Ferris State University

Manufacturing Technology

Academic Program Review

August 1, 2016

Program Review Panel

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Section 1

Program Overview

A. Program History

The manufacturing programs at Ferris State University originated in 1956, with the implementation of an associate degree program titled, Machine Tool. This program offered students the opportunity to earn a degree while learning to apply the science and methodology of precision machining technology. By the mid 1960's, Michigan's educational system was rapidly expanding and as part of this expansion, both community colleges and secondary vocational schools were developing similar programs. In order to ensure that the program remained unique, the program decided to focus more on the production side of precision machining technology.

By the mid 1970's, this focus on production had received considerable attention from industry. This attention, combined with an increasing demand for manufacturing engineers, eventually led to the development and implementation of the Manufacturing Engineering Technology bachelor of science degree program in 1976. As the first bachelors program in technology, this program served as an incubator for several other programs including: Plastics Engineering Technology, Welding Engineering Technology, and Product Design Engineering Technology.

Around this same time, Computer Numerical Control (CNC), Computer-Aided Design (CAD), and Computer-Aided Machining (CAM) technologies were becoming more affordable and common in the industry. By the early 1980's, the program had determined that these technologies should be an integral part of the associate degree. Given that the Manufacturing Engineering Technology program had taken over the "production" focus, the associates program decided to perform a major redirection and focus its attention on tooling applications. Due to the fact that this change was more significant than previous changes, the program's title was changed to Manufacturing Tooling Technology.

The program held this title and focus for more than 25 years until industries demand for more technologically diverse workers coupled with minimal opportunities for credit articulation prompted the program to rethink its curricular offerings. In 2007 and 2009, the program implemented two major curriculum actions that essentially redefined the program and created a concentration system that preserved the tooling applications option and added a general processing concentration that allows for a wide range of flexibility, particularly for articulation and transferability. Today, the program is titled Manufacturing Technology and it is unquestionably the most dynamic stepping stone of any College of Engineering Technology associate degree program.

B. Program Description

The Manufacturing Technology program requires a total of 61 credits for graduation including 31 credits in technical courses. The program's current capacity is 60 students with an annual enrollment goal is 30 new students each year. This degree provides students the option of concentrating on either "tooling technology" or "processing technology." Both concentrations share a common core with the difference being the nature of advanced technical courses.

The tooling technology concentration focuses on learning to apply the science and methodology of precision machining, CAM/CAM, and CNC to tooling applications. Students gain experience applying these technologies to the design, build, tryout, troubleshooting of major tool assemblies including jig and fixtures, metal stamping dies, and plastic injection molds. Exposure to project management and cost-estimating are included as part of these major projects.

The processing technology concentration focuses on learning to apply other (non-machining) manufacturing technologies such as welding, molding, programming automation controls, etc. This concentration allows students to select technical courses from a variety of options based on their interests.

In addition to this degree offering, the program also offers a certificate titled Basic CNC Programming and Machine Operation which provides students the opportunity to gain knowledge and skill in the programing, setup, and operation of CNC milling and turning equipment. This certificate requires a minimum of three related technical courses totaling eight credits including a course in basic machining, 3-D CAD modeling, and CNC programming and machine utilization. The only restriction in the number of students that can be served is the availability of CNC courses. Currently, the program can support 15 to 20 certificate students each year.

C. Program Mission, Vision, and Values

University Mission Statement

"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 Mission Statement

"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."

Program Mission Statement

“Provide the best educational opportunity in tooling technology by way of project-based, real-world experiences in well-equipped facilities resulting in a solid foundation on which our graduates can build their careers and continue their education.”

Program Vision

“To lead the nation in manufacturing process and tooling education as demonstrated by student success, graduate demand, and the extent of industrial partnerships.”

Program Values

“In addition to the values held by the university as a whole, we also believe in the following values and consider these to be critical in performing our mission and realizing our vision of the future.

We believe in:

- well-experienced, technically competent faculty members;
- up-to-date curriculum that reflects the current state of the industry;
- the importance of a solid technical foundation;
- project-based, real-world learning experience;
- providing a reasonable amount of time on task;
- the application of current technology; and
- well-equipped facilities that emulate those found in industry.”

The MFT program supports the mission of the university by providing unique career-oriented education opportunities through a dynamic curriculum structure. This curriculum structure provides the following advantages which are clearly supportive of the universities guiding principles and major initiatives:

- Concentration options that stimulate additional interest in the program.
- Improved functionality and increased ability to support articulation, dual-enrollment, and direct credit programs.
- The ability to individually tailor curriculum to a student’s interests or the needs of industrial sponsors.
- Greater assurance of on-time graduation.
- Greatly improved functionality as a stepping stone- allowing graduates to transfer directly into any of seven bachelor’s degree programs.

D. Program Goals

During the past six years, MFT program faculty members have been working diligently on advancing the program. The three areas of focus have been: curriculum, CAD/CAM technology, and enrollment. Following two major curriculum actions in 2007 and 2009 that essentially redefined the how the program was packaged, a new concentration-based system was implemented. Soon after implementation, it was realized that a series of additional adjustments were required to allow the program to continue its forward motion.

In order to ensure alignment with technology trends and better prepare students for continuing to a bachelor's degree, input from the program's advisory board and other industrial partners was used to update the majority of course assignments and related lab projects. Today the program's curriculum includes a series of up-to-date assignments and projects that better serve both the students and the industry.

With an ever increasing demand for CAD/CAM skills, the program realized the need to more thoroughly imbed the application of CAD/CAM technologies into all MFT courses. In order to accomplish this, program faculty have spent countless hours learning these technologies so they can share these with the students and assist them in applying these to the recently updated course projects. This has been a gradual process that faculty view as a mission-critical, ongoing effort. The result of this effort is significant and can be summarized by realizing that today students typically complete their major tooling projects including: design, production, tryout, and troubleshooting in about one-half the time (with better results) than they did just ten years ago.

Although enrollment has always been of key importance, the effects of the long standing recession that hit manufacturing hardest in 2009 took some time to overcome. At the height of the recession, the program experienced its lowest enrollment in its 60-year history- eight incoming freshmen. Thanks to the effort put forth by program faculty members during the recession, the program was well-prepared for the demand that followed. Enrollment has consistently increased over the past six years. For this year and preceding two years, this program is full and for the first time in recent history, the program is wait-listing students.

With all the project modifications and increased emphasis on the application of CAD/CAM technology, the program now faces the need to revisit its course outcomes and ensure that these are updated and implemented into a continuous improvement system. Getting these outcomes into TracDat and actually using the TracDat system to improve the program is a primary goal for this coming year.

In addition to goals related to the typical day-to-day operations of the program, the program faculty members from both manufacturing programs have spent considerable time during the past three years working with the welding program on a plan to perform a complete overhaul of the Swan Annex facility. This project which was recently approved for construction represents a $30,000,000 capital outlay project through the State of Michigan. This project will result in a comprehensive upgrade of the manufacturing programs educational spaces and equipment. As this program moves forward, the manufacturing and welding programs are now faced with the goal of securing $7,500,000 through a major capital campaign.

Section 2

Curriculum and Assessment

A. Curriculum

Overall, the curriculum system implemented in 2009 seems to be working well as students have consistently met program objectives and feedback from employers has been positive.

The concentration options have been an important factor in recruiting a wider range of students. The tooling concentration attracts those with interest in machining-intensive applications while the processing concentration provides options for those with interest in other areas of manufacturing. One unforeseen advantage and great example of the dynamic nature of the processing concentration is the ability for transfers and other students (especially wait-listed welding students) to easily complete a double associate's degree in three years. Even though the system seems to be working well, there are a number of items that need to be adjusted to improve the consistency and efficiency of program operations. These items include:

- Making the MFGT-114 (Producing Machine Components) lab course a first semester requirement for both concentrations. This will ensure that all successful students have the opportunity to pursue the tooling concentration after the first semester.

- Reconfiguring both first- and second-year CNC courses from separate lecture and lab courses back to combined lecture/lab courses. Although the program separated these in the last curriculum action with the hope of improving efficiency, it was realized that teaching a double section lecture of highly technical material that constantly involves sequential operations is simply not practical. Even though this has been tried on few occasions, feedback from both faculty members and students suggests that single sections are by far better for the students. In addition to this, having a combined lecture/lab course better facilitates floating time between lecture and lab as needed to accommodate course progression and intensive lab projects.

- Rebalancing the credit to contact-hour ratio for the lab portion of both first- and second-year CNC courses. During the period of time in which the last curriculum action was processed, the program was being pressed to reduce credits. Being that there were only four CNC machines and students could only use these machines during one-half of their official lab time, keeping the credit to contact ratio at 1:4 seemed justified. Now that there are 12 CNC machines in the lab, more intensive projects, and more emphasis on applying this technology, a ratio of 1:2 makes a lot more sense.

- Opening up the science requirement. Currently, the both concentrations require either PHYS-211 or CHEM-114. The problem with this is that

both of these options require advanced math placement and in the case of CHEM-114, potentially an additional chemistry course. This regularly results in students having to take an additional (unlisted) course in order to meet this requirement. The simple fact is that it really doesn't matter at the associate level what this course is. Although the program may prefer one of these, the fact is, there are other science courses that could also benefit the student depending on what sector of industry they choose to pursue.

- Moving the second-year CNC courses from processing concentration's "required" list to its "optional" list. This will provide additional flexibility, minimize course substitution paperwork, and allow processing students to more easily complete the Electronics and Industrial Controls minor.

