductive Exercise

Week 3:
- Lecture 3A - Convective (Gains / Losses) & Wanted / Unwanted
- Lecture 3B - Solar Gain
- Lecture 3C - People and Other Gain

Week 4:
- Lecture 4A - Air Systems & Ductwork (Components)
- Lecture 4B - Air Systems & Ductwork (Types)
- Lecture 4C - Ductwork Sizing
- EXAM 1 - Covers Lectures 1A,1B,1C,2A,2B,2C,3A,3B,3C,4A,4B,4C

Week 5:
- Lecture 5A - Hydronic Systems & Piping
- Lecture 5B - Piping Layouts
- Lecture 5C - Pipe Sizing

Week 6:
- Lecture 6A - Refrigeration Cycle
- Lecture 6B - Refrigeration Systems
- Lecture 6C - Steam Systems

Week 7:
- Lecture 7A - Basic Electricity (Terms)
- Lecture 7B - Basic Electricity (Components)
- Lecture 7C - Basic Electrical Wiring

Week 8:
- Lecture 8A - Energy / Power (Terms)
- Lecture 8B - Energy Sources
- Lecture 8C - Energy / Power (Billing)
- EXAM 2 - Covers Lectures 5A,5B,5C,6A,6B.6C,7A,7B,7C,8A,8B.8C

Week 9:
- Lecture 9A - Control Overview
- Lecture 9B - Control Point Types & Examples
- Lecture 9C - Control Strategies

Week 10:
- Lecture 10A - Lighting Definitions
- Lecture 10B - Incandescent Lighting (General)
- Lecture 10C - Incandescent Lighting (Quartz Halogen)

## MAJOR UNITS OF INSTRUCTION BY WEEK - cont.:

Week 11:
- Lecture 11A - Fluorescent Lighting (Standard)
- Lecture 11B - Fluorescent Lighting (CFL)
- Lecture 11C - Fluorescent Lighting (HID)

Week 12:
- Lecture 12A - Fluorescent Lighting (Induction)
- Lecture 12B - LED Lighting
- Lecture 12C - Lighting Design
- EXAM 3 - Covers Lectures 9A,9B,9C,10A,10B,10C,11A,11B,11C,12A,12B,12C

Week 13:
- Lecture 13A - Acoustics (Basics)
- Lecture 13B - Acoustics (Noise Sources)
- Lecture 13C - Acoustics (Equipment Selection)

Week 14:
- Lecture 14A - Plumbing - Source & Treatment
- Lecture 14B - Plumbing - Fixtures
- Lecture 14C - Plumbing - Supply Sizing

Week 15:
- Lecture 15A - Plumbing - Sanitary (Waste)
- Lecture 15B - Plumbing - Storm
- Lecture 15C - Fire Protection
- FINAL - Covers **ALL** Lectures

## COURSE SUCCESS:

Steps to be successful.

- Don’t get behind! The course is set up on a weekly basis. There is a schedule in this syllabus, print it out and follow it.
- When listening to the lectures, take good notes. Not all of the material are in the notes that your are given.
- Listen to the lectures multiple times.
- When you take the assessments and exams, read carefully, take your time before answering.
- You know you are ready to take an assessment or exam if you could teach the material!
- I have office hours, if you are having problems, come and see me.

## Additional Course Information:

**INSTRUCTOR:** Michael J. Korcal, C.E.M., MT (ASCP), Associate Professor
**OFFICE: GRN 203**
**OFFICE HOURS:** Tuesday: 8:00am - 9:30am, 3:00pm - 3:30pm
Thursday: 8:00am - 9:30am, 3:00pm - 3:30pm
By appointment
**PHONE:** 2626
**E-mail:** use Communication / message function in Blackboard!
**ANNOUNCEMENTS:** Watch for announcements posted in Blackboard!

EXAM 1 20 % (100 points) (Week 4)
EXAM 2 20% (100 points) (Week 8)
EXAM 3 20% (100 points) (Week 12)
FINAL 25.0% (125 points) (Week 15)
ASSIGN. 15% (75 points) (See below)

Total = 100% (500 points)

General Grading Policy:

| PERCENT | HP | GRADE |
|---|---|---|
| 100 - 94 | 4.0 | A |
| 93 - 90 | 3.7 | A- |
| 89 - 87 | 3.3 | B+ |
| 86 - 84 | 3.0 | B |
| 83 - 81 | 2.7 | B- |
| 80 - 78 | 2.3 | C+ |
| 77 - 75 | 2.0 | C |
| 74 - 73 | 1.7 | C- |
| 72 - 71 | 1.3 | D+ |
| 70 - 69 | 1.0 | D |
| 68-67 | 0.7 | D- |
| 66 - below | 0.0 | F |

| Assessments | Description | Lectures | % of tot. gr. |
|---|---|---|---|
| 1 - Week 1 | Terms / BOP / Psychrometrics | 1A,1B,1C | 1.25 |
| 2 - Week 2 | Load Calculations (Basics, Conductive) | 2A,2B,2C | 1.25 |
| 3 - Week 3 | Load Calculations (Convective, Solar, Other) | 3A,3B,3C | 1.25 |
| 4 - Week 5 | Air Systems & Ductwork | 4A,4B,4C | 1.25 |
| 5 - Week 6 | Hydronic Systems & Piping | 5A,5B,5C | 1.25 |
| 6 - Week 7 | Refrigeration / Steam / Electricity | 6A,6B,6C,7A,7B,7C | 1.25 |
| 7 - Week 9 | Energy / Control | 8A,8B,8C,9A,9B,9C | 1.25 |
| 8 - Week 10 | Lighting (Basics / Incandescent) | 10A,10B,10C | 1.25 |
| 9 - Week 11 | Lighting (Fluorescents) | 11A,11B,11C | 1.25 |
| 10 - Week 13 | Lighting (LED), Acoustics | 12A,12B,12C,13A,13B,13C | 1.25 |
| 11 - Week 14 | Plumbing - Supply / Waste | 14A,14B,14C | 1.25 |
| 12 - Week 15 | Plumbing - Storm / Fire | 15A.15B.15C | 1.25 |

## Fall 2018 - WEEKLY TO DO SCHEDULE:

| | | | |
|---|---|---|---|
| **WEEK 1** | **AUG 27 - SEP 1** | | |
| ☐ | Listen to Lectures 1A, 1B, 1C | ☐ | |
| ☐ | Do Assessment 1 | **WEEK 9** | **OCT 21 - 27** |
| **WEEK 2** | **SEP 2 - 8** | ☐ | Listen to Lectures 9A, 9B, 9C |
| ☐ | Listen to Lectures 2A, 2B, 2C | ☐ | Do Assessment 7 |
| ☐ | Do Assessment 2 | **WEEK 10** | **OCT 28 - NOV 3** |
| **WEEK 3** | **SEP 9 - 15** | ☐ | Listen to Lectures 10A, 10B, 10C |
| ☐ | Listen to Lectures 3A, 3B, 3C | ☐ | Do Assessment 8 |
| ☐ | Do Assessment 3 | **WEEK 11** | **NOV 4 - 10** |
| **WEEK 4** | **SEP 16 - 22** | ☐ | Listen to Lectures 11A, 11B, 11C |
| ☐ | Listen to Lectures 4A, 4B, 4C | ☐ | Do Assessment 9 |
| ☐ | Do **EXAM 1** | **WEEK 12** | **NOV 11 - 17** |
| **WEEK 5** | **SEP 23 - 29** | ☐ | Listen to Lectures 12A, 12B, 12C |
| ☐ | Listen to Lectures 5A, 5B, 5C | ☐ | Do **EXAM 3** |
| ☐ | Do Assessment 4 | **WEEK 13** | **NOV 18 - 24** |
| **WEEK 6** | **SEP 30 - OCT 6** | ☐ | Listen to Lectures 13A, 13B, 13C |
| ☐ | Listen to Lectures 6A, 6B, 6C | ☐ | Do Assessment 10 |
| ☐ | Do Assessment 5 | **WEEK 14** | **NOV 25 - DEC 1** |
| **WEEK 7** | **OCT 7 - 13** | ☐ | Listen to Lectures 14A, 14B, 14C |
| ☐ | Listen to Lectures 7A, 7B, 7C | ☐ | Do Assessment 11 |
| ☐ | Do Assessment 6 | **WEEK 15** | **DEC 2 - DEC 8** |
| **WEEK 8** | **OCT 14 - 20** | ☐ | Listen to Lectures 15A, 15B, 15C |
| ☐ | Listen to Lectures 8A, 8B, 8C | ☐ | Do Assessment 12 |
| ☐ | Do **EXAM 2** | ☐ | Do **FINAL EXAM** |

**FERRIS STATE UNIVERSITY**
College of Engineering Technology
School of Built Environment
**HVACR PROGRAMS**

# SYLLABUS

## COURSE TITLE:

HVAC 462, HVAC Primary Equipment Selection

## COURSE DESCRIPTION:

The selection, application and layout of state-of-the-art equipment and systems for commercial and industrial buildings. Emphasis will be placed upon the energy efficiency, integration of equipment into a complete system, and sequence of operation.

## SEMESTER HOURS:

4

## CONTACT HOURS:

Fall 2017
Sec. 211: Lec. T, R - 9:30am - 10:45am, Lab R - 2:00pm - 4:50pm
Sec. 212: Lec. T, R - 9:30am - 10:45am, Lab T - 2:00pm - 4:50pm

## PREREQUISITES:

HVAC 393 and MATH 126 with C- or better in both.

## TEXTBOOK REQUIRED:

**2013 or 2017 ASHRAE Fundamentals Handbook** - See library

**2012 or 2016 ASHRAE Handbook - HVAC Systems & Equipment** - See library

Suggested Reference: ACCA Manual CS "Commercial Applications, Systems and Equipment"

## Units of Instruction - (Time / Weight):

| | Areas of Instruction | Time |
|---|---|---|
| I | Introduction | 1 |
| II | Air Handling Units | 8 |
| III | Heat Exchangers | 3 |
| IV | Boiler Systems | 6 |
| V | Chiller Systems | 8 |
| VI | Cooling Towers | 5 |
| VII | Heat Pumps | 3 |

| | Areas of Instruction | Time |
|---|---|---|
| VIII | Thermal Storage | 2 |
| IX | Piping Layouts | 2 |
| X | Variable Refrigerant Flow Systems | 3 |
| XI | Semester Project | 1 |
| XII | Exams | 3 |
| | Total Hours | 45 |
| | | |

## Topic Unit Outline of Major Units of Instruction:

I. Introduction and Primary System Overview
  A. Understand course policy and requirements
  B. Define the various categories of primary HVAC equipment, design and selection process and document development.

II. Air Handling Units
  A. Define all the types of air handling units and support components.
  B. Apply and design an air handling unit.
  C. Select an air handling unit from available vendors
  D. Develop all documentation for an AHU design: piping schematics, AHU schedule, submittal documentation.

III. Heat Exchangers
  A. Define all the types of heat exchangers and support components.
  B. Apply and design a heat exchanger
  C. Select a heat exchanger from available vendor
  D. Develop all documentation for a heat exchanger design: piping schematics, heat exchanger schedule, submittal documentation.

IV. Boiler Systems
  A. Define all the types of boiler systems and support components.
  B. Apply and design a boiler system.
  C. Select a boiler system form available vendor
  D. Develop all documentation for a boiler design: piping schematics, boiler schedule, submittal documentation.

V. Chiller Systems
  A. Define all the types of chiller systems and support components.
  B. Apply and design a chiller system
  C. Select a chiller system form available vendors
  D. Develop all documentation for chiller design: piping schematics, chiller schedule, submittal documentation.

VI. Cooling Tower Systems
  A. Define all the types of cooling tower systems and support components.
  B. Apply and design a cooling tower system.
  C. Select a cooling tower system from available vendor
  D. Develop all documentation for a cooling tower design: piping schematics, cooling tower schedule, submittal documentation.

VII. Heat Pumps
  A. Define all the types of heat pumps and support components.
  B. Apply and design a heat pump system.
  C. Select a heat pump system form an available vendor.
  D. Develop all documentation for a heat pump system: piping schematics, heat pump schedule, submittal documentation.

VIII. Thermal Storage
  A. Define all the types of thermal storage and support components.
  B. Apply and design a thermal storage system.
  C. Select a thermal storage system form an available vendor.
  D. Develop all documentation for a thermal storage system: piping schematics, thermal storage schedule, submittal documentation.

## Topic Unit Outline of Major Units of Instruction - cont.:

IX. Piping Layouts
  A. Constant Primary Flow
  B. Primary / Secondary Flow
  C. Variable Primary Flow
X. Variable Refrigerant Flow Systems
XI. Semester Project
  A. Given a set of building specifications: Apply design, select and develop all documentation for a complete project building HVAC system.
XII. Exams

## Additional Course Information:

**INSTRUCTOR:** Michael J. Korcal, C.E.M., MT (ASCP), Associate Professor
**OFFICE: GRN 203**
**OFFICE HOURS:**
Tuesday: 12:00pm - 1:50pm
Thursday: 12:00pm - 1:50pm

By appointment
**PHONE:** 2626
**E-mail:** use message function in Blackboard!

## Additional Course Information:

| | |
|---|---|
| EXAM 1 | 10% (100 points) |
| EXAM 2 | 10% (100 points) |
| EXAM 3 | 10% (100 points) |
| FINAL EX. | 10% (100 points) |
| PROJECT | 15% (150 points) |
| LABS | 39% (390 points) |
| QUIZZES | 6% (60 points) |
| Total | 100% (1,000 points) |

General Grading Policy:

| PERCENT | HP | GRADE |
|---|---|---|
| 100 - 94 | 4.0 | A |
| 93 - 90 | 3.7 | A- |
| 89 - 87 | 3.3 | B+ |
| 86 - 84 | 3.0 | B |
| 83 - 81 | 2.7 | B- |
| 80 - 78 | 2.3 | C+ |
| 77 - 75 | 2.0 | C |
| 74 - 73 | 1.7 | C- |
| 72 - 71 | 1.3 | D+ |
| 70 - 69 | 1.0 | D |
| 68-67 | 0.7 | D- |
| 66 - below | 0.0 | F |

The following expectations will be applied to **ALL STUDENTS** within the HVAC 462 class.

A. All Ferris State University student policies will be applied

B. All granger student policies will be applied unless notified in advance

C. Cell Phones – it is expected that cell phones will be on vibrate only during class time and if you must take a call, please excuse yourself quietly outside of the classroom to take the call. Cell phones will be turned OFF during exams.

D. I-Pods and other similar devices – these items must be turned off during class unless given permission by the instructor.

E. Attendance – I will keep track of attendance in labs! If you must be absent from class for a good reason, please give me prior notification by e-mail or phone.

F. Assigned Homework and Lab Work – it is expected that you will complete all assignments, lab and quizzes on time! Failure to comply with due dates will result in a 0 (zero) for that assignment!

G. Exams – all exams will be open book and open note; however, exams are difficult unless you are well prepared. Please pay attention to the instructor on how you can be more successful on exams.

H. Lab Sessions – Lab sessions are very important as lab work is worth 27% of the overall grade. It is expected that students will be on time for each lab and prepared for whatever lab activity. The instructor shall provide prior announcements to students if anything is required beyond the text books and other associated items within this course. Attendance will be taken in lab.

I. Assistance – help is available via many sources (1) the FSU writing lab, (2) appointment with instructor during office hours, and (3) other classmates.

J. On-line Resources – This class will utilize Ferris Connect as a tool for placement of resources, grades, and provide a means of communication if necessary. It will be expected that all utilize this Resource to enhance the class. Additionally, many of the class sources of manufacturer's data and information will be via the internet to websites maintained by others outside of the University; thus, it is possible that changes may occur and create course modifications. It is expected that students stay abreast to potential changes by attending class and checking Ferris Connect on a regular basis for any potential changes.

## Fall 2017, Tentative Class Schedule:

| Week | Day | Date | Class Topic for that Day | LABS |
|---|---|---|---|---|
| 1 | Tues | 8/29/2017 | Introduction, Syllabus, IS01 | 1. Simple RTU / Catalog / Duct Sizing |
| | Thur | 8/31/2017 | AHU-1 | |
| 2 | Tues | 9/5/2017 | AHU-2 | 2. VVT / Verticle Outside |
| | Thur | 9/7/2017 | AHU-3 | |
| 3 | Tues | 9/12/2017 | AHU-4 | 3. Simple AHU / Computer |
| | Thur | 9/14/2017 | AHU-5 | |
| 4 | Tues | 9/19/2017 | AHU-6, HX-1 | 4. Complex AHU / Computer |
| | Thur | 9/21/2017 | HX-2 | |
| 5 | Tues | 9/26/2017 | Boiler-1 | Advisory |
| | Thur | 9/28/2017 | EXAM 1 | |
| 6 | Tues | 10/3/2017 | Boiler-2 | 5. Heat Exchanger |
| | Thur | 10/5/2017 | Boiler-3 | |
| 7 | Tues | 10/10/2017 | Boiler-4 | 6. Boiler |
| | Thur | 10/12/2017 | Chiller-1 | |
| 8 | Tues | 10/17/2017 | Chiller-2 | 7. Chiller / Air Cooled |
| | Thur | 10/19/2017 | Chiller-3 | |
| 9 | Tues | 10/24/2017 | Chiller-4 | 8. Chiller / Water Cooled |
| | Thur | 10/26/2017 | Chiller-5 | |
| 10 | Tues | 10/31/2017 | Chiller-6, Cooling Tower-1 | 9. Cooling Tower |
| | Thur | 11/2/2017 | EXAM 2 | |
| 11 | Tues | 11/7/2017 | Cooling Tower-2 | 10. Project |
| | Thur | 11/9/2017 | Cooling Tower-3 | |
| 12 | Tues | 11/14/2017 | Cooling Tower-4, Heat Pump-1 | 11. Project |
| | Thur | 11/16/2017 | Heat Pump-2 | |
| 13 | Tues | 11/21/2017 | Thermal Storage-1 | Thanksgiving |
| | Thur | 11/23/2017 | Thanksgiving Recess - NO CLASS | |
| 14 | Tues | 11/28/2017 | Piping Layouts | 12. Project |
| | Thur | 11/30/2017 | Variable Refrigerant Flow Systems | |
| 15 | Tues | 12/5/2017 | Project-1 | 13. Project |
| | Thur | 12/7/2017 | EXAM 3 | |
| Final | Mon | 12/11/2017 | 10:00am - 11:40am GRN113 | |

# SYLLABUS ATTACHMENT
# COLLEGE OF ENGINEERING TECHNOLOGY – FERRIS STATE UNIVERSITY
## *FALL 2017*

| IMPORTANT DATES | | |
|---|---|---|
| Late registration | Wed. – Fri. | Aug. 23 – 25 |
| First day of classes | Monday | Aug. 28 |
| Last day for Drop/Add | Thursday | Aug. 31 |
| Labor Day (no classes) | Monday | Sept. 4 |
| Mid-term grades due | Monday | Oct. 16 |
| Last day for "W" grades | Thursday | Nov. 2 |
| Thanksgiving recess begins (no classes) | Wed (noon) | Nov. 22 |
| Thanksgiving recess ends (classes resume) | Monday | Nov. 27 |
| Last day of classes | Friday | Dec. 8 |
| Examination Week | Mon – Fri | Dec. 11 – 15 |
| Commencement | Saturday | Dec. 16 |
| Final grades due by 1:00 pm | Monday | Dec. 18 |
| Grades available to students on MyFSU | Tuesday (after 8AM) | Dec. 19 |

| Sessions | Dates | Last Day to Withdraw |
|---|---|---|
| Full Session | Aug. 28 – Dec. 8 | Nov. 2 |
| Session A | Aug. 28 – Oct. 17 | Sept. 28 |
| Session B | Oct. 18 – Dec. 18 | Nov. 17 |
| Session D | Aug. 28 – Sept. 29 | Sept. 18 |
| Session E | Oct. 2 – Nov. 2 | Oct. 20 |
| Session F | Nov. 3 – Dec. 8 | Nov. 27 |

| College of Engineering Technology School Offices | | |
|---|---|---|
| Automotive &Heavy Equipment | AUT 101 | 591-2655 |
| Built Environment | GRN 227 | 591-3773 |
| Engineering & Computing Technology | SWN 312 | 591-2068 |
| Design & Manufacturing | NEC 211 | 591-2640 |
| Dean's Office | JOH 200 | 591-2890 |

## WHAT YOU NEED TO KNOW

**E-MAIL**

All registered FSU students have a Ferris Gmail account. This is the only e-mail to which all official University information about registration, financial aid, student activities, and class cancellations will be sent. Please check your account at least once a week. E-mail is our primary communication resource for students.

**CLASS ATTENDANCE IS IMPORTANT!**

Attendance usually has a high correlation with how well you do in a course. Many instructors have mandatory attendance policies by which your grade will be affected by absences. Some instructors also have policies about class tardiness to encourage students to be present for the full class period. Check your course syllabus or talk to your instructor about his/her policies.

**HOW TO CONTACT A FACULTY MEMBER OR ADVISOR**

If you have questions or need help, talk to your instructor. Faculty office locations, phone numbers, and office hours may be obtained from the class syllabus or department office, or through the Directories & Maps link on the FSU home page.

**DROPPING CLASSES OR WITHDRAWING**

Dropping and adding only occurs during the first four days of the term. You can adjust your schedule **online during the first four days** or in person at the Timme Center (from 8-5 except for the last day when it is 12-5).

*If you add a class you must pay for your additional charges by the fourth day or your schedule will be dropped.*

If you need to withdraw from a class after the official drop/add period, you must do so **OFFICIALLY**, through your dean's office, in order to avoid receiving an "F" grade in the course. **You may not withdraw online after the first four days of the term.** You will receive a "W" for the course. *You will not receive a refund.* If you need to totally withdraw from the University, you must do so **officially** at Admissions and Records in CSS 201. The last day to withdraw or drop a class may be different for different classes. **CHECK THE SESSIONS DATES SECTION ABOVE OR THE REGISTRATION AND ACADEMIC GUIDE FOR THE WITHDRAWAL DEADLINES FOR THE SEMESTER**.

In cases of extenuating circumstances (e.g., a serious illness requiring you to withdraw from school), contact Birkam Health Center at 591-2614.

**INCOMPLETES**

The "I" is only considered for extenuating circumstances that have led to a student missing a portion of the course. The intent and appropriate use of the "I" grade is NOT to avoid student probation, dismissal, or unacceptable grades, nor should it be considered as an extended alternative to withdraw from a class (W). Extenuating circumstances are generally defined as those situations over which a student has little or no control—e.g., illness, birth, jury duty, death of a parent, serious injury. Instructors may require suitable documentation.

Students must have completed at least 75% of the coursework at passing levels before an "I" will be considered, and they may be required to sign an agreement regarding course completion. An "I" grade automatically changes to an "F" after one semester (not counting summer) unless the faculty member files another grade or extends the incomplete.

**STUDENT COMPLAINT POLICY**

http://www.ferris.edu/HTMLS/administration/academicaffairs/Forms_Policies/Documents/Policy_Letters/AA-Student-Complaints.pdf

**GRADUATION**

Students should apply for their degree audit the semester prior to the degree completion term. To obtain a paper degree audit and clearance for your associate or bachelor degree for you must meet with your assigned academic advisor. In addition an online graduation application is REQUIRED and deadlines will be ENFORCED per the Provost's Office and Records Office. **ONLINE APPLICATION DEADLINE** for participation in Fall Commencement Ceremony: **OCTOBER 1, 2017**

Online application is accessed by logging into your MyFSU, (click on Student tab, My Records link, Degree Progress and Graduation, Apply to Graduate link). For more information, contact the Dean's Office.

**INCLEMENT WEATHER CONDITIONS**
Only during the most severe weather conditions – which could potentially endanger the safety of students or staff – will the Big Rapids campus consider cancelling classes. The decision to cancel classes due to weather conditions at the Big Rapids site will be made as early as possible. In the event it is necessary to cancel classes, periodic announcements will be made on area radio and television stations. It is the student's responsibility to listen for these announcements. A student may also call the Ferris Information Line at 231-591-5602 or check the Ferris website.

## ACADEMIC MISCONDUCT

Academic misconduct refers to dishonesty or misrepresentation with respect to assignments, tests, quizzes, written work, oral presentations, class projects, internship experience, or computer usage; violation of computer licenses, programs, or data bases; or unauthorized acquisition or distribution of tests or other academic material belonging to someone else. It includes such behaviors as cheating, copying materials from the internet without documentation, presenting another person's ideas or work as your own, taking someone else's exam for them, violating computer software licenses or program/data ownership, etc. It is the expectation of the College of Engineering Technology that all work you turn in is your own and is original for the course in which it is being submitted. If you are uncertain about whether a particular behavior might represent academic misconduct, be sure to ask your professor for clarification. Penalties for academic misconduct can include **FAILURE** of the assignment or the course, and/or disciplinary action up to and including probation or dismissal from the University.

**DISRUPTIVE BEHAVIOR**
The College of Engineering Technology strives to maintain a positive learning environment and educational opportunity for all students. Consequently, patterns of behaviors which obstruct or disrupt the teaching/learning environment will be addressed. The instructor is in charge of his or her course (e.g., assignments, due dates, attendance policy) and classroom (e.g., behaviors allowed, tardiness). Harassment, in any form, will not be tolerated. Penalties for disruptive behavior can include involuntary withdrawal from the course and/or disciplinary action up to and including probation or dismissal from the University.

## WHERE TO GO FOR HELP

The following services are available to any Ferris student, free of charge. They are designed to help you succeed in your courses, in your career planning, and in meeting the challenges of university life. Don't hesitate to explore and use these services at Ferris.

**ACADEMIC ADVISING**
All students have an assigned advisor and should confer with that advisor regularly. Students who have declared a major should see an advisor in that major. To find out who your advisor is, log in to MyFSU, (click on the Student tab, My Registration, Advisor Information, Select Term, Submit).

**ACADEMIC SUPPORT CENTER……………………….ASC 1017 – 591-3543**
**THE WRITING CENTER…………………………………ASC 1017 – 591-2534**
**The Academic Support Center, Tutoring Services, and Writing Center** join together to offer FSU students an array of academic support services. Tutors are available to answer questions for many courses. The Writing Center helps writers individually and in workshops with skills and assignments. There is also study skills assistance to help with note-taking, test-taking, memory and reading strategies, and time management.

**DISABILITIES SERVICES……………………………….....STR 313 – 591-3057**
According to the Americans with Disabilities Act, each student with a disability is responsible for notifying the University of his/her disability and requesting accommodations. Students requiring a classroom accommodation due to a physical, learning, mental or emotional disability should contact the Disabilities Services Office.

**SCHOLAR PROGRAM……………………………….....ASC 1021 – 591-5976**
SCHOLAR is an academic support program that aids in the student's successful progression by offering a Peer Mentor Program, a Student Retention Program, and an Academic Student Advisory Committee.

**PERSONAL COUNSELING, SEXUAL ASSAULT, SUBSTANCE ABUSE BIRKAM HEALTH CENTER ………………………….... 2nd Floor - 591-5968**
Personal counseling is available confidentially and free of charge. Counselors are available to assist with personal and stress-related problems, family and relationship issues, substance abuse, sexual assault, depression, or other similar problems. Call or stop by to obtain an appointment. ***If you or a friend are in immediate crisis, call 911.***

**EDUCATIONAL & CAREER COUNSELING ……………STR 313 – 591-3057**
Students wanting to examine their choice of major or career choice, learning styles or strategies can make one-on-one appointments with licensed counselors.

**CAREER SPECIALIST – Leigha Compson ……………JOH 200 – 591-3549**
Valuable support services and events are offered for students currently or previously enrolled in associate degree programs. To lean more visit: http://www. ferris.edu/HTMLS/colleges/technolo/ Career-Programs-Support/index.htm

**SAFETY**
Please observe the posted shelter and evacuation routes in the hallway nearest your classroom.

## OTHER RESOURCES

**BIRKAM HEALTH CENTER……………………….……..1st Floor - 591-2614**
The Birkam Health Center provides fee-for-service medical care including evaluation and treatment for illness and injury anytime during the year. Patients are seen on a walk-in and by appointment basis.

**FLITE LIBRARY……………………………………………………………...591-2669**
Regular hours for FLITE:
Monday – Thursday . . . . . . . . . . . . . . . . . . 7:30 a.m. – MIDNIGHT
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . ...7:30 a.m. – 6:00 p.m.
Saturday . . . . . . . . . . . . . . . . . . . . . . . . . . NOON – 5:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . .. . . . . . . . .1:00 p.m. – MIDNIGHT
Extended Studies Court will begin late night hours September 13, 2016
*Sunday-Thursday/MIDNIGHT to 7:30 a.m. *Friday/6 p.m. to MIDNIGHT
*Saturday/5 p.m. to MIDNIGHT)

**FSU BOOKSTORE…………………………UNIVERSITY CENTER 231 591-2607**
Regular on-campus hours for the Bookstore **:
Monday – Thursday . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 6:00 p.m.
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 5:00 p.m.
Saturday. . . . . . . . . . . . . . . . . . . . . . . . . . . . 12:00 p.m. – 4:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CLOSED

## HELPFUL NUMBERS

| | | | |
|---|---|---|---|
| Admissions | 2100 | Inst. Testing | 3628 |
| Business Office | 2125 | Public Safety | 5000 |
| Financial Aid | 2110 | Records | 2792 |
| Housing | 3745 | TAC | 4822 |

When calling from off campus, extensions can be called by using the prefix 231-591-_____.

## Arts & Sciences/General Education Department Offices

| | | |
|---|---|---|
| Biology | ASC 2004 | 591-2550 |
| Humanities | JOH 119 | 591-3675 |
| Languages & Literature | ASC 3080 | 591-3988 |
| Mathematics | ASC 2021 | 591-2565 |
| Physical Sciences | ASC 3021 | 591-2580 |
| Social Sciences | ASC 2108 | 591-2735 |

## College of Engineering Technology Diversity Statement

The College of Engineering Technology provides a dynamic experiential learning environment that is inclusive, equitable and just for all individuals, regardless of human differences.

Ferris State University is an equal opportunity institution. For information on the University's Policy on Non-Discrimination, visit http://www.ferris.edu/non-discrimination

Updated 8.18.2016 alm

**FERRIS STATE UNIVERSITY**
College of Engineering Technology
School of Built Environment
HVACR Programs

# SYLLABUS

## COURSE TITLE:

HVAC 499, Commercial HVAC System Design

## COURSE DESCRIPTION:

Given building architectural plans, appropriate software, codes and standards, and owner's requirements, students will select appropriate HVAC systems, conduct economic analysis, design system and produce working drawings, specifications and control sequences for evaluation.

## SEMESTER HOURS:

4

## PROFESSOR:

Michael J. Korcal, C.E.M., MT(ASCP)

## CONTACT & OFFICE HOURS:

**Spring Semester 2018**

Office Hours:
Mon: 11:00am - 11:50am & 1:00pm - 1:50pm
Wed: 11:00am - 11:50am, 1:00pm - 1:50pm

Office:
GRN 203

Phone:
231-591-2626

e-mail:
korcalm@ferris.edu (But use the Blackboard communications!)

## PREREQUISITES:

HVAC 451 with at least a C-

## TEXTBOOK REQUIRED:

ASHRAE Fundamentals Handbook (You should have this already)

## RECOMMENDED REFERANCE:

ASHRAE Applications Handbook
ASHRAE Systems and Equipment Handbook
**Commercial Applications Systems and Equipment, Manual CS**, Air Conditioning Contractors of America, 1993.

## TOPICAL UNIT OUTLINE OF MAJOR UNITS OF INSTRUCTION:

I. Course Overview
   A. Review of project design steps
   B. Course requirements and expectations
II. Building Operational Plan Development
   A. Review of all project information
   B. Review of BOP development
   C. Develop BOP
III. Equipment & System Review
   A. Review of major HVAC equipment and systems
      1. Applications
      2. Pros & Cons
IV. Load Calculation
   A. Review of computer load calculation
   B. Develop and perform load calculation
   C. Review load calculation results
   D. Determine parameters for proper equipment selection and sizing
V. Equipment Selection
   A. Determining equipment appropriate for project
   B. Positive aspects of equipment appropriate for project
   C. Negative aspects of equipment appropriate for project
   D. Develop equipment and system justification for project
VI. Equipment Layout
   A. Determine the drawings, details and schedules needed for project
   B. Develop drawings, details and schedules for project submittal
VII. Controls and Commissioning
   A. Develop control point list for each piece of equipment or system
   B. Develop control sequence of operation for each system
   C. Develop a commissioning plan that will ensure that the BOP will be met
VIII. Final Document
   A. Develop executive summary
   B. Collate the previous exercises into final document
   C. Submit final document in electronic form (pdf preferred)

## ASSIGNMENT OUTLINE:

Assignment 1 - Building Operational Plan (BOP) and Zoning

Assignment 2 - HVAC System Review

Assignment 3 - Load Calculation

Assignment 4 - Equipment Selection

Assignment 5 - Equipment Layout (Drawings)

Assignment 6 - Control, Sequence of Operation and Commissioning

Final Document (Executive summary + Assign 1 + Assign 3 + Assign 4 + Assign 5 + Assign 6)

## ASSIGNMENT NOTES:

- The instructor reserves the right to modify any of the above if it is necessary to keep the intent of the course on target and if unexpected events occur.
- The stated assignments 1, 3, 4, 5, 6 were carefully created so that they can be aligned to form the bulk of the final document. As such, the student should complete each assignment with the intent that its outcome will be included in a professional technical report.
- Assignment 2 is a review of systems.
- Students will be allowed to work in groups of not more than 4. Each student must contribute to the assignment that is turned in. At periodic times during the semester, the professor will interview the group and give each member a review grade. Also, at this time, each member of the group will do a peer review of each other member of the group.
- The final project must be submitted in one of two forms (bound or in a heavy duty ring binder)
- Read all information carefully prior to working on each assignment.
- Proof read your assignment prior to submittal.
- Each assignment will be reviewed by the professor and returned with suggested changes. You will have one re-submit for each assignment except for the final document.
- All assignments are released on day 1. You must work at your own pace. Turn in assignments as you complete them. DO NOT PROGRASTINATE! Each assignment takes time to do. If you wait too long to start something you WILL NOT HAVE TIME TO COMPLETE THIS COURSE!
- Make sure you get the blueprints printed out so you have something to work with and make notes on.

## GRADING SCALE:

| LETTER GRADE | PERCENTAGE |
|---|---|
| | |
| A | 94-100 |
| A- | 90-93 |
| B+ | 87-89 |
| B | 84-86 |
| B- | 81-83 |
| C+ | 78-80 |
| C | 75-77 |
| C- | 73-74 |
| D+ | 71-72 |
| D | 69-70 |
| D- | 66-68 |
| F | Less than 65 |

| ASSIGNMENTS | POINTS | % OF FINAL GRADE |
|---|---|---|
| | | |
| Assignment 1 | 130 | 13 |
| Assignment 2 | 130 | 13 |
| Assignment 3 | 130 | 13 |
| Assignment 4 | 130 | 13 |
| Assignment 5 | 130 | 13 |
| Assignment 6 | 130 | 13 |
| Assignment 7 | 100 | 10 |
| Peer & Prof. Eval. | 120 | 12 |
| Total | 1000 | 100 |

| PEER & PROF. REVIEW | DATES |
|---|---|
| | |
| Review 1 | Week 4 |
| Review 2 | Week 8 |
| Review 3 | Week 12 |
| Review 4 | Week 14 |

## Feasible Assignment Time Schedule for Spring 2018:

| WEEK | DATE | ASSIGNMENT | TIME NEEDED | TENTATIVE DUE DATE |
|---|---|---|---|---|
| 1 | JAN 8- JAN 12 | 1 - BOP | 3 weeks | Jan 26, 2017 |
| 2 | JAN 15- JAN 19 | | | |
| 3 | JAN 22 - JAN 26 | | | |
| 4 | JAN 29 - FEB 2 | 2 - Equip. Review | 1 week | Feb 2, 2017 |
| 5 | FEB 5 - FEB 9 | 3 - Load Calc. | 3 weeks | Feb 23, 2017 |
| 6 | FEB 12 - FEB 16 | | | |
| 7 | FEB 19 - FEB 23 | | | |
| 8 | FEB 26 - MAR 2 | 4 - Equip. Selc. | 2 weeks | Mar 16, 2017 |
| 9 | MAR 12 - MAR 16 | | | |
| 10 | MAR 19 - MAR 23 | 5 - Drawings | 3 weeks | Apr 6, 2017 |
| 11 | MAR 26 - MAR 30 | | | |
| 12 | APR 2 - APR 6 | | | |
| 13 | APR 9 - APR 13 | 6 - Control | 2 weeks | Apr 20, 2017 |
| 14 | APR 16 - APR 20 | | | |
| 15 | APR 23 - APR 27 | 7 - Exec. Summary | 1 week | Apr 27, 2017 |

## IMPORTANT INFORMATION:

The following should be taken note of:

- All of the information in this class has been delivered in other courses, this is your opportunity to put all of the information together in one project.
- Not all of the information in this class is straight forward (spoon fed to you), you need to use all of your resources to get some of the information to complete the assignments and the final project. Example: When doing the load calculation for the project building you will NOT be given space/zone occupancies. This is still needed in order to do a proper load calculation and it is up to you to get reasonable data for this, such as using ASHRAE 62.1 and taking typical occupancy density for each type of space. You are expected to use any reliable source to fill in the missing information. It should be noted that when working on projects out side of class not all of the information is straight forward. USE YOUR RESOURCES!!!!
- Be careful, the scale on the blueprints that you received might not be correct. You may have to make your own scale!
- Each of the assignments are part of the final project, so do a good job on the individual assignments.
- The most time consuming assignment is developing the BOP and getting a load calculation for the project building. Once you are done with this the rest of the course is less work.
- I try not to give rigid due dates on assignments, everybody takes different time to complete the work, so I have given rough time lines you can follow to complete the work.
- The blueprints are all pdf and you are responsible for getting them printed out at a location that has blueprint capability.
- You should also note that this is a capstone course in a 4-year program, it should be challenging but not impossible. I don’t mind giving you direction if you get off track, but I expect you to put in some effort ahead of time in figuring out a problem.
- Good Luck with your final class in the HVACR Engineering Technology Program here at Ferris.