As the program moves into the future and closer to making its vision a reality, the program is considering additional certificates in the areas of Advanced CNC Programming and System Utilization and Multi-Axis Programming and Applications. Currently, there are no certificate programs available in these areas and the industry is in serious need of such options.

See Appendix A, Curriculum Information, for program check sheets and a sample course syllabus.

B. Assessment of Student Learning

Assessment of student learning outcomes is an area in which the program is up-to-date at the program level but currently behind at the course level.

Program-level outcomes have been in place for several years and are assessed and reviewed on an annual basis. For the past several years, the program has been quite successful in producing graduates that consistently meet or exceed program outcomes. These outcomes include:

Outcome #1

Create and utilize process documentation including: flow charts, process sheets, set-up sheets, inspection reports, and standard operating procedures.

Outcome #2

Apply precision machining technology to produce the precision machined components and assemblies required in the corresponding lab courses.

Outcome #3

Calibrate, utilize, and maintain precision measuring equipment.

Outcome #4

Utilize 3-D solid modeling software to draw precision components, fixtures, metalform tooling, and plastic mold tooling.

Outcome #5

Utilize 3-D CAM-based programming software to produce precision components, fixtures, metalform tooling, and plastic mold tooling.

All program-level outcomes have a criteria for success that states: “75% of students will demonstrate a competency of 80% or better.”

Due to the nature of the program, most courses are sequential and cumulative in nature so the assessment points for program-level outcomes are typically final exams and/or major projects from capstone courses. For the tooling concentration, this assessment is simple and straight-forward being tied directly to second-year major tooling courses. For the processing concentration, this assessment is more challenging because of the wide variety of manufacturing-related courses a student may choose. Although three of the five program-level outcomes apply to both concentrations, outcomes four and five are difficult to assess for students under the processing concentration. It is likely that the program will have to develop additional objectives that are more general in nature so as to better-align with the processing concentration.

Once assessed, the results are reviewed by program faculty members and any concerns would be discussed with the program industry advisory committee. Comments from these discussions are again reviewed and adjustments are made as needed.

An example of the implementation of this feedback is the previous note regarding adjusting the curriculum to increase the credit to contact ratio for CNC courses. While reviewing student performance on program-level outcomes related to major tooling projects, the assessed performance levels suggested that more emphasis needed to be placed on the application of CAD/CAM technology. After discussing this adjustment with the programs industry advisory committee, this adjustment is slated to be included in an upcoming curriculum action.

In addition to reviewing program-level outcomes for better alignment with the processing concentration, the program also needs to thoroughly review course outcomes for all major courses. This is key to ensuring that assessment plans

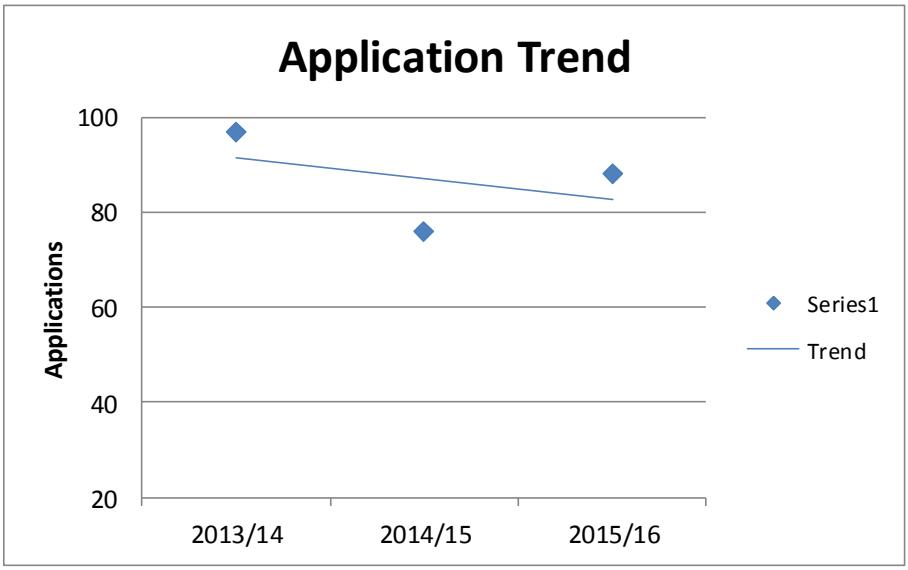
are up-to-date and that these become part of an active continuous improvement system.

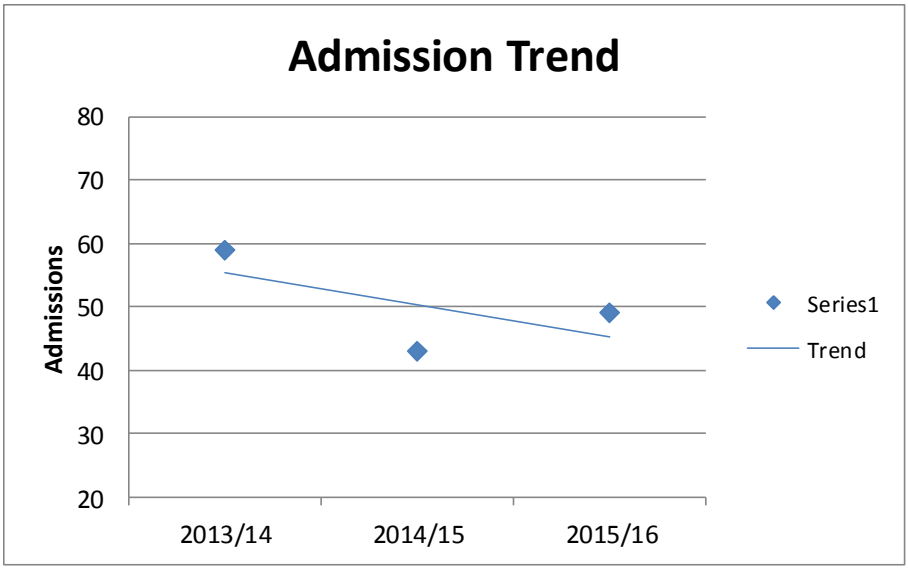
Section 3

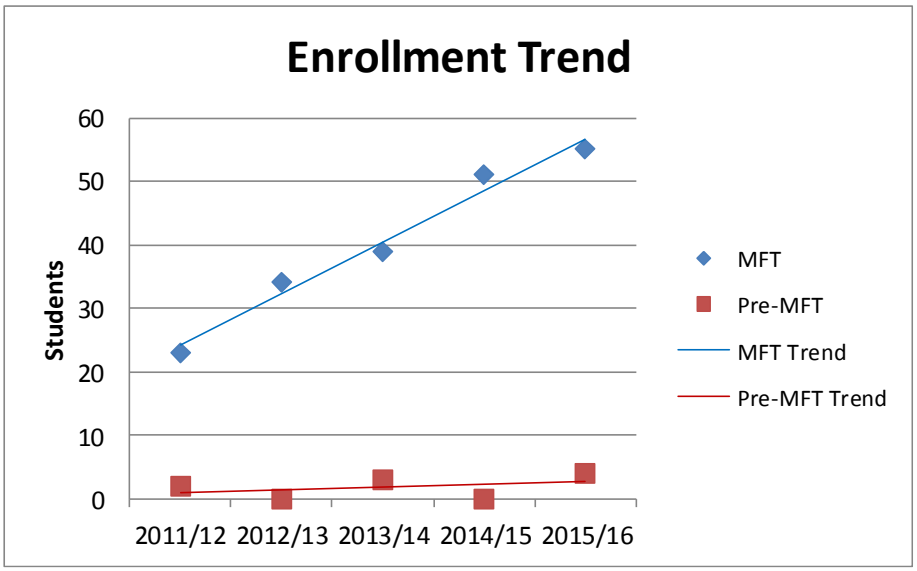
Program Profile

A. Applications, Admissions, and Enrollments

Applications, admissions, and enrollments have all been up significantly since 2009. The graphs below show these numbers and trends for all available years. Due to the fact that the program has not tracked the history of application and admission numbers, data from existing web focus reports was used. These reports currently date back to fall semester, 2013.







Being that the program has been “full” for the past three years and now wait listing students, the program has started to discuss ways in which it could expand. In considering the options, it is important to note that there are three significant hurdles to expansion. These include: available lab time, faculty resources, and S&E budget.

Currently, it seems the most realistic option for expansion involves adding a third section to the program. This option is based on the assumption that approximately one-third of all MFT students would pursue the processing concentration. Over the past several years, the program has developed a block scheduling system that is capable of supporting a third section. With a third section in place, the manufacturing labs would (with the exception of an hour break around lunch and dinner) be scheduled from 8:00 am until 10:00 pm Monday through Thursday and from 8:00 am until 5:00 pm on Fridays.

Even though lab time is at a premium, the program believes that increasing the faculty resources and S&E budget are the tallest hurdles. This expansion would require an additional fulltime tenure track faculty position and the conversion of an existing full-time (overloaded) adjunct position to a full-time staff position.

As for S&E budget, even though the program is full and far more productive than any other point during the past 20 years, the program is suffering from a serious lack of S&E. Due to a series of budget cuts that occurred between 2009 and 2013 with no significant increases since, the program is attempting to survive on approximately two-thirds of what it had 18 years ago. This means that annual S&E budget for this program is less than what is budgeted for most secondary vocational programs. Adjusting the S&E budget to an appropriate amount to support this growth is most likely the greatest challenge to expanding the program.

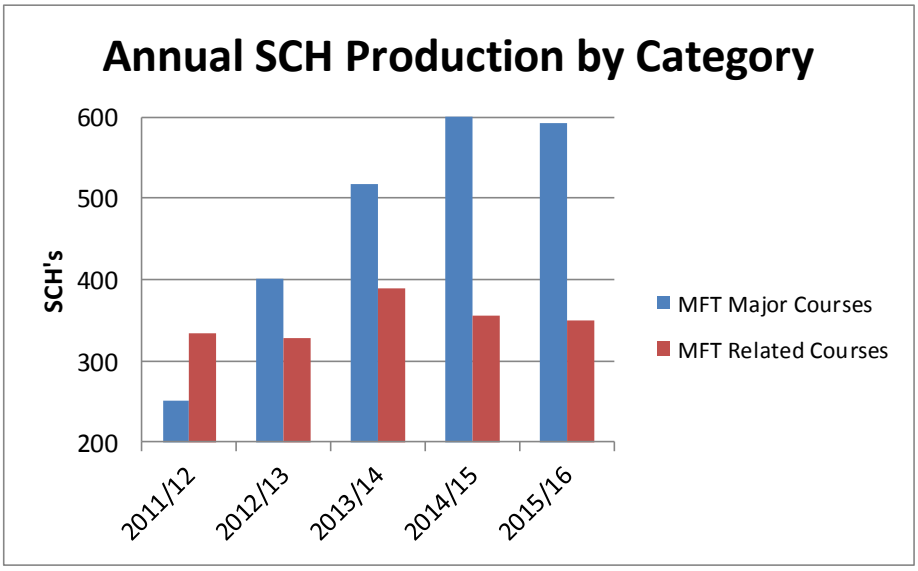
B. Enrollment / Headcounts

Given that all MFT courses are offered exclusively on the main campus and no online courses are included in the curriculum, there is no additional information to discuss in this section.

C. Student Credit Hour Production

When examining student credit hour production trends for the MFT program, it is important to realize that there is more to the story than what is represented in the university data tables. A primary example of this is that all three full-time tenured MFT faculty members regularly teach courses in the MFGE program. In some semesters, this MFGE load accounts for 30 – 40% of the total student credit hours generated by these faculty members; however, this load is not reflected in the data tables under the MFT program and it is not shown in the graphs provided.

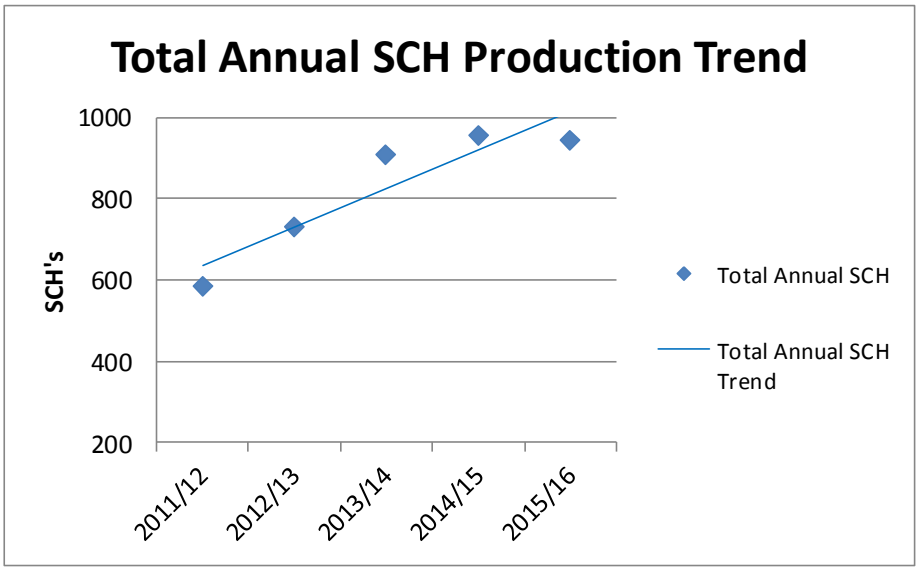
In addition to this, over the past few decades the program has generated a significant number of student credit hours through service courses for manufacturing related students. The graph below shows the total annual student credit hours generated under the MFT program for both MFT majors and related students.



There are a total of two service courses regularly scheduled for related students. These include MFGT-150, a basic machining course and MFGT-252, an overview of CAD/CAM and CNC technologies. The MFGT-150 course is a

required course for Mechanical, Welding, and CAD Drafting / Tool Design students and the MFGT-252 course is only required for CAD Drafting / Tool Design students. With the recent implementation of the Basic CNC certificate, other non-manufacturing students are enrolling in manufacturing courses in order to secure this additional credential. For the past two years, the manufacturing programs have offered additional sections of CNC courses to better facilitate this demand.

For a more complete view of student credit hour production trend for courses that fall under the MFT program, the combined total annual student credit hours generated are shown in the graph below.

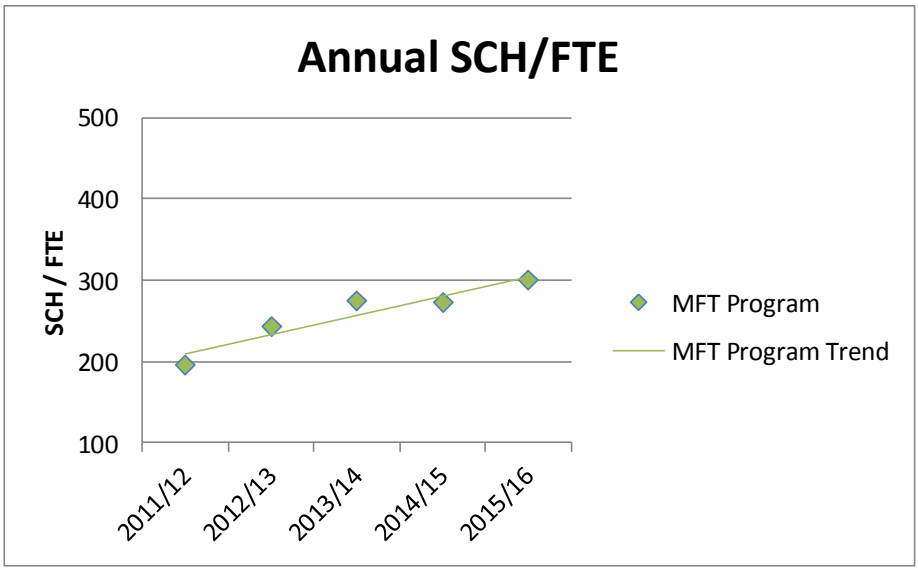


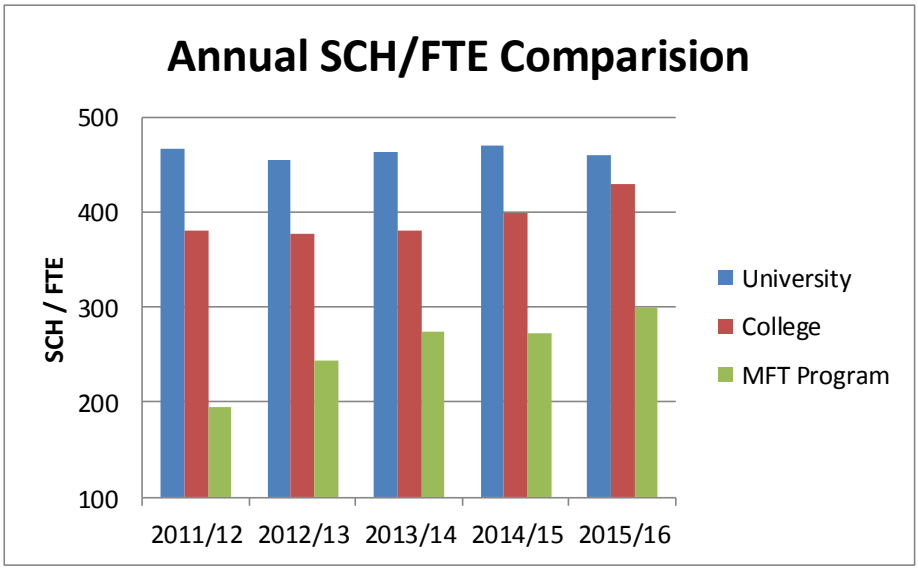
Plans to adjust the credit to contact hour ratio of CNC labs will result in a slight increase in student credit hour production.

D. Productivity

Being that productivity is directly related to student credit hour production, it is important to realize that there is more to the story than what is represented in the university data tables. A primary example of this is that all three full-time tenured MFT faculty members regularly teach courses in the MFGE program. In some semesters this MFGE load accounts for 30 – 40% of the total student credit hours generated by these faculty members; however, this load is not reflected in the data tables under the MFT program's SCH/FTE calculations therefore it is not shown in the graphs provided.