FERRIS STATE UNIVERSITY

**Course Syllabus**
**HVAC 101 Introduction to Refrigeration an A/C Systems**
**Spring 2018 – Section 211**

Instructor:...............................Eric Fradette
Office Hours: .........................Mondays: 4:00 – 5:00 PM, Tuesdays: 4:15 – 5:15 PM, Wednesdays: 3:00 – 4:00 PM, Thursdays: 4:15 – 5:15 PM,
Office: ...................................GRN 204
Phone: ...................................x 3763
E-mail: ..................................ericfradette@ferris.edu
Credits:..................................4 Hours: 3 lecture hours and 3 lab hours per week

Course Description: ...............An introductory course covering the physical and chemical laws governing the principles of refrigeration. The basic refrigeration cycle and components will be covered. Objectives include temperature and pressure conversion, evacuation, charging, transferring refrigerant, and basic system troubleshooting.

Course Co requisite:..............MATH 116

Final Exam:...........................The final exam for this course is scheduled by the University to prevent conflict with other courses. The scheduled time is as follows:

**Thursday, May 3rd, 8:00 – 9:40 AM.**

## Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

1. Understanding of physical and chemicals laws and equations that are the foundation of the **HVAC field**.
2. Describe component and system operations for typical Refrigeration equipment.
3. Performing various refrigeration charging and recovery operations with different refrigerants in a safe and proper manner.
4. Utilizing equipment name plate data, knowledge of vapor compression cycle, electrical schematics, and equipment sequences to troubleshoot refrigeration equipment.

**Instructional Unit Topic Descriptions and Time Allocations (not necessarily in order of delivery)**

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction, Orientation, and Safety | 1 | 1 |
| II. | History and Development of Refrigeration | 1 | 0 |
| III. | Heat & Temperature | 5 | 4 |
| IV. | Pressures | 3 | 1 |
| V. | Refrigeration System | 6 | 9 |
| VI. | Refrigerants | 3 | 0 |
| VII. | Thermodynamic Laws | 1 | 0 |
| VIII. | Manifold gauges, Service valves & Manufacturers Data Plates | 2 | 0 |
| IX. | Vacuum pumps & recover/reclaim/recycle equipment | 3 | 3 |
| X. | Use of and Transfer of Refrigerant to Charging Cylinders | 2 | 6 |
| XI. | Ammeter use, Cap Tube Systems | 2 | 3 |
| XII. | Establishing factory charge and field charging procedure | 1 | 1 |
| XIII. | System Components and Application | 11 | 12 |
| XIV. | Leak Checking, Dehydration, and Charging | 2 | 5 |
| XV. | Basic Psychrometrics | 2 | 0 |
| | Total Hours | 45 | 45 |

**Learning Outcomes for Each Instructional Unit**

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction<br>A. Demonstrate safe practices related to personal, electrical, refrigerant and tool safety every day while working in the lab.<br>B. Demonstrate competent operation of hand tools and instruments. |
| II. | History and Development of Refrigeration<br>A. Describe early developments in refrigeration, refrigerants and the economic drive behind refrigeration. |
| III. | Heat & Temperature<br>A. Describe the relationship between molecular motion and heat.<br>B. Define the British Thermal Unit (BTU).<br>C. List the specific heat of water and air.<br>D. Calculate the energy needed to change the state and the temperature of different substances according to their specific heat characteristics.<br>E. Define sensible and latent heat using enthalpy of water from $0^0$F to $230^0$F.<br>F. Apply the basic heat formula, BTU = lb x delta T x specific heat<br>A. Define modes of heat transfer (convection, conduction, radiation) and list |

| | |
|---|---|
| | examples of each.<br>B. Calculate energy and power conversions using common units of measure, such as BTU, watt, horsepower.<br>C. Explain the difference between temperature and heat.<br>D. Describe the difference between the temperature scales Fahrenheit, Centigrade, Kelvin and Rankin.<br>E. Convert temperatures between the scales of Fahrenheit, Centigrade, Kelvin and Rankin. |
| IV. | Pressure<br>A. Describe the difference between atmospheric, absolute and gauge pressure.<br>B. Define common units of measure for pressure used in the HVACR industry (psi, in HG, in water column, feet of water column, microns).<br>C. Perform pressure conversions (psi, in HG, in water column, feet of water column, microns).<br>D. Install pressure gauges.<br>E. Replace Schrader valves.<br>F. Apply gas laws for problem solving and calculation. |
| V. | Refrigeration System<br>A. Identify and explain the function of the evaporator, compressor, condenser, metering device and interconnection tubing.<br>B. Describe the state of refrigerant within each component, including liquid, vapor and saturation points.<br>C. Explain subcooled and superheated conditions and describe where, how, when and why they occur.<br>D. Describe the "sequence of operation". |
| VI. | Refrigerants<br>A. Determine the saturation properties of any given refrigerant, using reference materials.<br>B. Define and describe saturation point.<br>C. Determine the temperature/pressure relationship for any given refrigerant.<br>D. List typical applications for any given refrigerant.<br>E. Accurately determine temperature pressure relationships using an operating refrigeration system and a pressure temperature chart. |
| VII. | Thermodynamic Laws<br>A. Describe how heat transfer takes place throughout a mechanical refrigeration system by explaining where, how, when and why energy is absorbed by the system, rejected from the system and moved throughout the system. |
| VIII. | Manifold gauges, Service valves & Manufacturers Data Plates<br>A. Identify manifold gauge components using proper terminology.<br>B. Read pressure and temperature on gauge dial.<br>C. Properly purge hoses prior to connecting to system, charging cylinder or other device.<br>D. Properly connect manifold gauges to various service valves, charging cylinders and other devices.<br>E. Define the terms front-seated, mid-seated, and back-seated, and describe which portions of the service valve are connected in those perspective positions.<br>F. Properly operate manifold gauges and service valves for evacuation, charging, recovery, adding oil, etc.<br>G. Explain the usefulness of low-loss fittings. |

| | |
|---|---|
| | H. Describe the correct method for removing gauges from a system whether or not low-loss fittings are used.<br>I. Determine model number, running specifications, electrical specifications, RSIR-CSIR, voltage application, RLA, LRA, refrigerant, temperature application, capacity-mechanical abilities and warranty information from manufactures data plates. |
| IX. | Vacuum pumps & recover/reclaim/recycle equipment<br>A. Properly change lubricating oil and maintain vacuum pumps.<br>B. Explain the purpose of drawing a vacuum on a refrigeration system.<br>C. Describe the importance of a refrigeration system with no leaks prior to evacuation.<br>D. Describe the proper vacuum levels of a refrigeration system, and be able to identify an evacuated system, a system that still has moisture present, and a system that still has a leak.<br>E. Proper use of a micron gauge.<br>F. Define a gas-ballast and its purpose.<br>G. Use proper vacuum pump hoses due to permeation and hose length.<br>H. Successfully perform recovery/reclaim/recycle procedures per instruction and demonstration. |
| X. | Use of and Transfer of Refrigerant to Charging Cylinders<br>A. Demonstrate refrigerant safety precaution and procedures for safe handling of storage cylinders.<br>B. Fill a charging cylinder to a specified level using proper procedures and safety techniques.<br>C. Explain the meaning and the importance of markings on a reusable cylinder.<br>D. Explain how to charge as a liquid using both a reusable and a non-reusable cylinder.<br>E. Add a specified amount of refrigerant to a system using a charging scale. |
| XI. | Ammeter use, Cap Tube Systems<br>A. Determine the full load amps of an operating system using proper procedures and safety techniques.<br>B. Monitor and maintain safe ampere draw level through varying conditions of system load and charge.<br>C. Test, operate, analyze and adjust a capillary tube system<br>a. Analyze the effects created by restrictions, improper charge, inefficient compressor & improper air flows.<br>D. Demonstrate safe methods of transferring refrigerants.<br>E. Successfully pull a deep vacuum on the system using a vacuum pump and micron gauge.<br>F. Leak check a system using acceptable and current technologies and practices.<br>G. Achieve the critical charge using temperatures and pressure readings with appropriate calculations and system operating data. |
| XII. | Establishing factory charge and field charging procedure<br>A. Determine the proper charge by reading name plate data.<br>B. Reviewing factory charging and testing procedures in the laboratory.<br>C. Equalizing system pressure prior to start up.<br>D. Prevent liquid admission to compressor suction.<br>E. Locate the “King” valve and describe its purpose and operation.<br>F. Properly use portable charging cylinders and employ safety precautions during transport. |

| | |
|---|---|
| | G. Describe a pump down procedure employing "King" valve.<br>H. Use superheat, subcooling, and split to identify potential problems within a refrigeration system. |
| XIII. | System Components and Application<br>A. List and describe the function and operation of components in a built-up system employing a remote air cooled condensing unit.<br>B. Determine the sequence for installation of all components and electrical control of a small AC system.<br>C. Assemble a small AC or refrigeration unit using a capillary tube.<br>D. Explain the basic operating principles of a thermal expansion valve. |
| XIV. | Leak Checking, Dehydration, and Charging<br>A. Check a system for leaks, using various methods.<br>B. Dehydration a system using proper procedures.<br>C. Charge a system using proper procedures to obtain the correct charge.<br>D. Start a system using the startup checkout list and review of service valve positions.<br>E. Install test equipment in the correct locations and measure performance to ensure proper operation of system. |
| XV. | Basic Psychrometrics<br>A. Explain the relationships between the 7 properties of air, and be able to identify all of the properties based on a plot point of any two properties. |

**Attendance & Punctuality Policy**

All 100 level and 200 level courses at the university are required to have an attendance policy. As you move forward, you will discover that it is very difficult to succeed in your core classes without attending the course lectures and labs. Not only are the knowledge and skills gained in these classes essential to your success in this industry, but it is also essential in order to move forward in this program. The attendance policy for this class is as follows: You will start the class with a 2% bonus which will be applied to your final grade at the end of the semester. You will keep this bonus if all lectures and labs are attended and you arrive at or before the scheduled meeting time. For every absence from a lecture period your final grade will be penalized 1%, and an absence from a lab period will result in your final grade being penalized 2%. Therefore, after 2 absences to lectures or 1 absence for a lab, your bonus will be used up, and any subsequent absences will result in a **deduction** from your final grade prospectively. If you arrive up to 10 minutes late to a lab or a lecture, your deduction will be .5%. If you arrive more than 10 minutes late to a lab or a lecture, you are welcome to stay and participate but it will be counted as an absence (1% penalty for lecture, and 2% penalty for lab). If you leave early from lecture or lab without my approval, you will be counted as absent. You can use your bonus of 2% by missing class for whatever reason you see viable – hunting, video games, weekend recovery etc., but keep in mind that if you need to miss another day beyond your 2% due to more legitimate reasons, your final grade will be penalized. Also, consider that it is courteous to let me know ahead of time if you know you are going to miss class, with proper documentation or my approval this may count as an excused absence and there will be no penalty. Under no circumstance without proper documentation will an absence be excused if I have no prior notice of the absence. **The only time your calculated bonus/penalty for attendance will be posted is at the end of the semester with your final grade.** Also, be aware that this course will include both announced and unannounced quizzes – must be present for credit.

**Grading Scale**

| Letter Grade | Equal to or Greater Than | Below |
|---|---|---|
| A | 94% | |
| A- | 90% | 94% |
| B+ | 87% | 90% |
| B | 84% | 87% |
| B- | 80% | 84% |
| C+ | 77% | 80% |
| C | 74% | 77% |
| C- | 70% | 74% |
| D+ | 68% | 70% |
| D | 66% | 68% |
| D- | 65% | 66% |
| F | 64% | 0% |

**Category Allocation Percentage**

Homework....................15% (This includes 2 rough drafts)
Labs..............................20% (This includes your final report)
Quizzes……………… 15%
Mid-Term Exam...........25%
<u>Final Exam...................25%</u>
Total...........................100%

**Class Code**

This class should be interactive, students are encouraged to ask questions to ensure that they have a true understanding of the material. Bear in mind that if you have a question, chances are that others in the class are also in need of clarity, so please bring up your concerns during class so we can all benefit. However, it is rude and distracting to have side conversations occurring during a lesson, so side conversations will not be permitted.

Cell phone use will not be permitted in class. They are expected to be on silent or vibrate and stay in your pocket. I consider it to be extremely offensive to text or surf the internet while in class or lab. If you need your phone during class or lab to use as a calculator, let me know before you take it out of your pocket. But with this in mind, no phones are allowed during the tests so you will need to purchase a basic calculator anyway. If you are caught on your phone during either class or lecture during the semester, you will be asked to leave and it will count as an absence, if it occurs again, you will be asked to meet with the dean.

We will all treat each other with mutual respect in the classroom. This is essential for the interactive learning environment that benefits on campus learning.

You will be asked to leave if you are caught sleeping in class, and it will count as an absence.

**Late Assignments**

Assignments due on Blackboard must be completed by the assigned due date, no extensions will be given. Late homework assignments collected in class will not be accepted if they are already graded and returned. Providing that they are not graded and returned, I may choose to accept them based on circumstance, but there will be a 20% penalty enforced on the assignment. In the event that a grade is not entered in the grade book for an assignment, the grade will be zeroed at the end of the semester. Once it is zeroed, it will reduce your final calculated grade, so bear in mind that if you have assignments which do not show a grade, the posted semester grade will not be accurate. The best way to keep your posted grade accurate is to make sure to turn in all assignments on time.

**Test Taking**

Tests can only be taken during scheduled test time, if you miss a test you will receive zero points for the test. Any rare exception to this rule must be **approved** by me prior to the scheduled test time. Under no circumstance will cell phones be allowed when taking a test, so as noted earlier, please be sure to purchase a calculator.

**Lab Deductions**

Once the construction of the cooler and freezer units begin, each lab session will be worth 5 – points. Each student will start the lab session with all of the points, however points will be deducted based on the following measures:

- **Safety –**

- Caught without safety glasses (or worn improperly) 1st offense – **1-point**
- 2nd offense – **3-points**
- 3rd and each subsequent offense – **5 points, you will be asked to leave and it will count as an absence.**

- **Cell Phones –**

There will be some occasions when we will use our phones in a way that will enhance the learning process. However improper use of cell phones during class WILL result in point deductions.

- Caught using cell phone improperly 1st offense – **2-points**
- Caught using cell phone improperly 2nd offense – **4-points**
- Caught using cell phone improperly 3rd and each subsequent offense – **5-points**

- **Attitude, Work Ethic, and Workmanship –**

This will be a "group" project, and all members are expected to contribute equally.

- Seen "Sitting Out" or not contributing – **2-points**
- Poor workmanship (such as not using tubing benders) – **3-points**

- **Tool Usage and Clean-up –**

- Writing on units (must use tape or index cards to label!!) – **5-points**
- Not using proper heat shield resulting in burn on unit – **5-points**
- Improper use of (the schools) tools – **2-points**
- Not using back-up wrench when tightening or loosening flare nuts – **2-points**
- Workspace left looking messy – **2-points**
- Tools left in workspace – **2-points**
- Materials returned to wrong location/bin – **3-points**

**Changes to Syllabus**

As the faculty member responsible for this class, I reserve the right to change the syllabus at any time.

Excerpts from

Ferris State University
Code of Community Standards (Student Handbook)

http://www.ferris.edu/HTMLS/administration/studentaffairs/judicial/student-code.pdf

**Code of Student Community Standards**
**Section IV: General University Conduct Policies**

**A. Academic Integrity Violations**

Academic misconduct is managed in part through the conduct process in collaboration with Faculty at Ferris State University. In most cases, students are referred to the Office of Student Conduct by their faculty for allegations of academic misconduct. It is under the purview of each faculty member, in collaboration with their respective department and college, to spell out in their syllabus and enforce an academic sanction for academic integrity violations. Additionally, upon review of the allegation, the Office of Student Conduct may schedule the student for a conduct conference relating to the allegation of academic misconduct, which is defined as any activity that tends to undermine the academic integrity of the institution. A violation of the University policy on academic integrity includes, but is not limited to, the following:

**1. Cheating/Copying/Unauthorized Collaboration**
A student may not use unauthorized assistance, materials, information, or study aids in any academic exercise, nor should a student give assistance, materials, information, or study aids to another student in any academic exercise.

**2. Fabrication**
A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citations of the sources of information.

**3. Facilitating Academic Dishonesty**
A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct.
Additionally, each student is responsible for taking reasonable precautions to ensure his or her work is not accessed by or transferred to another individual wherein it may then be used to commit a violation of the University academic integrity policy.

**4. Interference**
a. A student must not steal, change, destroy, or impede another student’s work. Impeding another student’s work includes, but is not limited to, the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.

b. A student must not give or offer a bribe, promise favors, or make threats with the intention of affecting a grade or the evaluation of academic performance.

**5. Plagiarism**

a. Proper Acknowledgement. A student must not adopt or reproduce ideas, words, or statements of another person, including previous work of their own submitted for previous course credit, without appropriate acknowledgment.

b. Requirement for Acknowledgement v. Common Knowledge. A student must give credit to the originality of others and acknowledge indebtedness whenever he or she quotes or paraphrases another person's words, either oral or written and whenever he or she borrows facts, statistics, or other illustrative material, unless the information is common knowledge.

c. Sources used Verbatim. In instances where students are using content directly quoted from a source, that content MUST be indicated through the use of quotations AND properly cited both in - text and at the end of the document.

**6. Violation of Course Rules**

A student must not violate course rules as contained in a course syllabus which are rationally related to the content of the course or to the enhancement of the learning process in the course.

**7. Violation of Professional Standards and Ethics**

A student must not violate the professional standards or ethical code related to one's intended profession as defined by the academic program or department.

## HVACR STUDENT POLICY

The following policies have been set forth by the faculty of the HVACR Department for your protection and well being. Consequences for policy violations may affect your grade, according to your professor's syllabus. Consequences for violations are listed in the policy, giving you the information you need to make informed decisions. As a college student and an adult, you are responsible for your own actions and can make your own decisions. Please be responsible and make good decisions!

SAFETY GLASSES: You are required to wear your own safety glasses in all equipment labs at all times. This includes mechanical rooms and the energy lab when the equipment is operating. This does not include computer labs. Guests touring the Granger Center will be provided with safety glasses to wear while in rooms with operating equipment or with students working on equipment.

FOOT WEAR: You are required to wear closed toe shoes at all times in labs (except computer labs). No sandals are allowed. If you do not have proper footwear, you will be asked to leave and the absence will be counted as unexcused.

FOOD: Food is not allowed in computer labs, including snacks. If you have food in a computer lab you will be asked to dispose of the food, or leave the lab immediately.

BEVERAGES: Beverages are not allowed in computer labs.

TOOLS: All associate degree students are required to provide their own tools and have them available for each lab session. If you attend class without your tools, you will be denied access to the lab and your absence will be counted as unexcused.

ALCOHOL: You will not be allowed to attend class if you are under the influence of alcohol. If you are suspected of being under the influence of alcohol, your professor will call Public Safety and ask them to administer a Preliminary Breath Test (PBT). Under zero tolerance guidelines, anyone with a level of 0.02% alcohol or above will be removed from class and the absence will be counted as unexcused. Anyone with a percentage of alcohol above the legal limit will also face prosecution.

TOBACCO: You will not be allowed to consume tobacco products of any kind while in the Granger Center. This included chewing tobacco.

ATTENDANCE: Tardiness and/or absences will affect your grade, according to your professor's attendance policy. Violations of any policies in this document that include an unexcused absence could reduce your grade.

CELL PHONES: Cell phones are not allowed during class. They must be turned off. If you are expecting an emergency call (medical, call from car repair, etc.) you must notify your professor before class and put your phone on vibrate. Cell phone use is not allowed during a test under any circumstances.

Name<br>Class<br>Professor<br>Assignment<br>Date

HOMEWORK AND SUBMITTALS:

1. All papers and drawings are to be formatted according to the following guidelines:
2. All computer-generated documents are to be word processed using Microsoft Word or a similar product.

   FONT: Times New Roman

   FONT SIZE: 12 Pt

   LINE SPACING: Double

   PARAGRAPH SPACING: Double

   MARGINS (as in Word default)

   | | |
   |---|---|
   | Top | 1 |
   | Bottom | 1 |
   | Left | 1.25 |
   | Right | 1.25 |

   PAPER COLOR: White
3. Title Block and paper heading: At the top of each paper that you submit, include the information as listed at the top of this page. This is to be right-aligned and single spaced. It is suggested that you develop a template to be used for all submittals. You will only need to fill in the information for the assignment and date for each new submittal.

# Spring 2018 Exam Schedule

It is the professional obligation of all faculty members to ensure that all examinations be held at the time proposed on this guideline. The period assigned for the final examination of a class must be used either for an examination or for the continuation of the instructional program of that class. Any exception to this schedule must receive prior approval from the department chairperson and the college dean.

On the examination schedule, the M combinations are classes which meet primarily on the MWF schedule, and T combinations are classes which meet on the TR schedule.

| ***If your class meets:*** | | ***Your exam Day, Date & Time is:*** | |
|---|---|---|---|
| 8:00 am | M combinations | Wed, May 2 | 8-9:40 am |
| 8:00 am | T combinations | Thur, May 3 | 8-9:40 am |
| 9:00 am | M combinations | Mon, April 30 | 8-9:40 am |
| 9:00 am | T combinations | Tues, May 1 | 8-9:40 am |
| 9:30 or 10:00 am | T combinations | Mon, April 30 | 10-11:40 am |
| 10:00 am | M combinations | Tues, May 1 | 10-11:40 am |
| 11:00 am | M combinations | Thur, May 3 | 10-11:40 am |
| 12:00 pm | M combinations | Mon, April 30 | 12-1:40 pm |
| 12:00 pm | T combinations | Tues, May 1 | 12-1:40 pm |
| 1:00 pm | M combinations | Wed, May 2 | 12-1:40 pm |
| 1:00 pm | T combinations | Thur, May 3 | 12-1:40 pm |
| 1:30 or 2:00 pm | T combinations | Wed, May 2 | 2-3:40 pm |
| 2:00 pm | M combinations | Thur, May 3 | 2-3:40 pm |
| 3:00 pm | M combinations | Tues, May 1 | 2-3:40 pm |
| 3:00 pm | T combinations | Mon, April 30 | 2-3:40 pm |
| 4:00 pm | M combinations | Mon, April 30 | 4-5:40 pm |
| 4:00 pm | T combinations | Tues, May 1 | 4-5:40 pm |
| 4:30 or 5:00 pm | M combinations | Wed, May 2 | 4-5:40 pm |
| 4:30 or 5:00 pm | T combinations | Thur, May 3 | 4-5:40 pm |
| 6:00 pm | M combinations | Mon, April 30 | 6-7:40 pm |
| 6:00 pm | T combinations | Tues, May 1 | 6-7:40 pm |
| 7:00 or 7:30 pm | M combinations | Wed, May 2 | 6-7:40 pm |
| 7:00 or 7:30 pm | T combinations | Thur, May 3 | 6-7:40 pm |
| 8:00 pm | M combinations | Thur, May 3 | 8-9:40 pm |
| 8:00 pm | T combinations | Wed, May 2 | 8-9:40 pm |

# SYLLABUS ATTACHMENT
# COLLEGE OF ENGINEERING TECHNOLOGY – FERRIS STATE UNIVERSITY
## *Spring 2018*

| IMPORTANT DATES | | |
|---|---|---|
| Late registration | Wed. – Fri. | Jan. 3-5 |
| First day of classes | Monday | Jan. 8 |
| Last day for Drop/Add | Thursday | Jan. 11 |
| Martin Luther King Day (no classes) | Monday | Jan. 15 |
| Spring recess (Spring Break) | Sat. – Sun. | Mar. 3-11 |
| Mid-term grades due | Monday | Mar. 5 |
| Classes resume | Monday | Mar. 12 |
| Last day for "W" grades | Thursday | Mar. 22 |
| Mid-Semester Recess | Thur. – Sun. | Mar. 29-31 |
| Last day of classes | Friday | Apr. 27 |
| Examination Week | Mon – Fri | Apr 30 - May 4 |
| Commencement | Friday - Saturday | May 4-5 |
| Final grades due by 1:00 pm | Monday | May 7 |
| Grades available to students on MyFSU | Tuesday (after 8AM) | May 8 |

| Sessions | Dates | Last Day to Withdraw |
|---|---|---|
| Full Session | Jan. 8 – Apr. 27 | Mar. 22 |
| Session A | Jan. 8 – Feb. 8 | Feb. 27 |
| Session B | Feb. 28 – Apr. 27 | Apr. 10 |
| Session D | Jan. 8 – Feb. 9 | Jan. 29 |
| Session E | Feb. 12 – Mar. 22 | Mar. 2 |
| Session F | Mar. 23 – Apr. 27 | Apr. 16 |

| College of Engineering Technology School Offices | | |
|---|---|---|
| Automotive &Heavy Equipment | AUT 101 | 591-2655 |
| Built Environment | GRN 227 | 591-3773 |
| Engineering & Computing Technology | SWN 312 | 591-2068 |
| Design & Manufacturing | NEC 211 | 591-2640 |
| Dean's Office | JOH 200 | 591-2890 |

## WHAT YOU NEED TO KNOW

**E-MAIL**
All registered FSU students have a Ferris Gmail account. This is the only e-mail to which all official University information about registration, financial aid, student activities, and class cancellations will be sent. Please check your account at least once a week. E-mail is our primary communication resource for students.

**CLASS ATTENDANCE IS IMPORTANT!**
Attendance usually has a high correlation with how well you do in a course. Many instructors have mandatory attendance policies by which your grade will be affected by absences. Some instructors also have policies about class tardiness to encourage students to be present for the full class period. Check your course syllabus or talk to your instructor about his/her policies.

**HOW TO CONTACT A FACULTY MEMBER OR ADVISOR**
If you have questions or need help, talk to your instructor. Faculty office locations, phone numbers, and office hours may be obtained from the class syllabus or department office, or through the Directories & Maps link on the FSU home page.

**DROPPING CLASSES OR WITHDRAWING**
Dropping and adding only occurs during the first four days of the term. You can adjust your schedule **online during the first four days** or in person at the Timme Center (from 8-5 except for the last day when it is 12-5).

*If you add a class you must pay for your additional charges by the fourth day or your schedule will be dropped.*

If you need to withdraw from a class after the official drop/add period, you must do so **OFFICIALLY**, through your dean's office, in order to avoid receiving an "F" grade in the course. **You may not withdraw online after the first four days of the term.** You will receive a "W" for the course. *You will not receive a refund.* If you need to totally withdraw from the University, you must do so **officially** at Admissions and Records in CSS 201. The last day to withdraw or drop a class may be different for different classes. **CHECK THE SESSIONS DATES SECTION ABOVE OR THE REGISTRATION AND ACADEMIC GUIDE FOR THE WITHDRAWAL DEADLINES FOR THE SEMESTER**.
In cases of extenuating circumstances (e.g., a serious illness requiring you to withdraw from school), contact Birkam Health Center at 591-2614.

**INCOMPLETES**
The "I" is only considered for extenuating circumstances that have led to a student missing a portion of the course. The intent and appropriate use of the "I" grade is NOT to avoid student probation, dismissal, or unacceptable grades, nor should it be considered as an extended alternative to withdraw from a class (W). Extenuating circumstances are generally defined as those situations over which a student has little or no control—e.g., illness, birth, jury duty, death of a parent, serious injury. Instructors may require suitable documentation.
Students must have completed at least 75% of the coursework at passing levels before an "I" will be considered, and they may be required to sign an agreement regarding course completion. An "I" grade automatically changes to an "F" after one semester (not counting summer) unless the faculty member files another grade or extends the incomplete.

**STUDENT COMPLAINT POLICY**
http://www.ferris.edu/HTMLS/administration/academicaffairs/Forms_Policies/Documents/Policy_Letters/AA-Student-Complaints.pdf

**GRADUATION**
Students should apply for their degree audit the semester prior to the degree completion term. To obtain a degree audit and clearance for your associate or bachelor degree for you must meet with your assigned academic advisor. In addition an online graduation application is REQUIRED and deadlines will be ENFORCED per the Provost's Office and Records Office. **ONLINE APPLICATION DEADLINE** for participation in Fall Commencement Ceremony: **March 1, 2018**

Online application is accessed by logging into your MyFSU, (click on Student tab, My Records link, Degree Progress and Graduation, Apply to Graduate link). For more information, contact the Dean's Office.

**INCLEMENT WEATHER CONDITIONS**
Only during the most severe weather conditions – which could potentially endanger the safety of students or staff – will the Big Rapids campus consider cancelling classes. The decision to cancel classes due to weather conditions at the Big Rapids site will be made as early as possible. In the event it is necessary to cancel classes, periodic announcements will be made on area radio and television stations. It is the student's responsibility to listen for these announcements. A student may also call the Ferris Information Line at 231-591-5602 or check the Ferris website.

## ACADEMIC MISCONDUCT

Academic misconduct refers to dishonesty or misrepresentation with respect to assignments, tests, quizzes, written work, oral presentations, class projects, internship experience, or computer usage; violation of computer licenses, programs, or data bases; or unauthorized acquisition or distribution of tests or other academic material belonging to someone else. It includes such behaviors as cheating, copying materials from the internet without documentation, presenting another person's ideas or work as your own, taking someone else's exam for them, violating computer software licenses or program/data ownership, etc. It is the expectation of the College of Engineering Technology that all work you turn in is your own and is original for the course in which it is being submitted. If you are uncertain about whether a particular behavior might represent academic misconduct, be sure to ask your professor for clarification. Penalties for academic misconduct can include **FAILURE** of the assignment or the course, and/or disciplinary action up to and including probation or dismissal from the University.

**DISRUPTIVE BEHAVIOR**
The College of Engineering Technology strives to maintain a positive learning environment and educational opportunity for all students. Consequently, patterns of behaviors which obstruct or disrupt the teaching/learning environment will be addressed. The instructor is in charge of his or her course (e.g., assignments, due dates, attendance policy) and classroom (e.g., behaviors allowed, tardiness). Harassment, in any form, will not be tolerated. Penalties for disruptive behavior can include involuntary withdrawal from the course and/or disciplinary action up to and including probation or dismissal from the University.

## WHERE TO GO FOR HELP

The following services are available to any Ferris student, free of charge. They are designed to help you succeed in your courses, in your career planning, and in meeting the challenges of university life. Don't hesitate to explore and use these services at Ferris.

**ACADEMIC ADVISING**
All students have an assigned advisor and should confer with that advisor regularly. Students who have declared a major should see an advisor in that major. To find out who your advisor is, log in to MyFSU, (click on the Student tab, My Registration, Advisor Information, Select Term, Submit).

**ACADEMIC SUPPORT CENTER……………………….ASC 1017 – 591-3543**
**THE WRITING CENTER…………………………………..ASC 1017 – 591-2534**
**The Academic Support Center, Tutoring Services, and Writing Center** join together to offer FSU students an array of academic support services. Tutors are available to answer questions for many courses. The Writing Center helps writers individually and in workshops with skills and assignments. There is also study skills assistance to help with note-taking, test-taking, memory and reading strategies, and time management.

**DISABILITIES SERVICES…………………………………STR 313 – 591-3057**
According to the Americans with Disabilities Act, each student with a disability is responsible for notifying the University of his/her disability and requesting accommodations. Students requiring a classroom accommodation due to a physical, learning, mental or emotional disability should contact the Disabilities Services Office.

**SCHOLAR PROGRAM…………………………………ASC 1021 – 591-5976**
SCHOLAR is an academic support program that aids in the student's successful progression by offering a Peer Mentor Program, a Student Retention Program, and an Academic Student Advisory Committee.

**PERSONAL COUNSELING, SEXUAL ASSAULT, SUBSTANCE ABUSE BIRKAM HEALTH CENTER ……………………….…... 2nd Floor - 591-5968**
Personal counseling is available confidentially and free of charge. Counselors are available to assist with personal and stress-related problems, family and relationship issues, substance abuse, sexual assault, depression, or other similar problems. Call or stop by to obtain an appointment. ***If you or a friend are in immediate crisis, call 911.***

**EDUCATIONAL & CAREER COUNSELING ……………STR 313 – 591-3057**
Students wanting to examine their choice of major or career choice, learning styles or strategies can make one-on-one appointments with licensed counselors.

**CAREER SPECIALIST – Leigha Compson ……………JOH 200 – 591-3549**
Valuable support services and events are offered for students currently or previously enrolled in associate degree programs. To lean more visit: http://www. ferris.edu/HTMLS/colleges/technolo/ Career-Programs-Support/index.htm

**SAFETY**
Please observe the posted shelter and evacuation routes in the hallway nearest your classroom.

## OTHER RESOURCES

**BIRKAM HEALTH CENTER……………………..………1st Floor - 591-2614**
The Birkam Health Center provides fee-for-service medical care including evaluation and treatment for illness and injury anytime during the year. Patients are seen on a walk-in and by appointment basis.

**FLITE LIBRARY……………………………………………………………591-2669**
Regular hours for FLITE:
Monday – Thursday . . . . . . . . . . . . . . . . . 7:30 a.m. – MIDNIGHT
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . ...7:30 a.m. – 6:00 p.m.
Saturday . . . . . . . . . . . . . . . . . . . . . . . . . NOON – 5:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . .. . . . . . . . .1:00 p.m. – MIDNIGHT
Extended Studies Court will begin late night hours January 17, 2017
*Sunday-Thursday/MIDNIGHT to 7:30 a.m. *Friday/6 p.m. to MIDNIGHT
*Saturday/5 p.m. to MIDNIGHT)

**FSU BOOKSTORE……………………………UNIVERSITY CENTER 231 591-2607**
Regular on-campus hours for the Bookstore **:
Monday – Thursday . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 6:00 p.m.
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 5:00 p.m.
Saturday. . . . . . . . . . . . . . . . . . . . . . . . . . . . 12:00 p.m. – 4:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CLOSED

## HELPFUL NUMBERS

| | | | |
|---|---|---|---|
| Admissions | 2100 | Inst. Testing | 3628 |
| Business Office | 2125 | Public Safety | 5000 |
| Financial Aid | 2110 | Records | 2792 |
| Housing | 3745 | TAC | 4822 |

When calling from off campus, extensions can be called by using the prefix 231-591-_____.

## Arts & Sciences/General Education Department Offices

| | | |
|---|---|---|
| Biology | ASC 2004 | 591-2550 |
| Humanities | JOH 119 | 591-3675 |
| Languages & Literature | ASC 3080 | 591-3988 |
| Mathematics | ASC 2021 | 591-2565 |
| Physical Sciences | ASC 3021 | 591-2580 |
| Social Sciences | ASC 2108 | 591-2735 |

## College of Engineering Technology Diversity Statement

The College of Engineering Technology provides a dynamic experiential learning environment that is inclusive, equitable and just for all individuals, regardless of human differences.

Ferris State University is an equal opportunity institution. For information on the University's Policy on Non-Discrimination, visit http://www.ferris.edu/non-discrimination

Updated 1/2/2017 alm

2016 Spring
Semester Course Syllabus (HVACR 102)

**Instructor:** Joe Compton

**Office Location:** GRN 202

**Office Phone: 591-3062** Cell: 231-349-1294

**Office Hours:** **Wednesday: 11:00 AM – 2:00 PM**
**Thursday: 3:00 PM – 4:00 PM**

**E- Mail:** comptonj@ferris.edu

**Course Requirements**

**Attendance:** Regular attendance of each class session is expected, since it is proven that students who attend class on a regular basis are much more likely to excel in learning and mastering the given topic, and that is what you are here for. You will be allowed 2 absences without penalty (Includes Lecture and Lab). For each absence beyond two, the final numerical grade will be reduced by one point. Two points will be added to the final numerical grade if you attended all classes. One point will be added if you have only 1 absence. ***EXCUSED ABSENCES MUST BE IN WRITING.***

**Exceptions to the Attendance Policy:** Absences for the following reasons will be viewed as beyond the control of the students and will not cause a person's grade to be lowered or cause them to withdraw or fail the class.

a. death of a family member/or significant person
b. illness as long as accompanied by a physician's note or extended hospitalization
c. University sponsored events (permission from the Academic Vice President's Office is required).
d. Jury duty / or being subpoenaed for court testimony.

**Note:** All other exceptions must be discussed with the instructor prior to the time they occur to be considered as an excused absence **(There will be no exceptions)**.

**Tardiness:** Three times late for class will equal one absence.

**Assignments:** Assignments handed must be your own work. Collaboration with fellow students is encouraged to help better understand concepts and ideas, but the assignment handed in cannot be a duplication of others work.

**Late Assignments:** Assignments that have a due date are subject to a grade reduction if turned in late.

**Handouts:** Students are responsible to obtain any hand out passed out in class when absent.

**Cell Phones:** No use of cell phones in lecture or lab without permission. There will be a cell phone grade on final grade calculation. Excessive cell phone use will be penalized

***Note:** I reserve the right to make any changes in the content or the point system of this class that I may see necessary as the class progresses through the semester.