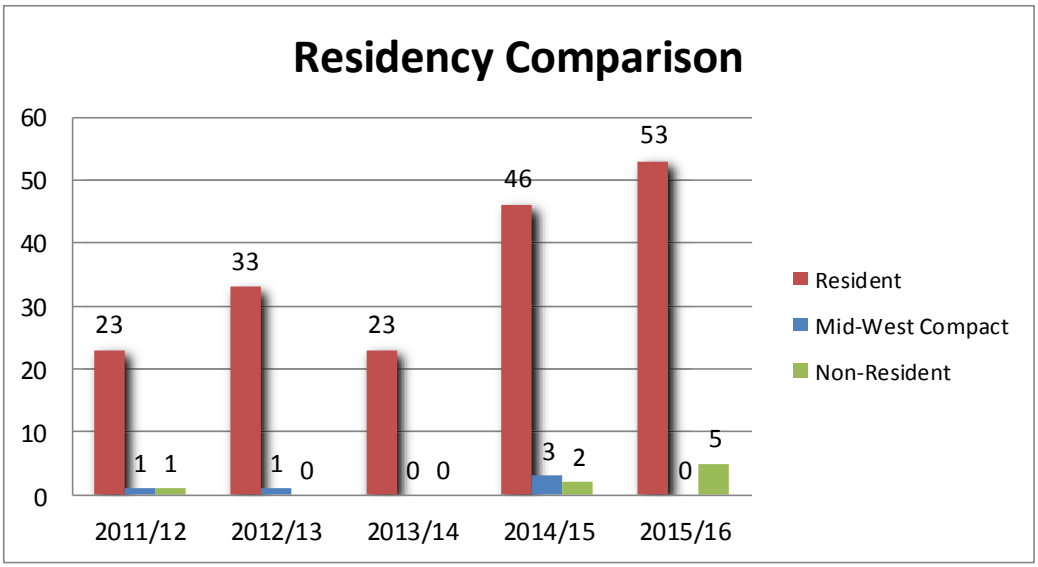
The following graphs shows the annual SCH/FTE for hours generated exclusively through courses under the MFT program. It should be noted that because the data tables for SCH/FTE for 2011/12 and 2012/13 provided a combined data set including both manufacturing programs under one calculation, the SCH/FTE for these years is approximated based on the information available.

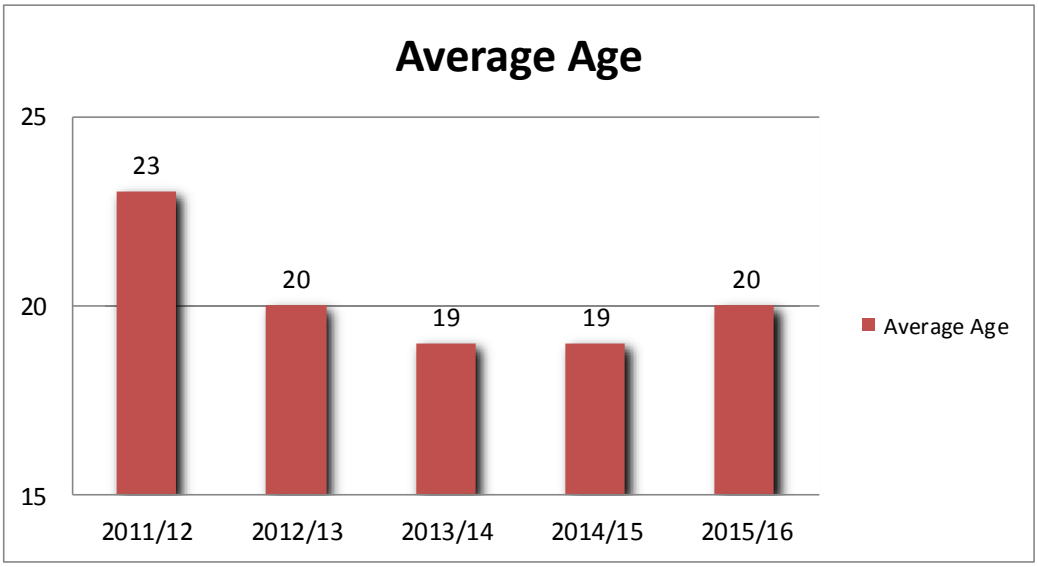


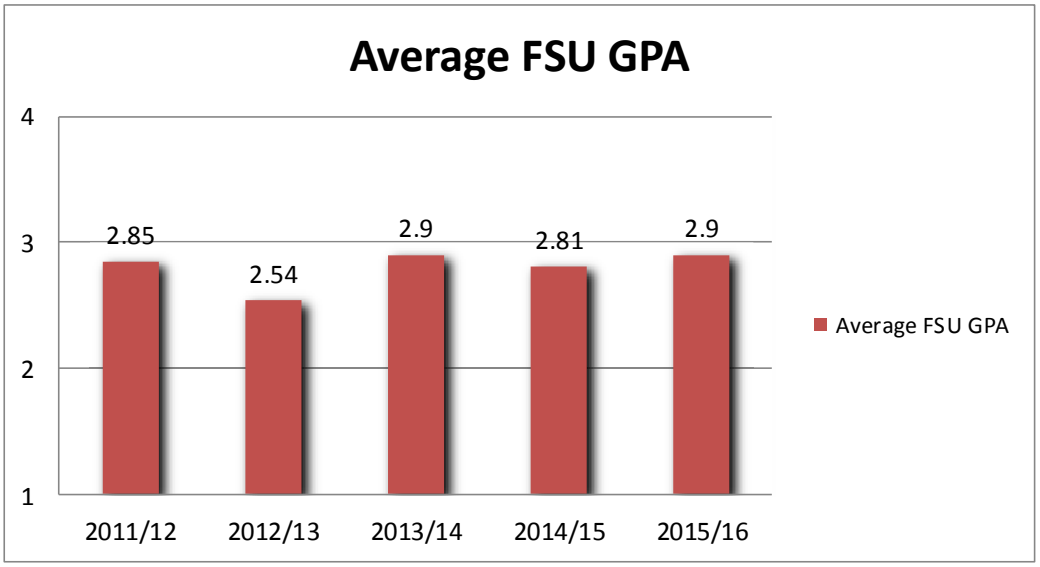


E. Enrollment Demographics

The following series of charts represent various characteristics of students enrolled in MFT programs during the past five years. This data includes Pre-MFT students.






Average FSU GPA
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2.9
2011/12
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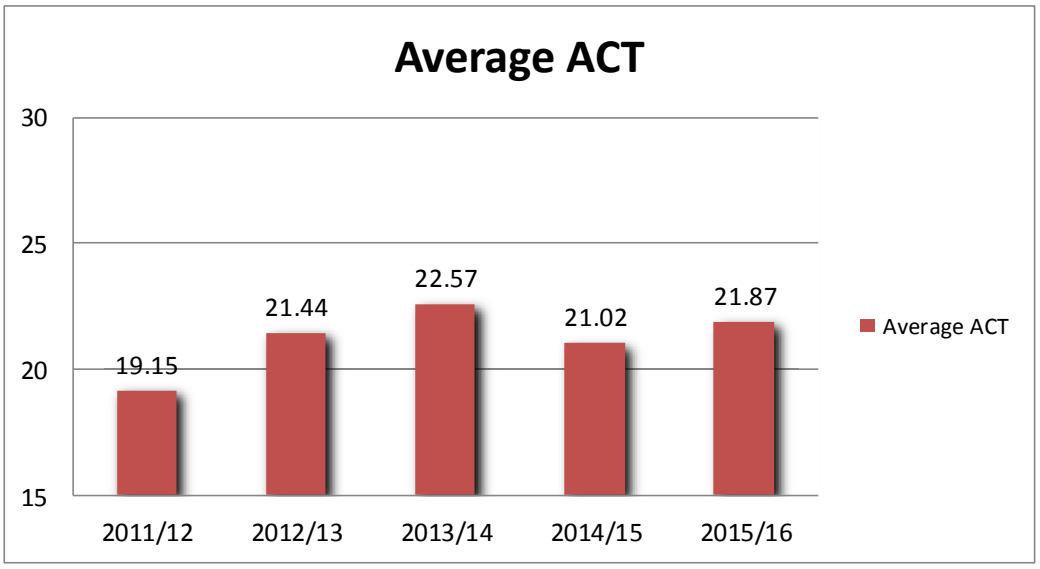
2014/15
2015/16
Average FSU GPA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21.02
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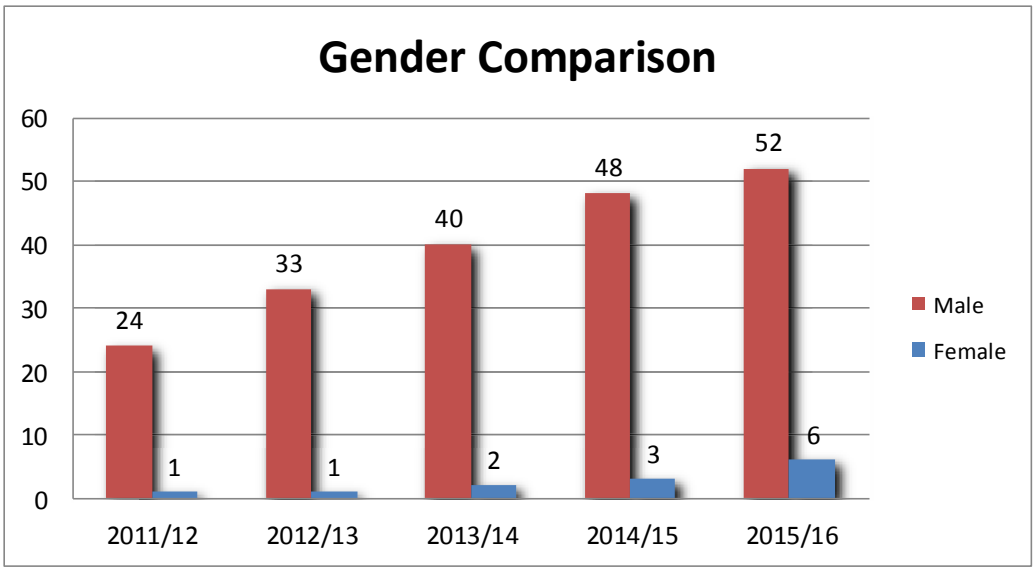
2013/14
2014/15
2015/16
Average ACT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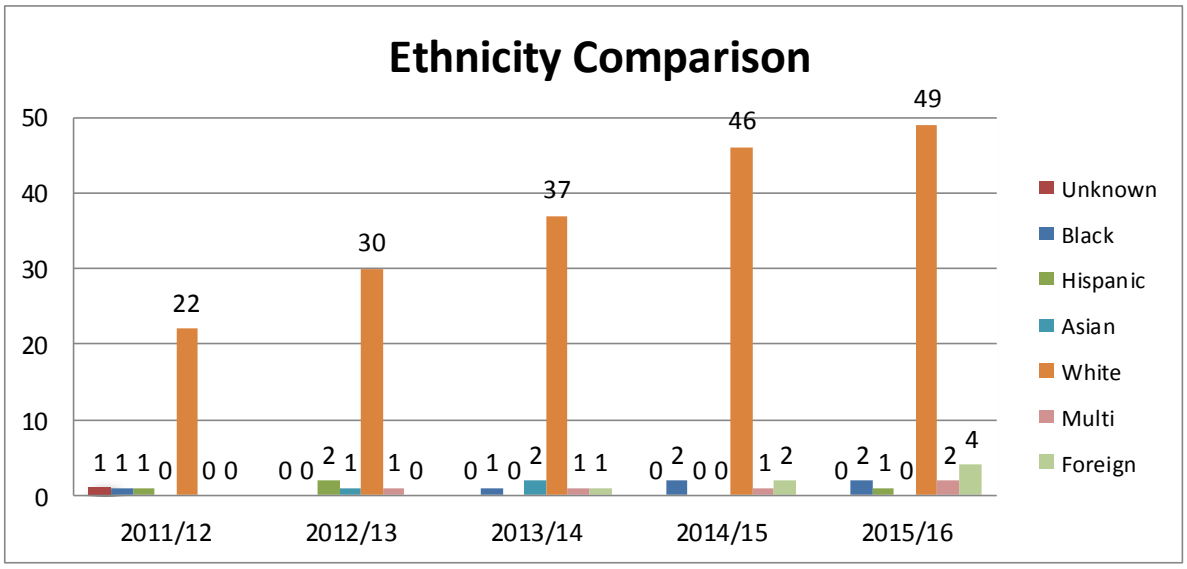
2015/16
Male
Female


Ethnicity Comparison
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0 2 0 0 46 1 2
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2015/16
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White
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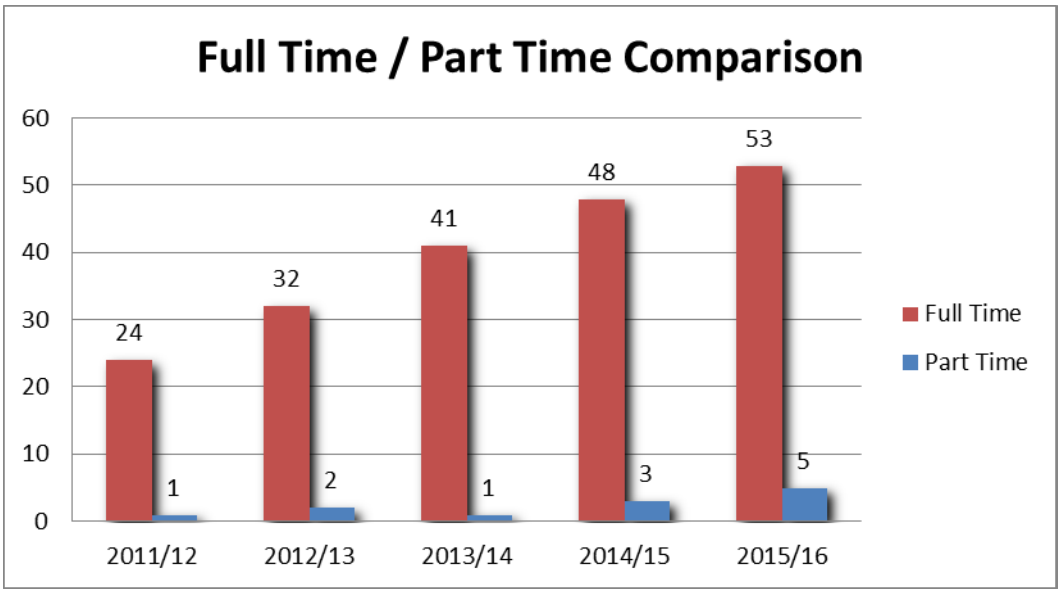


F. First Year Retention

The following table shows the total number of FTIACs and the percentage of those who were retained into the second year of the program. Data was not available for the 2015/2016 school year.

	2011/12	2012/13	2013/14	2014/15
Number of FTIACs	5	12	10	17
% Retained	80%	92%	60%	88%

Typically, students who fail to come back for the second year are those who experienced a financial hardship or they simply were not prepared for the college workload.

G. Program Graduates

The following table shows the total number of graduates for each year identified. Data was not available for the 2015/16 school year.

	2011/12	2012/13	2013/14	2014/15
Number of Graduates	8	6	10	9

H. Three-Year Graduation Rate

The following table shows the total number of on-time graduates for each year identified. Data was not available for the 2013/14, 2014/15, or 2015/16 school years.

	2011/12	2012/13
% Graduated On-Time	40%	33%

With approximately 85% of program graduates continuing their education in a bachelors degree at Ferris, it seems that a large number of these who could graduate on time do not. Most often this is because they wait to file the paperwork until they complete their bachelors program. Although this is discouraged, it continues to occur.

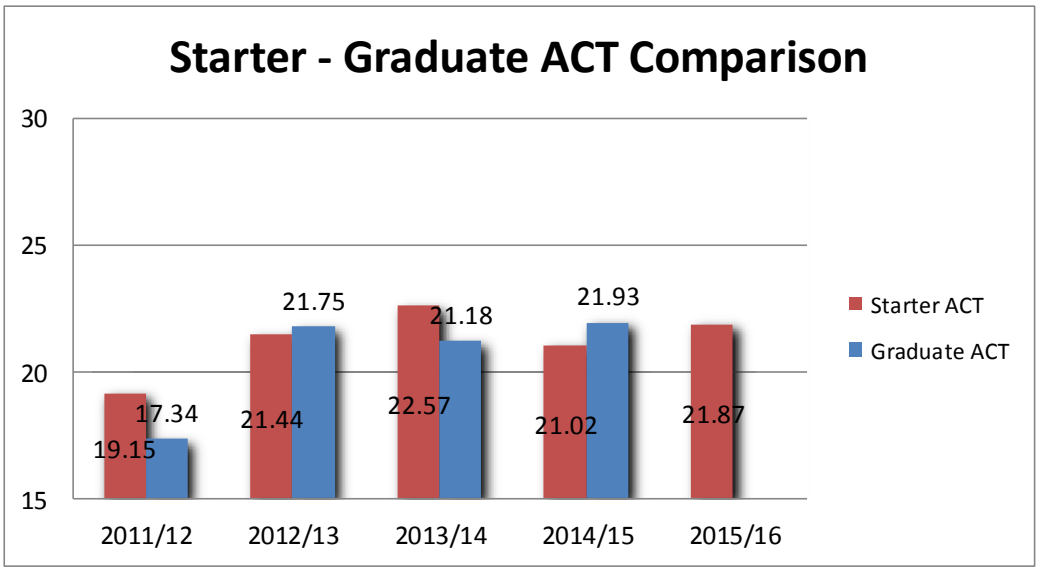
I. Graduate Average GPA

The following table shows the graduate average GPA for each year identified. Data was not available for the 2015/16 school year.

	2011/12	2012/13	2013/14	2014/15
Average GPA	2.16	3.33	2.85	3.33

J. Starter - Graduate ACT Comparison

The graph below compares the average ACT for students starting the program with the average ACT for program graduates. Data was not available for the 2015/16 school year. No significant variations exist between the scores of the two groups and therefore no identifiable correlation exists with this data.



K. State and National Examinations

In 2015 the program adopted the Precision Machining Technology Exam provided by the National Occupational Competency Testing Institute (NOCTI) as a means of assessing the knowledge gained through the program. This exam is an on-line knowledge exam regarding the core knowledge involved in precision machining technology. It is administered in the spring of each year to sophomore students preparing to complete the degree. To date, all but one student have passed this exam. The program has not yet compared the student's performance national pass rates.

Section 4

Program Value

A. Value Beyond Productivity and Enrollment Numbers

1. Value to the College

   Program faculty members have a diverse education and experience base providing support for the MFGE program with the majority of MFT faculty members teaching 30 – 40% of their annual load in MFGE courses. Program faculty members are also capable and qualified to teach related topics in other technology-based programs- particularly those dealing with process documentation, technical writing, and Computer-Aided Design (CAD) applications.

   The manufacturing lab facilities and equipment are used to support both the MFT and MFGE programs. In addition to this, they also support numerous service courses for seven related programs including: Mechanical, Welding, Automotive, Plastics, Rubber, CAD Drafting and Tool Design, and Product Design.

2. Value to the University

   Program faculty members are active throughout the university as shown by their participation in numerous committees and involvement in university activities.

   Lab facilities and equipment have proven to be of great value to many university groups including the physical plant, grounds crew, motor pool, dining services, and other academic departments. The manufacturing lab technician estimates that he and his lab attendants (student workers) perform approximately 150 hours of machining-related support work for the university each year. At a basic shop rate of $75 per hour, this equates to $11,250 per year in savings to the university.