**Tests:** 2 or 3 tests plus final exam
**Homework:** Numerous assignments
**Lab and Lab performance test:** Numerous assignments

**A.** Grading Policy for final grade *

Points earned /Total points
For example:
homework assignments, tests, and labs add up to 1000 points total and student earns 900 points.
900/1000 = .9 or 90%

After the grade is tabulated attendance employability points will be added or subtracted from Final grade average
90 + attendance + employability skills

## Grading Scale

| **Grade** | **HP** | **Grade** |
|---|---|---|
| 100-94 | 4 | A |
| 93-90 | 3.7 | A- |
| 89-87 | 3.3 | B+ |
| 86-84 | 3.0 | B |
| 83-81 | 2.7 | B- |
| 80-78 | 2.3 | C+ |
| 77-75 | 2.0 | C |
| 74-73 | 1.7 | C- |
| 72-71 | 1.3 | D+ |
| 70-69 | 1.0 | D |
| 68-67 | 0.7 | D- |
| 66-BELOW | 0.0 | F |

HOMEWORK AND SUBMITTALS:

1. All papers and drawings are to be formatted according to the following guidelines:
2. All computer-generated documents are to be word processed using Microsoft Word or a similar product.
   FONT: Times New Roman
   FONT SIZE: 12 Pt
   LINE SPACING: 1.5 lines
   PARAGRAPH SPACING: Double
   MARGINS (as in Word default)
   - Top 1
   - Bottom 1
   - Left 1.25
   - Right 1.25

   PAPER COLOR: White
3. Title Block and paper heading: At the top of each paper that you submit, include the information listed below. This is to be right-aligned and single spaced. It is suggested that you develop a template to be used for all submittals. You will only need to fill in the information for the assignment and date for each new submittal.

Name
Class
Professor
Assignment
Date

**FERRIS STATE UNIVERSITY**

COLLEGE OF TECHNOLOGY

HVACR DEPARTMENT

**HVAC 111**

**Course Syllabus**

| | |
|---|---|
| **Course:** | HVAC 111 Electricity, Blueprints, and Fabrication |
| **Semester Hours:** | 4 Hours per Week |
| **Contact Hours:** | Lecture: 3 Hours per Week, Lab: 3 Hours per Week |
| **Course Description:** | Layout and fabrication of duct, duct fittings (sheet metal and fiberglass) and piping/ tubing (copper, iron, and plastic) used in air conditioning and heating systems. Soldering, brazing, pipe cutting and fitting, component use and proper use of hand and shop tools will be emphasized. Basics of blueprint reading and sketching techniques. |
| **Co Requisite:** | Math 116 |
| **Textbooks Required:** | Refrigeration & Air Conditioning Technology, 8th Edition, Whitman, Johnson, Tomczyk, and Silberstein. |
| **Course Website:** | Gradebook and other information is provided through Blackboard for this course. |
| **Contact Information:** | Name: Professor Gerard Lucas<br>Office Location: Granger 218<br>Office Phone: 231-591-3764<br>Home Phone: 253-459-4071<br>E-mail: GerryLucas@ferris.edu |
| **Office Hours:** | Tuesday and Thursday 1:00 to 2:50, or by appointment. |

## Course Policies and Student Responsibilities:

**Attendance:** In general, treat this course as you would a job. Students without any unexcused absences will receive 2% added to their final grade. There is a maximum of two unexcused absences allowed without penalty. **Each unexcused absence after two will result in 1% drop in your final grade. Leaving lecture or lab early without approval from the professor will be considered an absence.**

**Excused Absence:** Documentation or previous professor approval is required for an absence to be considered excused.

**Punctuality:** Punctuality is expected. If there is a scheduling conflict, the student must inform the professor. **Every three late arrivals will be treated as a unexcused absence. Students must be on time for assessments.**

**Cell Phones:** Cell phones are not to be used in lecture or lab for any purpose. Cell phones must be on silent or off during lecture and lab.

**Assessment Policy:** No cell phones or electronic devices are allowed during assessments. Talking is strictly prohibited during the assessment. Assessments are only available at the scheduled date and time; assessments may only be rescheduled due to documented emergency or health issue.

**Late Assignment Policy:** Late assignments will be accepted up to one business day after the due date **with a deduction of 10% off the final grade for that assignment.**

**Student Conduct:** All students are expected to conduct themselves with dignity and respect for others. **Harassment of any kind is not acceptable. Students are responsible for their own work. The Code of Student Community Standards has been included in blackboard for the students to review.**

**Syllabus Changes:** **The professor reserves the right to make needed and appropriate adjustments to this syllabus.**

**Grading:** The class grading is weighted where the labs are worth 20%, assignments are worth 20%, exams are worth 40%, and the final exam is worth 20%. **You must receive 70% or greater final score to pass this class.** Students attending and participating in the Advisory Board Event will receive 2% extra credit added to their final grade.

| Letter Grade | A | A- | B+ | B | B- | C+ | C | C- |
|---|---|---|---|---|---|---|---|---|
| Final Percent | >=94% | <94% to >=90% | <90% to >=87% | <87% to >=84% | <84% to >=80% | <80% to >=77% | <77% to >=74% | <74% to >=70% |

**Course Learning Outcomes:**

1. Introduction, Orientation, and Safety
   A. Students will apply all safety procedures required in this course.
2. Piping Systems and Connections
   A. Students will identify the fittings by size and their use and application in a piping system.
   B. Students will measure, cut, thread, and assemble black or galvanized pipe and pipe fittings to sizes and directions indicated on the print given.
   C. Students will perform copper/brass tubing and fitting joining techniques.
   D. Students will identify (by name and size) standard forged brass and wrought copper refrigeration fittings utilized on domestic refrigeration and air conditioners and small commercial refrigeration systems.
   E. Students will ignite an oxygen and acetylene torch and adjust the flame to the proper type of flame and the proper heat to solder or braze a tubing project so it will be gas or liquid tight.
   F. Students will demonstrate soldering, brazing and tube working skills.
   G. Students will demonstrate plastic tubing/pipe joining techniques.
   H. Students will glue various plastic (PVC) tubing and fittings to accurately assemble a piping system according to a drawing.
   I. Students will demonstrate joining techniques for dissimilar materials.
   J. Students will accurately fabricate and assemble a copper, iron and plastic tubing/pipe system comprised of copper, iron and plastic tubing/pipe and fittings according to a drawing and pressure test the system to a pressure of 15 psig in a bath of water to verify that no leaks exist.
3. Tools and their uses
   A. Students will properly operate/manipulate hand and shop tools per instruction.
4. Metal Types and Gauges
   A. Students will identify samples of galvanized sheet metal.
   B. Students will determine the gauge of various samples of galvanized sheet metal.
5. Edges, Seams, and Connections
   A. Students will identify and fabricate the various types of edges, seams, and connections used in the sheet metal trade on residential and light commercial ducting.
6. Rigging
   A. Students will be able to identify and understand the function of common lifting devices including chin falls and gantries.
   B. Students will be able to identify nylon slings and wire rope slings and understand the proper application and use of nylon and wire rope slings and also common rope.
   C. Students will be able to explain common methods employed for moving heavy objects.
   D. Students will demonstrate ability to signal a crane operator with hand signals.

**Course Learning Outcomes (Continued):**

7. Layout of Common Duct Components
   A. Students will layout and fabricate some of the following common rectangular fittings:
      a. Square and rectangular duct.
      b. Plenum.
      c. S & drive end cap.
      d. 4-drive end cap.
      e. Round duct.
      f. Round tap-in.
      g. Transition.
8. Manufactured sheet metal fittings & components.
   A. Students will identify, connect and install manufactured sheet metal fitting.
9. Supports and fasteners.
   A. Students will display ability to identify common support steel and fasteners.
10. Job cost estimation.
   A. Make a cost and material estimation of all material needed to complete a required job, based on a set of mechanical prints with a duct system requiring a heating and cooling system.
11. Drawing and plan reading.
   A. Students will sketch orthographic views of the object based on an isometric view.
   B. Students will sketch an isometric view of an object based on orthographic view.
   C. Given a set of building prints the student will be able to understand how the building is constructed, what symbols are used in the making and drawing of blueprints.
   D. Students will locate and identify all the mechanical components of a system on a blueprint.
   E. Students will determine sizing of pipes and ducting on mechanical drawings.
   F. Students will determine joining techniques of piping and ducting from blueprints.
   G. Students will locate listings of pumps, valves, fans and other mechanical components on mechanical schedules.
   H. Students will accurately locate and interpret drawings of building sections and details on mechanical and building prints.
   I. Students will locate requested information in a specification book.
   J. Students will accurately read dimensions of various scales using an architect's scale.
12. Conduit bending.
   A. Display ability to measure cut and assemble conduit to match dimension provided.

# SYLLABUS ATTACHMENT
# COLLEGE OF ENGINEERING TECHNOLOGY – FERRIS STATE UNIVERSITY
## *Spring 2017*

| IMPORTANT DATES | | |
|---|---|---|
| **Late registration** | **Wed. – Fri.** | **Jan. 4-6** |
| **First day of classes** | **Monday** | **Jan. 9** |
| **Last day for Drop/Add** | **Thursday** | **Jan. 12** |
| **Martin Luther King Day (no classes)** | **Monday** | **Jan. 16** |
| **Spring recess (Spring Break)** | **Sat. – Sun.** | **Mar. 4-12** |
| **Mid-term grades due** | **Monday** | **Mar. 6** |
| **Classes resume** | **Monday** | **Mar. 13** |
| **Last day for "W" grades** | **Thursday** | **Mar. 23** |
| **Mid-Semester Recess** | **Thur. – Sun.** | **Apr. 13-17** |
| **Last day of classes** | **Friday** | **Apr. 28** |
| **Examination Week** | **Mon – Fri** | **May 1- 5** |
| **Commencement** | **Friday - Saturday** | **May 5-6** |
| **Final grades due by 1:00 pm** | **Monday** | **May 8** |
| **Grades available to students on MyFSU** | **Tuesday (after 8AM)** | **May 9** |

| Sessions | Dates | Last Day to Withdraw |
|---|---|---|
| **Full Session** | **Jan. 9 – Apr. 28** | **Mar. 23** |
| **Session A** | **Jan. 9 – Feb. 9** | **Feb. 28** |
| **Session B** | **Mar. 1 – Apr. 28** | **Apr. 11** |
| **Session D** | **Jan. 9 – Feb. 10** | **Jan. 30** |
| **Session E** | **Feb. 13 – Mar. 23** | **Mar. 3** |
| **Session F** | **Mar. 24 – Apr. 28** | **Apr. 17** |

| College of Engineering Technology School Offices | | |
|---|---|---|
| Automotive &Heavy Equipment | AUT 101 | 591-2655 |
| Built Environment | GRN 227 | 591-3773 |
| Engineering & Computing Technology | SWN 312 | 591-2068 |
| Design & Manufacturing | NEC 211 | 591-2640 |
| Dean's Office | JOH 200 | 591-2890 |

## WHAT YOU NEED TO KNOW

**E-MAIL**
All registered FSU students have a Ferris Gmail account. This is the only e-mail to which all official University information about registration, financial aid, student activities, and class cancellations will be sent. Please check your account at least once a week. E-mail is our primary communication resource for students.

**CLASS ATTENDANCE IS IMPORTANT!**
Attendance usually has a high correlation with how well you do in a course. Many instructors have mandatory attendance policies by which your grade will be affected by absences. Some instructors also have policies about class tardiness to encourage students to be present for the full class period. Check your course syllabus or talk to your instructor about his/her policies.

**HOW TO CONTACT A FACULTY MEMBER OR ADVISOR**
If you have questions or need help, talk to your instructor. Faculty office locations, phone numbers, and office hours may be obtained from the class syllabus or department office, or through the Directories & Maps link on the FSU home page.

**DROPPING CLASSES OR WITHDRAWING**
Dropping and adding only occurs during the first four days of the term. You can adjust your schedule **online during the first four days** or in person at the Timme Center (from 8-5 except for the last day when it is 12-5).

*If you add a class you must pay for your additional charges by the fourth day or your schedule will be dropped.*

If you need to withdraw from a class after the official drop/add period, you must do so **OFFICIALLY**, through your dean's office, in order to avoid receiving an "F" grade in the course. **You may not withdraw online after the first four days of the term.** You will receive a "W" for the course. *You will not receive a refund.* If you need to totally withdraw from the University, you must do so **officially** at Admissions and Records in CSS 201. The last day to withdraw or drop a class may be different for different classes. **CHECK THE SESSIONS DATES SECTION ABOVE OR THE REGISTRATION AND ACADEMIC GUIDE FOR THE WITHDRAWAL DEADLINES FOR THE SEMESTER**.
In cases of extenuating circumstances (e.g., a serious illness requiring you to withdraw from school), contact Birkam Health Center at 591-2614.

**INCOMPLETES**
The "I" is only considered for extenuating circumstances that have led to a student missing a portion of the course. The intent and appropriate use of the "I" grade is NOT to avoid student probation, dismissal, or unacceptable grades, nor should it be considered as an extended alternative to withdraw from a class (W). Extenuating circumstances are generally defined as those situations over which a student has little or no control—e.g., illness, birth, jury duty, death of a parent, serious injury. Instructors may require suitable documentation.
Students must have completed at least 75% of the coursework at passing levels before an "I" will be considered, and they may be required to sign an agreement regarding course completion. An "I" grade automatically changes to an "F" after one semester (not counting summer) unless the faculty member files another grade or extends the incomplete.

**STUDENT COMPLAINT POLICY**
http://www.ferris.edu/HTMLS/administration/academicaffairs/Forms_Policies/Documents/Policy_Letters/AA-Student-Complaints.pdf

**GRADUATION**
Students should apply for their degree audit the semester prior to the degree completion term. To obtain a degree audit and clearance for your associate or bachelor degree for you must meet with your assigned academic advisor. In addition an online graduation application is REQUIRED and deadlines will be ENFORCED per the Provost's Office and Records Office. **ONLINE APPLICATION DEADLINE** for participation in Fall Commencement Ceremony: **March 1, 2017**

Online application is accessed by logging into your MyFSU, (click on Student tab, My Records link, Degree Progress and Graduation, Apply to Graduate link). For more information, contact the Dean's Office.

**INCLEMENT WEATHER CONDITIONS**

Only during the most severe weather conditions – which could potentially endanger the safety of students or staff – will the Big Rapids campus consider cancelling classes. The decision to cancel classes due to weather conditions at the Big Rapids site will be made as early as possible. In the event it is necessary to cancel classes, periodic announcements will be made on area radio and television stations. It is the student's responsibility to listen for these announcements. A student may also call the Ferris Information Line at 231-591-5602 or check the Ferris website.

## ACADEMIC MISCONDUCT

Academic misconduct refers to dishonesty or misrepresentation with respect to assignments, tests, quizzes, written work, oral presentations, class projects, internship experience, or computer usage; violation of computer licenses, programs, or data bases; or unauthorized acquisition or distribution of tests or other academic material belonging to someone else. It includes such behaviors as cheating, copying materials from the internet without documentation, presenting another person's ideas or work as your own, taking someone else's exam for them, violating computer software licenses or program/data ownership, etc. It is the expectation of the College of Engineering Technology that all work you turn in is your own and is original for the course in which it is being submitted. If you are uncertain about whether a particular behavior might represent academic misconduct, be sure to ask your professor for clarification. Penalties for academic misconduct can include **FAILURE** of the assignment or the course, and/or disciplinary action up to and including probation or dismissal from the University.

**DISRUPTIVE BEHAVIOR**

The College of Engineering Technology strives to maintain a positive learning environment and educational opportunity for all students. Consequently, patterns of behaviors which obstruct or disrupt the teaching/learning environment will be addressed. The instructor is in charge of his or her course (e.g., assignments, due dates, attendance policy) and classroom (e.g., behaviors allowed, tardiness). Harassment, in any form, will not be tolerated. Penalties for disruptive behavior can include involuntary withdrawal from the course and/or disciplinary action up to and including probation or dismissal from the University.

## WHERE TO GO FOR HELP

The following services are available to any Ferris student, free of charge. They are designed to help you succeed in your courses, in your career planning, and in meeting the challenges of university life. Don't hesitate to explore and use these services at Ferris.

**ACADEMIC ADVISING**

All students have an assigned advisor and should confer with that advisor regularly. Students who have declared a major should see an advisor in that major. To find out who your advisor is, log in to MyFSU, (click on the Student tab, My Registration, Advisor Information, Select Term, Submit).

**ACADEMIC SUPPORT CENTER……………………….ASC 1017 – 591-3543**
**THE WRITING CENTER…………………………………ASC 1017 – 591-2534**
**The Academic Support Center, Tutoring Services, and Writing Center** join together to offer FSU students an array of academic support services. Tutors are available to answer questions for many courses. The Writing Center helps writers individually and in workshops with skills and assignments. There is also study skills assistance to help with note-taking, test-taking, memory and reading strategies, and time management.

**DISABILITIES SERVICES……………………………….....STR 313 – 591-3057**

According to the Americans with Disabilities Act, each student with a disability is responsible for notifying the University of his/her disability and requesting accommodations. Students requiring a classroom accommodation due to a physical, learning, mental or emotional disability should contact the Disabilities Services Office.

**SCHOLAR PROGRAM……………………………….ASC 1021 – 591-5976**

SCHOLAR is an academic support program that aids in the student's successful progression by offering a Peer Mentor Program, a Student Retention Program, and an Academic Student Advisory Committee.

**PERSONAL COUNSELING, SEXUAL ASSAULT, SUBSTANCE ABUSE BIRKAM HEALTH CENTER …………………………... 2nd Floor - 591-5968**

Personal counseling is available confidentially and free of charge. Counselors are available to assist with personal and stress-related problems, family and relationship issues, substance abuse, sexual assault, depression, or other similar problems. Call or stop by to obtain an appointment. ***If you or a friend are in immediate crisis, call 911.***

**EDUCATIONAL & CAREER COUNSELING ……………STR 313 – 591-3057**

Students wanting to examine their choice of major or career choice, learning styles or strategies can make one-on-one appointments with licensed counselors.

**CAREER SPECIALIST – Leigha Compson ……………JOH 200 – 591-3549**

Valuable support services and events are offered for students currently or previously enrolled in associate degree programs. To lean more visit: http://www. ferris.edu/HTMLS/colleges/technolo/ Career-Programs-Support/index.htm

**SAFETY**

Please observe the posted shelter and evacuation routes in the hallway nearest your classroom.

## OTHER RESOURCES

**BIRKAM HEALTH CENTER…………………………………1st Floor - 591-2614**

The Birkam Health Center provides fee-for-service medical care including evaluation and treatment for illness and injury anytime during the year. Patients are seen on a walk-in and by appointment basis.

**FLITE LIBRARY……………………………………………………………….591-2669**

Regular hours for FLITE:
Monday – Thursday . . . . . . . . . . . . . . . . . . 7:30 a.m. – MIDNIGHT
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . ...7:30 a.m. – 6:00 p.m.
Saturday . . . . . . . . . . . . . . . . . . . . . . . . . . NOON – 5:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . .. . . . . . . . .1:00 p.m. – MIDNIGHT
Extended Studies Court will begin late night hours January 17, 2017
*Sunday-Thursday/MIDNIGHT to 7:30 a.m. *Friday/6 p.m. to MIDNIGHT
*Saturday/5 p.m. to MIDNIGHT)

**FSU BOOKSTORE…………………………UNIVERSITY CENTER 231 591-2607**

Regular on-campus hours for the Bookstore **:
Monday – Thursday . . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 6:00 p.m.
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 5:00 p.m.
Saturday. . . . . . . . . . . . . . . . . . . . . . . . . . . . . 12:00 p.m. – 4:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CLOSED

## HELPFUL NUMBERS

| | | | |
|---|---|---|---|
| Admissions | 2100 | Inst. Testing | 3628 |
| Business Office | 2125 | Public Safety | 5000 |
| Financial Aid | 2110 | Records | 2792 |
| Housing | 3745 | TAC | 4822 |

When calling from off campus, extensions can be called by using the prefix 231-591-_____.

## Arts & Sciences/General Education Department Offices

| | | |
|---|---|---|
| Biology | ASC 2004 | 591-2550 |
| Humanities | JOH 119 | 591-3675 |
| Languages & Literature | ASC 3080 | 591-3988 |
| Mathematics | ASC 2021 | 591-2565 |
| Physical Sciences | ASC 3021 | 591-2580 |
| Social Sciences | ASC 2108 | 591-2735 |

## College of Engineering Technology Diversity Statement

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Name

Class

Professor

Assignment

Date

HOMEWORK AND SUBMITTALS:

1. All papers and drawings are to be formatted according to the following guidelines:

2. All computer-generated documents are to be word processed using Microsoft Word or a similar product.

FONT: Times New Roman

FONT SIZE: 12 Pt

LINE SPACING: Double

PARAGRAPH SPACING: Double

MARGINS (as in Word default)

| | |
|---|---|
| Top | 1 |
| Bottom | 1 |
| Left | 1.25 |
| Right | 1.25 |

PAPER COLOR: White

3. Title Block and paper heading: At the top of each paper that you submit, include the information as listed at the top of this page. This is to be right-aligned and single spaced. It is suggested that you develop a template to be used for all submittals. You will only need to fill in the information for the assignment and date for each new submittal.

FERRIS STATE UNIVERSITY

**Course Syllabus**
**HVAC 117 Advanced HVACR Electricity & Circuits**
**Spring 2018 – Section 211**

Instructor:...............................Eric Fradette
Office Hours: .........................Mondays: 4:00 – 5:00 PM, Tuesdays: 4:15 – 5:15 PM,
Wednesdays: 3:00 – 4:00 PM, Thursdays: 4:15 – 5:15 PM,
Office: ...................................GRN 204
Phone: ...................................x 3763
E-mail: ..................................ericfradette@ferris.edu
Credits:..................................4 Hours: 3 lecture hours and 3 lab hours per week

Course Description: AC electrical theory and application, concentrating on the operation, installation and analysis of HVACR components and control circuits. The components include single and polyphase transformer and motors, heating and air conditioning controls, commercial defrost timers, motor starters, contactors, relays and other control devices. Lab exercises focus on developing wiring diagrams; wiring, troubleshooting and analyzing circuits based on lecture material.

Course Co requisite:..............MATH 116

Final Exam:...........................Final Exam: The final exam for this course is scheduled by the University to prevent conflict with other courses. The scheduled time is as follows:

**Monday, April 30th, 10:00 – 11:40 AM.**

## Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

1. Alternating current and electrical circuit characteristics.
2. Single and three phase transformers.
3. All forms of motors.
4. Wiring diagrams and schematics.
5. Low voltage devices.
6. Control devices.

Instructional Unit Topic Descriptions and Time Allocations (not necessarily in order of delivery)

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction, Orientation, and Safety | 1 | 1 |
| II. | Alternating Current, Series and Parallel Circuits, and Ohms & Watts laws | 4 | 5 |
| III. | Single phase transformers | 2 | 1 |
| IV. | Three phase power & transformers | 2 | 1 |
| V. | Low voltage thermostats | 4 | 3 |
| VI. | Wiring Diagrams | 5 | 3 |
| VII. | Troubleshooting | 3 | 3 |
| VIII. | Motor Starters | 2 | 4 |
| IX. | Compressor Start Devices | 3 | 3 |
| X. | Relays, Contactors, and HVAC Controls | 3 | 3 |
| XI. | Single phase motors and ECMs | 4 | 3 |
| XII. | Three phase motors | 3 | 3 |
| XIII. | Defrost timers | 2 | 5 |
| XIV. | Conductor sizing and over current protection | 3 | 1 |
| XV. | Relays and Ladder Logic | 4 | 6 |
| | Total Hours | 45 | 45 |

Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| | |
|---|---|
| I. | Introduction, Orientation, and Safety.<br>A. Apply all safety procedures required in this course. |
| II. | Alternating Current, Series and Parallel Circuits, and Ohms and Watts laws<br>A. Explain how alternating current is generated.<br>B. Define the voltage, amperage, and resistance characteristics of series and parallel circuits.<br>C. Be able to apply Ohms and Watts laws to real world HVAC circuits. |
| III. | Single phase transformers<br>A. Describe the operation and use of single phase transformers for controls, ignition circuits and voltage correction. |
| IV. | Three phase power & transformers<br>A. Explain three phase power generation.<br>B. Describe the characteristics of three phase wye and delta configurations. |
| V. | Low voltage thermostats<br>A. Explain how a heat/cool thermostat operates and is properly wired.<br>B. Describe programming functions of modern programmable thermostats. |
| VI. | Wiring Diagrams<br>A. Explain the use of a wiring diagram for troubleshooting.<br>B. Explain how to develop a wiring diagram for a piece of equipment.<br>C. Efficiently convert a pictorial diagram to a ladder schematic for the purpose of troubleshooting. |
| VII. | Troubleshooting<br>A. Describe how to accurately predict voltage, resistance, and current measurements throughout an HVAC control circuit.<br>B. Accurately diagnose electrical problems by using a multi-meter. |
| VIII. | Motor Starters<br>A. Explain the different types, operation, and troubleshooting techniques for motor starters. |
| IX. | Compressor Start Devices<br>A. Describe the operation of current relays, potential relays, and PTC devices.<br>B. Explain the proper wiring procedures of current relays, potential relays, and PTC devices. |
| X. | Relays, Contactors, and HVAC Controls<br>A. Describe the operation of relays and contactors.<br>B. Explain physical limitations, and replacement procedures for relays and contactors.<br>C. Explain the use and selection of relays for the purpose of isolation, latching, and resetting.<br>D. Explain the operation and function of low pressure controls, high pressure controls, and oil pressure safeties. |
| XI. | Single phase motors and ECMs<br>A. Define the characteristics of AC run and start capacitors.<br>B. Define the starting and running characteristics, construction, CEMF and resulting phase shifts of the following motor types: CSIR, CSCR, SP, PSC, Synchronous, Shaded pole and Universal.<br>C. Define the starting, running and other operating characteristics of AC induction |

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| | motor starting relays; potential, solid state and centrifugal switches.<br>D. Identify the correct starting relay to use with a specific single phase motor.<br>E. Explain the operation and how to troubleshoot an ECM motor. |
| XII. | Three phase motors<br>A. Explain proper wiring procedures and limitations of 6, 9, and 12 lead motors.<br>B. Explain the purpose, operation and application of wye-delta starting schemes. |
| XIII. | Defrost timers<br>A. Describe the sequence of operation and application of various types of defrost timers and circuits. |
| XIV. | Conductor sizing and over current protection<br>A. Use NEC to properly size wire and describe the problems associated with improperly sized and misapplied conductors.<br>B. Describe operation of various types of circuit breaker, fuses and circuit protectors. |
| XV. | Relays and Ladder Logic<br>A. Design and construct a functional electrical circuit from a written sequence of events.<br>B. Apply latching relays, and reset relays to HVAC control circuits. |

Minimum Required Student Laboratory Activities

| | |
|---|---|
| I. | Student will demonstrate safe practices related to personal, electrical and tool safety every day while working in the lab. Student will demonstrate safe and competent operation of hand tools and instruments. |
| II. | Student will use proper testing procedures to identify and diagnose both run and start capacitors. |
| III. | Student will correctly wire a transformer and test under various loaded conditions. |
| VI. | Student will properly select and wire a current relay and a potential relay to a working compressor. |
| VII. | Student will draw the schematic diagram for AC induction motors including: CSIR, CSCR, SP, PSC, and Shaded pole. |
| VIII. | Student will draw the schematic diagram of the AC induction motor starting relays and switches. Student will correctly wire starting relays to appropriate single phase motors. Student will troubleshoot a single phase motor with a faulty starting relay. Student wire a single phase multi tap motor to operate at different specified speeds and reverse rotation. Students will correctly wire a dual-voltage single phase motor for each voltage. Student will troubleshoot a single phase motor to correctly identify faults such as open windings, shorted windings, dirty motor, worn bearings, faulty capacitors and faulty start switches/relays. |
| IX. | Student will wire a three phase motor to reverse rotation. Student will correctly wire a dual-voltage three phase motor for each voltage. Student will troubleshoot a three phase motor to correctly identify faults such as open windings, shorted windings, dirty motor, worn bearings. Student will wire both the line and control circuits of a three phase motor starter. |
| X. | Student will draw and wire various motor starter circuits complete with overload and auxiliary circuits, including but not limited to: HOA (Hand/Off/Auto), OA, Start/stop, mechanically latched. Student will wire various motor starter circuits and correctly |

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|---|---|
| | size and overload circuit for a specific motor. Student will troubleshoot starter circuits. |
| XI. | Student will convert a pictorial wiring diagram to a ladder diagram and visa versa. Student will use a wiring diagram to develop a description of operation. Student will develop a pictorial wiring diagram, component schematics and ladder diagram for various HVACR equipment using the correct symbols, labels, legends and methodology. Student will wire a system correctly when given a drawing of various heating system components, and convert the pictorial into a ladder diagram. Student will troubleshoot a circuit based on ladder diagram assignments sheets with open and short circuits using a multi-meter. Student will determine the wiring configuration of a three-phase power supply. |
| XII. | Student will correctly develop a schematic of the thermostat and subbase and incorporating them into a ladder diagram of a heating/cooling unit. Student will use a ladder diagram to mount, wire and calibrate a thermostat and subbase and hard wire it to various components in the lab. |
| XIV. | Student will wire a commercial refrigeration defrost timer with all of the the related controls. |
| XV. | Student will wire and troubleshoot circuits using isolation, latching, and reset relays. |
| | Student will design and construct a functional electrical circuit. |

**Attendance & Punctuality Policy**

All 100 level and 200 level courses at the university are required to have an attendance policy. As you move forward, you will discover that it is very difficult to succeed in your core classes without attending the course lectures and labs. Not only are the knowledge and skills gained in these classes essential to your success in this industry, but it is also essential in order to move forward in this program. The attendance policy for this class is as follows: You will start the class with a 2% bonus which will be applied to your final grade at the end of the semester. You will keep this bonus if all lectures and labs are attended and you arrive at or before the scheduled meeting time. For every absence from a lecture period your final grade will be penalized 1%, and an absence from a lab period will result in your final grade being penalized 2%. Therefore, after 2 absences to lectures or 1 absence for a lab, your bonus will be used up, and any subsequent absences will result in a **deduction** from your final grade prospectively. If you arrive up to 10 minutes late to a lab or a lecture, your deduction will be .5%. If you arrive more than 10 minutes late to a lab or a lecture, you are welcome to stay and participate but it will be counted as an absence (1% penalty for lecture, and 2% penalty for lab). If you leave early from lecture or lab without my approval, you will be counted as absent. You can use your bonus of 2% by missing class for whatever reason you see viable – hunting, video games, weekend recovery etc., but keep in mind that if you need to miss another day beyond your 2% due to more legitimate reasons, your final grade will be penalized. Also, consider that it is courteous to let me know ahead of time if you know you are going to miss class, with proper documentation or my approval this may count as an excused absence and there will be no penalty. Under no circumstance without proper documentation will an absence be excused if I have no prior notice of the absence. Also, be aware that this course will include both announced and unannounced quizzes – must be present for credit. **The only time your calculated bonus/penalty for attendance will be posted is at the end of the semester with your final grade.**

**Grading Scale**

| Letter Grade | Equal to or Greater Than | Below |
|---|---|---|
| A | 94% | |
| A- | 90% | 94% |
| B+ | 87% | 90% |
| B | 84% | 87% |
| B- | 80% | 84% |
| C+ | 77% | 80% |
| C | 74% | 77% |
| C- | 70% | 74% |
| D+ | 68% | 70% |
| D | 66% | 68% |
| D- | 65% | 66% |
| F | 64% | 0% |

**Category Allocation Percentage**

Homework & Quizzes...... .25%
Labs ................................ .25%
Mid-Term Exam.............. .25%
Final Exam ...................... .25%
Total ................................ .100%

**Class Code**

This class should be interactive, students are encouraged to ask questions to ensure that they have a true understanding of the material. Bear in mind that if you have a question, chances are that others in the class are also in need of clarity, so please bring up you concerns during class so we can all benefit. However, it is rude and distracting to have side conversations occurring during a lesson, so side conversations will not be permitted.

Cell phone use will not be permitted in class. They are expected to be on silent or vibrate and stay in your pocket. I consider it to be extremely offensive to text or surf the internet while in class or lab. If you need your phone during class or lab to use as a calculator, let me know before you take it out of your pocket. But with this in mind, no phones are allowed during the tests so you will need to purchase a basic calculator anyway. If you are caught on your phone during either class or lecture during the semester, you will be asked to leave and it will count as an absence. If it occurs again, you will be asked to meet with the dean.

We will all treat each other with mutual respect in the classroom. This is essential for the interactive learning environment that benefits on campus learning.

You will be asked to leave if you are caught sleeping in class, and it will count as an absence.

**Late Assignments**

Assignments due on Blackboard must be completed by the assigned due date, no extensions will be given. Late homework assignments collected in class will not be accepted if they are already graded and returned. Providing that they are not graded and returned, I may choose to accept them based on circumstance, but there will be a 20% penalty enforced on the assignment. In the event that a grade is not entered in the grade book for an assignment, the grade will be zeroed at the end of the semester. Once it is zeroed, it will reduce your final calculated grade, so bear in mind that if you have assignments which do not show a grade, the posted semester grade will not be accurate. The best way to keep your posted grade accurate is to make sure to turn in all assignments on time.

**Test Taking**

Tests can only be taken during scheduled test time, if you miss a test you will receive zero points for the test. Any rare exception to this rule must be **approved** by me prior to the scheduled test time. Under no circumstance will cell phones be allowed when taking a test, so as noted earlier, please be sure to purchase a calculator.

**Lab Deductions**

I have created a "lab sheet" for the majority of the labs in this course. Depending on the lab activity, the lab sheets are worth between 20 and 50 points. Please remember that the purpose of each activity should not be to simply FINISH the lab sheet. There is A LOT that we can LEARN from each one of these labs, but we must take time to reflect on what the voltage, current, or resistance measurements actually mean. The majority of the time, I will be able to check your lab sheets and correct any misconceptions you may have before you leave the lab. THIS MEANS THAT AS LONG AS YOU ALLOW ME TO CHECK YOUR FINDINGS BEFORE YOU LEAVE THE LAB, YOU SHOULD BE ABLE TO RECEIVE THE MAJORITY OF THESE POINTS… To receive any of these points, you must turn in your lab sheets at the end of the lab period in the mailbox located on the 1st cabinet labeled "117 labs". However, further points can be deducted from your lab project each day based on the following measures:

- **Attitude, Work Ethic, and Workmanship –**

We do not have two full sections of students this semester, so most of the labs will be completed independently, but there will be times that we will have to spread out and work in groups on due to time and equipment restraints. However, we should be able to work together in a way that every student achieves competency in the learning outcomes of each lab.

- Seen "Sitting Out" or not contributing – **10-points**
- Poor workmanship (such as sloppy wiring at wiring boards "birds-nest", not securing 2x4 boxes and electrical devises on the board, not securing switches or electrical devices to 2 x 4 boxes) – **10-points**
- Using wrong gauge wire, or not color coding – **10-points**

- **Cell Phones –**

There will be some occasions when we will use our phones in a way that will enhance the learning process. However improper use of cell phones during class WILL result in point deductions.

- Caught using cell phone improperly 1st offense – **10-points**
- Caught using cell phone improperly 2nd offense – **20-points**
- Caught using cell phone improperly 3rd offense and each subsequent offense – **40-points**

(continued on next page)

**Safety –**

- Caught without safety glasses (or worn improperly) 1st offense – **10-point**
- 2nd offense – **20-points**
- 3rd offense and each subsequent offense – **40-points, you will be asked to leave and it will count as an absence.**

**Tool Usage and Clean-up –**

- Writing on components or boards (must use tape to label!!) – **20-points**
- Improper use of (the schools) tools – **10-points**
- Workspace left looking messy – **10-points**
- Tools left in workspace – **10-points**
- Materials returned to wrong location/bin – **20-points**

**Changes to Syllabus**

As the faculty member responsible for this class, I reserve the right to change the syllabus at any time.

Excerpts from

**Ferris State University**
**Code of Community Standards (Student Handbook)**

http://www.ferris.edu/HTMLS/administration/studentaffairs/judicial/student-code.pdf

**Code of Student Community Standards**
**Section IV: General University Conduct Policies**

**A. Academic Integrity Violations**

Academic misconduct is managed in part through the conduct process in collaboration with Faculty at Ferris State University. In most cases, students are referred to the Office of Student Conduct by their faculty for allegations of academic misconduct. It is under the purview of each faculty member, in collaboration with their respective department and college, to spell out in their syllabus and enforce an academic sanction for academic integrity violations.
Additionally, upon review of the allegation, the Office of Student Conduct may schedule the student for a conduct conference relating to the allegation of academic misconduct, which is defined as any activity that tends to undermine the academic integrity of the institution. A violation of the University policy on academic integrity includes, but is not limited to, the following:

**1. Cheating/Copying/Unauthorized Collaboration**
A student may not use unauthorized assistance, materials, information, or study aids in any academic exercise, nor should a student give assistance, materials, information, or study aids to another student in any academic exercise.

**2. Fabrication**
A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citations of the sources of information.

**3. Facilitating Academic Dishonesty**
A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct.
Additionally, each student is responsible for taking reasonable precautions to ensure his or her work is not accessed by or transferred to another individual wherein it may then be used to commit a violation of the University academic integrity policy.

**4. Interference**
a. A student must not steal, change, destroy, or impede another student’s work. Impeding another student’s work includes, but is not limited to, the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.

b. A student must not give or offer a bribe, promise favors, or make threats with the intention of affecting a grade or the evaluation of academic performance.

**5. Plagiarism**

a. Proper Acknowledgement. A student must not adopt or reproduce ideas, words, or statements of another person, including previous work of their own submitted for previous course credit, without appropriate acknowledgment.

b. Requirement for Acknowledgement v. Common Knowledge. A student must give credit to the originality of others and acknowledge indebtedness whenever he or she quotes or paraphrases another person's words, either oral or written and whenever he or she borrows facts, statistics, or other illustrative material, unless the information is common knowledge.

c. Sources used Verbatim. In instances where students are using content directly quoted from a source, that content MUST be indicated through the use of quotations AND properly cited both in - text and at the end of the document.