3. Value to Related Students

   Each year as junior/senior projects arise, program faculty members often serve as consultants to dozens of manufacturing-related (non-majors) working on junior/senior projects.

   As a result of student interest in special project teams, program faculty members implemented “open-lab” opportunities to help support these initiatives. Since implementing these opportunities nearly eight years ago, several faculty members have invested hundreds of non-paid hours working with these students and facilitating the design and build of such projects.

With the implementation of open lab opportunities, the lab facilities and equipment are now seeing much greater utilization- particularly with special project teams. Special project teams such as the Formula Team, Baja Team, and Human-Powered Vehicle Team utilize the manufacturing lab regularly to produce their projects. After eight years of offering these opportunities to special project teams, it has been estimated that the lab facility and equipment are now receiving an additional 2,000 man hours of student use each year above and beyond what is scheduled for official courses.

4. Value to Other Educational Entities

   During the past five years, the students, faculty, and staff of the manufacturing programs helped launch three F.I.R.S.T. Robotics teams in the Big Rapids area. The faculty and staff of the program provide access to the manufacturing lab facilities and mentor these high school students in the design and build of their robots.

   Program faculty members serve the greater educational community and industry through educational advisory boards, serving as certification test proctors, guest speakers at manufacturing education events, participating in technology user groups, and participating on regional and state education committees.

5. Value to the Local Community and General Public

   Program faculty are well-engaged in the local community and support a number of community service groups and non-profit agencies.
   On several occasions since the last program review, MFT courses have taken on special development projects for both the community as well as private business These special projects provide students service-learning opportunities that bring a great deal of reality to the course projects.

B. Flexibility and Access

The Manufacturing Technology program operates as a traditional on-campus program. Because of the programs dependency on active labs, the block scheduling system for all major courses is geared around lab availability. No on-line courses currently exist in the program.

This program is one-of-a-kind in that it provides both an intensive tooling technology concentration that includes a well-rounded exposure to primary tooling applications and a general processing option that provides students the opportunity to customize their education to specific areas of interest. This

dynamic nature allows the program to function as an excellent stepping stone for a variety of career paths.

The curriculum structure also provides non-majors opportunities for additional technical electives and better supports cross-programmatic projects as well as greater accessibility for all students.

Since implementing the last curriculum action, the number of articulations is up 800 percent compared to the preceding ten-year history.

Although no counter-effects have yet been identified, it's possible that with continued growth, the program could end up with issues in meeting the demand for courses (particularly for the CNC certificate) and therefore need to add additional sections. This may create issues regarding the availability of CNC machines and possibly impact open lab opportunities.

C. Visibility and Distinctiveness

1. Unique Features/Components of the Program

The following list of highlights includes factual statements currently used to gain visibility and identify the uniqueness of the program.

Unique, Diverse, Project-Based Experience

This program is the only university-based associate degree in the nation offering a comprehensive education in tooling technology. The curriculum covers multiple tooling categories including jigs and fixtures, metal-forming dies, and plastic molds. All major tooling courses are project-based and require the application of CAD, CAM, and CNC technology in producing real-world, functional tools.

Articulation Options

Students entering this program from a secondary school with an official articulation agreement may have multiple opportunities to receive college credit for their secondary technical education experience.

Concentration Options

This degree provides students the option of concentrating on either "tooling technology" or "processing technology." Both concentrations share a common core with the difference being the nature of advanced technical courses.

The tooling technology concentration focuses on learning to apply the science and methodology of precision machining, CAM/CAM, and CNC to tooling applications. Students gain experience applying these technologies to the design, build, tryout, troubleshooting of tool assemblies including jig and fixtures, metal stamping dies, and plastic injection molds. Exposure to project management and cost estimating are included as part of these major projects.

The processing technology concentration focuses on learning to apply other (non-machining) manufacturing technologies such as welding, molding, programming automation controls, etc. This concentration allows students to select technical courses from a variety of options based on their interests.

Communicating with Industry Standard Process Documentation

Throughout the program, students further develop communication skills by creating and utilizing industry standard process documentation including: flow charts, process sheets, setup sheets, inspection reports, and standard operating procedures.

Application of World-Class CAD/CAM Technology

Beginning in the first semester, students apply world-class CAD/CAM software to create 3-D solid models and component drawings. Throughout the remaining semesters, these skills are further developed through the design, tool-pathing, and production of complete tool assemblies. Second-year tooling projects rely exclusively on the application of CAM generated toolpaths and focus on producing accurate, efficient programs.

Direct Entry to Numerous Bachelor Degree Programs

Both concentrations result in direct entry to seven bachelor degree programs including the following:

College of Engineering Technology:

- Manufacturing Engineering Technology (MFGE)
- Product Design Engineering Technology (PDET)
- Mechanical Engineering Technology (MET)
- Plastics Engineering Technology (PLTE)
- Rubber Engineering Technology (RUBE)

College of Business:

- Business Administration with Professional Tracks (BAPT)

College of Education and Human Services:

- Technical Education (TCED)

Support from Industry Leading Companies

This program is supported by numerous industry-leading companies who have pledged their support through scholarships, tooling and equipment donations, consignments, and industrial projects. Over the past five years, this support has accumulated a 'value" of gift-in-kind receipts of more than $500,000.

2. Programs Ability to Attract Quality Students

The MFT program is currently in a better position to attract quality students than ever before. The program can now boast a dynamic curriculum with multiple articulation options, application of the latest CAD/CAM technology, and a direct path to multiple bachelor's degree programs.

These factors, along with higher enrollment standards, have clearly had a positive impact on attracting quality students.

3. Competitive Programs

Although the program is very unique and without any direct competition in this region of the country regarding tooling applications, prospective students are often confused by propaganda from community colleges promoting manufacturing degrees with CAD/CAM courses. Most often, the difference comes down to the amount of required lab time and the extent of project work. Most community college programs in the state of Michigan have only about 30% of the required lab time that Ferris' program has. Therefore, they simply do not have the time on task to go as far or dig as deep into the application of technology.

Other programs with similar course offerings that also embrace the value of intensive, hands-on labs include: Pennsylvania College of Technology's Automated Manufacturing Technology program and Vincennes University's Advanced CNC Machining and Programming Technology program.

When comparing the Manufacturing Technology program at Ferris with other programs nationally, it appears that Ferris is ahead of the pack in regard to actively engaging its students with CAD/CAM technology early in the program. In addition to this, Ferris' program also seems to have a greater extent of CAD/CAM application and more significant course projects. On the other hand, these other programs appear to have a greater diversity in their curriculums in that many integrate electronics and/or mechatronics courses into their manufacturing programs. Although this is an option for Ferris students under the processing concentration, there is no way to draw a direct comparison due to the fact that the processing concentration provides students the option of customizing their education to their interests.

Anyone looking to compare programs will likely come to the realization that although some programs appear to be the same, every program has a unique flavor based on its history. At Ferris, that flavor is machining for tooling applications.

4. Preeminent Program

Determining the preeminent program for manufacturing technology may require a lot more time and energy than what the program has available. Sorting programs by "flavor" is a reasonable start. Considering the fact that five similarly titled programs (two in-state and three out-of-state) have contacted the Ferris' MFT program coordinator this past year to inquire about the programs curriculum and project portfolio may indicate that the program is viewed in high-regard. Considering that these other programs were referred to Ferris by their industry associates may help qualify that thought.

D. Relevance and Demand

1. Student's Rationale for Enrolling in MFT

The majority of incoming freshmen see the MFT program as a stepping stone and technical base for advancing their education. According to recent surveys, over 90 percent of the program's incoming freshmen are focused on completing a bachelor of science degree in technology with the majority of these directing their attention to the Manufacturing Engineering Technology program. Others come planning to pursue a bachelor's in Product Design Engineering Technology or Plastics Engineering Technology. On occasion, a few have their sights set on a bachelor's in business or technical education.

2. Program Relevance and Adequacy

   Based on recent surveys of current students, recent graduates, employers/advisory committee members, and program faculty, all respondents agreed that the programs curriculum and related course projects were both relevant and adequate.

3. Response to Emerging Technologies, Stakeholder Needs, and Other Issues

   Responding to change is a key component to the program's success. Although faculty members often meet with actively engaged industrial partners, the program's industrial advisory committee serves a key role in the planning and development process. The program uses input gathered from stakeholders, reviews the information with the assistance of the program's industrial advisory committee, and adjusts the development plan accordingly.

4. Labor Market Demand Analysis

   In reviewing labor market data produced by the Federal Department of Labor for careers associated with completing the MFT program as a terminal degree, the current growth projection shows an anticipated growth of six percent over the next ten years. The demand for these workers will remain high as the majority of current workers are nearing retirement and significantly fewer young people have pursued these careers over the past 20 years. The majority of manufacturing companies are reporting serious difficulties finding qualified workers which presents major concerns due to the fact that these workers are those primarily responsible for producing and advancing manufacturing equipment and systems.

   In reviewing labor market data produced by the Federal Department of Labor for careers associated with completing the MFT program as a stepping stone to a career in Manufacturing Engineering, the data is somewhat difficult to interpret as the Department of Labor just recently identified a SOC code for this specific occupation. Currently, Manufacturing Engineering is classified under Industrial Engineering. Closely related careers show a stable projection for the future.

   See Appendix B, Career and Labor Market Reports, for detailed information on three primary careers associated with completing the MFT program as a terminal degree.

E. Student Achievement

Students of the manufacturing technology program are actively engaged in registered student organizations, special project teams, and national competition teams.