**6. Violation of Course Rules**

A student must not violate course rules as contained in a course syllabus which are rationally related to the content of the course or to the enhancement of the learning process in the course.

**7. Violation of Professional Standards and Ethics**

A student must not violate the professional standards or ethical code related to one's intended profession as defined by the academic program or department.

HVACR STUDENT POLICY

The following policies have been set forth by the faculty of the HVACR Department for your protection and well being. Consequences for policy violations may affect your grade, according to your professor's syllabus. Consequences for violations are listed in the policy, giving you the information you need to make informed decisions. As a college student and an adult, you are responsible for your own actions and can make your own decisions. Please be responsible and make good decisions!

SAFETY GLASSES: You are required to wear your own safety glasses in all equipment labs at all times. This includes mechanical rooms and the energy lab when the equipment is operating. This does not include computer labs. Guests touring the Granger Center will be provided with safety glasses to wear while in rooms with operating equipment or with students working on equipment.

FOOT WEAR: You are required to wear closed toe shoes at all times in labs (except computer labs). No sandals are allowed. If you do not have proper footwear, you will be asked to leave and the absence will be counted as unexcused.

FOOD: Food is not allowed in computer labs, including snacks. If you have food in a computer lab you will be asked to dispose of the food, or leave the lab immediately.

BEVERAGES: Beverages are not allowed in computer labs.

TOOLS: All associate degree students are required to provide their own tools and have them available for each lab session. If you attend class without your tools, you will be denied access to the lab and your absence will be counted as unexcused.

ALCOHOL: You will not be allowed to attend class if you are under the influence of alcohol. If you are suspected of being under the influence of alcohol, your professor will call Public Safety and ask them to administer a Preliminary Breath Test (PBT). Under zero tolerance guidelines, anyone with a level of 0.02% alcohol or above will be removed from class and the absence will be counted as unexcused. Anyone with a percentage of alcohol above the legal limit will also face prosecution.

TOBACCO: You will not be allowed to consume tobacco products of any kind while in the Granger Center. This includes chewing tobacco.

ATTENDANCE: Tardiness and/or absences will affect your grade, according to your professor's attendance policy. Violations of any policies in this document that include an unexcused absence could reduce your grade.

CELL PHONES: Cell phones are not allowed during class. They must be turned off. If you are expecting an emergency call (medical, call from car repair, etc.) you must notify your professor before class and put your phone on vibrate. Cell phone use is not allowed during a test under any circumstances.

Name<br>Class<br>Professor<br>Assignment<br>Date

HOMEWORK AND SUBMITTALS:

1. All papers and drawings are to be formatted according to the following guidelines:
2. All computer-generated documents are to be word processed using Microsoft Word or a similar product.

   FONT: Times New Roman

   FONT SIZE: 12 Pt

   LINE SPACING: Double

   PARAGRAPH SPACING: Double

   MARGINS (as in Word default)

   | | |
   |---|---|
   | Top | 1 |
   | Bottom | 1 |
   | Left | 1.25 |
   | Right | 1.25 |

   PAPER COLOR: White
3. Title Block and paper heading: At the top of each paper that you submit, include the information as listed at the top of this page. This is to be right-aligned and single spaced. It is suggested that you develop a template to be used for all submittals. You will only need to fill in the information for the assignment and date for each new submittal.

## Spring 2018 Exam Schedule

It is the professional obligation of all faculty members to ensure that all examinations be held at the time proposed on this guideline. The period assigned for the final examination of a class must be used either for an examination or for the continuation of the instructional program of that class. Any exception to this schedule must receive prior approval from the department chairperson and the college dean.

On the examination schedule, the M combinations are classes which meet primarily on the MWF schedule, and T combinations are classes which meet on the TR schedule.

| ***If your class meets:*** | | ***Your exam Day, Date & Time is:*** | |
|---|---|---|---|
| 8:00 am | M combinations | Wed, May 2 | 8-9:40 am |
| 8:00 am | T combinations | Thur, May 3 | 8-9:40 am |
| 9:00 am | M combinations | Mon, April 30 | 8-9:40 am |
| 9:00 am | T combinations | Tues, May 1 | 8-9:40 am |
| 9:30 or 10:00 am | T combinations | Mon, April 30 | 10-11:40 am |
| 10:00 am | M combinations | Tues, May 1 | 10-11:40 am |
| 11:00 am | M combinations | Thur, May 3 | 10-11:40 am |
| 12:00 pm | M combinations | Mon, April 30 | 12-1:40 pm |
| 12:00 pm | T combinations | Tues, May 1 | 12-1:40 pm |
| 1:00 pm | M combinations | Wed, May 2 | 12-1:40 pm |
| 1:00 pm | T combinations | Thur, May 3 | 12-1:40 pm |
| 1:30 or 2:00 pm | T combinations | Wed, May 2 | 2-3:40 pm |
| 2:00 pm | M combinations | Thur, May 3 | 2-3:40 pm |
| 3:00 pm | M combinations | Tues, May 1 | 2-3:40 pm |
| 3:00 pm | T combinations | Mon, April 30 | 2-3:40 pm |
| 4:00 pm | M combinations | Mon, April 30 | 4-5:40 pm |
| 4:00 pm | T combinations | Tues, May 1 | 4-5:40 pm |
| 4:30 or 5:00 pm | M combinations | Wed, May 2 | 4-5:40 pm |
| 4:30 or 5:00 pm | T combinations | Thur, May 3 | 4-5:40 pm |
| 6:00 pm | M combinations | Mon, April 30 | 6-7:40 pm |
| 6:00 pm | T combinations | Tues, May 1 | 6-7:40 pm |
| 7:00 or 7:30 pm | M combinations | Wed, May 2 | 6-7:40 pm |
| 7:00 or 7:30 pm | T combinations | Thur, May 3 | 6-7:40 pm |
| 8:00 pm | M combinations | Thur, May 3 | 8-9:40 pm |
| 8:00 pm | T combinations | Wed, May 2 | 8-9:40 pm |

# SYLLABUS ATTACHMENT

# COLLEGE OF ENGINEERING TECHNOLOGY – FERRIS STATE UNIVERSITY

## *Spring 2018*

| IMPORTANT DATES | | |
|---|---|---|
| Late registration | Wed. – Fri. | Jan. 3-5 |
| First day of classes | Monday | Jan. 8 |
| Last day for Drop/Add | Thursday | Jan. 11 |
| Martin Luther King Day (no classes) | Monday | Jan. 15 |
| Spring recess (Spring Break) | Sat. – Sun. | Mar. 3-11 |
| Mid-term grades due | Monday | Mar. 5 |
| Classes resume | Monday | Mar. 12 |
| Last day for "W" grades | Thursday | Mar. 22 |
| Mid-Semester Recess | Thur. – Sun. | Mar. 29-31 |
| Last day of classes | Friday | Apr. 27 |
| Examination Week | Mon – Fri | Apr 30 - May 4 |
| Commencement | Friday - Saturday | May 4-5 |
| Final grades due by 1:00 pm | Monday | May 7 |
| Grades available to students on MyFSU | Tuesday (after 8AM) | May 8 |

| Sessions | Dates | Last Day to Withdraw |
|---|---|---|
| Full Session | Jan. 8 – Apr. 27 | Mar. 22 |
| Session A | Jan. 8 – Feb. 8 | Feb. 27 |
| Session B | Feb. 28 – Apr. 27 | Apr. 10 |
| Session D | Jan. 8 – Feb. 9 | Jan. 29 |
| Session E | Feb. 12 – Mar. 22 | Mar. 2 |
| Session F | Mar. 23 – Apr. 27 | Apr. 16 |

| College of Engineering Technology School Offices | | |
|---|---|---|
| Automotive &Heavy Equipment | AUT 101 | 591-2655 |
| Built Environment | GRN 227 | 591-3773 |
| Engineering & Computing Technology | SWN 312 | 591-2068 |
| Design & Manufacturing | NEC 211 | 591-2640 |
| Dean's Office | JOH 200 | 591-2890 |

## WHAT YOU NEED TO KNOW

**E-MAIL**

All registered FSU students have a Ferris Gmail account. This is the only e-mail to which all official University information about registration, financial aid, student activities, and class cancellations will be sent. Please check your account at least once a week. E-mail is our primary communication resource for students.

**CLASS ATTENDANCE IS IMPORTANT!**

Attendance usually has a high correlation with how well you do in a course. Many instructors have mandatory attendance policies by which your grade will be affected by absences. Some instructors also have policies about class tardiness to encourage students to be present for the full class period. Check your course syllabus or talk to your instructor about his/her policies.

**HOW TO CONTACT A FACULTY MEMBER OR ADVISOR**

If you have questions or need help, talk to your instructor. Faculty office locations, phone numbers, and office hours may be obtained from the class syllabus or department office, or through the Directories & Maps link on the FSU home page.

**DROPPING CLASSES OR WITHDRAWING**

Dropping and adding only occurs during the first four days of the term. You can adjust your schedule **online during the first four days** or in person at the Timme Center (from 8-5 except for the last day when it is 12-5).

*If you add a class you must pay for your additional charges by the fourth day or your schedule will be dropped.*

If you need to withdraw from a class after the official drop/add period, you must do so **OFFICIALLY**, through your dean's office, in order to avoid receiving an "F" grade in the course. **You may not withdraw online after the first four days of the term.** You will receive a "W" for the course. *You will not receive a refund.* If you need to totally withdraw from the University, you must do so **officially** at Admissions and Records in CSS 201. The last day to withdraw or drop a class may be different for different classes. **CHECK THE SESSIONS DATES SECTION ABOVE OR THE REGISTRATION AND ACADEMIC GUIDE FOR THE WITHDRAWAL DEADLINES FOR THE SEMESTER**.

In cases of extenuating circumstances (e.g., a serious illness requiring you to withdraw from school), contact Birkam Health Center at 591-2614.

**INCOMPLETES**

The "I" is only considered for extenuating circumstances that have led to a student missing a portion of the course. The intent and appropriate use of the "I" grade is NOT to avoid student probation, dismissal, or unacceptable grades, nor should it be considered as an extended alternative to withdraw from a class (W). Extenuating circumstances are generally defined as those situations over which a student has little or no control—e.g., illness, birth, jury duty, death of a parent, serious injury. Instructors may require suitable documentation.

Students must have completed at least 75% of the coursework at passing levels before an "I" will be considered, and they may be required to sign an agreement regarding course completion. An "I" grade automatically changes to an "F" after one semester (not counting summer) unless the faculty member files another grade or extends the incomplete.

**STUDENT COMPLAINT POLICY**

http://www.ferris.edu/HTMLS/administration/academicaffairs/Forms_Policies/Documents/Policy_Letters/AA-Student-Complaints.pdf

**GRADUATION**

Students should apply for their degree audit the semester prior to the degree completion term. To obtain a degree audit and clearance for your associate or bachelor degree for you must meet with your assigned academic advisor. In addition an online graduation application is REQUIRED and deadlines will be ENFORCED per the Provost's Office and Records Office. **ONLINE APPLICATION DEADLINE** for participation in Fall Commencement Ceremony: **March 1, 2018**

Online application is accessed by logging into your MyFSU, (click on Student tab, My Records link, Degree Progress and Graduation, Apply to Graduate link). For more information, contact the Dean's Office.

**INCLEMENT WEATHER CONDITIONS**

Only during the most severe weather conditions – which could potentially endanger the safety of students or staff – will the Big Rapids campus consider cancelling classes. The decision to cancel classes due to weather conditions at the Big Rapids site will be made as early as possible. In the event it is necessary to cancel classes, periodic announcements will be made on area radio and television stations. It is the student's responsibility to listen for these announcements. A student may also call the Ferris Information Line at 231-591-5602 or check the Ferris website.

## ACADEMIC MISCONDUCT

Academic misconduct refers to dishonesty or misrepresentation with respect to assignments, tests, quizzes, written work, oral presentations, class projects, internship experience, or computer usage; violation of computer licenses, programs, or data bases; or unauthorized acquisition or distribution of tests or other academic material belonging to someone else. It includes such behaviors as cheating, copying materials from the internet without documentation, presenting another person's ideas or work as your own, taking someone else's exam for them, violating computer software licenses or program/data ownership, etc. It is the expectation of the College of Engineering Technology that all work you turn in is your own and is original for the course in which it is being submitted. If you are uncertain about whether a particular behavior might represent academic misconduct, be sure to ask your professor for clarification. Penalties for academic misconduct can include **FAILURE** of the assignment or the course, and/or disciplinary action up to and including probation or dismissal from the University.

**DISRUPTIVE BEHAVIOR**

The College of Engineering Technology strives to maintain a positive learning environment and educational opportunity for all students. Consequently, patterns of behaviors which obstruct or disrupt the teaching/learning environment will be addressed. The instructor is in charge of his or her course (e.g., assignments, due dates, attendance policy) and classroom (e.g., behaviors allowed, tardiness). Harassment, in any form, will not be tolerated. Penalties for disruptive behavior can include involuntary withdrawal from the course and/or disciplinary action up to and including probation or dismissal from the University.

## WHERE TO GO FOR HELP

The following services are available to any Ferris student, free of charge. They are designed to help you succeed in your courses, in your career planning, and in meeting the challenges of university life. Don't hesitate to explore and use these services at Ferris.

**ACADEMIC ADVISING**

All students have an assigned advisor and should confer with that advisor regularly. Students who have declared a major should see an advisor in that major. To find out who your advisor is, log in to MyFSU, (click on the Student tab, My Registration, Advisor Information, Select Term, Submit).

**ACADEMIC SUPPORT CENTER……………………….ASC 1017 – 591-3543**
**THE WRITING CENTER………………………………….ASC 1017 – 591-2534**

**The Academic Support Center, Tutoring Services, and Writing Center** join together to offer FSU students an array of academic support services. Tutors are available to answer questions for many courses. The Writing Center helps writers individually and in workshops with skills and assignments. There is also study skills assistance to help with note-taking, test-taking, memory and reading strategies, and time management.

**DISABILITIES SERVICES………………………………….STR 313 – 591-3057**

According to the Americans with Disabilities Act, each student with a disability is responsible for notifying the University of his/her disability and requesting accommodations. Students requiring a classroom accommodation due to a physical, learning, mental or emotional disability should contact the Disabilities Services Office.

**SCHOLAR PROGRAM………………………………….ASC 1021 – 591-5976**

SCHOLAR is an academic support program that aids in the student's successful progression by offering a Peer Mentor Program, a Student Retention Program, and an Academic Student Advisory Committee.

**PERSONAL COUNSELING, SEXUAL ASSAULT, SUBSTANCE ABUSE BIRKAM HEALTH CENTER …………………………… 2nd Floor - 591-5968**

Personal counseling is available confidentially and free of charge. Counselors are available to assist with personal and stress-related problems, family and relationship issues, substance abuse, sexual assault, depression, or other similar problems. Call or stop by to obtain an appointment. ***If you or a friend are in immediate crisis, call 911.***

**EDUCATIONAL & CAREER COUNSELING ……………STR 313 – 591-3057**

Students wanting to examine their choice of major or career choice, learning styles or strategies can make one-on-one appointments with licensed counselors.

**CAREER SPECIALIST – Leigha Compson ……………JOH 200 – 591-3549**

Valuable support services and events are offered for students currently or previously enrolled in associate degree programs. To lean more visit: http://www. ferris.edu/HTMLS/colleges/technolo/ Career-Programs-Support/index.htm

**SAFETY**

Please observe the posted shelter and evacuation routes in the hallway nearest your classroom.

## OTHER RESOURCES

**BIRKAM HEALTH CENTER…………………………………1st Floor - 591-2614**

The Birkam Health Center provides fee-for-service medical care including evaluation and treatment for illness and injury anytime during the year. Patients are seen on a walk-in and by appointment basis.

**FLITE LIBRARY……………………………………………………………………591-2669**

Regular hours for FLITE:
Monday – Thursday . . . . . . . . . . . . . . . . . . 7:30 a.m. – MIDNIGHT
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . ..7:30 a.m. – 6:00 p.m.
Saturday . . . . . . . . . . . . . . . . . . . . . . . . . NOON – 5:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . . . . . . . .1:00 p.m. – MIDNIGHT
Extended Studies Court will begin late night hours January 17, 2017
*Sunday-Thursday/MIDNIGHT to 7:30 a.m. *Friday/6 p.m. to MIDNIGHT
*Saturday/5 p.m. to MIDNIGHT)

**FSU BOOKSTORE…………………………UNIVERSITY CENTER 231 591-2607**

Regular on-campus hours for the Bookstore **:
Monday – Thursday . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 6:00 p.m.
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 5:00 p.m.
Saturday. . . . . . . . . . . . . . . . . . . . . . . . . . . . 12:00 p.m. – 4:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . . . . . . . . . . CLOSED

## HELPFUL NUMBERS

| | | | |
|---|---|---|---|
| Admissions | 2100 | Inst. Testing | 3628 |
| Business Office | 2125 | Public Safety | 5000 |
| Financial Aid | 2110 | Records | 2792 |
| Housing | 3745 | TAC | 4822 |

When calling from off campus, extensions can be called by using the prefix 231-591-_____.

## Arts & Sciences/General Education Department Offices

| | | |
|---|---|---|
| Biology | ASC 2004 | 591-2550 |
| Humanities | JOH 119 | 591-3675 |
| Languages & Literature | ASC 3080 | 591-3988 |
| Mathematics | ASC 2021 | 591-2565 |
| Physical Sciences | ASC 3021 | 591-2580 |
| Social Sciences | ASC 2108 | 591-2735 |

## College of Engineering Technology Diversity Statement

The College of Engineering Technology provides a dynamic experiential learning environment that is inclusive, equitable and just for all individuals, regardless of human differences.

Ferris State University is an equal opportunity institution. For information on the University's Policy on Non-Discrimination, visit http://www.ferris.edu/non-discrimination

Updated 1/2/2017 alm

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

## HVAC 127 SYLLABUS

**Course: HVAC 127** **Advanced HVACR Controls**

**Credit hours:** Three
**Contact hours** Two lecture hours and three lab hours

**Course description:** The study of advanced controls related to residential and commercial applications. The course focuses on control components, wiring, and control sequences used in direct digital control systems. Lab exercises concentrate on control system wiring, configuration, operations, and troubleshooting.

**Prerequisites: HVAC 101, HVAC 111, HVAC 117, all with a grade of C- or better.**

**Required Textbooks:** *Refrigeration & Air Conditioning Technology*, Whitman, Johnson, Tomczyk, and Silberstein, 7th or 8th edition.


**Faculty:** Brian Holton
**Office location:** Grainger 212
**Office phone:** 591-2322
**Home phone**
**E mail:** brianholton@ferris.edu


### Office hours:

Assistance in this course is available to help you with academic or personal problems.
Students are encouraged to seek help as needed.
**Sources for assistance:**

1. Office hours: I am available during regular scheduled office hours or by appointment.
2. Academic advisor: meet with your advisor for assistance with registration.
3. Education counselor
4. Academic Support Services Center: this center provides free tutoring and assistance with test anxiety, study skills, writing skills, exam preparation, content reading, personal growth, and classroom skills.

**Disabilities Services:**
Any student registered with Disabilities Services should contact the instructor as soon as possible for assistance with classroom accommodations.

**Student Learning Outcomes**

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Students satisfactorily completing this course will achieve proficiency in:

1. HVACR control terminology and Direct digital controls (DDC) basics
2. Valve and damper actuators
3. Pneumatic control basics
4. Advanced residential and light commercial thermostats
5. Variable frequency drives (VFD)
6. Air-side economizer controls
7. Change-over bypass (VVT) control systems
8. Variable Air Volume Systems and Controls

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

HVAC 127 SYLLABUS

**Course Assessments:** Student assessment will be based on quizzes and exams.
**Exams:** two paper exams, mid-term and final

**Grading:** Final grade based on student point total compared to total possible points. The grade book is available in the Blackboard web site for this course.

| Letter Grade | Equal to or greater than | Below | Letter Grade | Equal to or greater than | Below |
|---|---|---|---|---|---|
| A | 94 | | C+ | 77 | 80 |
| A- | 90 | 94 | C | 74 | 77 |
| B+ | 87 | 90 | C- | 72 | 74 |
| B | 84 | 87 | D+ | 71 | 72 |
| B- | 80 | 84 | D | 70 | 71 |

**Course Policies**

**Attendance:** In general, treat the course as you would for a job. Lab period attendance is mandatory except for excused absences. Students absent for more than two lab periods will receive a failing grade for the course. Lab exercises, and assessments cannot be made up with exception for excused absences.

**Excused Absence:** Documentation or approval from the professor is required for excused absences.

**Punctuality:** Punctuality is expected. Please inform me if you have a scheduling conflict. Repeated late arrivals will result in disciplinary action including dismissal from class. **Students must be on time for assessments.**

**Cell Phones:** **Make sure cell phones are turned to vibrate or off. Do not text during class. Wait until end of class or a break to attend to calls.**

**Electronic recording devices:** No recording device of any type is allowed in the lecture or lab periods without approval from the faculty teaching the class.

**Assessment policy:** No cell phones or electronic devices allowed with the exception of calculators as required for subject context. Quizzes or exams cannot be taken at any time other than the scheduled date unless there is a prior arrangement or a documented emergency or health issue.

**Tobacco use:** In accordance with university policies, no tobacco use is allowed in the lecture or lab periods. This includes smokeless tobacco products and vapor products.

**Student conduct:** All students are expected to conduct themselves with dignity and respect for others. Harassment of any kind is not acceptable.
Students are responsible for adhering to university policies as set forth in the Student Handbook. Students should read the section III.A. Academic Misconduct and understand that the minimum penalty for Academic Misconduct is outlined in the Student Handbook. Students caught cheating, falsifying, plagiarizing, or interfering as defined in the Student Handbook will receive a failing grade for the course.

**Syllabus changes:** I reserve the right to make needed and appropriate adjustments to this syllabus.

**20 Section III: General University and Housing Policies Regarding Misconduct**

***A. Academic Misconduct***

The university may discipline a student for academic misconduct, which is defined as any activity that tends to undermine the academic integrity of the institution. Academic misconduct includes, but is not limited to, the following:

**1. Cheating**

A student may not use unauthorized assistance, materials, information, or study aids in any academic exercise, neither should they give assistance, materials, information, nor study aids in any academic exercise, including but not limited to the following:

a. A student must not use or give external assistance on any "in-class" or "take-home" examination, unless the instructor has specifically authorized external assistance. This prohibition includes, but is not limited to, the use of tutors, books, notes, and calculators.

b. A student must not use another person as a substitute in the taking of an examination or quiz.

c. A student must not steal examinations or other course materials.

d. A student must not allow others; offer to conduct research, or to prepare work for him/her without advance authorization from the instructor for whom the work is being submitted. Under this prohibition, a student must not make any unauthorized use of materials obtained from commercial term paper companies or from files of papers prepared by other persons.

e. A student must not collaborate with other persons on a particular project and submit a copy of a written report, which is represented explicitly or implicitly as the student's individual work.

f. A student must not use or give any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.

g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor to whom the work is being submitted.

h. A student must not alter a grade or score in any way.

**2. Fabrication**

A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citations of the sources of information.

**3. Facilitating Academic Dishonesty**

A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct.

A student is responsible for taking reasonable precautions to ensure his or her work is not accessed by or transferred to another individual wherein it may then be used to commit an act of academic misconduct.

**4. Interference**

a. A student must not steal, change, destroy, or impede another student's work. Impeding another student's work includes, but is not limited to: the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.

b. A student must not give or offer a bribe, promise favors, or make threats with the intention of affecting a grade or the evaluation of academic performance.

**5. Plagiarism**

A student must not adopt or reproduce ideas, words, or statements of another person without appropriate acknowledgment. A student must give credit to the originality of others and acknowledge indebtedness whenever he or she does any of the following:

a. Quotes another person's actual words, either oral or written;

b. Paraphrases another person's words, either oral or written;

c. Uses another person's idea, opinion, or theory; or

d. Borrows facts, statistics, or other illustrative material, unless the information is common knowledge.

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

HVAC 127 SYLLABUS

**Units of instruction: Note; the following is for reference only; exact schedule may vary.**

Week 1: Lecture Period; Syllabus, Pneumatic Controls

Lab: Pneumatic thermostat calibration and testing

Week 2: Lecture Period; No Classes Monday – Martin Luther King Day

Wednesday, Unit 1 Control Fundamentals

Lab: Tour of Granger controls & Input-output and sensors identification -using Energy Lab

Week 3: Lecture; Unit 1 Control Fundamentals and Unit 2 Actuators

Lab; Actuator and reset control lab

Week 4: Lecture; Unit 1 Control Fundamentals

Lab; Actuator and Reset control lab

Week 5: Lecture; Unit 3 Advanced thermostats

Lab; Advanced thermostats

Week 6: Lecture; Unit 4 Economizers

Lab; Economizer control wiring and testing

Week 7: Lecture; Unit 4 Economizers

Lab; Economizer control wiring and testing

Week 8: Lecture; Review for exam and exam

Lab; No lab- Leave for Spring Break

Week 9: Spring Break

Week 10: Lecture; Unit 5 Variable Frequency Drives

Lab; Variable Frequency Drives – wiring and testing

Week 11: Lecture; Unit 5 Variable Frequency Drives (VFD)

Lab; VFD and static transmitter – wiring, configuration, and testing

Week 12: Lecture; Classes cancelled – MSCA Student Organization trip

Lab; No lab- Mid semester break

Week 13: Lecture; Unit 6 Variable Volume and Temperature (VVT)

Lab; Carrier VVT control system- Air Conditioning lab room

Week 14: Lecture; Unit 6 Variable Volume and Temperature (VVT)

Lab; Carrier VVT control system- Air Conditioning lab room

Week 15: Lecture; Unit 6 Variable Air Volume Controls and Systems

Lab; Lab cancelled- HVAC Advisory Board meeting

Week 16: Lecture; Unit 6 Variable Air Volume Controls and Systems and review for exam

Lab; Automated Logic VAV Control commissioning- Location – Energy Lab

Week 17: Lecture; Exam 5-2, Wednesday 12:00 -1:40

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

HVAC 127 SYLLABUS

## WHAT YOU NEED TO KNOW

**E-MAIL**

All registered FSU students have a Ferris Gmail account. This is the only e-mail to which all official University information about registration, financial aid, student activities, and class cancellations will be sent. Please check your account at least once a week. E-mail is our primary communication resource for students.

**HOW TO CONTACT A FACULTY MEMBER OR ADVISOR**

If you have questions or need help, talk to your instructor. Faculty office locations, phone numbers, and office hours may be obtained from the class syllabus or department office, or through the Directories & Maps link on the FSU home page.

**DROPPING CLASSES OR WITHDRAWING**

Dropping and adding only occurs during the first four days of the term. You can adjust your schedule **online during the first four days** or in person at the Timme Center (from 8-5 except for the last day when it is 12-5).

*If you add a class you must pay for your additional charges by the fourth day or your schedule will be dropped.*

If you need to withdraw from a class after the official drop/add period, you must do so **OFFICIALLY**, through your dean's office, in order to avoid receiving an "F" grade in the course. **You may not withdraw online after the first four days of the term.** You will receive a "W" for the course. *You will not receive a refund.* If you need to totally withdraw from the University, you must do so **officially** at Admissions and Records in CSS 201. The last day to withdraw or drop a class may be different for different classes. **CHECK THE SESSIONS DATES SECTION ABOVE OR THE REGISTRATION AND ACADEMIC GUIDE FOR THE WITHDRAWAL DEADLINES FOR THE SEMESTER**.

In cases of extenuating circumstances (e.g., a serious illness requiring you to withdraw from school), contact Birkam Health Center at 591-2614.

**INCOMPLETES**

The "I" is only considered for extenuating circumstances that have led to a student missing a portion of the course. The intent and appropriate use of the "I" grade is NOT to avoid student probation, dismissal, or unacceptable grades, nor should it be considered as an extended alternative to withdraw from a class (W). Extenuating circumstances are generally defined as those situations over which a student has little or no control—e.g., illness, birth, jury duty, death of a parent, serious injury. Instructors may require suitable documentation.

Students must have completed at least 75% of the coursework at passing levels before an "I" will be considered, and they may be required to sign an agreement regarding course completion. An "I" grade automatically changes to an "F" after one semester (not counting summer) unless the faculty member files another grade or extends the incomplete.

**GRADUATION**

Students should apply for their degree audit the **semester prior** to the degree completion term. To obtain a degree audit and clearance for your associate or bachelor degree for you must meet with your assigned academic advisor. In addition, an online graduation application is REQUIRED and deadlines will be ENFORCED per the Provost's Office and Records Office.

Online application is accessed by logging into your MyFSU, (click on Student tab, My Records link, Degree Progress and Graduation, Apply to Graduate link). For more information, contact the Dean's Office.

**INCLEMENT WEATHER CONDITIONS**

Only during the most severe weather conditions – which could potentially endanger the safety of students or staff – will the Big Rapids campus consider cancelling classes. The decision to cancel classes due to weather conditions at the Big Rapids site will be made as early as possible. In the event it is necessary to cancel classes, periodic announcements will be made on area radio and television stations. It is the student's responsibility to listen for these announcements. A student may also call the Ferris Information Line at 231-591-5602 or check the Ferris website.

### ACADEMIC MISCONDUCT

Academic misconduct refers to dishonesty or misrepresentation with respect to assignments, tests, quizzes, written work, oral presentations, class projects, internship experience, or computer usage; violation of computer licenses, programs, or data bases; or unauthorized acquisition or distribution of tests or other academic material belonging to someone else. It includes such behaviors as cheating, copying materials from the internet without documentation, presenting another person's ideas or work as your own, taking someone else's exam for them, violating computer software licenses or program/data ownership, etc. It is the expectation of the College of Engineering Technology that all work you turn in is your own and is original for the course in which it is being submitted. If you are uncertain about whether a particular behavior might represent academic misconduct, be sure to ask your professor for clarification. Penalties for academic misconduct can include **FAILURE** of the assignment or the course, and/or disciplinary action up to and including probation or dismissal from the University.

**DISRUPTIVE BEHAVIOR**
The College of Engineering Technology strives to maintain a positive learning environment and educational opportunity for all students. Consequently, patterns of behaviors which obstruct or disrupt the teaching/learning environment will be addressed. The instructor is in charge of his or her course (e.g., assignments, due dates, attendance policy) and classroom (e.g., behaviors allowed, tardiness). Harassment, in any form, will not be tolerated. Penalties for disruptive behavior can include involuntary withdrawal from the course and/or disciplinary action up to and including probation or dismissal from the University.

## WHERE TO GO FOR HELP

The following services are available to any Ferris student, free of charge. They are designed to help you succeed in your courses, in your career planning, and in meeting the challenges of university life. Don't hesitate to explore and use these services at Ferris.

**ACADEMIC ADVISING**
All students have an assigned advisor and should confer with that advisor regularly. Students who have declared a major should see an advisor in that major. To find out who your advisor is, log in to MyFSU, (click on the Student tab, My Registration, Advisor Information, Select Term, Submit).

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**THE WRITING CENTER……………………………………ASC 1017 – 591-2534**
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Sunday . . . . . . . . . . . . . . . . . . . .. . . . . . . . .1:00 p.m. – MIDNIGHT
Extended Studies Court will begin late night hours January 17, 2017
*Sunday-Thursday/MIDNIGHT to 7:30 a.m. *Friday/6 p.m. to MIDNIGHT
*Saturday/5 p.m. to MIDNIGHT)

**FSU BOOKSTORE……………………………UNIVERSITY CENTER 231 591-2607**

## HELPFUL NUMBERS

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| Business Office | 2125 | Public Safety | 5000 |
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**FERRIS STATE UNIVERSITY**

COLLEGE OF TECHNOLOGY

HVACR DEPARTMENT

**HVAC 132**

**Course Syllabus**

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| | |
|---|---|
| **Course:** | HVAC 132: Fundamentals of Heating and Mechanical Systems |
| **Semester Hours:** | 5 Hours per Week |
| **Contact Hours:** | Lecture: 3 Hours a Week, Lab: 6 Hours per Week |
| **Course Description:** | A study of combustion in conventional and high-efficiency units. The study of residential and commercial gas fired equipment. Topics include mechanical and electrical components, operations, testing, and Troubleshooting. |
| **Prerequisites:** | HVAC 111 and Math 116, both with a grade of C– or better or a minimum score of 24 on ACT or 560 on SAT |
| **Textbooks Required:** | Refrigeration & Air Conditioning Technology, 8th Edition, Whitman, Johnson, Tomczyk, and Silberstein. |
| **Course Website:** | Gradebook and other information is provided through Blackboard for this course. |
| **Contact Information:** | Name: Professor Gerard Lucas<br>Office Location: Granger 218<br>Office Phone: 231-591-3764<br>Home Phone: 253-459-4071<br>E-mail: GerryLucas@ferris.edu |
| **Office Hours:** | Tuesday and Thursday 1:00 to 2:50, or by appointment. |

**Course Learning Outcomes:**

**Notice:** Students must demonstrate the ability to perform basic troubleshooting skills required for solving common mechanical and electrical problems that occur with residential gas forced-air furnaces to receive credit for this course.

1. Students will demonstrate safe working practices and respect for tools, equipment, and other students.
2. Students will be able to identify all components, and explain the function of all components in residential or commercial gas heating equipment. This includes all electrical and mechanical components.
3. Students will be able to explain the basic sequence of operations for residential furnaces.
4. Students will be able to describe the venting requirements for various models of furnaces.
5. Students will demonstrate knowledge of natural gas, supply pipe installations in compliance with mechanical codes.
6. Students will demonstrate ability to test and adjust residential and commercial gas heating equipment to obtain proper and efficient operation. This includes the ability to analyze the combustion of an operating gas fired heating device to determine if the device is operating safely and efficiently.
7. Students will be able to determine the correct orifice size for a gas burner.
8. Students will be able to modify a gas fired heating device to burn a different gas fuel type, i.e. convert from natural gas to propane.
9. Students will demonstrate knowledge of carbon monoxide sources, health effects, testing devices and methods, and acceptable exposure limits.
10. Students will demonstrate knowledge of combustion air requirements and worst-case depressurization testing.
11. Students will gain experience with estimating a quoted repair for common residential and/or commercial heating system.
12. Students will demonstrate knowledge of customer relations and conflict management.
13. Students will demonstrate ability to measure air pressures and velocities and be able to apply an understanding of air pressures, air flow, and fan laws to typical real life applications.
14. Students will be able to identify components and understand operations for make-up air systems.
15. Students will be able to identify components and understand operations of a flame safeguard or burner management control for large gas burners.
16. Students will be able to identify components and understand operations of a gas train assembly for large gas burners.

**Course Policies and Student Responsibilities:**

**Attendance:** In general, treat this course as you would a job. Students without any unexcused absences will receive 2% added to their final grade. There is a maximum of two unexcused absences allowed without penalty. **Each unexcused absence after two will result in 1% drop in your final grade. Leaving lecture or lab early without approval from the professor will be considered an absence.**

**Excused Absence:** Documentation or previous professor approval is required for an absence to be considered excused.

**Punctuality:** Punctuality is expected. If there is a scheduling conflict, the student must inform the professor. **Every three late arrivals will be treated as a unexcused absence. Students must be on time for assessments.**

**Cell Phones:** Cell phones are not to be used in lecture or lab for any purpose. Cell phones must be on silent or off during lecture and lab.

**Assessment Policy:** No cell phones or electronic devices are allowed during assessments with the exception of a calculator. Talking is strictly prohibited during the assessment. Assessments are only available at the scheduled date and time; assessments may only be rescheduled due to documented emergency or health issue.

**Late Assignment Policy:** Late assignments will be accepted up to one business day after the due date **with a deduction of 10% off the final grade for that assignment.**

**Student Conduct:** All students are expected to conduct themselves with dignity and respect for others. Harassment of any kind is not acceptable. **Students are responsible for their own work. The Code of Student Community Standards has been included in blackboard for the students to review.**

**Syllabus Changes:** **The professor reserves the right to make needed and appropriate adjustments to this syllabus.**

**Grading:** The class grading is weighted where the labs are worth 15%, quizzes are worth 10%, assignments are worth 10%, written exams are worth 25%, lab exams are worth 25%, Final Exam is worth 10%, and Employability is worth 5%. **You must receive 70% or greater final score to pass this class.** Students attending and participating in the Advisory Board Event will receive 2% extra credit added to their final grade.

| Letter Grade | A | A- | B+ | B | B- | C+ | C | C- |
|---|---|---|---|---|---|---|---|---|
| Final Percent | >=94% | <94% to >=90% | <90% to >=87% | <87% to >=84% | <84% to >=80% | <80% to >=77% | <77% to >=74% | <74% to >=70% |

| Week | Learning Goals |
|---|---|
| Week 1 | Understand the Syllabus and student policies. Understand Nameplate Data, Basic Furnace Configurations, Recall basic Terms and Components. Recall Burner Components. Understand Pressure Testing Procedures. |
| Week 2 | Understand Furnace Efficiencies and Stack Temperatures. Recall basic Furnace Sequence of Operations for Standing Pilot, Intermittent Pilot, Direct Ignition, and Honeywell Smart Valve Systems. |
| Week 3 | Recall different Regulator Types and their Operation. Recall different Types of Gas Valves. Understand Operation of different types of Gas Valves. Understand the Operation of a Combination Gas Valve. Recall the Combustion Process. Understand the basic Adjustments for Maintaining a Safe and Reliable Combustion System. |
| Week 4 | Understand the Associated Functions of a Multi-meter with Furnace Maintenance and Troubleshooting. Recall Basic Furnace Electrical Components and Their Operation. Understand the Flame Rectification Process. Understand Standing Pilot Safety Devices. Understand the Operation and Purpose of Electronic Ignition Modules. |
| Week 5 | Understand Furnace Troubleshooting Procedures. Understand Furnace Repair and Replacement Procedures. |
| Week 6 | Understand Customer Relation Skills. Exam 1 |
| Week 7 | Understand Air Flow Measurement Equipment and Procedures. Understand different Fan Systems. Understand Fan System Tables and Graphs. Understand Fan Bearing Types and Maintenance Procedures. |
| Week 8 | Understand Fan Laws and Associated Calculations. Understand Rooftop Unit Construction and Installation |
| Week 9 | Understand Trane Rooftop Unit Power Burner Operation. Recall Large Gas Train Components. Understand Large Gas Train Operation. |
| Week 10 | Recall Flame Safeguard Control Components. Understand Flame Safeguard Control Operation. Understand Flame Safeguard Control Troubleshooting. |
| Week 11 | Exam 2 |
| Week 12 | Recall two Gas Pipe Sizing Methods. Understand two Gas Pipe Sizing Methods. Understand how to Access Code Materials through the Ferris State University Library Website. Perform Gas Pipe Sizing Procedures. |
| Week 13 | Recall Venting Types. Understand Vent Sizing Procedures. Understand Make-up Air Requirements and Procedures. Recall Infrared Heater Types. Understand the Operation and Maintenance of different types of Infrared Heaters. |
| Week 14 | Understand Operation and Maintenance on Unit Heaters. Understand Infrared Heater and Unit Heater Troubleshooting Procedures. Review Furnace Troubleshooting Procedures. |
| Week 15 | Review Airflow Testing Procedures. Review Fan Law Calculations. Review Gas Pipe Sizing Procedures. |

# SYLLABUS ATTACHMENT
# COLLEGE OF ENGINEERING TECHNOLOGY – FERRIS STATE UNIVERSITY
## *Spring 2017*

| IMPORTANT DATES | | |
|---|---|---|
| Late registration | Wed. – Fri. | Jan. 4-6 |
| First day of classes | Monday | Jan. 9 |
| Last day for Drop/Add | Thursday | Jan. 12 |
| Martin Luther King Day (no classes) | Monday | Jan. 16 |
| Spring recess (Spring Break) | Sat. – Sun. | Mar. 4-12 |
| Mid-term grades due | Monday | Mar. 6 |
| Classes resume | Monday | Mar. 13 |
| Last day for "W" grades | Thursday | Mar. 23 |
| Mid-Semester Recess | Thur. – Sun. | Apr. 13-17 |
| Last day of classes | Friday | Apr. 28 |
| Examination Week | Mon – Fri | May 1- 5 |
| Commencement | Friday - Saturday | May 5-6 |
| Final grades due by 1:00 pm | Monday | May 8 |
| Grades available to students on MyFSU | Tuesday (after 8AM) | May 9 |

| Sessions | Dates | Last Day to Withdraw |
|---|---|---|
| Full Session | Jan. 9 – Apr. 28 | Mar. 23 |
| Session A | Jan. 9 – Feb. 9 | Feb. 28 |
| Session B | Mar. 1 – Apr. 28 | Apr. 11 |
| Session D | Jan. 9 – Feb. 10 | Jan. 30 |
| Session E | Feb. 13 – Mar. 23 | Mar. 3 |
| Session F | Mar. 24 – Apr. 28 | Apr. 17 |

| College of Engineering Technology School Offices | | |
|---|---|---|
| Automotive &Heavy Equipment | AUT 101 | 591-2655 |
| Built Environment | GRN 227 | 591-3773 |
| Engineering & Computing Technology | SWN 312 | 591-2068 |
| Design & Manufacturing | NEC 211 | 591-2640 |
| Dean's Office | JOH 200 | 591-2890 |

## WHAT YOU NEED TO KNOW

**E-MAIL**

All registered FSU students have a Ferris Gmail account. This is the only e-mail to which all official University information about registration, financial aid, student activities, and class cancellations will be sent. Please check your account at least once a week. E-mail is our primary communication resource for students.

**CLASS ATTENDANCE IS IMPORTANT!**

Attendance usually has a high correlation with how well you do in a course. Many instructors have mandatory attendance policies by which your grade will be affected by absences. Some instructors also have policies about class tardiness to encourage students to be present for the full class period. Check your course syllabus or talk to your instructor about his/her policies.

**HOW TO CONTACT A FACULTY MEMBER OR ADVISOR**

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**DROPPING CLASSES OR WITHDRAWING**

Dropping and adding only occurs during the first four days of the term. You can adjust your schedule **online during the first four days** or in person at the Timme Center (from 8-5 except for the last day when it is 12-5).

*If you add a class you must pay for your additional charges by the fourth day or your schedule will be dropped.*

If you need to withdraw from a class after the official drop/add period, you must do so **OFFICIALLY**, through your dean's office, in order to avoid receiving an "F" grade in the course. **You may not withdraw online after the first four days of the term.** You will receive a "W" for the course. *You will not receive a refund.* If you need to totally withdraw from the University, you must do so **officially** at Admissions and Records in CSS 201. The last day to withdraw or drop a class may be different for different classes. **CHECK THE SESSIONS DATES SECTION ABOVE OR THE REGISTRATION AND ACADEMIC GUIDE FOR THE WITHDRAWAL DEADLINES FOR THE SEMESTER**.

In cases of extenuating circumstances (e.g., a serious illness requiring you to withdraw from school), contact Birkam Health Center at 591-2614.

**INCOMPLETES**

The "I" is only considered for extenuating circumstances that have led to a student missing a portion of the course. The intent and appropriate use of the "I" grade is NOT to avoid student probation, dismissal, or unacceptable grades, nor should it be considered as an extended alternative to withdraw from a class (W). Extenuating circumstances are generally defined as those situations over which a student has little or no control—e.g., illness, birth, jury duty, death of a parent, serious injury. Instructors may require suitable documentation.

Students must have completed at least 75% of the coursework at passing levels before an "I" will be considered, and they may be required to sign an agreement regarding course completion. An "I" grade automatically changes to an "F" after one semester (not counting summer) unless the faculty member files another grade or extends the incomplete.

**STUDENT COMPLAINT POLICY**

http://www.ferris.edu/HTMLS/administration/academicaffairs/Forms_Policies/Documents/Policy_Letters/AA-Student-Complaints.pdf

**GRADUATION**

Students should apply for their degree audit the semester prior to the degree completion term. To obtain a degree audit and clearance for your associate or bachelor degree for you must meet with your assigned academic advisor. In addition an online graduation application is REQUIRED and deadlines will be ENFORCED per the Provost's Office and Records Office. **ONLINE APPLICATION DEADLINE** for participation in Fall Commencement Ceremony: **March 1, 2017**

Online application is accessed by logging into your MyFSU, (click on Student tab, My Records link, Degree Progress and Graduation, Apply to Graduate link). For more information, contact the Dean's Office.

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## ACADEMIC MISCONDUCT

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**ACADEMIC SUPPORT CENTER…………………………ASC 1017 – 591-3543**
**THE WRITING CENTER……………………………………ASC 1017 – 591-2534**
**The Academic Support Center, Tutoring Services, and Writing Center** join together to offer FSU students an array of academic support services. Tutors are available to answer questions for many courses. The Writing Center helps writers individually and in workshops with skills and assignments. There is also study skills assistance to help with note-taking, test-taking, memory and reading strategies, and time management.

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**SCHOLAR PROGRAM.......................................ASC 1021 – 591-5976**
SCHOLAR is an academic support program that aids in the student's successful progression by offering a Peer Mentor Program, a Student Retention Program, and an Academic Student Advisory Committee.

**PERSONAL COUNSELING, SEXUAL ASSAULT, SUBSTANCE ABUSE BIRKAM HEALTH CENTER …………………………….. 2nd Floor - 591-5968**
Personal counseling is available confidentially and free of charge. Counselors are available to assist with personal and stress-related problems, family and relationship issues, substance abuse, sexual assault, depression, or other similar problems. Call or stop by to obtain an appointment. ***If you or a friend are in immediate crisis, call 911.***

**EDUCATIONAL & CAREER COUNSELING ……………STR 313 – 591-3057**
Students wanting to examine their choice of major or career choice, learning styles or strategies can make one-on-one appointments with licensed counselors.

**CAREER SPECIALIST – Leigha Compson ……………JOH 200 – 591-3549**
Valuable support services and events are offered for students currently or previously enrolled in associate degree programs. To lean more visit: http://www. ferris.edu/HTMLS/colleges/technolo/ Career-Programs-Support/index.htm

**SAFETY**

Please observe the posted shelter and evacuation routes in the hallway nearest your classroom.

## OTHER RESOURCES

**BIRKAM HEALTH CENTER……………………….………1st Floor - 591-2614**
The Birkam Health Center provides fee-for-service medical care including evaluation and treatment for illness and injury anytime during the year. Patients are seen on a walk-in and by appointment basis.

**FLITE LIBRARY…………………………………………………………….…591-2669**
Regular hours for FLITE:
Monday – Thursday . . . . . . . . . . . . . . . . . . 7:30 a.m. – MIDNIGHT
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . ...7:30 a.m. – 6:00 p.m.
Saturday . . . . . . . . . . . . . . . . . . . . . . . . . . NOON – 5:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . .. . . . . . . . .1:00 p.m. – MIDNIGHT
Extended Studies Court will begin late night hours January 17, 2017
*Sunday-Thursday/MIDNIGHT to 7:30 a.m. *Friday/6 p.m. to MIDNIGHT
*Saturday/5 p.m. to MIDNIGHT)

**FSU BOOKSTORE……………………………UNIVERSITY CENTER 231 591-2607**
Regular on-campus hours for the Bookstore **:
Monday – Thursday . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 6:00 p.m.
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 5:00 p.m.
Saturday. . . . . . . . . . . . . . . . . . . . . . . . . . . . 12:00 p.m. – 4:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CLOSED

## HELPFUL NUMBERS

| | | | |
|---|---|---|---|
| Admissions | 2100 | Inst. Testing | 3628 |
| Business Office | 2125 | Public Safety | 5000 |
| Financial Aid | 2110 | Records | 2792 |
| Housing | 3745 | TAC | 4822 |

When calling from off campus, extensions can be called by using the prefix 231-591-_____.

## Arts & Sciences/General Education Department Offices

| | | |
|---|---|---|
| Biology | ASC 2004 | 591-2550 |
| Humanities | JOH 119 | 591-3675 |
| Languages & Literature | ASC 3080 | 591-3988 |
| Mathematics | ASC 2021 | 591-2565 |
| Physical Sciences | ASC 3021 | 591-2580 |
| Social Sciences | ASC 2108 | 591-2735 |

## College of Engineering Technology Diversity Statement

The College of Engineering Technology provides a dynamic experiential learning environment that is inclusive, equitable and just for all individuals, regardless of human differences.

Ferris State University is an equal opportunity institution. For information on the University's Policy on Non-Discrimination, visit http://www.ferris.edu/non-discrimination

FERRIS STATE UNIVERSITY

COLLEGE OF TECHNOLOGY

HVACR DEPARTMENT

**HVAC 111**

**Assignment and Lab**

**Submission Guide**

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Name

Class

Professor

Assignment

Date

HOMEWORK AND SUBMITTALS:

1. All papers and drawings are to be formatted according to the following guidelines:

2. All computer-generated documents are to be word processed using Microsoft Word or a similar product.

FONT: Times New Roman

FONT SIZE: 12 Pt

LINE SPACING: Double

PARAGRAPH SPACING: Double

MARGINS (as in Word default)

| | |
|---|---|
| Top | 1 |
| Bottom | 1 |
| Left | 1.25 |
| Right | 1.25 |

PAPER COLOR: White

3. Title Block and paper heading: At the top of each paper that you submit, include the information as listed at the top of this page. This is to be right-aligned and single spaced. It is suggested that you develop a template to be used for all submittals. You will only need to fill in the information for the assignment and date for each new submittal.

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

Spring 2018 SYLLABUS

**Course: HVAC 207** **Commercial Refrigeration Systems**

**Credit hours:** Five
**Contact hours** Three lecture hours and six lab hours
**Course description:** A study of commercial and industrial refrigeration systems associated with supermarkets, restaurants and storage facilities. Topics include electrical & mechanical refrigeration systems found in today's applications. Laboratory periods will cover testing, adjusting and troubleshooting electrical and mechanical systems.

**Prerequisites: HVAC 102, HVAC 117, both with a grade of C- or better.**

**Required Textbooks:** *Refrigeration & Air Conditioning Technology*, Whitman, Johnson, Tomczyk, and Silberstein.

**Faculty:** Brian Holton
**Office location:** Grainger
**Office phone:** 591-2322
**E mail:** brianholton@ferris.edu

**Office hours:**

Assistance in this course is available to help you with academic or personal problems.
**Sources for assistance:**

1. Office hours: I am available during regular scheduled office hours or by appointment.
2. Academic advisor: meet with your advisor for assistance with registration.
3. Education counselor
4. Academic Support Services Center: this center provides free tutoring and assistance with test anxiety, study skills, writing skills, exam preparation, content reading, personal growth, and classroom skills.

**Disabilities Services:**
A student registered with Disabilities Services shall contact the instructor as soon as possible for assistance with classroom accommodations.

**Student Learning Outcomes**

Students satisfactorily completing this course will achieve proficiency in:

1. Commercial ice machines.
2. Water cooled condensers.
3. Single phase compressor starting devices
4. Commercial refrigeration components
5. Commercial refrigeration control systems – temperature, pump-down, and defrost
6. Food preservation issues and effect of coil TD on humidity
7. Troubleshooting commercial refrigeration systems.
8. Low ambient controls, valves, and operation
9. Compressor failures and corrections
10. Specialty refrigeration valves.
11. Refrigeration system lubrication issues and safety controls
12. Parallel compressors and supermarket systems
13. Applicable ammonia and carbon dioxide systems (time permitting)

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

Spring 2018 SYLLABUS

**Syllabus changes:** I reserve the right to make needed and appropriate adjustments to this syllabus.

**Course Assessments:** Student assessment will be based on quizzes and exams.
**Exams:** two paper exams and two lab (hands on) exams

**Grading:** Final grade based on student point total compared to total possible points. The grade book is available in the Blackboard web site for this course.

| Letter Grade | Equal to or greater than | Below | Letter Grade | Equal to or greater than | Below |
|---|---|---|---|---|---|
| A | 94 | | C+ | 77 | 80 |
| A- | 90 | 94 | C | 74 | 77 |
| B+ | 87 | 90 | C- | 72 | 74 |
| B | 84 | 87 | D+ | 71 | 72 |
| B- | 80 | 84 | D | 70 | 71 |

**Course Policies**

**Attendance:** In general, treat the course as you would for a job. Lab period attendance is mandatory except for excused absences. Lab exercises, quizzes and exams cannot be made up except for excused absences. Students missing more than four lab periods will receive a failing grade for the course.

**Excused Absence:** Documentation or approval from the professor is required for excused absences.

**Punctuality:** Punctuality is expected. Please inform me if you have a scheduling conflict. Repeated late arrivals will result in disciplinary action including dismissal from class. **Students must be on time for assessments.**

**Cell Phones:** **Make sure cell phones are turned to vibrate or off unless needed for class activities. Do not text during class.**

**Electronic recording devices:** No recording device of any type is allowed in the lecture or lab periods without approval from the faculty teaching the class.

**Assessment policy:** No cell phones or electronic devices allowed with the exception of calculators as required for subject context. Quizzes or exams cannot be taken at any time other than the scheduled date unless there is a prior arrangement or a documented emergency or health issue.

**Tobacco use:** In accordance with university policies, no tobacco use is allowed in the lecture or lab periods. This includes smokeless tobacco products and vapor products.

**Student conduct:** All students are expected to conduct themselves with dignity and respect for others. Harassment of any kind is not acceptable.

Students should read the section III.A. Academic Misconduct and understand that the minimum penalty for Academic Misconduct is outlined in the *Student Handbook*. Students caught cheating, falsifying, plagiarizing, or interfering as defined in the *Student Handbook* will receive a failing grade for the course. Repeated conduct problems, including, but not limited to inappropriate phone use during class or sleeping in class will result in disciplinary action and may result in a failing grade for the course if the conduct continues.

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

Spring 2018 SYLLABUS

**Units of instruction: Note; the following is for reference only; exact schedule may vary.**

Week 1: Lecture Period; Syllabus, Unit 1 Commercial Ice Machines
Lab: Commercial Ice Machines

Week 2: Lecture Period; No Classes Monday – Martin Luther King Day
Wednesday and Friday; Unit 1 Commercial Ice Machines
Lab: Commercial Ice Machines

Week 3: Lecture; Unit 1 Commercial Ice Machines, estimated week for quiz
Lab; Commercial Ice Machines

Week 4: Lecture; Unit 2, Water cooled condensers and Start Components
Lab; Commercial Ice Machines

Week 5: Lecture; Unit 5, Refrigeration components and drains
Lab; Complete Commercial Ice Machines and start components

Week 6: Lecture; Unit 6, Pump down and defrost operations
Lab; Trouble shooting ice machines, water cooled condensers, and start components

Week 7: Lecture; Food preservation issues and low-pressure control as temperature control.
Lab; Commercial refrigeration units and water-cooled condensers

Week 8: Lecture; Review for exam and exam. No lecture period Friday
Lab; Lab exams

Week 9: Spring Break

Week 10: Lecture; Review of mid-term exam. Refrigeration and electrical troubleshooting
Lab; Continue with commercial refrigeration labs

Week 11: Lecture; Head Pressure Control and Compressor failures, causes and corrections
Lab; Continue with commercial refrigeration labs

Week 12: Lecture; No lecture periods- MCAA Convention and mid-term break
Lab; No lab periods- MCAA Convention and mid-term break

Week 13: Lecture; Compressor failures, causes and corrections Compressor lubrication controls
Lab; Compressor tear-down lab and continue with commercial refrigeration labs

Week 14: Lecture; Parallel compressor refrigeration systems
Lab; Compressor tear-down lab and Field trip- Tour at Meijer

Week 15: Lecture; Specialty Valves. No lecture period Friday- HVAC Advisory Committee
Lab; Complete all lab exercises, lab clean-up and tool sign in.

Week 16: Lecture; Ammonia refrigeration systems and review for final exam
Lab; Lab exams

Week 17: Exam

**20 Section III: General University and Housing Policies Regarding Misconduct**

***A. Academic Misconduct***

The university may discipline a student for academic misconduct, which is defined as any activity that tends to undermine the academic integrity of the institution. Academic misconduct includes, but is not limited to, the following:

**1. Cheating**

A student may not use unauthorized assistance, materials, information, or study aids in any academic exercise, neither should they give assistance, materials, information, nor study aids in any academic exercise, including but not limited to the following:

a. A student must not use or give external assistance on any "in-class" or "take-home" examination, unless the instructor has specifically authorized external assistance. This prohibition includes, but is not limited to, the use of tutors, books, notes, and calculators.

b. A student must not use another person as a substitute in the taking of an examination or quiz.

c. A student must not steal examinations or other course materials.

d. A student must not allow others; offer to conduct research, or to prepare work for him/her without advance authorization from the instructor for whom the work is being submitted. Under this prohibition, a student must not make any unauthorized use of materials obtained from commercial term paper companies or from files of papers prepared by other persons.

e. A student must not collaborate with other persons on a particular project and submit a copy of a written report, which is represented explicitly or implicitly as the student's individual work.

f. A student must not use or give any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.

g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor to whom the work is being submitted.

h. A student must not alter a grade or score in any way.

**2. Fabrication**

A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citations of the sources of information.

**3. Facilitating Academic Dishonesty**

A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct.

A student is responsible for taking reasonable precautions to ensure his or her work is not accessed by or transferred to another individual wherein it may then be used to commit an act of academic misconduct.

**4. Interference**

a. A student must not steal, change, destroy, or impede another student's work. Impeding another student's work includes, but is not limited to: the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.

b. A student must not give or offer a bribe, promise favors, or make threats with the intention of affecting a grade or the evaluation of academic performance.

**5. Plagiarism**

A student must not adopt or reproduce ideas, words, or statements of another person without appropriate acknowledgment. A student must give credit to the originality of others and acknowledge indebtedness whenever he or she does any of the following:

a. Quotes another person's actual words, either oral or written;

b. Paraphrases another person's words, either oral or written;

c. Uses another person's idea, opinion, or theory; or

d. Borrows facts, statistics, or other illustrative material, unless the information is common knowledge.

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

Spring 2018 SYLLABUS

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SCHOLAR is an academic support program that aids in the student's successful progression by offering a Peer Mentor Program, a Student Retention Program, and an Academic Student Advisory Committee.

**PERSONAL COUNSELING, SEXUAL ASSAULT, SUBSTANCE ABUSE BIRKAM HEALTH CENTER ………………………………..… 2nd Floor - 591-5968**
Personal counseling is available confidentially and free of charge. Counselors are available to assist with personal and stress-related problems, family and relationship issues, substance abuse, sexual assault, depression, or other similar problems. Call or stop by to obtain an appointment. ***If you or a friend are in immediate crisis, call 911.***

**EDUCATIONAL & CAREER COUNSELING ……………STR 313 – 591-3057**
Students wanting to examine their choice of major or career choice, learning styles or strategies can make one-on-one appointments with licensed counselors.

**CAREER SPECIALIST – Leigha Compson ……………JOH 200 – 591-3549**
Valuable support services and events are offered for students currently or previously enrolled in associate degree programs. To lean more visit: http://www. ferris.edu/HTMLS/colleges/technolo/ Career-Programs-Support/index.htm

**SAFETY**
Please observe the posted shelter and evacuation routes in the hallway nearest your classroom.

## OTHER RESOURCES

# *FERRIS STATE UNIVERSITY*
## COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM
## Spring 2018 SYLLABUS

**BIRKAM HEALTH CENTER……………………………….1st Floor - 591-2614**
The Birkam Health Center provides fee-for-service medical care including evaluation and treatment for illness and injury anytime during the year. Patients are seen on a walk-in and by appointment basis.

**FLITE LIBRARY……………………………………………………………591-2669**
Regular hours for FLITE:
Monday – Thursday . . . . . . . . . . . . . . . . . . 7:30 a.m. – MIDNIGHT
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . ...7:30 a.m. – 6:00 p.m.
Saturday . . . . . . . . . . . . . . . . . . . . . . . . . . NOON – 5:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . .. . . . . . . . .1:00 p.m. – MIDNIGHT
Extended Studies Court will begin late night hours January 17, 2017
*Sunday-Thursday/MIDNIGHT to 7:30 a.m. *Friday/6 p.m. to MIDNIGHT
*Saturday/5 p.m. to MIDNIGHT)

**FSU BOOKSTORE……………………………UNIVERSITY CENTER 231 591-2607**
Regular on-campus hours for the Bookstore **:
Monday – Thursday . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 6:00 p.m.
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 5:00 p.m.
Saturday. . . . . . . . . . . . . . . . . . . . . . . . . . . . . 12:00 p.m. – 4:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CLOSED

### HELPFUL NUMBERS

| | | | |
|---|---|---|---|
| Admissions | 2100 | Inst. Testing | 3628 |
| Business Office | 2125 | Public Safety | 5000 |
| Financial Aid | 2110 | Records | 2792 |
| Housing | 3745 | TAC | 4822 |

When calling from off campus, extensions can be called by using the prefix 231-591-_____.

FERRIS STATE UNIVERSITY

**Course Syllabus**
**HVAC 208 Air Conditioning Applications**
**Spring 2018 – Section 211/212**

Instructor:..............................Eric Fradette
Office Hours: .........................Mondays: 4:00 – 5:00 PM, Tuesdays: 4:15 – 5:15 PM, Wednesdays: 3:00 – 4:00 PM, Thursdays: 4:15 – 5:15 PM,
Office: ...................................GRN 204
Phone: ...................................x 3763
E-mail: ..................................ericfradette@ferris.edu
Credits:..................................5 Hours: 3 lecture hours and 3 lab hours per week

Course Description: A study of mechanical air conditioning equipment including heat pump, chiller, absorption refrigeration, cooling tower and evaporative cooling applications. Compressor types and capacity control systems are included. Hands on laboratories cover electrical systems, capacity testing and troubleshooting of residential and light commercial mechanical and electrical systems.

Course Prerequisites: ............HVAC 102, HVAC 117, both with a grade of C- or better

Final Exam:...........................Final Exam: The final exam for this course is scheduled by the University to prevent conflict with other courses. The scheduled time is as follows:

**Monday, April 30th, 2:00 PM – 3:40 PM.**

## Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

1. System classifications.
2. Psychrometrics in relationship to air conditioning
3. Air conditioning systems
4. Heat pump systems
5. Chiller systems
6. Safety controls, electrical diagramming, electrical testing and troubleshooting
7. Cooling tower systems
8. Capacity control systems
9. Tubing installation procedures

Instructional Unit Topic Descriptions and Time Allocations (not necessarily in order of delivery)

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction, orientation and safety | 1 | 1 |
| II. | System classifications | 2 | 0 |
| III. | Psychrometrics | 9 | 3 |
| IV. | Air Conditioning Systems | 6 | 39 |
| V. | Heat pump systems | 8 | 23 |
| VI. | Chillers | 3 | 9 |
| VII. | Cooling towers and evaporative condensers | 3 | 6 |
| VIII. | Capacity control systems | 2 | 0 |
| IX. | Overload devices | 2 | 3 |
| X. | Centrifugal compressors | 1 | 3 |
| XI. | Screw type compressors | 1 | 3 |
| XII. | Absorption refrigeration | 2 | 0 |
| XIII. | Tubing and installation procedures | 2 | 0 |
| | Total Hours | 45 | 90 |

**Attendance & Punctuality Policy**

All 100 level and 200 level courses at the university are required to have an attendance policy. As you move forward, you will discover that it is very difficult to succeed in your core classes without attending the course lectures and labs. Not only are the knowledge and skills gained in these classes essential to your success in this industry, but it is also essential in order to move forward in this program. The attendance policy for this class is as follows: You will start the class with a 2% bonus which will be applied to your final grade at the end of the semester. You will keep this bonus if all lectures and labs are attended and you arrive at or before the scheduled meeting time. For every absence from a lecture period your final grade will be penalized 1%, and an absence from a lab period will result in your final grade being penalized 1.5%. Therefore, after 2 absences to lectures, your bonus will be used up, and any subsequent absences will result in a **deduction** from your final grade prospectively. If you arrive up to 10 minutes late to a lab or a lecture, your deduction will be .5%. If you arrive more than 10 minutes late to a lab or a lecture, you are welcome to stay and participate but it will be counted as an absence (1% penalty for lecture, and 1.5% penalty for lab). If you leave early from lecture or lab without my approval, you will be counted as absent. You can use your bonus of 2% by missing class for whatever reason you see viable – hunting, video games, weekend recovery etc., but keep in mind that if you need to miss another day beyond your 2% due to more legitimate reasons, your final grade will be penalized. Also, consider that it is courteous to let me know ahead of time if you know you are going to miss class, with proper documentation or my approval this may count as an excused absence and there will be no penalty. Under no circumstance without proper documentation will an absence be excused if I have no prior notice of the absence. Also, be aware that this course will include both announced and unannounced quizzes – must be present for credit. **The only time your calculated bonus/penalty for attendance will be posted is at the end of the semester with your final grade.** Also, be aware that this course will include both announced and unannounced quizzes – must be present for credit.

**Grading Scale**

| Letter Grade | Equal to or Greater Than | Below |
|---|---|---|
| A | 94% | |
| A- | 90% | 94% |
| B+ | 87% | 90% |
| B | 84% | 87% |
| B- | 80% | 84% |
| C+ | 77% | 80% |
| C | 74% | 77% |
| C- | 70% | 74% |
| D+ | 68% | 70% |
| D | 66% | 68% |
| D- | 65% | 66% |
| F | 64% | 0% |

**Category Allocation Percentage**

Homework & Quizzes..... .15%
Labs & Lab Exams.......... .35%
Mid-Term Exam.............. .25%
Final Exam ...................... .25%
Total ................................ .100%

**Class Code**

This class should be interactive, students are encouraged to ask questions to ensure that they have a true understanding of the material. Bear in mind that if you have a question, chances are that others in the class are also in need of clarity, so please bring up you concerns during class so we can all benefit. However, it is rude and distracting to have side conversations occurring during a lesson, so side conversations will not be permitted.

Cell phone use will not be permitted in class. They are expected to be on silent or vibrate and stay in your pocket. I consider it to be extremely offensive to text or surf the internet while in class or lab. If you need your phone during class or lab to use as a calculator, let me know before you take it out of your pocket. But with this in mind, no phones are allowed during the tests so you will need to purchase a basic calculator anyway. If you are caught on your phone during either class or lecture during the semester, you will be asked to leave and it will count as an absence. If it occurs again, you will be asked to meet with the dean.

We will all treat each other with mutual respect in the classroom. This is essential for the interactive learning environment that benefits on campus learning.

You will be asked to leave if you are caught sleeping in class, and it will count as an absence.

**Late Assignments**

Assignments due on Blackboard must be completed by the assigned due date, no extensions will be given. Late homework assignments collected in class will not be accepted if they are already graded and returned. Providing that they are not graded and returned, I may choose to accept them based on circumstance, but there will be a 20% penalty enforced on the assignment. In the event that a grade is not entered in the grade book for an assignment, the grade will be zeroed at the end of the semester. Once it is zeroed, it will reduce your final calculated grade, so bear in mind that if you have assignments which do not show a grade, the posted semester grade will not be accurate. The best way to keep your posted grade accurate is to make sure to turn in all assignments on time.

**Test Taking**

Tests can only be taken during scheduled test time, if you miss a test you will receive zero points for the test. Any rare exception to this rule must be **approved** by me prior to the scheduled test time. Under no circumstance will cell phones be allowed when taking a test, so as noted earlier, please be sure to purchase a calculator.

**Lab Deductions**

Regardless of whether or not the lab activity that you will be participating in for each lab period is accompanied with a "lab sheet", the purpose of the activity should not be to simply FINISH the lab sheet. There is A LOT that we can LEARN from each piece of equipment in this lab!! Instead of collecting lab sheets from each student for every lab period throughout this semester, each lab session will be worth 5 –points. To earn your points, you must discuss progress with your lab with your instructor, AND also fill out the LAB TASK/PROGRESS Form at the end of each lab period. Additionally, if your lab is accompanied with a lab sheet, to earn your points it must be filled out in its entirety, discussed with your instructor and turned in upon completion of the lab. Each student will start the lab session with all of the points, however points will be deducted based on the following measures:

- **Attitude, Work Ethic, and Workmanship –**

We will have two sections for lab this semester and one section is full, so there will times that we will have to spread out and work in groups on different pieces of equipment. Additionally, there will be times when a unit which you are working on will be needed for another section, so when you see it again it may not be exactly how you left it. Welcome to the next 40 years of your life… However, we should be able to work together in a way which will provide every student the opportunity to achieve competency in the learning outcomes of the lab. Aside from the point deductions in this area, it should be known that there will be several lab exams throughout this course which will account for a large portion of your "lab" grade.

- Seen "Sitting Out" or not contributing – **2-points**
- Poor workmanship (such as sloppy wiring at wiring boards, poor braze connections, piping that is not level or not plum….) – **3-points**
- Lab sheet is turned in incomplete, or student unable to answer verbal questions about the specifics of the measurements. **– 3-points (This will be deducted from each lab period in which student was working on the task.)**

- **Cell Phones –**

There will be some occasions when we will use our phones in a way that will enhance the learning process. However improper use of cell phones during class WILL result in point deductions.

- Caught using cell phone improperly 1st offense – **2-points**
- Caught using cell phone improperly 2nd offense – **4-points**
- Caught using cell phone improperly 3rd offense (and each subsequent offense) – **5-points**

- **Safety –**

- Caught without safety glasses (or worn improperly) 1st offense – **1-point**
- 2nd offense – **3-points**
- 3rd offense (and each subsequent offense) – **5 points, you will be asked to leave and it will count as an absence.**

- **Tool Usage and Clean-up –**

- Writing in or on manuals, units, or unit wiring diagrams – **5-points**
- Improper use of (the schools) tools – **2-points**
- Workspace left looking messy – **2-points**
- Tools left in workspace – **2-points**
- Covers or panels not put back onto units – **3-points**
- Materials returned to wrong location/bin – **3-points**

- **TASK COMPLETION QUIZ –**

- When the task and or exploration of each unit is complete, the instructor each student will take a verbal quiz given by the instructor regarding what was learned, operation of unit, and any problems that should have been found – **up to 5-points (any deductions will be applied to each day student spent working on unit/task).**

**Changes to Syllabus**

As the faculty member responsible for this class, I reserve the right to change the syllabus at any time.

Excerpts from

**Ferris State University**
**Code of Community Standards (Student Handbook)**

http://www.ferris.edu/HTMLS/administration/studentaffairs/judicial/student-code.pdf

**Code of Student Community Standards**
**Section IV: General University Conduct Policies**

**A. Academic Integrity Violations**

Academic misconduct is managed in part through the conduct process in collaboration with Faculty at Ferris State University. In most cases, students are referred to the Office of Student Conduct by their faculty for allegations of academic misconduct. It is under the purview of each faculty member, in collaboration with their respective department and college, to spell out in their syllabus and enforce an academic sanction for academic integrity violations. Additionally, upon review of the allegation, the Office of Student Conduct may schedule the student for a conduct conference relating to the allegation of academic misconduct, which is defined as any activity that tends to undermine the academic integrity of the institution. A violation of the University policy on academic integrity includes, but is not limited to, the following:

**1. Cheating/Copying/Unauthorized Collaboration**
A student may not use unauthorized assistance, materials, information, or study aids in any academic exercise, nor should a student give assistance, materials, information, or study aids to another student in any academic exercise.

**2. Fabrication**
A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citations of the sources of information.

**3. Facilitating Academic Dishonesty**
A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct.
Additionally, each student is responsible for taking reasonable precautions to ensure his or her work is not accessed by or transferred to another individual wherein it may then be used to commit a violation of the University academic integrity policy.

**4. Interference**
a. A student must not steal, change, destroy, or impede another student's work. Impeding another student's work includes, but is not limited to, the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.

b. A student must not give or offer a bribe, promise favors, or make threats with the intention of affecting a grade or the evaluation of academic performance.

**5. Plagiarism**

a. Proper Acknowledgement. A student must not adopt or reproduce ideas, words, or statements of another person, including previous work of their own submitted for previous course credit, without appropriate acknowledgment.

b. Requirement for Acknowledgement v. Common Knowledge. A student must give credit to the originality of others and acknowledge indebtedness whenever he or she quotes or paraphrases another person's words, either oral or written and whenever he or she borrows facts, statistics, or other illustrative material, unless the information is common knowledge.

c. Sources used Verbatim. In instances where students are using content directly quoted from a source, that content MUST be indicated through the use of quotations AND properly cited both in - text and at the end of the document.

**6. Violation of Course Rules**

A student must not violate course rules as contained in a course syllabus which are rationally related to the content of the course or to the enhancement of the learning process in the course.

**7. Violation of Professional Standards and Ethics**

A student must not violate the professional standards or ethical code related to one's intended profession as defined by the academic program or department.

The following policies have been set forth by the faculty of the HVACR Department for your protection and well being. Consequences for policy violations may affect your grade, according to your professor's syllabus. Consequences for violations are listed in the policy, giving you the information you need to make informed decisions. As a college student and an adult, you are responsible for your own actions and can make your own decisions. Please be responsible and make good decisions!

SAFETY GLASSES: You are required to wear your own safety glasses in all equipment labs at all times. This includes mechanical rooms and the energy lab when the equipment is operating. This does not include computer labs. Guests touring the Granger Center will be provided with safety glasses to wear while in rooms with operating equipment or with students working on equipment.

FOOT WEAR: You are required to wear closed toe shoes at all times in labs (except computer labs). No sandals are allowed. If you do not have proper footwear, you will be asked to leave and the absence will be counted as unexcused.

FOOD: Food is not allowed in computer labs, including snacks. If you have food in a computer lab you will be asked to dispose of the food, or leave the lab immediately.

BEVERAGES: Beverages are not allowed in computer labs.

TOOLS: All associate degree students are required to provide their own tools and have them available for each lab session. If you attend class without your tools, you will be denied access to the lab and your absence will be counted as unexcused.

ALCOHOL: You will not be allowed to attend class if you are under the influence of alcohol. If you are suspected of being under the influence of alcohol, your professor will call Public Safety and ask them to administer a Preliminary Breath Test (PBT). Under zero tolerance guidelines, anyone with a level of 0.02% alcohol or above will be removed from class and the absence will be counted as unexcused. Anyone with a percentage of alcohol above the legal limit will also face prosecution.

TOBACCO: You will not be allowed to consume tobacco products of any kind while in the Granger Center. This includes chewing tobacco.

ATTENDANCE: Tardiness and/or absences will affect your grade, according to your professor's attendance policy. Violations of any policies in this document that include an unexcused absence could reduce your grade.

CELL PHONES: Cell phones are not allowed during class. They must be turned off. If you are expecting an emergency call (medical, call from car repair, etc.) you must notify your professor before class and put your phone on vibrate. Cell phone use is not allowed during a test under any circumstances.

Name<br>Class<br>Professor<br>Assignment<br>Date

HOMEWORK AND SUBMITTALS:

1. All papers and drawings are to be formatted according to the following guidelines:
2. All computer-generated documents are to be word processed using Microsoft Word or a similar product.