Approximately one-half of MFT students are actively engaged in the local student chapter of the Society of Manufacturing Engineers (SME). This global organization serves as the only certification agency for certifying manufacturing technicians and engineers. In this organization, students get exposure to a wide variety of manufacturing sectors and have the opportunity to learn more about their industry. Over the past five years, two program graduates were selected by the society for a feature article in the organizations special edition publication titled “Thirty Under 30, a Look at Thirty Future Industry Leaders Under Age 30”. Being that these selections were made by their industry associates, this is clearly a great achievement.

Special project teams like SAE Formula and Baja rely heavily on the assistance of manufacturing students. Each year, these teams receive a significant amount of support from manufacturing students who commit their time and energy as active team members making components for these vehicles. The level of quality in the work that these students complete is quite inspiring. They often receive acknowledgement from other teams regarding the quality of their work.

This past year, three manufacturing students started a new RSO titled the “Ferris F.I.R.S.T. Alumni RSO”. This organization was the first college-level RSO in the nation that focused exclusively on providing mentoring support for local F.I.R.S.T. robotics teams. In this organization, students from a variety of CET programs assist local F.I.R.S.T. Robotics teams in the design, manufacturing, and project management involved in building competition robots.

Throughout the past decade, manufacturing students have competed in numerous Skills USA competitions. They typically do quite well and have brought home several medals including a gold medal in automated manufacturing.

F. Employability of Graduates

The MFT program is synonymous with high-quality, technically competent graduates. Several industry leading companies have correlated their success in tool manufacturing to a history of hiring MFT graduates. Although a considerable number of companies recruit annually, many surpass expectations and provide incentives for students to connect with them. These incentives include multiple on-campus information sessions with food, gas cards to reimburse students for

visiting the company, corporate sponsorships for performing well in the program, and in some cases, even corporate vehicles and apartments for summer interns.

On several occasions over the past few years, program faculty members have been contacted by recruiting companies commissioned by major corporations to find associate-level tooling graduates for positions ranging from tool makers to tooling engineers. This level of recruiting for associate-level graduates was simply unheard of ten years ago.

It has become common, over the past few years, for those completing the MFT program, to have numerous job opportunities for summer internships and fulltime employment well before spring break in March. Last year, over 125 companies came looking to fill more than 200 manufacturing-related positions during the course of the school year.

Program faculty members cannot identify a single case where a student has not found a job directly related to manufacturing within a few months of graduation. The university data on graduate follow-up surveys supports this by showing 100% placement for the past five years.

Section 5

Faculty Composition and Engagement

A. Faculty Members, Programmatic Load, and Teaching Locations

Tenured Faculty

Name: David Borck, Assistant Professor
Programmatic Load: 57% MFT, 43% MFGE
Teaching Location: 67% Main Campus, 33% Grand Rapids

Name: Dean Krager, Associate Professor / Program Coordinator
Programmatic Load: 36% MFT, 14% MFGE, 50% Coordinator
Teaching Location: 100% Main Campus

Name: Louis Nemastil, Associate Professor
Programmatic Load: 70% MFT, 30% MFGE
Teaching Location: 100% Main Campus

Tenure-Track Faculty

None

Adjunct Faculty

Name: Christopher Rybak, Full-time, Adjunct
Programmatic Load: 93% MFT, 7% MFGE
Teaching Location: 100% Main Campus

Name: Bruce Hammond, Part-time, Adjunct
Programmatic Load: 100% MFT
Teaching Location: 100% Main Campus

B. Efficiency and Effectiveness of Current Structure

The current faculty group structure seems to work fine. For the most part, this structure allows the program to schedule faculty members in courses related to their areas of expertise. Due to the diverse background and experience of faculty members, they tend to complement one another so the students receive a well-rounded exposure to various industrial experiences.

C. Suggestions for Improvement of Structure

In an attempt to gain long-term stability and more efficient lab operations, the program would like to see the current full-time (overloaded) adjunct position be converted to a nine month full-time staff position. This position would include a

mix of lab management responsibilities and the supervision of basic machining labs and open lab opportunities.

D. Curriculum Vitae

Tenured Faculty

Name: David Borck, Assistant Professor
Highest Degree Earned: Master of Science
Average Annual Teaching Load: 21 Credits / 39 Contacts

Name: Dean Krager, Associate Professor (Program Coordinator)
Highest Degree Earned: Master of Science
Average Annual Teaching Load: 23 Credits / 35 Contacts***

Name: Louis Nemastil, Associate Professor
Highest Degree Earned: Master of Science
Average Annual Teaching Load: 20 Credits / 38 Contacts

*** Load includes one-half release time for coordinator duties.

Adjunct Faculty

Name: Christopher Rybak, Full-time, Adjunct
Highest Degree Earned: Master of Science
Average Annual Teaching Load: 14 Credits / 42 Contacts

Name: Bruce Hammond, Part-time, Adjunct
Highest Degree Earned: Master of Science
Average Annual Teaching Load: 8 Credits / 16 Contacts

E. Service

Program faculty members serve the greater educational community and industry through educational advisory boards, serving as certification test proctors, guest speakers at manufacturing education events, participating in technology user groups, and participating on regional and state education committees.

F. Research

The program is currently engaged in a machining research project with the American Iron and Steel Institute (AISI). In this project, the program is contracted to perform a series of machining tests for the organizations Bar

Products Machinability Committee. These tests involve machining mill certified steel alloys, measuring the insert wear, capturing digital images of the wear, compiling a tool life report, and presenting the information at regular meetings. Information gathered from this project is being used to update industry standard reference tables for machining speeds and feeds. This project allows both students and faculty members a chance to be actively engaged in activities that positively impact the industry.

G. Continuing Education / Professional Development

With the program's recent push towards advanced technology, faculty have spent considerable hours engaged in professional/technical development. Faculty are aware of the need to progress in professional/technical development and continue implementing industrial and academic best practices.

See Appendix C, Faculty Information, for faculty specific education and professional/technical development activities.

H. Stakeholder Perceptions of the Quality and Composition of Faculty

Based on recent surveys of current students, recent graduates, and employers/advisory committee members, there is no indication of issues regarding the quality and/or composition of faculty.

I. Program Policies and Procedures

According to college and school policies, all MFT faculty members advise students on a regular basis. Having program advisers that teach directly in the program provides students the best possible scenario for getting the most accurate, up-to-date information for scheduling and career planning.

J. Hiring and Retention

Hiring well-qualified adjunct instructors to cover extra load is extremely difficult based on the fact that there are not many in the surrounding rural area. Those that do exist are typically working a lot of hours in industry. The current adjunct pay does nothing to entice someone to travel any distance to teach as an adjunct. Most of these prospects can earn significantly more by putting in a little overtime.

Section 6

Program Administration and Support

A. Administration

It seems the program is well-served with the current CET organizational structure. The only administrative concern is the funding regarding program S&E dollars. The only comments received on a recent faculty survey refer primarily to program funding. These comments are as follows:

"We are drastically underfunded. For the number of students we support (not only in our own program from other programs with related classes to the clubs on campus that use our facilities) we are underfunded. We are not like most programs. Much of our cost are not out in the open. On top of that, we support the Ferris maintenance staff as well. This needs to be recognized. Also, we need a full time lab supervisor that would watch over the lab outside of class time and manage tooling as well. We could cut tooling costs if there was a supervisor watching over this. This person could also sharpen much of our tooling to save costs in sending it out to be done. This could help us in the safety department do to the fact all too often students are in the lab working without supervision. When our program was redone and lab hours shortened, we were told by the Dean of the CET that this would happen. It never happened so therefore students work unsupervised outside of classes to get the work done."

"The program has come a long way in developing over the past few years; much better utilization of current technology and much more concerted team effort. The greatest issue threatening this ongoing development is properly funding this program. For the past 3 years we've been full in regard to enrollment and this year we are wait-listing students yet our S&E budget is only 66% of what we had 18 years ago. This is not only unacceptable, it's downright embarrassing-particularly when you realize that a typical high school program (vocational/technical center program) has more money to work with. Something is wrong with our S&E allocation system and this needs to get fixed. If it wasn't for our industrial discounts and donations, there is absolutely no way we could do what we do with our students."

B. Staff

The program enjoys having a friendly, competent, and efficient secretary and lab technician to help support the many tasks associated with running the day-to-day operations of a growing program.

Section 7

Support Services

Support Services

The program does not have any concerns regarding the quality of any of the support services provided by the university. Program faculty and students use a variety of these services on a regular basis and appear to be content with the service they are receiving.

Section 8
Facilities and Equipment

Facilities and Equipment

During the course of the past three years, the manufacturing programs have spent considerable time working together with the welding programs on a major initiative to secure a complete overhaul of the Swan Annex facility. This project, which was recently approved for construction, represents a $30,000,000 capital outlay project through the State of Michigan. This will result in a comprehensive upgrade of both program's educational spaces and equipment. When complete, this facility will allow both the manufacturing and welding programs to integrate all their educational resources into a single location. All current issues regarding inadequate facilities and aging equipment should be resolved through this project.

Section 9
Perceptions of Overall Quality

A. Perceptions of the School of Design and Manufacturing Director

Evaluation of Overall Quality July 20, 2016

Manufacturing Technology (AAS) and Manufacturing Engineering Technology (BS) Programs Evaluation.