   FONT: Times New Roman

   FONT SIZE: 12 Pt

   LINE SPACING: Double

   PARAGRAPH SPACING: Double

   MARGINS (as in Word default)

   | | |
   |---|---|
   | Top | 1 |
   | Bottom | 1 |
   | Left | 1.25 |
   | Right | 1.25 |

   PAPER COLOR: White
3. Title Block and paper heading: At the top of each paper that you submit, include the information as listed at the top of this page. This is to be right-aligned and single spaced. It is suggested that you develop a template to be used for all submittals. You will only need to fill in the information for the assignment and date for each new submittal.

# Spring 2018 Exam Schedule

It is the professional obligation of all faculty members to ensure that all examinations be held at the time proposed on this guideline. The period assigned for the final examination of a class must be used either for an examination or for the continuation of the instructional program of that class. Any exception to this schedule must receive prior approval from the department chairperson and the college dean.

On the examination schedule, the M combinations are classes which meet primarily on the MWF schedule, and T combinations are classes which meet on the TR schedule.

| ***If your class meets:*** | | ***Your exam Day, Date & Time is:*** | |
|---|---|---|---|
| 8:00 am | M combinations | Wed, May 2 | 8-9:40 am |
| 8:00 am | T combinations | Thur, May 3 | 8-9:40 am |
| 9:00 am | M combinations | Mon, April 30 | 8-9:40 am |
| 9:00 am | T combinations | Tues, May 1 | 8-9:40 am |
| 9:30 or 10:00 am | T combinations | Mon, April 30 | 10-11:40 am |
| 10:00 am | M combinations | Tues, May 1 | 10-11:40 am |
| 11:00 am | M combinations | Thur, May 3 | 10-11:40 am |
| 12:00 pm | M combinations | Mon, April 30 | 12-1:40 pm |
| 12:00 pm | T combinations | Tues, May 1 | 12-1:40 pm |
| 1:00 pm | M combinations | Wed, May 2 | 12-1:40 pm |
| 1:00 pm | T combinations | Thur, May 3 | 12-1:40 pm |
| 1:30 or 2:00 pm | T combinations | Wed, May 2 | 2-3:40 pm |
| 2:00 pm | M combinations | Thur, May 3 | 2-3:40 pm |
| 3:00 pm | M combinations | Tues, May 1 | 2-3:40 pm |
| 3:00 pm | T combinations | Mon, April 30 | 2-3:40 pm |
| 4:00 pm | M combinations | Mon, April 30 | 4-5:40 pm |
| 4:00 pm | T combinations | Tues, May 1 | 4-5:40 pm |
| 4:30 or 5:00 pm | M combinations | Wed, May 2 | 4-5:40 pm |
| 4:30 or 5:00 pm | T combinations | Thur, May 3 | 4-5:40 pm |
| 6:00 pm | M combinations | Mon, April 30 | 6-7:40 pm |
| 6:00 pm | T combinations | Tues, May 1 | 6-7:40 pm |
| 7:00 or 7:30 pm | M combinations | Wed, May 2 | 6-7:40 pm |
| 7:00 or 7:30 pm | T combinations | Thur, May 3 | 6-7:40 pm |
| 8:00 pm | M combinations | Thur, May 3 | 8-9:40 pm |
| 8:00 pm | T combinations | Wed, May 2 | 8-9:40 pm |

# SYLLABUS ATTACHMENT
# COLLEGE OF ENGINEERING TECHNOLOGY – FERRIS STATE UNIVERSITY
## *Spring 2018*

| IMPORTANT DATES | | |
|---|---|---|
| Late registration | Wed. – Fri. | Jan. 3-5 |
| First day of classes | Monday | Jan. 8 |
| Last day for Drop/Add | Thursday | Jan. 11 |
| Martin Luther King Day (no classes) | Monday | Jan. 15 |
| Spring recess (Spring Break) | Sat. – Sun. | Mar. 3-11 |
| Mid-term grades due | Monday | Mar. 5 |
| Classes resume | Monday | Mar. 12 |
| Last day for "W" grades | Thursday | Mar. 22 |
| Mid-Semester Recess | Thur. – Sun. | Mar. 29-31 |
| Last day of classes | Friday | Apr. 27 |
| Examination Week | Mon – Fri | Apr 30 - May 4 |
| Commencement | Friday - Saturday | May 4-5 |
| Final grades due by 1:00 pm | Monday | May 7 |
| Grades available to students on MyFSU | Tuesday (after 8AM) | May 8 |

| Sessions | Dates | Last Day to Withdraw |
|---|---|---|
| Full Session | Jan. 8 – Apr. 27 | Mar. 22 |
| Session A | Jan. 8 – Feb. 8 | Feb. 27 |
| Session B | Feb. 28 – Apr. 27 | Apr. 10 |
| Session D | Jan. 8 – Feb. 9 | Jan. 29 |
| Session E | Feb. 12 – Mar. 22 | Mar. 2 |
| Session F | Mar. 23 – Apr. 27 | Apr. 16 |

| College of Engineering Technology School Offices | | |
|---|---|---|
| Automotive &Heavy Equipment | AUT 101 | 591-2655 |
| Built Environment | GRN 227 | 591-3773 |
| Engineering & Computing Technology | SWN 312 | 591-2068 |
| Design & Manufacturing | NEC 211 | 591-2640 |
| Dean's Office | JOH 200 | 591-2890 |

## WHAT YOU NEED TO KNOW

**E-MAIL**
All registered FSU students have a Ferris Gmail account. This is the only e-mail to which all official University information about registration, financial aid, student activities, and class cancellations will be sent. Please check your account at least once a week. E-mail is our primary communication resource for students.

**CLASS ATTENDANCE IS IMPORTANT!**
Attendance usually has a high correlation with how well you do in a course. Many instructors have mandatory attendance policies by which your grade will be affected by absences. Some instructors also have policies about class tardiness to encourage students to be present for the full class period. Check your course syllabus or talk to your instructor about his/her policies.

**HOW TO CONTACT A FACULTY MEMBER OR ADVISOR**
If you have questions or need help, talk to your instructor. Faculty office locations, phone numbers, and office hours may be obtained from the class syllabus or department office, or through the Directories & Maps link on the FSU home page.

**DROPPING CLASSES OR WITHDRAWING**
Dropping and adding only occurs during the first four days of the term. You can adjust your schedule **online during the first four days** or in person at the Timme Center (from 8-5 except for the last day when it is 12-5).

*If you add a class you must pay for your additional charges by the fourth day or your schedule will be dropped.*

If you need to withdraw from a class after the official drop/add period, you must do so **OFFICIALLY**, through your dean's office, in order to avoid receiving an "F" grade in the course. **You may not withdraw online after the first four days of the term.** You will receive a "W" for the course. *You will not receive a refund.* If you need to totally withdraw from the University, you must do so **officially** at Admissions and Records in CSS 201. The last day to withdraw or drop a class may be different for different classes. **CHECK THE SESSIONS DATES SECTION ABOVE OR THE REGISTRATION AND ACADEMIC GUIDE FOR THE WITHDRAWAL DEADLINES FOR THE SEMESTER**.
In cases of extenuating circumstances (e.g., a serious illness requiring you to withdraw from school), contact Birkam Health Center at 591-2614.

**INCOMPLETES**
The "I" is only considered for extenuating circumstances that have led to a student missing a portion of the course. The intent and appropriate use of the "I" grade is NOT to avoid student probation, dismissal, or unacceptable grades, nor should it be considered as an extended alternative to withdraw from a class (W). Extenuating circumstances are generally defined as those situations over which a student has little or no control—e.g., illness, birth, jury duty, death of a parent, serious injury. Instructors may require suitable documentation.
Students must have completed at least 75% of the coursework at passing levels before an "I" will be considered, and they may be required to sign an agreement regarding course completion. An "I" grade automatically changes to an "F" after one semester (not counting summer) unless the faculty member files another grade or extends the incomplete.

**STUDENT COMPLAINT POLICY**
http://www.ferris.edu/HTMLS/administration/academicaffairs/Forms_Policies/Documents/Policy_Letters/AA-Student-Complaints.pdf

**GRADUATION**
Students should apply for their degree audit the semester prior to the degree completion term. To obtain a degree audit and clearance for your associate or bachelor degree for you must meet with your assigned academic advisor. In addition an online graduation application is REQUIRED and deadlines will be ENFORCED per the Provost's Office and Records Office. **ONLINE APPLICATION DEADLINE** for participation in Fall Commencement Ceremony: **March 1, 2018**

Online application is accessed by logging into your MyFSU, (click on Student tab, My Records link, Degree Progress and Graduation, Apply to Graduate link). For more information, contact the Dean's Office.

**INCLEMENT WEATHER CONDITIONS**

Only during the most severe weather conditions – which could potentially endanger the safety of students or staff – will the Big Rapids campus consider cancelling classes. The decision to cancel classes due to weather conditions at the Big Rapids site will be made as early as possible. In the event it is necessary to cancel classes, periodic announcements will be made on area radio and television stations. It is the student's responsibility to listen for these announcements. A student may also call the Ferris Information Line at 231-591-5602 or check the Ferris website.

## ACADEMIC MISCONDUCT

Academic misconduct refers to dishonesty or misrepresentation with respect to assignments, tests, quizzes, written work, oral presentations, class projects, internship experience, or computer usage; violation of computer licenses, programs, or data bases; or unauthorized acquisition or distribution of tests or other academic material belonging to someone else. It includes such behaviors as cheating, copying materials from the internet without documentation, presenting another person's ideas or work as your own, taking someone else's exam for them, violating computer software licenses or program/data ownership, etc. It is the expectation of the College of Engineering Technology that all work you turn in is your own and is original for the course in which it is being submitted. If you are uncertain about whether a particular behavior might represent academic misconduct, be sure to ask your professor for clarification. Penalties for academic misconduct can include **FAILURE** of the assignment or the course, and/or disciplinary action up to and including probation or dismissal from the University.

**DISRUPTIVE BEHAVIOR**

The College of Engineering Technology strives to maintain a positive learning environment and educational opportunity for all students. Consequently, patterns of behaviors which obstruct or disrupt the teaching/learning environment will be addressed. The instructor is in charge of his or her course (e.g., assignments, due dates, attendance policy) and classroom (e.g., behaviors allowed, tardiness). Harassment, in any form, will not be tolerated. Penalties for disruptive behavior can include involuntary withdrawal from the course and/or disciplinary action up to and including probation or dismissal from the University.

## WHERE TO GO FOR HELP

The following services are available to any Ferris student, free of charge. They are designed to help you succeed in your courses, in your career planning, and in meeting the challenges of university life. Don't hesitate to explore and use these services at Ferris.

**ACADEMIC ADVISING**

All students have an assigned advisor and should confer with that advisor regularly. Students who have declared a major should see an advisor in that major. To find out who your advisor is, log in to MyFSU, (click on the Student tab, My Registration, Advisor Information, Select Term, Submit).

**ACADEMIC SUPPORT CENTER………………………..ASC 1017 – 591-3543**
**THE WRITING CENTER…………………………………..ASC 1017 – 591-2534**

**The Academic Support Center, Tutoring Services, and Writing Center** join together to offer FSU students an array of academic support services. Tutors are available to answer questions for many courses. The Writing Center helps writers individually and in workshops with skills and assignments. There is also study skills assistance to help with note-taking, test-taking, memory and reading strategies, and time management.

**DISABILITIES SERVICES………………………………….STR 313 – 591-3057**

According to the Americans with Disabilities Act, each student with a disability is responsible for notifying the University of his/her disability and requesting accommodations. Students requiring a classroom accommodation due to a physical, learning, mental or emotional disability should contact the Disabilities Services Office.

**SCHOLAR PROGRAM………………………………….ASC 1021 – 591-5976**

SCHOLAR is an academic support program that aids in the student's successful progression by offering a Peer Mentor Program, a Student Retention Program, and an Academic Student Advisory Committee.

**PERSONAL COUNSELING, SEXUAL ASSAULT, SUBSTANCE ABUSE BIRKAM HEALTH CENTER ……………………………. 2nd Floor - 591-5968**

Personal counseling is available confidentially and free of charge. Counselors are available to assist with personal and stress-related problems, family and relationship issues, substance abuse, sexual assault, depression, or other similar problems. Call or stop by to obtain an appointment. ***If you or a friend are in immediate crisis, call 911.***

**EDUCATIONAL & CAREER COUNSELING ……………STR 313 – 591-3057**

Students wanting to examine their choice of major or career choice, learning styles or strategies can make one-on-one appointments with licensed counselors.

**CAREER SPECIALIST – Leigha Compson ……………JOH 200 – 591-3549**

Valuable support services and events are offered for students currently or previously enrolled in associate degree programs. To lean more visit: http://www. ferris.edu/HTMLS/colleges/technolo/ Career-Programs-Support/index.htm

**SAFETY**

Please observe the posted shelter and evacuation routes in the hallway nearest your classroom.

## OTHER RESOURCES

**BIRKAM HEALTH CENTER………………………………1st Floor - 591-2614**

The Birkam Health Center provides fee-for-service medical care including evaluation and treatment for illness and injury anytime during the year. Patients are seen on a walk-in and by appointment basis.

**FLITE LIBRARY………………………………………………………………591-2669**

Regular hours for FLITE:
Monday – Thursday . . . . . . . . . . . . . . . . . . 7:30 a.m. – MIDNIGHT
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . ...7:30 a.m. – 6:00 p.m.
Saturday . . . . . . . . . . . . . . . . . . . . . . . . . . NOON – 5:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . .. . . . . . . . .1:00 p.m. – MIDNIGHT
Extended Studies Court will begin late night hours January 17, 2017
*Sunday-Thursday/MIDNIGHT to 7:30 a.m. *Friday/6 p.m. to MIDNIGHT
*Saturday/5 p.m. to MIDNIGHT)

**FSU BOOKSTORE…………………………UNIVERSITY CENTER 231 591-2607**

Regular on-campus hours for the Bookstore **:
Monday – Thursday . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 6:00 p.m.
Friday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 9:00 a.m. – 5:00 p.m.
Saturday. . . . . . . . . . . . . . . . . . . . . . . . . . . . 12:00 p.m. – 4:00 p.m.
Sunday . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CLOSED

## HELPFUL NUMBERS

| | | | |
|---|---|---|---|
| Admissions | 2100 | Inst. Testing | 3628 |
| Business Office | 2125 | Public Safety | 5000 |
| Financial Aid | 2110 | Records | 2792 |
| Housing | 3745 | TAC | 4822 |

When calling from off campus, extensions can be called by using the prefix 231-591-_____.

## Arts & Sciences/General Education Department Offices

| | | |
|---|---|---|
| Biology | ASC 2004 | 591-2550 |
| Humanities | JOH 119 | 591-3675 |
| Languages & Literature | ASC 3080 | 591-3988 |
| Mathematics | ASC 2021 | 591-2565 |
| Physical Sciences | ASC 3021 | 591-2580 |
| Social Sciences | ASC 2108 | 591-2735 |

## College of Engineering Technology Diversity Statement

The College of Engineering Technology provides a dynamic experiential learning environment that is inclusive, equitable and just for all individuals, regardless of human differences.

Ferris State University is an equal opportunity institution. For information on the University's Policy on Non-Discrimination, visit http://www.ferris.edu/non-discrimination

Updated 1/2/2017 alm

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

Fall 2017 SYLLABUS

**Course: HVAC 208** **Air-Conditioning Applications**

**Credit hours:** Five
**Contact hours** Three lecture hours and six lab hours
**Course description:** A study of mechanical air conditioning equipment including heat pump, chiller, absorption refrigeration, cooling tower and evaporative cooling applications. Compressor types and capacity control systems are included. Hands on laboratories cover electrical systems, capacity testing and troubleshooting of residential and light commercial mechanical and electrical systems.

**Prerequisites: HVAC 102, HVAC 117, both with a grade of C- or better.**
**Required Textbooks:** Refrigeration & Air Conditioning Technology, 7th Edition, Whitman, Johnson, Tomczyk, and Silberstein.

**Faculty:** Brian Holton
**Office location:** Grainger
**Office phone:** 591-2322
**Home phone**
**E mail:**

**Office hours:**

Assistance in this course is available to help you with academic or personal problems.
Students are encouraged to seek help as needed.
**Sources for assistance:**

1. Office hours: I am available during regular scheduled office hours or by appointment.
2. Academic advisor: meet with your advisor for assistance with registration.
3. Education counselor
4. Academic Support Services Center: this center provides free tutoring and assistance with test anxiety, study skills, writing skills, exam preparation, content reading, personal growth, and classroom skills

**Disabilities Services:**
Any student registered with Disabilities Services should contact the instructor as soon as possible for assistance with classroom accommodations.

## Student Learning Outcomes

Students satisfactorily completing this course will achieve proficiency in:

1. System classifications
2. Psychrometrics for air conditioning
3. Refrigerants and refrigerant charging for air conditioning
4. Maintenance, testing and troubleshooting for air conditioning systems
5. Installation and replacement considerations for air conditioning systems
6. Economizers
7. Heat pump system types and operation
8. Cooling tower system types and operation
9. Chiller system types and operation
10. Capacity control methods

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

Fall 2017 SYLLABUS

**Course Assessments:** Student assessment will be based on quizzes and exams.
**Exams:** two paper exams and two lab (hands on) exams

**Grading:** Final grade based on student point total compared to total possible points. The grade book is available in the Blackboard web site for this course.

| **Letter Grade** | **Equal to or greater than** | **Below** | **Letter Grade** | **Equal to or greater than** | **Below** |
|---|---|---|---|---|---|
| **A** | **94** | | **C+** | **77** | **80** |
| **A-** | **90** | **94** | **C** | **74** | **77** |
| **B+** | **87** | **90** | **C-** | **72** | **74** |
| **B** | **84** | **87** | **D+** | **71** | **72** |
| **B-** | **80** | **84** | **D** | **70** | **71** |

## Course Policies

**Attendance:** In general, treat the course as you would for a job. Lab period attendance is mandatory except for excused absences. Lab exercises, quizzes and exams cannot be made up except for excused absences.

**Excused Absence:** Documentation or approval from the professor is required for excused absences.
**Punctuality:** Punctuality is expected. Please inform me if you have a scheduling conflict. Repeated late arrivals will result in disciplinary action including dismissal from class. **Students must be on time for assessments.**

**Cell Phones:** **Make sure cell phones are turned to vibrate or off. Do not text during class. Wait until end of class or a break to attend to calls.**

**Electronic recording devices:** No recording device of any type is allowed in the lecture or lab periods without approval from the faculty teaching the class.

**Assessment policy:** No cell phones or electronic devices allowed with the exception of calculators as required for subject context. Quizzes or exams cannot be taken at any time other than the scheduled date unless there is a prior arrangement or a documented emergency or health issue.

**Tobacco use:** In accordance with university policies, no tobacco use is allowed in the lecture or lab periods. This includes smokeless tobacco products and vapor products.

**Student conduct:** All students are expected to conduct themselves with dignity and respect for others. Harassment of any kind is not acceptable.
Students are responsible for adhering to university policies as set forth in the Student Handbook. Students should read the section III.A. Academic Misconduct and understand that the minimum penalty for Academic Misconduct is outlined in the Student Handbook. Students caught cheating, falsifying, plagiarizing, or interfering as defined in the Student Handbook will receive a failing grade for the course.

**Syllabus changes:** I reserve the right to make needed and appropriate adjustments to this syllabus.

**20 Section III: General University and Housing Policies Regarding Misconduct**

***A. Academic Misconduct***

The university may discipline a student for academic misconduct, which is defined as any activity that tends to undermine the academic integrity of the institution. Academic misconduct includes, but is not limited to, the following:

**1. Cheating**

A student may not use unauthorized assistance, materials, information, or study aids in any academic exercise, neither should they give assistance, materials, information, nor study aids in any academic exercise, including but not limited to the following:

a. A student must not use or give external assistance on any “in-class” or “take-home” examination, unless the instructor has specifically authorized external assistance. This prohibition includes, but is not limited to, the use of tutors, books, notes, and calculators.

b. A student must not use another person as a substitute in the taking of an examination or quiz.

c. A student must not steal examinations or other course materials.

d. A student must not allow others; offer to conduct research, or to prepare work for him/her without advance authorization from the instructor for whom the work is being submitted. Under this prohibition, a student must not make any unauthorized use of materials obtained from commercial term paper companies or from files of papers prepared by other persons.

e. A student must not collaborate with other persons on a particular project and submit a copy of a written report, which is represented explicitly or implicitly as the student’s individual work.

f. A student must not use or give any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.

g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor to whom the work is being submitted.

h. A student must not alter a grade or score in any way.

**2. Fabrication**

A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citations of the sources of information.

**3. Facilitating Academic Dishonesty**

A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct.

A student is responsible for taking reasonable precautions to ensure his or her work is not accessed by or transferred to another individual wherein it may then be used to commit an act of academic misconduct.

**4. Interference**

a. A student must not steal, change, destroy, or impede another student’s work. Impeding another student’s work includes, but is not limited to: the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.

b. A student must not give or offer a bribe, promise favors, or make threats with the intention of affecting a grade or the evaluation of academic performance.

**5. Plagiarism**

A student must not adopt or reproduce ideas, words, or statements of another person without appropriate acknowledgment. A student must give credit to the originality of others and acknowledge indebtedness whenever he or she does any of the following:

a. Quotes another person’s actual words, either oral or written;

b. Paraphrases another person’s words, either oral or written;

c. Uses another person’s idea, opinion, or theory;

# *FERRIS STATE UNIVERSITY*

COLLEGE OF ENGINEERING TECHNOLOGY, HVACR PROGRAM

Fall 2017 SYLLABUS

**E-MAIL**
All registered FSU students have a Ferris Gmail account. This is the only e-mail to which all official University information about registration, financial aid, student activities, and class cancellations will be sent. Please check your account at least once a week. E-mail is our primary communication resource for students.

**CLASS ATTENDANCE IS IMPORTANT!**
Attendance usually has a high correlation with how well you do in a course. Many instructors have mandatory attendance policies by which your grade will be affected by absences. Some instructors also have policies about class tardiness to encourage students to be present for the full class period. Check your course syllabus or talk to your instructor about his/her policies.

**HOW TO CONTACT A FACULTY MEMBER OR ADVISOR**
If you have questions or need help, talk to your instructor. Faculty office locations, phone numbers, and office hours may be obtained from the class syllabus or department office, or through the Directories & Maps link on the FSU home page.

**DROPPING CLASSES OR WITHDRAWING**
Dropping and adding only occurs during the first four days of the term. You can adjust your schedule **online during the first four days** or in person at the Timme Center (from 8-5 except for the last day when it is 12-5). *If you add a class you must pay for your additional charges by the fourth day or your schedule will be dropped.*

If you need to withdraw from a class after the official drop/add period, you must do so **OFFICIALLY**, through your dean's office, in order to avoid receiving an "F" grade in the course. **You may not withdraw online after the first four days of the term.** You will receive a "W" for the course. *You will not receive a refund.* If you need to totally withdraw from the University, you must do so **officially** at Admissions and Records in CSS 201. The last day to withdraw or drop a class may be different for different classes. **CHECK THE SESSIONS DATES SECTION ABOVE OR THE EGISTRATION AND ACADEMIC GUIDE FOR THE WITHDRAWAL DEADLINES FOR THE SEMESTER**.

In cases of extenuating circumstances (e.g., a serious illness requiring you to withdraw from school), contact Birkam Health Center at 591-2614.

**INCOMPLETES**
The "I" is only considered for extenuating circumstances that have led to a student missing a portion of the course. The intent and appropriate use of the "I" grade is NOT to avoid student probation, dismissal, or unacceptable grades, nor should it be considered as an extended alternative to withdraw from a class (W). Extenuating circumstances are generally defined as those situations over which a student has little or no control—e.g., illness, birth, jury duty, death of a parent, serious injury. Instructors may require suitable documentation.

Students must have completed at least 75% of the coursework at passing levels before an "I" will be considered, and they may be required to sign an agreement regarding course completion. An "I" grade automatically changes to an "F" after one semester (not counting summer) unless the faculty member files another grade or extends the incomplete.

**GRADUATION**
Students should apply for their degree audit the semester prior to the degree completion term. To obtain a degree audit and clearance for your associate or bachelor degree for you must meet with your assigned academic advisor. In addition an online graduation application is REQUIRED and deadlines will be ENFORCED per the Provost's Office and Records Office. **ONLINE APPLICATION DEADLINE** for participation in Spring Commencement Ceremony: **MARCH 1, 2016**
Online application is accessed by logging into your MyFSU, (click on Student tab, My Records link, Degree Progress and Graduation, Apply to Graduate link). For more information, contact the Dean's Office.

**INCLEMENT WEATHER CONDITIONS**
Only during the most severe weather conditions – which could potentially endanger the safety of students or staff – will the Big Rapids campus consider cancelling classes. The decision to cancel classes due to weather
conditions at the Big Rapids site will be made as early as possible. In the event it is necessary to cancel classes, periodic announcements will be made on area radio and television stations. It is the student's responsibility to listen for these announcements. A student may also call the Ferris Information Line at 231-591-5602 or check the Ferris website.

**ACADEMIC MISCONDUCT**

Academic misconduct refers to dishonesty or misrepresentation with respect to assignments, tests, quizzes, written work, oral presentations, class projects, internship experience, or computer usage; violation of computer licenses, programs, or data bases; or unauthorized acquisition or distribution of tests or other academic material belonging to someone else. It includes such behaviors as cheating, copying materials from the internet without documentation, presenting another person's ideas or work as your own, taking someone else's exam for them, violating computer software licenses or program/data ownership, etc. It is the expectation of the College of Engineering Technology that all work you turn in is your own and is original for the course in which it is being submitted. If you are uncertain about whether a particular behavior might represent academic misconduct, be sure to ask your professor for clarification. Penalties for academic misconduct can include **FAILURE** of the assignment or the course, and/or disciplinary action up to and including probation or dismissal from the University.

**DISRUPTIVE BEHAVIOR**
The College of Engineering Technology strives to maintain a positive learning environment and educational opportunity for all students. Consequently, patterns of behaviors which obstruct or disrupt the teaching/learning environment will be addressed. The instructor is in charge of his or her course (e.g., assignments, due dates, attendance policy) and classroom (e.g., behaviors allowed, tardiness). Harassment, in any form, will not be tolerated. Penalties for disruptive behavior can include involuntary withdrawal from the course and/or disciplinary action up to and including probation or dismissal from the University.

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**SCHOLAR PROGRAM.......................................ASC 1021 – 591-5976**
SCHOLAR is an academic support program that aids in the student's successful progression by offering a Peer Mentor Program, a Student Retention Program, and an Academic Student Advisory Committee.

**PERSONAL COUNSELING, SEXUAL ASSAULT, SUBSTANCE ABUSE BIRKAM HEALTH CENTER …………………………….... 2nd Floor - 591-5968**
Personal counseling is available confidentially and free of charge. Counselors are available to assist with personal and stress-related problems, family and relationship issues, substance abuse, sexual assault, depression, or other similar problems. Call or stop by to obtain an appointment. ***If you or a friend are in immediate crisis, call 911.***

**EDUCATIONAL & CAREER COUNSELING ……………STR 313 – 591-3057**
Students wanting to examine their choice of major or career choice, learning styles or strategies can make one-on-one appointments with licensed counselors.

**OTHER RESOURCES**

**BIRKAM HEALTH CENTER………………………….………1st Floor - 591-2614**
The Birkam Health Center provides fee-for-service medical care including evaluation and treatment for illness and injury anytime during the year. Patients are seen on a walk-in and by appointment basis.

**HELPFUL NUMBERS**

| | | | |
|---|---|---|---|
| Admissions | 2100 | Inst. Testing | 3628 |
| Business Office | 2125 | Public Safety | 5000 |
| Financial Aid | 2110 | Registrar (Records) | 2792 |
| Housing | 3745 | TAC | 4822 |

When calling from off campus, extensions can be called by using the prefix 231-591-_____.

**FERRIS STATE UNIVERSITY**

COLLEGE OF TECHNOLOGY

HVACR DEPARTMENT

**HVAC 245**

**Course Syllabus**

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**Course:** HVAC 245: Design of Heating, Ventilating, and Air-Conditioning Systems

**Semester Hours:** 4 Hours per Week

**Contact Hours:** Lecture: 3 Hours a Week, Lab: 3 Hours per Week

**Course Description:** The study of psychrometrics, load calculation, and design of residential and light commercial HVAC systems.

**Prerequisites:** Math 116

**Textbooks Required:** **ACCA Manual Jae, 8th edition**, Rutkowski, P.E. **ACCA Manual D, 3rd edition**, Rutkowski, P.E.

**Course Website:** Gradebook and other information is provided through Blackboard for this course.

**Contact Information:**
Name: Professor Gerard Lucas
Office Location: Granger 218
Office Phone: 231-591-3764
Home Phone: 253-459-4071
E-mail: GerryLucas@ferris.edu

**Office Hours:** Monday 10:00 to 10:50, Tuesday 3:00 to 3:50, Wednesday 10:00 to 10:50, Friday 1:00 to 1:50, or by appointment.

**Student Responsibilities:**

Assistance in this course is available to help you with academic or personal problems. Students are encouraged to seek help as needed.

**Sources for Assistance:**

1. Office Hours: I am available during regular scheduled office hours or by appointment.
2. Academic Advisor: Meet with your advisor for assistance with registration.
3. Education Counselor.
4. Academic Support Services Center: This center provides free tutoring and assistance with test anxiety, study skills, writing skills, exam preparation, content reading, personal growth, and classroom skills.

## Course Policies and Student Responsibilities:

**Attendance:** In general, treat this course as you would a job. Students without any unexcused absences will receive 2% added to their final grade. There is a maximum of two unexcused absences allowed without penalty. **Each unexcused absence after two will result in 1% drop in your final grade up to 5%. Leaving lecture or lab early without approval from the professor will be considered an absence.**

**Excused Absence:** Documentation or previous professor approval is required for an absence to be considered excused.

**Punctuality:** Punctuality is expected. If there is a scheduling conflict, the student must inform the professor. **Every three late arrivals will be treated as a unexcused absence. Students must be on time for assessments.**

**Cell Phones:** Cell phones are not to be used in lecture or lab for any purpose. Cell phones must be on silent or off during lecture and lab.

**Assessment Policy:** No cell phones or electronic devices are allowed during assessments with the exception of a calculator. Talking is strictly prohibited during the assessment. Assessments are only available at the scheduled date and time; assessments may only be rescheduled due to documented emergency or health issue.

**Late Assignment Policy:** Late assignments will be accepted up to one business day after the due date **with a deduction of 10% off the final grade for that assignment.**

**Student Conduct:** All students are expected to conduct themselves with dignity and respect for others. Harassment of any kind is not acceptable. **Students are responsible for their own work. The Code of Student Community Standards has been included in blackboard for the students to review.**

**Syllabus Changes:** **The professor reserves the right to make needed and appropriate adjustments to this syllabus.**

**Grading:** The class grading is weighted where the labs are worth 30%, quizzes are worth 10%, assignments are worth 20%, and exams are worth 40%. You must receive 70% or greater final score to pass this class. Students attending and participating in the Advisory Board Event will receive 2% extra credit added to their final grade.

| Letter Grade | A | A- | B+ | B | B- | C+ | C | C- |
|---|---|---|---|---|---|---|---|---|
| Final Percent | >=94% | <94% to >=90% | <90% to >=87% | <87% to >=84% | <84% to >=80% | <80% to >=77% | <77% to >=74% | <74% to >=70% |

**Course Learning Outcomes:**

1. Students will be able to perform psychrometric calculations for heating, cooling, and dehumidify processes; including plotting a cooling equipment selection on a psychrometric chart.
2. Students will be able to calculate the heat transfer through series and parallel paths for building components.
3. Students will be able to perform a load calculation using ACCA Manual Jae procedures on a residential house; including heating and cooling calculations for opaque panels, fenestrations, floors, ventilation, infiltration, and ductwork.
4. Students will be able to select residential forced air equipment; including furnace, air-conditioner, filter, humidifier, and ventilation heat recovery equipment.
5. Students will be able to design and size a duct system using ACCA Manual D procedures; including determining TEL, friction rate, and duct sizes.
6. Students will be able to design a residential hydronic system; including boiler selection, terminal unit selection, control valve selection, pipe sizing, in-floor radiant layout, and pump selection.
7. Students will be able to recall the sequence of operation, common installation and maintenance issues, and troubleshooting theory for common commercial systems; including single zone constant volume systems, variable air volume system, water source heat pump systems, multi-zone systems, and dual duct systems.

**Course Assessments:**

1. Exams: There will be 5 exams. Exam 1 will be on Psychrometrics and Heat Transfer. Exam 2 will be on Manual J. Exam 3 will be on Equipment Selection and Duct Design. Exam 4 will be on Hydronic Design. Exam 5 will be on Commercial Systems.
2. Assignments: There will be several assignments to help student learn the course objectives between exams.
3. Quizzes: There will be quizzes between exams to show student progression toward the learning objectives.
4. Projects: There will be 4 projects. Project one will be Manual J Load Calculation. Project 2 will be Equipment Selection. Project 3 will be Duct Design and Manual D. Project 4 will be Hydronic Design.

**FERRIS STATE UNIVERSITY**

COLLEGE OF TECHNOLOGY

HVACR DEPARTMENT

**HVAC 245**

**Course Syllabus**

| Week | Learning Goals |
|---|---|
| Week 1 | Understand the Course Syllabus and Student Policies. Understand Basic Psychrometric Terms. Understand Psychrometric Chart Plotting Procedures. Understand Psychrometric Processes and how to plot them on a Psychrometric Chart. Understand how to plot systems on a Psychrometric Chart. Understand Standard Heat Transfer Formulas and Mass Flow Rate Formulas. |
| Week 2 | Understand Basic Terms used in developing Heat Transfer Coefficients. Understand difference between Series and Parallel Heat Transfer Coefficients. Understand how to pick Components from Manual Jae Tables. Understand How to read Manual Jae Weather Tables. Understand how to calculate Loads based on Parallel Heat Transfer Coefficients and Manual Jae Tables. |
| Week 3 | Exam 1. Understand Reading Architectural Plans for Performing Load Calculations. |
| Week 4 | Understand Heat Calculations for Opaque Panels and Fenestrations. Understand heat Calculations for Basement Floors, Floors Over Enclosed Crawl Spaces, and Slab on Grade Floors. Understand Cooling Calculations for Opaque Panels. |
| Week 5 | Understand Cooling Calculations for Fenestrations with and without shading. Understand Internal Loads for cooling Calculations. Understand Infiltration Loads for Heating and Cooling Calculations. |
| Week 6 | Understand Residential Ventilation Requirements and Associated Heating and Cooling Loads. Understand Duct Heating and Cooling Load Calculations. |
| Week 7 | Understand Uses of Residential Load Calculation Software. Exam 2. Understand Heating Equipment Selection Procedures. |
| Week 8 | Understand Cooling Equipment Selection Procedures. Understand Heat Recover Equipment Selection Procedures. |
| Week 9 | Understand Different Duct System Designs. Understand Manual D TEL Calculations. Understand Manual D Friction Rate Calculations. Understand Duct Sizing Principles and Guidelines. |
| Week 10 | Understand Hydronic Heating System Parameters. Understand Hydronic System Boiler Selection Procedures. Understand Pipe Sizing Procedures and Guidelines. |
| Week 11 | Understand Terminal Unit Selection Procedures. Understand Control Valve Selection Procedures. Understand Pump Selection Procedures. Understand using Pump Curves to find System Operating Points. |
| Week 12 | Understand Radiant In floor Heating Layout Procedures. Understand Radiant In floor Heating Sizing Procedures. |
| Week 13 | Exam 4. Understand the Operation of Commercial Single Zone Constant Volume Equipment; including Change Over Bypass VAV and Terminal Reheat Systems. Understand Variable Air Volume Air Handler Systems. |
| Week 14 | Understand the Three Types of VAV Boxes. Understand Operation of Water Source Heat Pumps; Including the Heat Pumps, Water Loop, Boiler, and Cooling Devices. |
| Week 15 | Understand Basics of other common Commercial Systems; including Multi-zone and Dual Duct. Final Exam Review. |

HVAC 285 SYLLABUS

FERRIS STATE UNIVERSITY

**COURSE OUTLINE AND SYLLABUS**
**HVAC 285 HVAC System Design using BIM**

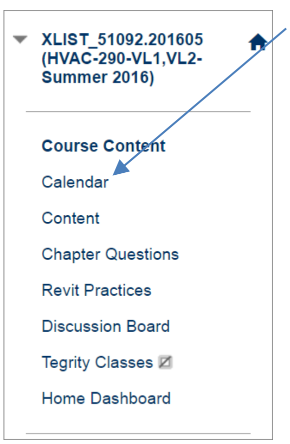
## Course Information:

Credits: ..................................2 Credits: 4 Hours: 1 lecture hour and 3 lab hours per week
Course Description: ...............Design of mechanical systems for buildings using Building Information Modeling (BIM). For HVAC students only.
Course prerequisites: .............Department approval
Required Textbooks...............Autodesk® Revit® 2018 MEP Fundamentals
Required Software .................Revit 2018

## Instructor Information:

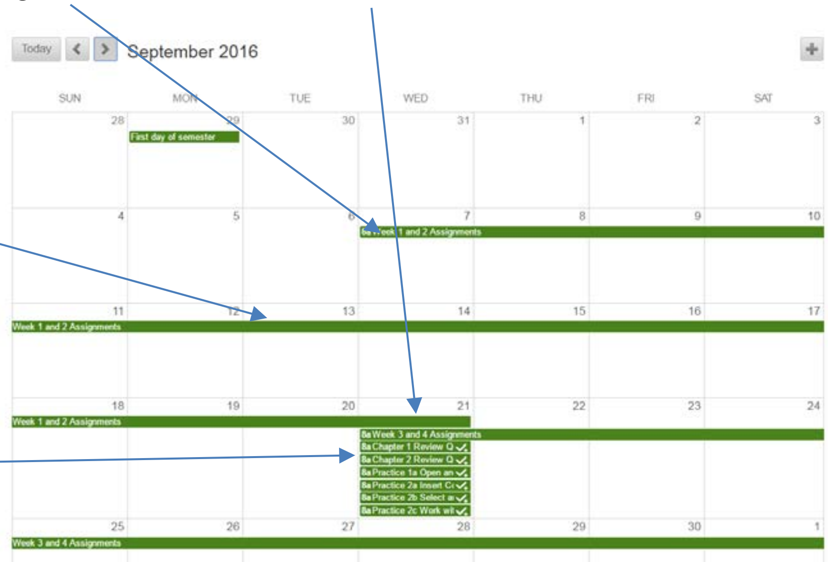
Instructor: ...............................Professor Michael J. Feutz, Ph.D., LEED AP
Office Hours:..........................No office hours are listed as this is an online course
E-mail: .................................[feutzm@ferris.edu](mailto:feutzm@ferris.edu)
Office location & phone:........Office number: GRN 213. Phone: 231-591-2351
Communication:.....................Use email as your primary form of communication (it provides a written record).

## Assignments/Schedule/To Do List (September 2016 used as example):




**Course Calendar**: The calendar in Blackboard contains all of the assignments for the semester. All assignments are listed in the calendar by date with a bar that begins on the assignment date and ends on the due date.

You can click on the bar on any day through which it passes and open up the assignment to read what you are required to complete.




Additionally, assignments are listed on the due date.

The calendar assignment will direct you to specific modules in the Learning Modules for a complete listing of what reading and videos pertain to the lesson.

## Materials

This course requires you to download Revit, obtain both an Ebook and a hard copy text, and download Practice Files. This will take some time, so it is important to obtain your materials ASAP.

## Course Design:

This course is laid out in a 12-week format. Assignments are due every two weeks (see the calendar in Blackboard). All of the material is available on the first day of class. You can progress as quickly as you like. However, no late work is accepted. Any work submitted after the due date will be scored as zero. Please manage your time wisely.

## Late Work:

Late work is not accepted for any reason unless prior arrangements are made, or unless something happened beyond your control that prevented you from meeting your due date. Since you are given two weeks to complete all assignments in this course, waiting until the due date to do the work is not recommended.

I STRONGLY suggest that you create an artificial due date one week ahead of the actual due date. That will provide a cushion in case something happens, such as Blackboard crashing on the due date.

## Learning Revit:

When I first taught Revit, I contacted Reid Johnson to seek advice on the best way to teach it. Mr. Johnson is the program manager for Architecture + Engineering + Construction education (Autodesk AEC) at Autodesk (the company that produces Revit, AutoCAD, and other design software). His advice was to use Google, YouTube, and forums. When I asked Google, "What's the best way to learn Revit?" I was taken to this forum: http://www.revitforum.org/tutorials-tips-tricks/1563-whats-best-way-learn-revit.html. There you will see several contributors referring to blogs, forums, and videos.

Adding in my experience of learning Revit on my own, the only conclusion I can draw is that learning Revit requires self-engagement. It is like learning to drive a car. You can watch others drive for years; ask questions about how driving works; ask what all the pedals, levers, buttons and knobs are for; but until you actually get behind the wheel, you will never learn to drive. Revit is the same. You can watch someone else use Revit all day, read books, and watch videos, but until you actually strap in and get to work, you will not learn Revit.

The book and videos for this course are excellent for introducing you to Revit, but they only work if you use them. You may be tempted to just jump into the software and "figure it out." Don't. You will be frustrated to no end. Be patient and take the time to read the book and view the videos. Because this is an online course, the odds of me being online to help while you are trying to figure something out are slim. Take the advice of others who have learned Revit. Use Google and YouTube as your resources in case the book or course videos don't have the answer you seek. Not only will you learn what you are trying to do, you will also discover some great websites.

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Course Outline | Time Allocation |
|---|---|---|
| 1 | Introduction | 5% |
| 2 | Basic Drawing and Modify Tools | 10% |
| 3 | Basic HVAC Systems Tools | 10% |
| 4 | HVAC Systems Projects | 15% |
| 5 | Working with Views | 5% |
| 6 | Spaces and Zones | 5% |
| 7 | Energy Analysis | 10% |
| 8 | HVAC Networks | 15% |
| 9 | Advanced Systems for HVAC | 15% |
| 10 | Construction Documents | 5% |
| 11 | Tags, Schedules, Details | 5% |
| | Total Hours | 100% |

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Course Outcomes |
|---|---|
| 1 | Define BIM and Revit terms |
| 2 | Start, open and save projects |
| 3 | Create foundational project elements (datum (levels), elevations, 2D and 3D views, details, legends, schedules, sheets, families) |
| 4 | Apply view commands (zoom, pan, rotate, visual styles, detail level, hide/reveal/filter elements, visibility/graphic overrides, reference planes, 2D and 3D sections, camera and walkthrough views) |
| 5 | Identify and employ user interface tools (quick access toolbar, status bar, application menu, ribbon, options bar, navigation cube, project browser, properties palette, navigation bar, system browser, status bar) |
| 6 | Load, insert, select, and edit components (families) |
| 7 | Modify elements (move, copy, rotate, offset, align, spit, mirror, trim, extend, array) |
| 8 | Create spaces and zones |
| 9 | Prepare, analyze and export heating and cooling loads |
| 10 | Add, connect, and modify mechanical equipment, ducts and pipes, fittings, accessories, insulation and lining |

**Weighting of Student Performance:**

This course consists of two components: Chapter Review Questions and Practice Exercises. The weighting of the components is shown in the table below.

The instructor reserves the right to modify the grading process as deemed necessary if issues or situations arise in the future.

## SCORING

| | |
|---|---|
| Chapter Review Questions | 30% |
| Practice Exercises | 70% |
| Total | 100% |

## GRADING SCALE

| Letter Grade | Equal to or Greater Than | Below |
|---|---|---|
| A | 94% | |
| A- | 90% | 94% |
| B+ | 87% | 90% |
| B | 84% | 87% |
| B- | 80% | 84% |
| C+ | 77% | 80% |
| C | 74% | 77% |
| C- | 70% | 74% |
| D+ | 68% | 70% |
| D | 66% | 68% |
| D- | 65% | 66% |
| F | 0% | 65% |

## Online Course-Netiquette

People often voice concerns in taking an online course regarding the challenge it is to express oneself safely in an online environment and to be able to communicate well due to the limitation of having to do all communication through writing. Particularly for the visual and audio learners, the online environment can feel quite restrictive. However, there are numerous ways that we can improve our communication online by taking advantage of using "emoticons", learning the social mores that have been developed in "talking" online and developing our thought through the written word.

Here are several recommendations for those entering into an online communication are:

1. **Stay on topic.** While discussion is helpful, it is necessary to communicate your ideas in a thoughtful, sequenced fashion so others can follow your thought and argument.
2. **Use appropriate subject lines**. This is helpful for the reader to selectively view the discussions where they want to become involved. Subject matter often changes during the course in a conversation, it is helpful to always have the subject line reflect the content of the posted message. If you have something that you want to discuss that is not related to the course, post the message in the Chat discussion thread, If you have a comment you want to make that is off the discussion subject matter, but is related to the course, start a new discussion thread.
3. **Keep your dialogue professional and respectful**. This does not mean necessarily formal communication like you would use for writing an assignment or paper. What it does mean is that you keep your language to being polite and constructive. If you become angry with a response from a peer. It is important not to respond in anger. Allow yourself to cool down and reflect on your response before posting it. Name-calling, blaming, judging behavior ("that's a stupid idea", for example) are unacceptable behavior for constructive learning dialogue. You want to be positive in your approach. Often communicating in an online environment may mean not all responses are grammatically correct, nor are they necessarily free from spelling errors. However, all your responses need to be able to be read and understood by your peers. The goal is to build a collaborative environment and one that invites you to learn with others.
4. **Avoid using all caps even when trying to emphasize a point.** Using all caps in an online environment is translated as shouting or yelling to whom you are responding. Underline, bold, italicize or change the font color for a point you wish to emphasize.

**EXCERPTS FROM**

**Ferris State University**
**Code of Community Standards (Student Handbook)**

http://www.ferris.edu/htmls/administration/StudentAffairs/Studenthandbook/06HandbookMaster.pdf

## 20 Section III: General University and Housing Policies Regarding Misconduct

***A. Academic Misconduct***

The university may discipline a student for academic misconduct, which is defined as any activity that tends to undermine the academic integrity of the institution. Academic misconduct includes, but is not limited to, the following:

**1. Cheating**

A student may not use unauthorized assistance, materials, information, or study aids in any academic exercise, neither should they give assistance, materials, information, or study aids in any academic exercise, including but not limited to the following:

a. A student must not use or give external assistance on any "in-class" or "take-home" examination, unless the instructor has specifically authorized external assistance. This prohibition includes, but is not limited to, the use of tutors, books, notes, and calculators.

b. A student must not use another person as a substitute in the taking of an examination or quiz.

c. A student must not steal examinations or other course materials.

d. A student must not allow others, offer to conduct research, or to prepare work for him/her without advance authorization from the instructor for whom the work is being submitted. Under this prohibition, a student must not make any unauthorized use of materials obtained from commercial term paper companies or from files of papers prepared by other persons.

e. A student must not collaborate with other persons on a particular project and submit a copy of a written report, which is represented explicitly or implicitly as the student's individual work.

f. A student must not use or give any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.

g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor to whom the work is being submitted.

h. A student must not alter a grade or score in any way.

**2. Fabrication**

A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citations of the sources of information.

**3. Facilitating Academic Dishonesty**

A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct.

A student is responsible for taking reasonable precautions to ensure his or her work is not accessed by or transferred to another individual wherein it may then be used to commit an act of academic misconduct.

**4. Interference**

a. A student must not steal, change, destroy, or impede another student's work. Impeding another student's work includes, but is not limited to: the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.
b. A student must not give or offer a bribe, promise favors, or make threats with the intention of affecting a grade or the evaluation of academic performance.

**5. Plagiarism**

A student must not adopt or reproduce ideas, words, or statements of another person without appropriate acknowledgment. A student must give credit to the originality of others and acknowledge indebtedness whenever he or she does any of the following:

a. Quotes another person's actual words, either oral or written;
b. Paraphrases another person's words, either oral or written;
c. Uses another person's idea, opinion, or theory; or
d. Borrows facts, statistics, or other illustrative material, unless the information is common knowledge.

**6. Violation of Course Rules**

A student must not violate course rules as contained in a course syllabus which are rationally related to the content of the course or to the enhancement of the learning process in the course.

## Section IV: Administrative Policies

Student sanctions in the Ferris State University Code of Community Standards Administrative Policies and Procedures specifically include official reprimands, behavioral contracts, disciplinary probation, suspension from the University, or dismissal from the University without opportunity to enroll in the future. In addition, these include the opportunity for other sanctions to be imposed, such as the requirement or reimbursement for damages, loss of special privileges, or participation in campus provided educational programs.

The University considers involvement in the student judicial process to be part of a student's learning experience. Through a system of progressive discipline, it is anticipated that a student will realize the importance of functioning within the University's policies, procedures, and regulations. Though every case involving the violation of University policies or procedures is considered on the basis of the merits in that case, there are some categories of violations for which the anticipated sanction would be suspension or dismissal from the University. Such serious infractions include but are not limited to the distribution of alcohol to minors, distribution of illegal drugs or the use, possession, or distribution of alcohol or illegal drugs that result in a serious safety or health matter for any member of the campus or local community.

Ferris State University

**Syllabus – Winter 201X**

**HVAC 312**

**HVACR Department**

**COURSE TITLE:** HVAC 312 Control Theory and Application

**COURSE DESCRIPTION:** The study of control loop theory related to commercial and industrial comfort, process and safety applications. The course focuses on analog electronic and pneumatic control components and their systems used in new and existing applications. Lab exercises concentrate on control system operation and analysis.

**CREDIT HOURS:** 4 Semester Credit Hours

**PREREQUISITE:** A grade of C- or better in HVAC 321, HVAC 342 and MATH 126

**REQUIRED TEXT:** Information sheets provided within BlackBoard

Instructor: Eric Quilitzsch

Phone 231-591-2747

GRN 219

E:Mail: quilitzj@ferris.edu

## GRADING POLICY

| | |
|---|---|
| A | 94 - 100 |
| A- | 90 - 93 |
| B+ | 87 - 89 |
| B | 84 - 86 |
| B- | 81 - 83 |
| C+ | 78 - 80 |
| C | 75 - 77 |
| C- | 73 - 74 |
| D+ | 71 – 72 |
| D | 69 - 70 |
| D- | 66 - 68 |
| F | Below 66 |

Classroom Policies:

Late entry may result in being marked absent.

2 Days absence will be excused automatically.

Attendance shall be based on 5 days for the 50 Pts Attendance grade.

Late work will may be reduced by 10% / day

Students are responsible for adhering to University policies as set forth in the Student Handbook. In particular I would invite you to read the section III.A. Academic Misconduct and understand that the minimum penalty for Academic Misconduct is outlined in the Student Handbook. Students caught cheating, falsifying, plagiarizing, or interfering as defined in the Student Handbook will receive a failing grade for the course.

**Office Hours**

M,W,F 10-10:50

W 9-9:50

**Approximate Course Points**

Quizzes (5 @ 10 pts) 50

Online Assessments (10 @ 10 pts ea.) 100

Labs (13@ 30 pts ea.) 390

Exams (4 @ 100) 400

Attendance (5 missed or late days @ 10pts ea.) 50

## Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

I. Terminology
   A. Apply control terminology.
   B. Identify control system components by name.

II. Loop Components
   A. Identify low and high volume pneumatic control systems.
   B. Identify process variable and final control device for a specific control loop.
   C. Identify a open or closed control loop.
   D. Identify a control loop used for safety.
   E. Identify the feedback utilized in a control loop.

III. Elements of a Transfer Function
   A. Apply the following terms:
      a. Throttling range
      b. Proportional gain
      c. Proportional band
      d. Gain
      e. Error
      f. Bias
      g. Setpoint
      h. Signal path, type and terminations

IV. Application of a Transfer Function
   A. Calculate a transfer function for a sensor and then utilize to calibrate the sensor.
   B. Utilize transfer functions to predict signal values for controllers and final control device positions.
   C. Apply setpoint reset to multiple applications

V. Sensors
   A. Apply proper installation, best practice, calibration, handling and termination of sensors of all types.
   B. Plot a sensor response in a computer application.
   C. Create a spreadsheet for calculating and graphing a linear transfer function.

VI. Controllers
   A. Understand the types of controllers (electronic, pneumatic, digital).
   B. Understand the different modes of control (2 position, timed two position, incremental, Proportional (P), Proportional + Integral (PI), Proportional + Integral + Derivative (PID), Proportional + Derivative (PD).
   C. Utilize a tuning process to return a process with an unstable controller to a steady state error.
   D. Identify different loop responses (underdamped, overdamped, critically damped, unstable with increasing amplitude, unstable with constant amplitude)
   E. Examine linear response and response over time of a control loop.

VII. Process Characteristics
   A. Select a controller output based on calculated thermal characteristics of sample spaces.

VIII. Modulating Final Control Devices
   A. Identify the various components that make up a control valve.
   B. Identify the various types of control valves.
   C. Identify the various ways to connect valves to a system.
   D. Identify how various control valves are applied.
   E. Identify the following control valve engineering terms: (size, authority, CV).
   F. Identify the various components that make up a damper.
   G. Identify the various types of dampers.
   H. Identify the various ways to connect dampers.
   I. Identify how various dampers are applied.
   J. Size and select control valves for a sample project.

IX. Documentation
   A. Use control plans and specifications.
   B. Understand changes made to control documentation, including: RFI, bulletin, addendum.
   C. Generate control documentation for a sample project using plans and specs., includes the following documents:
      a. Flow diagram
      b. Point schedule
      c. Wiring detail
      d. Bill of material

**Minimum Required Student Laboratory Activities**

I. **Identify commercial control components for Air Handling, Hot and Chilled Water systems.**

II. **Student will calculate transfer function for several system components.**

III. **Student will examine current control literature and graph sensor functions.**

IV. **Student will perform point verification for multiple HVAC systems.**

V **Student will Commission multiple HVAC systems. Student will use Question and Answer programming to create an Application Specific program. Student will examine Proportional and Integral response in a functional loop.**

VI. **Student will assemble and calibrate a pneumatic control loop. Student will examine loop operation and correct mal-functioning loop.**

FERRIS STATE UNIVERSITY

**COURSE OUTLINE AND SYLLABUS**
**HVAC 321 Air System Select-Design**

Instructor: ................................Professor Mike Feutz, Ph.D.
Office Hours:...........................M & W 11 – noon, and 4 - 5 pm
Office:.....................................GRN 213
Phone:.....................................x 2351
E-mail: ...................................feutzm@ferris.edu
Credits: ...................................4 Hours: 3 lecture hours and 3 lab hours per week
Course Description: ................A study of air systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.
Course Co requisite: ...............Admission to Bachelor of Science in HVAC Engineering Technology and Energy Management (code HVAC)

Required Textbooks (four total):

- ASHRAE Handbooks[1]:
  - *2013 ASHRAE Handbook: Fundamentals, I-P version*. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
  - *2016 ASHRAE Handbook: HVAC Systems and Equipment, I-P version* American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc.
  - *2015 ASHRAE Handbook: HVAC Applications ASHRAE, I-P version.* American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc.
- *Manual Q: Commercial Low Pressure Low Velocity Duct System Design: Theory and Applications, Duct Sizing and Fan Selection.* Air Conditioning Contractors of America. 1990.
- *HVAC DUCT CONSTRUCTION STANDARDS, Metal and Flexible.* Sheet Metal and Air Conditioning Contractors Association (SMACNA). 2009.
  The Third Edition is available to you through FLITE. To download and save your own copy:
  - Access the Library through MyFSU
  - Click on Databases
  - Browse by academic major or topic
  - Click on HVACR
  - Click on Techstreet
  - Log in again (for security reasons)
  - Type "smacna" in the search window
  - Click on SMACNA 1966
  - Click on Read where you see "Available to download"
  - Save to your computer or flash drive

[1] ASHRAE Handbooks are available electronically through FLITE Library at no charge for student use.

Other items required

- Duct Calculator (commonly called a "Ductulator," provided by Ferris)

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Applied Psychrometrics | 6 | 6 |
| III. | Air Diffusion | 6 | 3 |
| IV. | Ductwork | 5 | 3 |
| V. | Air System Pressure Loss Calculations | 3 | 6 |
| VI. | Air System Configurations | 6 | 3 |
| VII. | Fan Selection and Performance | 6 | 6 |
| VIII. | Duct System Design Procedure | 6 | 6 |
| IX. | Air System Testing and Balancing | 3 | 6 |
| X. | Exams | 3 | 6 |
| | | | |
| | Total Hours | 45 | 45 |

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome |
|---|---|
| | |
| I. | Introduction |
| II. | Applied Psychrometrics<br>A. Review basic psychrometrics.<br>B. Apply psychrometrics to the air system design process |
| III. | Air Diffusion<br>A. Determine type, size and location of diffusers and grilles.<br>B. Determine location and size of ventilation air intake.<br>C. Determine location and size of exhaust air grille. |
| IV. | Ductwork<br>A. Calculate cross-sectional area of a duct.<br>B. Calculate velocity of air in a duct.<br>C. Calculate volume of air in a duct.<br>D. Determine space air flow requirements.<br>E. Determine type, size and routing of duct system (including ventilation air intake and exhaust ducts). |
| V. | Air System Pressure Loss Calculations |

| | |
|---|---|
| | A. Find fitting loss coefficients from tabular data.<br>B. Calculate friction loss in a duct system.<br>C. Utilize manufacturer's computer software to calculate duct system friction loss. |
| VI. | Air System Configuration<br>A. Describe the components and operating characteristics of a(n)<br>a. single zone air system.<br>b. terminal reheat air system.<br>c. dual-duct air system.<br>d. Multizone air system.<br>e. variable air volume system.<br>f. variable volume, variable temperature (VVT) system.<br>g. induction air system. |
| VII. | Fan Selection and Performance<br>A. Identify two main categories of fans.<br>a. forward curve fans.<br>b. backward inclined and air foil fans.<br>c. radial blade fans.<br>d. propeller fans.<br>e. vane-axial fans.<br>f. tube-axial fans.<br>B. Select a fan from manufacturer's performance data.<br>C. Use fan laws to plot system curve on fan performance curve.<br>D. Select proper motor horsepower for circulating fan.<br>E. Describe effects of varying fan volume on fan performance curve. |
| VIII. | Duct System Design Procedure<br>A. Utilizing all available information design an air system in its entirety (diffuser to fan). |
| IX. | Air System Testing and Balancing<br>A. Identify and summarize the function of instruments used to balance air systems.<br>B. Determine actual operating characteristics of fans.<br>C. Determine flow rates of air systems using various flow measuring devices.<br>D. Calculate the resistance in a ductwork system. |

## ADDITIONAL COURSE INFORMATION

**Weighting of Student Performance:**

There will be exams and a final exam in this course. The exams are worth 50% of the final grade and are weighted proportionally (an exam worth 150 points is worth more than an exam worth 90 points). The final exam is cumulative and worth 20% of the final grade. Thus, all exams are worth 70% of the total grade.

The laboratories account for 20% of the final grade. Homework accounts for 10% of the final grade. Labs and homework serve as student guide material for the exams.

Students routinely complain that the exam weighting is too low. It is low because students work together on labs, even when instructed to work individually. Thus, it is not possible to assess the work of a single student when scoring labs. The only way to assess individual performance is through tests, where students have no choice but to work alone.

It is recommended that you do your own work on labs. They are the best preparation for tests. If you allow other students to do your thinking for you during lab, you are only hurting yourself and the results will show up during test time.

If you need extra time for tests, you must have a documented learning disability, and you must work with Disability Services (see section on STUDENTS WITH LEARNING DISABILITIES on page 5.

The instructor reserves the right to modify the grading process as deemed necessary.

**SCORING**

| | |
|---|---|
| Homework | 10% |
| Labs | 20% |
| Exams | 50% |
| Final Exam | 20% |
| Total | 100% |

**GRADING SCALE**

| Letter Grade | Equal to or Greater Than | Below |
|---|---|---|
| A | 94% | |
| A- | 90% | 94% |
| B+ | 87% | 90% |
| B | 84% | 87% |
| B- | 80% | 84% |
| C+ | 77% | 80% |
| C | 74% | 77% |
| C- | 70% | 74% |
| D+ | 68% | 70% |
| D | 66% | 68% |
| D- | 65% | 66% |
| F | 0% | 65% |

## STUDENTS WITH LEARNING DISABILITIES

If you have a learning disability, contact Disability Services at https://ferris.edu/HTMLS/colleges/university/disability/. They are located at Starr 313. You can contact them by phone (231) 591-3057. If you want to contact them by email, follow the link above and then use the link of their homepage.

## CLASS COURTESY

It is unfortunate that this section even needs to be written, but experience has proven the need to explain what is meant by common courtesy in the classroom.

RESPECT: We will treat each other with mutual respect. I respect you as a student and as a person, and I am here because I want you and your fellow students to be successful. Because I respect you, I will not purposely embarrass you in class unless you are acting in a disrespectful manner that causes me to take action. Your respect for your fellow students and for me will be shown through your consideration of others. The items listed below describe disrespectful behavior and the consequences for such behavior.

CELL PHONES & PORTABLE ELECTRONIC DEVICES: Under no circumstances are you allowed to use phones and/or portable electronic devices of any kind in the classroom or laboratory. If you must take a phone call, you must let me know before class that you are expecting an important call, and then step out during class or lab to take the call. If you use your phone or portable electronic device during class, it will be confiscated. You may pick it up at the end of class. If you use your phone or portable electronic device a second time, it will again be confiscated and will be returned to you after you have met with the dean and explain why your device was confiscated. The device will be returned once I receive notice from the dean that you are authorized to get it back. If you use a phone or portable electronic device for a third time, you will receive a grade of "F" for the semester. You are welcome to attend the class for the remainder of the semester, but will not have the opportunity to improve your grade.

SLEEPING IN CLASS: While in class, you are expected to be awake and alert. If you fall asleep during class, you will be asked to leave the class.

TALKING IN CLASS: While lecture is taking place, you are expected to be attentive and quiet. Class participation is encouraged, but individual conversations are not allowed. If you are engaged in a private conversation during lecture, it is disruptive to other students and disrespectful to them and to me. If you are talking, I will ask you to stop. If you continue, I will ask you to leave the classroom. If you persist throughout the semester, I will change your seating assignment. If it continues to be a problem, I will ask you to meet with the dean.

ATTITUDE: For whatever reason, you have been assigned to this class. If you find it to be of no interest to you, that is your prerogative. However, you must respect that others are interested in the class and are working to learn the material. You must not let your lack of interest stand in the way of their learning. If students begin to complain to me about your attitude, I will document the complaints and then I will meet with you to discuss the situation. If improvements are not made, I will turn the matter over to student judicial services.

## Test Taking

Tests can only be taken during scheduled test time. If you miss a test, you will receive a zero for that test.

**Exceptions**: If you know you cannot make it to class on a test date, you must receive prior permission to take the test at another time. It will be up to my discretion to grant or deny a reschedule. This means that you must communicate with me before the test, and you must receive a response back from me. This does not mean that you can leave an email, phone, text or any other type of message with me. I must be able to acknowledge your request before it can be granted.

There are extenuating circumstances. If you have a car accident, a death in the family, an illness, or some other crisis of a nature that cannot be predicted or avoided, you must provide written proof. It will be your burden to convince me that you have a valid reason for missing the test.

**Rationale**: When you miss a test and take it at a later time, it prevents me from handing the test back to the rest of the class until you have finished your test. More importantly, you are in college, and it is important for you to realize the importance of fulfilling your obligations to yourself. Tests are not to be taken lightly.

Excerpts from

**Ferris State University**
**Code of Community Standards (Student Handbook)**

http://www.ferris.edu/htmls/administration/StudentAffairs/Studenthandbook/06HandbookMaster.pdf

## 20 Section III: General University and Housing Policies Regarding Misconduct

### *A. Academic Misconduct*

The university may discipline a student for academic misconduct, which is defined as any activity that tends to undermine the academic integrity of the institution. Academic misconduct includes, but is not limited to, the following:

**1. Cheating**

A student may not use unauthorized assistance, materials, information, or study aids in any academic exercise, neither should they give assistance, materials, information, or study aids in any academic exercise, including but not limited to the following:

a. A student must not use or give external assistance on any "in-class" or "take-home" examination, unless the instructor has specifically authorized external assistance. This prohibition includes, but is not limited to, the use of tutors, books, notes, and calculators.

b. A student must not use another person as a substitute in the taking of an examination or quiz.

c. A student must not steal examinations or other course materials.

d. A student must not allow others, offer to conduct research, or to prepare work for him/her without advance authorization from the instructor for whom the work is being submitted. Under this prohibition, a student must not make any unauthorized use of materials obtained from commercial term paper companies or from files of papers prepared by other persons.

e. A student must not collaborate with other persons on a particular project and submit a copy of a written report, which is represented explicitly or implicitly as the student’s individual work.

f. A student must not use or give any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.

g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor to whom the work is being submitted.

h. A student must not alter a grade or score in any way.

**2. Fabrication**

A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citations of the sources of information.

**3. Facilitating Academic Dishonesty**

A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct.
A student is responsible for taking reasonable precautions to ensure his or her work is not accessed by or transferred to another individual wherein it may then be used to commit an act of academic misconduct.

**4. Interference**

a. A student must not steal, change, destroy, or impede another student's work. Impeding another student's work includes, but is not limited to: the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.
b. A student must not give or offer a bribe, promise favors, or make threats with the intention of affecting a grade or the evaluation of academic performance.

**5. Plagiarism**

A student must not adopt or reproduce ideas, words, or statements of another person without appropriate acknowledgment. A student must give credit to the originality of others and acknowledge indebtedness whenever he or she does any of the following:

a. Quotes another person's actual words, either oral or written;
b. Paraphrases another person's words, either oral or written;
c. Uses another person's idea, opinion, or theory; or
d. Borrows facts, statistics, or other illustrative material, unless the information is common knowledge.

**6. Violation of Course Rules**

A student must not violate course rules as contained in a course syllabus which are rationally related to the content of the course or to the enhancement of the learning process in the course.

## Section IV: Administrative Policies

Student sanctions in the Ferris State University Code of Community Standards Administrative Policies and Procedures specifically include official reprimands, behavioral contracts, disciplinary probation, suspension from the University, or dismissal from the University without opportunity to enroll in the future. In addition, these include the opportunity for other sanctions to be imposed, such as the requirement or reimbursement for damages, loss of special privileges, or participation in campus provided educational programs.

The University considers involvement in the student judicial process to be part of a student's learning experience. Through a system of progressive discipline, it is anticipated that a student will realize the importance of functioning within the University's policies, procedures, and regulations. Though every case involving the violation of University policies or procedures is considered on the basis of the merits in that case, there are some categories of violations for which the anticipated sanction would be suspension or dismissal from the University. Such serious infractions include but are not limited to the distribution of alcohol to minors, distribution of illegal drugs or the use, possession, or distribution of alcohol or illegal drugs that result in a serious safety or health matter for any member of the campus or local community.

The following policies have been set forth by the faculty of the HVACR Department for your protection and well-being. Consequences for policy violations may affect your grade, according to your professor's syllabus. Consequences for violations are listed in the policy, giving you the information you need to make informed decisions. As a college student and an adult, you are responsible for your own actions and can make your own decisions. Please be responsible and make good decisions!

BEVERAGES: Beverages are allowed in computer labs.

ALCOHOL: You will not be allowed to attend class if you are under the influence of alcohol. If you are suspected of being under the influence of alcohol, your professor will call Public Safety and ask them to administer a Preliminary Breath Test (PBT). Under zero tolerance guidelines, anyone with a level of 0.02% alcohol or above will be removed from class and the absence will be counted as unexcused. Anyone with a percentage of alcohol above the legal limit will also face prosecution.

TOBACCO: You will not be allowed to consume tobacco products of any kind while in the Granger Center. This included chewing tobacco.

ATTENDANCE: Tardiness and/or absences will affect your grade, according to your professor's attendance policy. Violations of any policies in this document that include an unexcused absence could reduce your grade.

CELL PHONES: Cell phones are not allowed during class. They must be turned off. If you are expecting an emergency call (medical, call from car repair, etc.) you must notify your professor before class and put your phone on vibrate. Cell phone use is not allowed during a test under any circumstances, including use as a calculator.

CALCULATORS: Cell phone calculators are not allowed during tests. A minimum of a scientific calculator is required for test taking.

Name<br>Class<br>Professor<br>Assignment<br>Date

HOMEWORK AND SUBMITTALS:

1. All papers and drawings are to be formatted according to the following guidelines:
2. All computer-generated documents are to be word processed using Microsoft Word or a similar product.
   FONT: Times New Roman
   FONT SIZE: 12 Pt
   LINE SPACING: Double
   PARAGRAPH SPACING: Double
   MARGINS (as in Word default)
   - Top 1
   - Bottom 1
   - Left 1.25
   - Right 1.25

   PAPER COLOR: White
3. Title Block and paper heading: At the top of each paper that you submit, include the information as listed at the top of this page. This is to be right-aligned and single spaced. It is suggested that you develop a template to be used for all submittals. You will only need to fill in the information for the assignment and date for each new submittal.

FERRIS STATE UNIVERSITY

**COURSE OUTLINE AND SYLLABUS**
**HVAC 325 HVAC Hydronic System Selection & Design**

Instructor: ................................Professor Mike Feutz, Ph.D.
Office Hours:...........................T-R, 9:15 – 11:00 am
Office:.....................................GRN 213
Phone:.....................................x 2351
E-mail: ...................................feutzm@ferris.edu
Credits: ...................................4 Hours: 3 lecture hours and 3 lab hours per week
Course Description: ................A study of water systems used in commercial and industrial buildings. Course emphasizes system design, equipment and component selection and selected problems and solutions. Instrumentation, testing and balancing will be emphasized for optimum energy conservation and maximum comfort.
Course prerequisites: ..............C- or better in HVAC 321, HVAC 342, MATH 126
Required Textbooks (four total):

- ASHRAE Handbooks (available online through FLITE):
  - *2013 ASHRAE Handbook: Fundamentals, I-P version*. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
  - *2012 ASHRAE Handbook: HVAC Systems and Equipment, I-P version* American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc.
  - *2011 ASHRAE Handbook: HVAC Applications ASHRAE, I-P version.* American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc.
- *Autodesk® Revit® 2016MEP Fundamentals Student Guide*
- *HVAC 325 Course Pack (available in Blackboard)*
- B&G System Syzer (provided by Ferris)

Final Exam: ............................The final exam for this course is scheduled according to normal meeting time as follows:

| | | | |
|---|---|---|---|
| 8:00 am | T combinations | Thur, May 3 | 8-9:40 am |

The final exam schedule for the entire university can be found in MyFSU

## Instructional Unit Topic Descriptions and Time Allocations

| NO. | Unit Topic Description Summary | Lecture Hours | Lab Hours |
|---|---|---|---|
| I. | Introduction | 1 | 0 |
| II. | Hydronic System Definition and Classification | 2 | 3 |
| III. | Terminal Devices | 6 | 3 |
| VI. | Hydronic System Design Procedure | 12 | 15 |
| V. | Flow Control Devices | 9 | 6 |
| VI. | Pumps | 9 | 6 |
| VII. | Balancing Hydronic Systems | 3 | 6 |
| VIII. | Exams | 3 | 6 |
| | Total Hours | 45 | 45 |

## Learning Outcomes for Each Instructional Unit

Upon Completion of each Instructional unit, the learner will be able to satisfactorily:

| NO. | Outcome |
|---|---|
| I. | Introduction |
| II. | Hydronic System Definition and Classification<br>A. Classify hydronic systems based upon flow generation, temperature, pressure, piping and pumping arrangement.<br>B. Explain the advantages and disadvantages of various piping and pumping arrangements.<br>C. Calculate primary and secondary flowrates and temperatures in primary-secondary pumping arrangements. |
| III. | Terminal Devices<br>A. Determine type, size and location of finned tube radiation units.<br>B. Determine type, size and location of hot water convector units.<br>C. Determine type, size and location of cabinet unit heaters.<br>D. Determine type, size and location of unit heaters. |
| IV. | Hydronic System Design Procedure<br>A. Select terminal devices based on load requirements and calculate the required flow of water for each temperature control zone.<br>B. Determine pipe size required to carry desired water flowrate based upon friction loss and velocity.<br>C. Calculate equivalent length of pipe fittings in piping network.<br>D. Calculate friction loss of piping circuits.<br>E. Determine pressure losses of equipment and terminal units from manufacturer's data.<br>F. Calculate total head loss in closed loop piping systems.<br>G. Use pump affinity laws to plot system curve on pump performance curve for closed loop piping system.<br>H. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>I. Calculate total head loss in open piping systems. |

| | |
|---|---|
| | J. Use pump affinity laws to plot system curve on pump performance curve for open loop piping system.<br>K. Select a circulating pump from manufacturer's performance data for closed loop piping system.<br>L. Select proper motor horsepower for circulating pump from manufacturer's performance data.<br>M. Develop parallel pump performance curves and identify operating points.<br>N. Develop series pump performance curves and identify operating points.<br>O. Analyze the effects of glycol on pump performance.<br>P. Determine the type, size and location of the system expansion tank.<br>Q. Utilize manufacturer's computer software to calculate piping system friction loss.<br>R. Utilize manufacturer's computer software to select proper circulating pump.<br>S. Utilize manufacturer's computer software to select proper expansion tank size. |
| V. | Flow Control Devices<br>A. Explain the application of various service valves in hydronic systems.<br>B. Explain the relationship between heat transfer, temperature differential and flow through a terminal convection element.<br>C. Explain the relationship between valve port configuration and stem travel.<br>D. Explain the relationship between energy transfer and valve stem travel for various valve types.<br>E. Define the control flow coefficient (Cv).<br>F. Select two-way modulating and three-way mixing and diverting valves using the flow coefficient (Cv). |
| VI. | Pumps<br>A. Identify the components and summarize the operation of a centrifugal pump.<br>B. Explain the relationship between flowrate and total dynamic head in a closed hydronic system.<br>C. Explain the difference between open and closed hydronic systems. |
| VII. | Balancing Hydronic Systems<br>A. Identify and summarize the function of instruments used to balance hydronic systems.<br>B. Determine circulating pump impeller size.<br>C. Determine actual operating characteristics of circulating pump.<br>D. Determine flow rates of hydronic circuits using various flow measuring devices.<br>E. Calculate resistance necessary to pre-balance hydronic circuit.<br>F. Determine new impeller size to produce required flowrate. |

## ADDITIONAL COURSE INFORMATION

### Weighting of Student Performance:

There will be exams and a final exam in this course. The exams are worth 50% of the final grade and are weighted proportionally (an exam worth 150 points is worth more than an exam worth 90 points). The final exam is cumulative and worth 20% of the final grade. Thus, all exams are worth 70% of the total grade.

The laboratories account for 20% of the final grade. Homework accounts for 10% of the final grade; however, the homework (if done properly) acts as student guide material for the exams.

The instructor reserves the right to modify the grading process as deemed necessary if issues or situations arise in the future.

### SCORING

Homework .................... 10%
Labs ............................... 20%
Exams ............................ 50%
Final Exam ................... 20%
Total............................ 100%

### GRADING SCALE

| Letter Grade | Equal to or Greater Than | Below |
|---|---|---|
| A | 94% | |
| A- | 90% | 94% |
| B+ | 87% | 90% |
| B | 84% | 87% |
| B- | 80% | 84% |
| C+ | 77% | 80% |
| C | 74% | 77% |
| C- | 70% | 74% |
| D+ | 68% | 70% |
| D | 66% | 68% |
| D- | 65% | 66% |
| F | 0% | 65% |

## CLASS COURTESY

It is unfortunate that this section even needs to be written, but experience has proven the need to explain what is meant by common courtesy in the classroom.

RESPECT: We will treat each other with mutual respect. I respect you as a student and as a person, and I am here because I want you and your fellow students to be successful. Because I respect you, I will not purposely embarrass you in class unless you are acting in a disrespectful manner that causes me to take action. Your respect for your fellow students and for me will be shown through your consideration of others. The items listed below describe disrespectful behavior and the consequences for such behavior.

CELL PHONES & PORTABLE ELECTRONIC DEVICES: Under no circumstances are you allowed to use phones and/or portable electronic devices of any kind in the classroom or laboratory. If you must take a phone call, you must let me know before class that you are expecting an important call, and then step out during class or lab to take the call. If you use your phone or portable electronic device during class, it will be confiscated. You may pick it up at the end of class. If you use your phone or portable electronic device a second time, it will again be confiscated and will be returned to you after you have met with the dean and explain why your device was confiscated. The device will be returned once I receive notice from the dean that you are authorized to get it back. If you use a phone or portable electronic device for a third time, you will receive a grade of "F" for the semester. You are welcome to attend the class for the remainder of the semester, but will not have the opportunity to improve your grade.

SLEEPING IN CLASS: While in class, you are expected to be awake and alert. If you fall asleep during class, you will be asked to leave the class.

TALKING IN CLASS: While lecture is taking place, you are expected to be attentive and quiet. Class participation is encouraged, but individual conversations are not allowed. If you are engaged in a private conversation during lecture, it is disruptive to other students and disrespectful to them and to me. If you are talking, I will ask you to stop. If you continue, I will ask you to leave the classroom. If you persist throughout the semester, I will change your seating assignment. If it continues to be a problem, I will ask you to meet with the dean.

ATTITUDE: For whatever reason, you have been assigned to this class. If you find it to be of no interest to you, that is your prerogative. However, you must respect that others are interested in the class and are working to learn the material. You must not let your lack of interest stand in the way of their learning. If students begin to complain to me about your attitude, I will document the complaints and then I will meet with you to discuss the situation. If improvements are not made, I will turn the matter over to student judicial services.

### Test Taking

Tests can only be taken during scheduled test time. If you miss a test, you will receive a zero for that test.

**Exceptions**: If you know you cannot make it to class on a test date, you must receive prior permission to take the test at another time. It will be up to my discretion to grant or deny a reschedule. This means that you must communicate with me before the test, and you must receive a response back from me. This does not mean that you can leave an email, phone, text or any other type of message with me. I must be able to acknowledge your request before it can be granted.

There are extenuating circumstances. If you have a car accident, a death in the family, an illness, or some other crisis of a nature that cannot be predicted or avoided, you must provide written proof. It will be your burden to convince me that you have a valid reason for missing the test.

**Rationale**: When you miss a test and take it at a later time, it prevents me from handing the test back to the rest of the class until you have finished your test. More importantly, you are in college, and it is important for you to realize the importance of fulfilling your obligations to yourself. Tests are not to be taken lightly.

**EXCERPTS FROM**

**Ferris State University**
**Code of Community Standards (Student Handbook)**

http://www.ferris.edu/htmls/administration/StudentAffairs/Studenthandbook/06HandbookMaster.pdf

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SAFETY GLASSES: You are required to wear your own safety glasses in all equipment labs at all times. This includes mechanical rooms and the energy lab when the equipment is operating. This does not include computer labs. Guests touring the Granger Center will be provided with safety glasses to wear while in rooms with operating equipment or with students working on equipment.

FOOT WEAR: You are required to wear closed toe shoes at all times in labs (except computer labs). No sandals are allowed. If you do not have proper footwear, you will be asked to leave and the absence will be counted as unexcused.

FOOD: Food is not allowed in computer labs, including snacks. If you have food in a computer lab you will be asked to dispose of the food, or leave the lab immediately.

BEVERAGES: Beverages are allowed in computer labs.

TOOLS: All associate degree students are required to provide their own tools and have them available for each lab session. If you attend class without your tools, you will be denied access to the lab and your absence will be counted as unexcused.

ALCOHOL: You will not be allowed to attend class if you are under the influence of alcohol. If you are suspected of being under the influence of alcohol, your professor will call Public Safety and ask them to administer a Preliminary Breath Test (PBT). Under zero tolerance guidelines, anyone with a level of 0.02% alcohol or above will be removed from class and the absence will be counted as unexcused. Anyone with a percentage of alcohol above the legal limit will also face prosecution.

TOBACCO: You will not be allowed to consume tobacco products of any kind while in the Granger Center. This included chewing tobacco.

ATTENDANCE: Tardiness and/or absences will affect your grade, according to your professor's attendance policy. Violations of any policies in this document that include an unexcused absence could reduce your grade.

CELL PHONES: Cell phones are not allowed during class. They must be turned off. If you are expecting an emergency call (medical, call from car repair, etc.) you must notify your professor before class and put your phone on vibrate. Cell phone use is not allowed during a test under any circumstances, including use as a calculator.

Name<br>Class<br>Professor<br>Assignment<br>Date

HOMEWORK AND SUBMITTALS:

1. All papers and drawings are to be formatted according to the following guidelines:
2. All computer-generated documents are to be word processed using Microsoft Word or a similar product.
   FONT: Times New Roman
   FONT SIZE: 12 Pt
   LINE SPACING: Double
   PARAGRAPH SPACING: Double
   MARGINS (as in Word default)
      Top 1
      Bottom 1
      Left 1.25
      Right 1.25
   PAPER COLOR: White

3. Title Block and paper heading: At the top of each paper that you submit, include the information as listed at the top of this page. This is to be right-aligned and single spaced. It is suggested that you develop a template to be used for all submittals. You will only need to fill in the information for the assignment and date for each new submittal.

***Course:*** ***HVAC415***

**Term:** Fall, 2017

**Course Credits:** 4 semester credit hours

Required Text & Course Materials:

There is no required textbook for this course. We will use information sheets and links to publicly available internet resources.

**Instructor:** J. Eric Quilitzsch, Associate Professor

**Email:** quilitzj@ferris.edu

**Address:** 219 Granger Ferris State University

605 S. Warren Big Rapids, Mi 49307

**Phone:** 231.591.2747

**Office:** GRN 219

Tuesday / Thursday 9:30AM – 10:50 AM

1:20 PM – 1:50 PM

Chat sessions can be scheduled at your request.

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## Course Description

This is the second of the two controls courses in the HVACR Technology program. The focus of the second course is on Digital Control Systems. We will be exploring components and programming of digital control systems.

The main modules of the course are:

| |
|---|
| Flowcharting |
| Numbering Systems |
| Binary Logic |
| Microcomputers |
| HVAC Sequences |
| Programming |

## About the Instructor / Course Author

Associate Professor Eric Quilitzsch received B.S. and A.A.S degrees in HVACR Technology from Ferris State University. He also holds a Master of Science degree in Information Systems Management from Ferris State University. Mr. Quilitzsch has 5 years commercial and industrial HVACR service experience, where he earned journeyman status with the United Association and spent 5 years with Johnson Controls Inc. in West Michigan where he installed, engineered, and managed temperature control projects. Professor Quilitzsch has been with FSU since 2002.

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## Weekly Schedule

The electronic week for HVAC415 online begins on Tuesday (Day 1) and ends on Monday (Day 7). All assignments are due by 11:59 PM on their date due. Please check the course calendar and the weekly assignments for possible changes each week. Due dates and Release dates may overlap on Day 1.

Week 15 is a short week and the due dates will be adjusted accordingly.

| |
|---|
| Day 1- Tuesday<br>Day 2- Wednesday<br>Day 3- Thursday<br>Day 4- Friday<br>Day 5- Saturday<br>Day 6- Sunday<br>Day 7- Monday |

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## Assignments and Labs

The main assignments within the course are:

| Assignments /Quizzes | Labs |
|---|---|
| Lab 1<br>Assessment 2<br>Lab 2<br>Lab 3<br>Exam1<br>Assessment 4<br>Lab 4<br>Lab 5<br>Assessment 6<br>Lab 6<br>Exam 2<br>Lab 7<br>Assessment 8<br>Lab 8<br>Lab 9<br>Exam 3<br>Assessment 10<br>Lab 10<br>Lab 11<br>Assessment 12<br>Lab 12<br>Final Exam | Lab 1 - Flowcharting<br>Lab 2 - Flowcharting<br>Lab 3 Binary logic<br>Lab 4 Binary Logic<br>Lab 5-12 Programming |

**Late Assignments:** The Ferris Connect shell has two late work assignment drop boxes. You may submit one assignment or assessment (excluding exams) in each drop box up to the 10th of December. The grade for the missing assignment will be zero and the late work drop box will display the grade for each late assignment. There are no point deductions for the two late assignments and no additional late assignments or assessments will be accepted.

**Feedback on Assignments:** Usually, you will receive feedback on the graded assignments within seven days of the due date for the assignment. Please be sure you check your work before submitting it, spelling and grammar needs to be correct.

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## Grading

The grading for this course is as follows:

| Letter Grade | Percentage | Assignment | Points |
|---|---|---|---|
| A | 94-100 | Lab 1 | 30 |
| A- | 90-94 | Assessment 2 | 20 |
| B+ | 87-90 | Lab 2 | 30 |
| B | 84-87 | Lab 3 | 30 |
| B- | 81-84 | Assessment 4 | 20 |
| C+ | 78-81 | Lab 4 | 30 |
| C | 75-78 | Lab 5 | 30 |
| C- | 73-75 | Assessment 6 | 20 |
| D+ | 71-73 | Lab 6 | 30 |
| D | 69-71 | Lab 7 | 30 |
| D- | 66-69 | Assessment 8 | 20 |
| F | less than 66 | Lab 8 | 30 |
| | | Assessment 10 | 20 |
| | | Lab 10 | 30 |
| | | Lab 11 | 30 |
| | | Assessment 12 | 20 |
| | | Exam 1 | 120 |
| | | Exam 2 | 120 |
| | | Exam 3 | 120 |
| | | Final Exam | 120 |

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## Communication

E-mail is the preferred method.

Personal questions and/or concerns, please use my campus e-mail address (quilitzj@ferris.edu)

You may post questions for your classmates in the Ferris Connect discussion area under the main topic.

If you require a prompt response, email the professor or call during the office hours.

I will either reply individually to questions or copy the reply to all students as is appropriate.

## Expectations for Students

This course is arranged in sequence. In order to get the most out of the course, you will need to follow the readings, lectures and assignments in the order presented. Each module is arranged according to a specific task. The task must be completed to show competency in the subject matter. The course is designed to be completed in fifteen weeks. For the most part, a major topic will be completed each week. You will be expected to keep pace with the course. A schedule of course activities is located in the calendar and in the course content

College courses, particularly those delivered online, like employment require developing good time management skills. This course makes extensive use of the Ferris Connect Calendar to assist students in managing the various readings, lecture topics, exams, and assignment deadlines. From the day you begin the course, you have access to every due date and exam date. This is intended to help you budget your time, so you will be prepared to successfully execute each exam or assignment. It is your responsibility to meet these deadlines. Acceptance of late papers and/or penalties are at the discretion of the instructor.

| |
|---|
| You will be expected to keep pace with the course.<br><br>It is your responsibility to meet assignment deadlines. |

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## *Writing Proficiency*

Assignments with more than four (4) combined spelling or grammar errors will not be read, but will returned to the student to be rewritten and re-submitted.

**Please note**: Any student found to have significant writing deficiencies will be required to use the services of the University Writing Center to improve to a satisfactory level.

## *Academic Honesty*

Follow University standards for student dignity.

Students are responsible for adhering to University policies as set forth in the Student Handbook. In particular I would invite you to read the section III.A. Academic Misconduct and understand that the minimum penalty for Academic Misconduct is outlined in the Student Handbook. Students caught cheating, falsifying, plagiarizing, or interfering as defined in the Student Handbook will receive a failing grade for the course.

Academic Dishonesty in an online learning environment can involve:

Having a tutor or friend complete a portion of your assignments

Having a reviewer make extensive revision to an assignment

Copying work submitted by another student to a public class meeting

Using information from an online information services without proper citation.

## *Ferris Connect Course Tools*

This course makes use of Ferris Connect Tools to assist students in managing the various readings, view lecture topics, take exams, and complete assignments.

**Calendar:** The online calendar shows each week's topic and the associated reading. Also posted are dates for exams, and completion dates for homework.

**Learning Modules:** A Ferris Connect Learning Module can consist of a number of pages of content such as lecture notes, assignments, charts, tables and quizzes. Your course instructor will have created your Content Modules for you. When you first look at a Content Module, you see an outline, representing the content pages. These are usually organized into the sequence in which you are expected to complete them. To view a content page, click its hyperlink.

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**Online Course Support Numbers:** Ferris State University 231.591.4822.

FERRIS STATE UNIVERSITY

**COURSE OUTLINE AND SYLLABUS**
**HVAC 483 HVACR Building Systems**

Instructor: ................................Professor Mike Feutz, Ph.D.
Office Hours:...........................T-R, 9:15 – 11:00 am, W noon – 1:00 pm
Office:.....................................GRN 213
Phone:.....................................x 2351
E-mail: ..................................feutzm@ferris.edu
COURSE DESCRIPTION:....HVACR systems and controls found in commercial and industrial buildings for facility managers: energy utilization, utility rates, and building management systems that optimize comfort and reduce energy costs for buildings. Includes site visitations and reports.
Credit Hours:...........................3: Lecture, 3 hours/week
Prerequisites:...........................None
Textbooks Required: ............HVAC 483 Course pack.
Final Exam: .............................The final exam for this course is scheduled according to normal meeting time as follows:

| | | | |
|---|---|---|---|
| 12:00 pm | T combinations | Tues, May 3 | 12-1:40 pm |

The final exam schedule for the entire university can be found in My FSU

**MINIMUM REQUIRED STUDENT LEARNING ACTIVITIES:**

Given lecture notes, reading assignments, handouts and field trip experience, students will:

A. describe the energy sources that are available to buildings and identify the benefits and limitations of each energy source discussed.

B. breakdown and understand utility billing, the effects of various charges on energy budgets and the importance of working with utilities to ensure minimum charges.

C. select energy sources from calculated economic analysis, including annual cost of operation.

D. describe the types of co-generation systems, their application and economic advantages including payback relative to utility billings, rate structure and buy-back of power.

E. tour a power plant and file a report on the efficiency of the plant and rationale for the type of energy used and produced.

F. qualify and quantify "human comfort" and describe the implication on HVAC systems.

G. identify some problems, solutions and regulations relative to indoor air quality (IAQ) and the describe influence of IAQ on the HVAC building systems, the office environment and sick building syndrome.

H. develop a working knowledge of Psychrometrics as applied to HVAC processes and human comfort.

I. perform an economic analysis on energy costs of building applications through heat loss/gain load calculations, and relate energy savings to envelope, ventilation and temperature setting standards.

J. identify the major components found in an HVAC system and describe the function of the components in relationship to the entire HVAC system.

K. identify the different types of HVAC systems found in buildings and describe the advantages/disadvantages/special needs in reference to selected applications such as open office plan flexibility, clean rooms, etc.

L. describe control sequences, components and loops of HVAC systems.

M. describe energy conservation and management strategies, their application and economic advantages (payback) relative to utility billings and rate structure.

N. describe strategies, programs, and the short- and long-term economic impact of preventative maintenance related to HVAC building systems.

O. describe and be able to locate information on codes, ordinances and regulations that effect the installation, operation and maintenance of HVACR building systems.

P. describe criteria, including licensure/certification requirements used to hire contractors/vendors/staff for HVACR building system installation, operation and maintenance.

TOPICAL OUTLINE OF UNITS OF INSTRUCTION:

*A.* Develop a working knowledge of energy sources that are available to buildings and identify the benefits and limitations of energy sources.

A-1. Develop a working knowledge of electrical energy sources.
- A-1-1. Explain electrical generation by inductance.
- A-1-2. Describe methods of generating electricity including hydroelectric, solar, nuclear, fossil fuel and co-generation.
- A-1-3. Compare and contrast single phase verses three-phase electricity.
- A-1-4. Calculate values for amperage, voltage and ohms using Ohm's Law.
- A-1-5. Calculate values for watts, volts and amps using Watt's Law.
- A-1-6. Describe the application/advantage of various voltages of electrical supply.
- A-1-7. Differentiate between voltage, amperage, resistance, real power (watts), apparent power (volt-amps), reactive power (volt-amps reactive), watt-hour, capacitance and inductance.
- A-1-8. Calculate power factor.
- A-1-9. Calculate transmission losses using Ohm's and Watt's Law.
- A-1-10. Convert electrical power (watt) to btu.
- A-1-11. Differentiate between energy and power.
- A-1-12. List safety concerns relating to the use of electricity.

A-2. Develop a working knowledge of natural gas.
- A-2-1. Explain the origin of natural gas (methane).
- A-2-2. Describe the method of producing usable natural gas.
- A-2-3. Detail the distribution of natural gas.
- A-2-4. List typical applications for natural gas.

- A-2-5. List advantages and disadvantages of natural gas.
- A-2-6. List safety concerns relating to the use of natural gas.

A-3. Develop a working knowledge of fuel oil.

- A-3-1. Explain the origin of fuel oil.
- A-3-2. Describe the method of producing usable fuel oil.
- A-3-3. List applications for various weights of fuel oil.
- A-3-4. Detail the distribution of fuel oil.
- A-3-5. Define fuel oil terms such as grade, weight, gallon and heat rate.
- A-3-6. List advantages and disadvantages of fuel oil.
- A-3-7. List safety concerns relating to the use of fuel oil.

A-4. Develop a working knowledge of liquefied petroleum gas.

- A-4-1. Explain the origin of liquefied petroleum gas.
- A-4-2. Describe the method of producing usable liquefied petroleum gas.
- A-4-3. Detail the distribution of liquefied petroleum gas.
- A-4-4. Define liquefied petroleum gas terms such as pound, gallon and heat rate.
- A-4-5. List typical applications for liquefied petroleum gas.
- A-4-6. List advantages and disadvantages of liquefied petroleum gas.
- A-4-7. List safety concerns relating to the use of liquefied petroleum gas.

A-5. Develop a working knowledge of biomass fuel.

- A-5-1. Define biomass fuels.
- A-5-2. List applications for biomass fuels.

A-6. Develop a working knowledge of coal as a fuel

- A-6-1. Explain the origin of coal.
- A-6-2. Describe the method of producing usable coal.
- A-6-3. Define coal terms such as pound, ton and heat rate.
- A-6-4. List typical applications for coal.
- A-6-5. List advantages and disadvantages of coal.
- A-6-6. List safety concerns relating to the use of coal.

B. Develop a working knowledge of utility billing and charges from utilities for building usage.

B-1. Analyze electrical utility billing and charges.

- B-1-1. Recognize electrical utility billing terms such as energy charge, capacity charge (billing demand), on-peak, off-peak, cost recovery factor (base rate adjustment), surcharge, customer charge, industrial, commercial, demand management, power factor, ratchet clause, time of day, primary voltage, secondary voltage, and rate codes.

B-2. Analyze Consumers Energy electrical bills for the following rates:

- B-2-1. General Service Secondary Rate B& B-1 (020 & 042).
- B-2-2. General Service Secondary Rate C (021 & 721).
- B-2-3. General Service Primary Rate D (028).

B-3. Predict the optimum electrical rate given historical energy consumption and power demand for a one year time period.

B-4. Analyze natural gas utility billing and charges

B-4-1. Define natural gas terms such as cf, ccf, mcf, therm and heat rate.

C. Select energy sources from calculated economic analysis.

C-1. Calculate annual cost of operation given load calculations, cost per unit of energy, equipment efficiency and hours of operation for electricity, natural gas, propane and fuel oil using steady state and bin load methods.

D. Describe the types of co-generation systems, their application and economic advantages including payback relative to utility billings, rate structure and buy-back of power (see Economic Analysis).

E. Field Trip: Students will have the opportunity to visit site installations of energy sources and report why it was used for that particular installation (FSU Co-generation site)

E-1. Calculate life cycle cost of operation given load calculations, cost per unit of energy, equipment efficiency, equipment cost, equipment life expectancy, equipment maintenance costs and hours of operation for electricity and natural gas using the FSU Co-generation site.

F. Qualify and quantify "Human Comfort". Describe the impact of human comfort on the type of HVAC system chosen and identify the limitations of the systems for various installations, particularly in terms of IAQ.

F-1. Qualify and quantify human comfort relative to

F-1-1. Human physiology
F-1-2. Human heat balance
F-1-3. Metabolism, quantified in met units
F-1-4. Clothing, quantified in clo value
F-1-5. Mean radiant temperature
F-1-6. Thermal Comfort Standards

G. Understand Indoor Air Quality problems, sources and solutions.

G-1. History:

G-2. Agents effecting indoor air quality:

G-3. Biological

G-3-1. By-products of respiration
G-3-2. Bacterial / fungal

G-4. Chemical

G-4-1. Volatile organic compounds (VOC's)
G-4-2. By-products of combustion
G-4-3. Radon

G-5. Particulates

G-5-1. Smoke

G-5-2. Dust
G-5-3. Allergens
G-5-4. Fibers

G-6. Current building evaluation for baseline:

H. Describe environmental factors affecting human comfort.
H-1-1. Psychrometric conditions
H.1.1.1. Temperature (dry bulb)
H.1.1.2. Wed bulb
H.1.1.3. Humidity (relative humidity)
H.1.1.4. Enthalpy
H.1.1.5. Specific volume
H.1.1.6. Comfort zone
H-1-2. Rate of change

I. Analyze energy costs of building applications.

I-1. Develop a working knowledge of HVACR terms, nomenclature and basic thermodynamic principles
I-1-1. Definition of terms
I-1-2. Abbreviations & acronyms
I-1-3. Heat transfer formulae for convection and conduction used by the energy engineer
I.1.3.1. Conduction through building envelope materials
I.1.3.2. Energy quantity calculation
I.1.3.3. Energy transportation by air
I.1.3.4. Energy transportation by water

I-2. Calculate
I-2-1. Building heat loss and heat gain.
I-2-2. Sensible and latent heat loads using Psychrometric charts.
I-2-3. Building lighting load based on hours of occupancy and type of lights used.

I-3. Compare the cost of lighting using various types of lamps as the light source.

I-4. Relate energy savings to temperature setting standards.

I-5. Relate energy savings to building envelope standards.

I-6. Relate energy savings to various maintenance strategies.
I-6-1. Filter changes
I-6-2. Equipment lubrication
I-6-3. Equipment cleaning
I-6-4. Belt inspection and replacement
I-6-5. Variable speed fan/pump motors

J. Identify the major components found in an HVAC system and describe the function of the components in relationship to the entire HVAC system.

- J-1. Cooling Equipment
  - J-1-1. Define a ton of cooling
  - J-1-2. Understand and describe the vapor compression cycle.
  - J-1-3. Understand and describe the adsorption refrigeration cycle
    - J.1.3.1. Ammonia-Water Systems
    - J.1.3.2. Water-Lithium Bromide Systems
  - J-1-4. Identify and describe the operation of DX systems
  - J-1-5. Identify and describe the operation of chillers
  - J-1-6. Identify and describe the operation of various compressors used in air conditioning applications:
    - J.1.6.1. Reciprocating
    - J.1.6.2. Screw
    - J.1.6.3. Scroll
    - J.1.6.4. Centrifugal
    - J.1.6.5. Hermetic
    - J.1.6.6. Semi-hermetic
    - J.1.6.7. Open drive
  - J-1-7. Identify and describe the operation of various condensers used in air conditioning applications:
    - J.1.7.1. Air-cooled
    - J.1.7.2. Water-cooled
      - J.1.7.2.1. Shell and tube
      - J.1.7.2.2. Shell and coil
      - J.1.7.2.3. Tube in tube
      - J.1.7.2.4. Brazed plate
    - J.1.7.3. Evaporative condensers
    - J.1.7.4. Cooling towers

- J-2. Heating Equipment
  - J-2-1. Identify and describe the operation of various heating devices used in air conditioning applications:
    - J.2.1.1. Furnaces
    - J.2.1.2. Boilers
      - J.2.1.2.1. Steam
      - J.2.1.2.2. Low-medium-high pressure systems
      - J.2.1.2.3. Water tube verses fire tube steel boilers
      - J.2.1.2.4. Cast iron sectional boilers

K. Identify the different types of HVAC systems found in buildings and describe the advantages and disadvantages of selected applications.

- K-1. Air Systems. Identify and describe the operation of various air systems used in air conditioning applications
  - K-1-1. Single path/double path systems
    - K.1.1.1. Single zone
    - K.1.1.2. Terminal reheat
    - K.1.1.3. Multi-zone

K.1.1.4. Dual-duct
K.1.1.5. Variable volume
K.1.1.6. Induction

K-2. Piping Systems. Identify and describe the operation of various piping systems used in air conditioning applications

- K-2-1. Open/closed loop
  - K.2.1.1. One-pipe
  - K.2.1.2. Two-pipe
    - K.2.1.2.1. Direct/indirect return
  - K.2.1.3. Three-pipe
  - K.2.1.4. Four-pipe
- K-2-2. Primary-secondary pumping systems
- K-2-3. Steam piping

K-3. Describe the advantages and disadvantages of various systems in selected applications with special needs:

- K-3-1. Flexible open office plan layout
  - K.3.1.1. large, flexible zone serving many people
  - K.3.1.2. perimeter and interior adjacencies
  - K.3.1.3. HVAC acoustic considerations
  - K.3.1.4. infrequent renovations
- K-3-2. Office building
  - K.3.2.1. potential for many small zones
  - K.3.2.2. space may be perimeter or interior
  - K.3.2.3. relatively inflexible design
  - K.3.2.4. frequent renovations
  - K.3.2.5. need for acoustical treatment in ducting between offices
- K-3-3. Professional office building
  - K.3.3.1. multiple clients with various levels of demand on HVAC systems
  - K.3.3.2. special ventilation/exhaust requirements
  - K.3.3.3. special acoustical needs
- K-3-4. Clean room
  - K.3.4.1. ultra-high level of filtration
  - K.3.4.2. ultra-low velocities required
  - K.3.4.3. large impact of HVAC on building volume/structure
- K-3-5. Hospital
  - K.3.5.1. multiple clients with various levels of demand on HVAC systems
  - K.3.5.2. multiple systems with multiple zones
    - K.3.5.2.1. isolation wards
    - K.3.5.2.2. surgical suites
    - K.3.5.2.3. office/administration areas
    - K.3.5.2.4. emergency
    - K.3.5.2.5. patient rooms
    - K.3.5.2.6. cafeterias/kitchens
    - K.3.5.2.7. loading docks
    - K.3.5.2.8. helicopter pads

K.3.5.3. high level of control
K.3.5.4. special ventilation/exhaust requirements
K.3.5.5. different pressure requirements between zones (positive and negative)
K.3.5.6. special acoustical needs

K-3-6. School
K.3.6.1. ventilation needs, $CO_2$ levels critical
K.3.6.2. different requirements for various parts of the building (classrooms, offices, athletic facilities, shops, etc)
K.3.6.3. high day time occupancy, low evening occupancy

K-3-7. Restaurant
K.3.7.1. special ventilation needs, various zones
K.3.7.1.1. smokers/non smokers
K.3.7.1.2. kitchen
K.3.7.1.3. bathroom

K-3-8. Hotel
K.3.8.1. various special needs
K.3.8.1.1. pools, high humidity
K.3.8.1.2. restaurants, odors
K.3.8.1.3. guest rooms, individual control
K.3.8.1.4. conference/banquet facilities, ventilation, high occupancy

L. Understand and describe control sequences and control loops of HVAC systems and identify individual components.

L-1. Define control terms
L-1-1. Control, control purpose
L-1-2. Three main components
L.1.2.1. Sensor, controller, final control device
L-1-3. Identify and describe types of control loops
L.1.3.1. Open/closed
L-1-4. Define types of control points
L.1.4.1. Analog input & output
L.1.4.2. Digital input & output
L-1-5. Describe features of energy management systems
L.1.5.1. Optimal start/stop
L.1.5.2. Demand limiting/load shedding
L.1.5.3. Duty cycling

M. Describe energy conservation and management strategies, their application and economic advantages (payback) relative to utility billings and rate structure

M-1. Demand leveling

M-2. Demand limiting/load shedding

M-3. Power factor control

M-4. Co-generation/on site generation

M-5. Thermal storage systems
- M-5-1. Water/chemical
- M-5-2. Phase change (ice)

N. Describe strategies, programs, and the short- and long-term economic impact of preventative maintenance related to HVAC building systems.

N-1. Strategy
- N-1-1. RTF (run to fail)
- N-1-2. PM (preventative maintenance)
- N-1-3. PPM (predictive preventative maintenance)
- N-1-4. Scheduled Overhaul
- N-1-5. Redundancy

N-2. Equipment
- N-2-1. Air handlers
- N-2-2. Rooftop units
- N-2-3. Compressors
- N-2-4. Boilers
- N-2-5. Chillers
- N-2-6. Controls
- N-2-7. Pumps
- N-2-8. Make up air Units
- N-2-9. Production burners, and other heat sources
- N-2-10. Water side systems
  - N.2.10.1. closed loop
  - N.2.10.2. open loop
  - N.2.10.3. Cooling towers
  - N.2.10.4. chilled water
  - N.2.10.5. Humidifiers
- N-2-11. Dehumidifiers
- N-2-12. Direct expansion
  - N.2.12.1. Coil cleaning
- N-2-13. Desiccant (chemical)
- N-2-14. Steam traps
- N-2-15. exhaust fans, belts, fasteners, connections
- N-2-16.

O. Describe and be able to locate information on codes, ordinances and regulations that effect the installation, operation and maintenance of HVA-CR building systems.

O-1. Unions

O-2. Codes/ordinances
- O-2-1. local

- O-2-2. state
- O-2-3. national
- O-2-4. international

O-3. Codes/Standards

- O-3-1. ADA (Americans with Disabilities Act)
- O-3-2. ASHRAE (American Society of Heating Refrigeration and Air Conditioning Engineers)
- O-3-3. BOCA (Building Officials Code Administrators International
- O-3-4. EPA (Environmental Protection Agency)
- O-3-5. IBC (International Building Code)
- O-3-6. ICC (International Code Council)
  - O.3.6.1. Code Requirements for Housing Accessibility
  - O.3.6.2. ICC Electrical Code
  - O.3.6.3. International Energy Conservation Code
  - O.3.6.4. International Fire Code
  - O.3.6.5. International Fuel Gas Code
  - O.3.6.6. International Mechanical Code
  - O.3.6.7. International Plumbing Code
  - O.3.6.8. International Private Sewage Disposal Code
  - O.3.6.9. International Property Maintenance Code
  - O.3.6.10. International Residential Code
  - O.3.6.11. International Zoning Code
- O-3-7. NEC (National Electrical Code)
- O-3-8. NEMA (National Electrical Manufacturers Association)
- O-3-9. NFPA (formerly the National Fire Protection Association
- O-3-10. NSPC (National Standard Plumbing Code)
- O-3-11. OSHA (Occupational Safety and Health Act)
- O-3-12. SMACNA (Sheet Metal and Air Conditioning National Association)

P. Describe criteria, including licensure/certification/insurance requirements, used to hire contractors/vendors/staff for HVACR building system installation, operation and maintenance.

P-1. How to find

- P-1-1. advertise/interview
- P-1-2. open bid
- P-1-3. network of friends, peers, word of mouth
- P-1-4. invite to bid (requires prior knowledge)

P-2. Qualification for job

- P-2-1. Years in business/of experience
- P-2-2. Familiarity with type of work
- P-2-3. Connections within industry, networking
- P-2-4. Ability to work with others
- P-2-5. Quality of work/workmanship

P-3. Scope of work

- P-3-1. Size and duration of project/job
- P-3-2. Reputation and experience of contractor to match
- P-3-3. Ability to finance work, working capital, bonding

P-4. Union/Jurisdiction issues

P-5. Race/gender/ethnicity issues

P-6. Funding issues, state/federal money involved

P-7. International issues
- P.7.1.1. ISO required?
- P.7.1.2. Product/technology compatible overseas?
- P.7.1.3. Language barriers?
- P.7.1.4. Time zone
- P.7.1.5. Cultural differences/barriers?

P-8. License/certificate/insurance required
- P-8-1. CFC
- P-8-2. Plumbing
- P-8-3. Electrical
- P-8-4. Building Engineer
- P-8-5. Professional Engineer
- P-8-6. Boiler Operator
- P-8-7. Mechanical
- P-8-8. Workers Comp
- P-8-9. Liability insurance/bonding

## ADDITIONAL COURSE INFORMATION

**Scoring:**

| | |
|---|---|
| Exams | 50% |
| Homework | 30% |
| Cumulative Final | 20% |
| Total | 100% |

**Grading Scale**

| Letter Grade | Equal to or Greater Than | Below |
|---|---|---|
| A | 94% | |
| A- | 90% | 94% |
| B+ | 87% | 90% |
| B | 84% | 87% |
| B- | 80% | 84% |
| C+ | 77% | 80% |
| C | 74% | 77% |
| C- | 70% | 74% |
| D+ | 68% | 70% |
| D | 66% | 68% |
| D- | 65% | 66% |
| F | 64% | 0% |

**Attendance:** I do not keep attendance in this class as it is a 400 level class.

**Test Taking:** If you have to miss for a test or quiz, you must alert me in advance to make alternate arrangements. You will not be allowed to make up the test or quiz without prior arrangements.

**Homework Due Date:** all homework must be submitted on the due date at the time due. No late work will be accepted.

**Class Expectations:** I expect you to actively engage in the learning process. It is my sincere hope, as you take this course, that you understand that HVACR, though not in your primary field of study, will play a role in your career, and that you see this course as a means to help you prepare more completely for that career. A mentality of trying to earn a grade, with the minimum effort necessary, will be a great disservice to you.

Excerpts from

**Ferris State University**

**Code of Community Standards (Student Handbook)**

http://www.ferris.edu/htmls/administration/StudentAffairs/Studenthandbook/06HandbookMaster.pdf

## 20 Section III: General University and Housing Policies Regarding Misconduct

***A. Academic Misconduct***

The university may discipline a student for academic misconduct, which is defined as any activity that tends to undermine the academic integrity of the institution. Academic misconduct includes, but is not limited to, the following:

**1. Cheating**

A student may not use unauthorized assistance, materials, information, or study aids in any academic exercise, neither should they give assistance, materials, information, or study aids in any academic exercise, including but not limited to the following:

a. A student must not use or give external assistance on any "in-class" or "take-home" examination, unless the instructor has specifically authorized external assistance. This prohibition includes, but is not limited to, the use of tutors, books, notes, and calculators.

b. A student must not use another person as a substitute in the taking of an examination or quiz.

c. A student must not steal examinations or other course materials.

d. A student must not allow others, offer to conduct research, or to prepare work for him/her without advance authorization from the instructor for whom the work is being submitted. Under this prohibition, a student must not make any unauthorized use of materials obtained from commercial term paper companies or from files of papers prepared by other persons.

e. A student must not collaborate with other persons on a particular project and submit a copy of a written report, which is represented explicitly or implicitly as the student's individual work.

f. A student must not use or give any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.

g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor to whom the work is being submitted.

h. A student must not alter a grade or score in any way.

**2. Fabrication**

A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citations of the sources of information.

**3. Facilitating Academic Dishonesty**

A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct.

A student is responsible for taking reasonable precautions to ensure his or her work is not accessed by or transferred to another individual wherein it may then be used to commit an act of academic misconduct.

**4. Interference**

a. A student must not steal, change, destroy, or impede another student's work. Impeding another student's work includes, but is not limited to: the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.

b. A student must not give or offer a bribe, promise favors, or make threats with the intention of affecting a grade or the evaluation of academic performance.

**5. Plagiarism**

A student must not adopt or reproduce ideas, words, or statements of another person without appropriate acknowledgment. A student must give credit to the originality of others and acknowledge indebtedness whenever he or she does any of the following:

a. Quotes another person's actual words, either oral or written;

b. Paraphrases another person's words, either oral or written;

c. Uses another person's idea, opinion, or theory; or

d. Borrows facts, statistics, or other illustrative material, unless the information is common knowledge.

**6. Violation of Course Rules**

A student must not violate course rules as contained in a course syllabus which are rationally related to the content of the course or to the enhancement of the learning process in the course.

## Section IV: Administrative Policies

Student sanctions in the Ferris State University Code of Community Standards Administrative Policies and Procedures specifically include official reprimands, behavioral contracts, disciplinary probation, suspension from the University, or dismissal from the University without opportunity to enroll in the future. In addition, these include the opportunity for other sanctions to be imposed, such as the requirement or reimbursement for damages, loss of special privileges, or participation in campus provided educational programs.

The University considers involvement in the student judicial process to be part of a student's learning experience. Through a system of progressive discipline, it is anticipated that a student will realize the importance of functioning within the University's policies, procedures, and regulations. Though every case involving the violation of University policies or procedures is considered on the basis of the merits in that case, there are some categories of violations for which the anticipated sanction would be suspension or dismissal from the University. Such serious infractions include but are not limited to the distribution of alcohol to minors, distribution of illegal drugs or the use, possession, or distribution of alcohol or illegal drugs that result in a serious safety or health matter for any member of the campus or local community.