My evaluation of the Manufacturing degree programs on a 1 - 100 scale with 100 representing the highest quality achievable would be 92. Basis of Evaluation. The Manufacturing programs evaluated as part of this Academic Program Review (APR) process were the original degree offerings of what today is the College of Engineering Technology. Because many other degree programs were developed from a Manufacturing background, the Manufacturing Technology AAS (MFGT) and the Manufacturing Engineering BS (MFGE) programs continue to provide a number of required courses for the Mechanical Engineering Technology, Product Design Engineering Technology, Plastics Engineering Technology CAD Drafting and Tool Design, Automotive Engineering Technology, Industrial Technology Management and Welding Engineering Technology programs. These courses taught for other programs are provided in addition to the classes taught for MFGT and MFGE students. Because of this dual responsibility the Manufacturing programs are often impacted by changes outside their direct control.

The two degree programs evaluated by this review, despite being interdependent upon each other, have only recently began moving toward a closely linked program identity. The Manufacturing Tooling (AAS MFGT) program has experienced solid growth from a low enrollment point approximately 8 years ago. This resurgence of interest has been driven by rapidly expanding career opportunities in advanced machining processes (CNC) and by the development of a more flexible curriculum allowing easier scheduling and integration with other College of Engineering Technology programs. The Manufacturing Engineering Technology (BS MFGE) program has an established record of very productive enrollment levels as well as a sustained history of high levels of post-graduate employment with starting salaries among the highest of Bachelor's Degree programs at FSU. The BS MFGE program is also one of only three CET programs to be successfully offered by FSU in Grand Rapids in an evening format for non-traditional students with full time employment. Both the MFGE and MFGT programs have benefitted from the increased cooperation between the two programs in the areas of curriculum development, program planning, faculty hiring and equipment acquisition.

Recommendations for Improvement. With current all current trends seemingly positive for the Manufacturing programs, I can identify no areas requiring immediate improvement. Some areas that should be considered to continue the positive changes that have been made already are;

1. Facility Improvement – The current facilities used by the Manufacturing program are not a positive or accurate reflection on the program or the profession. In some cases, excellent equipment is being used in areas with limited space, producing instructional difficulties. Within the current laboratory areas there are no facility improvements that seem practical without major renovation. There is currently a major renovation project for the Swan Building Annex that has received final approval by the State of Michigan. It is vitally important to the future of the program that this project be successfully completed.

2. Faculty Diversification – It is likely that the Manufacturing programs will find it necessary to add faculty in the near future. Previous experience with the hiring process indicates that it will be difficult to fill these positions within salary constraints without compromising the level and quality of experience or educational qualifications. To address this potential problem area, the Manufacturing program is encouraged to continuously solicit interest among qualified potential faculty in view of potential openings. It will be important to hire faculty with at least five years of successful, relevant professional experience and to give preference to candidates with at least a technical BS degree and graduate education that includes a degree from an institution other that Ferris State.

3. Improved Waiting List Policy – The success of the Manufacturing program has created a growing demand to enroll beyond program capacity. In addition, other CET programs with poor enrollment management often use manufacturing courses to fill the schedules of pre-program students increasing the demand for manufacturing courses. Currently the program uses a first come – first served approach. While this is a fair and reasonable way to manage demand before full program enrollment, the students currently seeking admission would be better served by a strictly competitive admissions process. This would improve the program by admitting the best applicants rather than those who happen to apply early. This type of competitive admission is typical of the most selective academic programs nationwide and would raise the stature of the manufacturing programs while still providing an admission process that is fair to all. The Manufacturing programs must also rigorously manage enrollment in MFGE and MFGT courses to ensure that critical capacity is not being used to support students from other programs that are in a pre-program status.

4. Merge MFGT & MFGE – Since the AAS and BS programs are essentially a 0-4 program in Manufacturing, it is expected that they will continue to have common interests. It is recommended that Manufacturing programs merge their budgets and faculty groups into a single entity. While this is not an easy step because of years of historic separation, such a merger would provide increased flexibility and encourage focus on common objectives that would benefit both programs.

5. Improved Laboratory Staffing Strategy for MFGT – There are a number of laboratory sections in MFGT programs that could be conducted using non-tenured faculty. While the lecture portion and the laboratory content of a course should remain the responsibility of tenured program faculty, many MFGT laboratory sections would be more effectively conducted by technical staff rather than faculty. While this will not be easy to implement, it would provide for well supported laboratories while allowing tenured faculty resources to concentrate on course content.

6. Improved Implementation of Laptop PCs – Currently MFGT & MFGE programs both require students to have a student owned laptop computer. Unfortunately, due to a variety of reasons, the use of student owned laptop PCs has been spotty in the Manufacturing courses. The manufacturing programs should make a renewed effort to insist that the required student PCs are used in all computer based activities in program courses. It is acknowledged that that this may require changes in the software used and its licensing however it is believed that suitable alternatives exist that would allow a complete implementation while continuing to meet course objectives. Only a more complete implementation of student owned laptop PCs would provide all the benefits identified when this requirement was originally implemented.

Richard F. Goosen PE, PhD
Director School of Design & Manufacturing
College of Engineering Technology
Ferris State University

B. Perceptions of the College of Engineering Technology Dean

ACADEMIC PROGRAM REVIEW
Manufacturing Engineering Technology - AAS & BS Programs

Perceptions of Overall Quality

Dean Rating – 92%

Rationale:

- These programs provide education in manufacturing concepts that are always in demand. These concepts include how to make products better, faster, safer, and less expensive. The student develops strong analytical and problem solving skills through classroom theory and laboratory hands-on implementation. Students procure high paying and high performance level positions upon graduation, and are in high demand in Michigan as well as across the nation. There also exists a high demand for these graduates within many international companies.
- There are two concentrations that a student may follow, the tooling track or the processing track. This assists in recruiting a wider range of students
- The graduates from this program have numerous job offerings immediately. Companies that pursue the graduates are among the leaders in a wide range of industries. This includes automotive, equipment, machinery, defense, etc.
- The program curriculum is diverse. It includes foundational courses within the first year and advances into applied practical engineering courses. The program prepares students for a very broad range of occupations and how to deal with manufacturing engineering challenges found daily in industry. All of the faculty have extensive, applicable industry experience. Faculty currency is kept by attendance to seminars, membership to professional engineering societies, and working with companies throughout the year. The same diverse group of companies that hire the graduates also repeatedly take program interns, a degree requirement. Faculty visit and monitor the interns as coordinators. This also aids in the currency and updating of faculty knowledge.
- The program uses TracDat assessment software to create, house, monitor and manage curriculum outcomes and assessment methods. The coordinator of the programs is a current tenured faculty member. In rotating faculty through this position, they share in program administrative duties and issues. This assists in understanding and consensus gaining with decisions that support program quality and keep it student focused.
- This program demonstrates its value to the university through attracting an abundance of students who represent a high level of academic ability. As such, the program enrollment trend along with its retention rate are both upward and high. The graduates bring notoriety back to the program, college, and university. This notoriety is due to the graduates having a solid technical background which allows them to solve a broad array of problems in areas such as design, testing, and manufacturing. This leads to an increasing amount of students entering the programs.

Improvement Recommendation:

- The updating and new facilities construction of the laboratory and educational spaces need a foundational maintenance plan for state-of-the-art appearance and functionality with an emphasis on cleanliness.
- Continue curriculum improvements and enhancements through the utilization of data and self-studies.

- Eliminate the program wait list and create student flexibility as the building activities occur.

Larry Schult
Dean, College of Engineering Technology
Ferris State University

Section 10
Implementation of Findings

Implementation of Findings

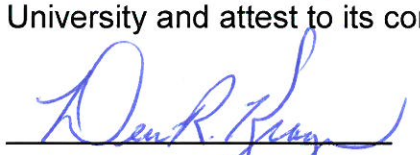
The programs standard operating procedure regarding the findings of the APR process is to forward a copy of these findings to the program's industry advisory committee for review. Given that the committee will have already had a chance to review the APR document submitted by the program, the resulting APRC report will serve as topic of discussion in the following advisory committee meeting. Once the report is discussed, recommendations from the committee will be incorporated into the programs operational system and/or future planning.

Section 11

Signature Page

Manufacturing Technology Program- AAS
915 Campus Drive, Swan-108
Big Rapids, MI 49307
231.591.2511

My signature below indicates that I was a contributing member of the Program Review Panel responsible for the completion of the final academic Program Review report submitted for review by the Academic Senate, Provost, and President of Ferris State University and attest to its completeness and soundness.



Dean Krager
PRP Chair and MFT/MFGE Coordinator
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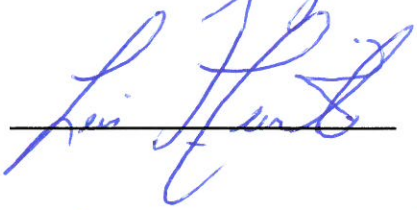

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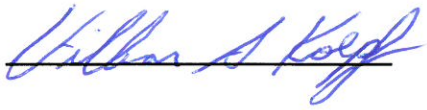

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My signature below indicates that I was a contributing member of the Program Review Panel responsible for the completion of the final academic Program Review report submitted for review by the Academic Senate, Provost, and President of Ferris State University and attest to its completeness and soundness.

Larry Schult
Dean, College of Engineering Technology
231.591.2890 schultl@ferris.edu

Appendix A
Curriculum Information

FERRIS STATE UNIVERSITY
Imagine More

Associate in Applied Science

Manufacturing Technology

Tooling Technology Concentration

Course Sequence Guide

Student:			
Email:		ID:	
Advisor:		Ph:	

YEAR 1 - FALL SEMESTER			Crs	Gr
MFGT	110	Theory of Producing Machined Components	3	
MFGT	113	Overview of Producing Machined Components (MFGT 110) [160 co-req]	1	
MFGT	114	Producing Machined Components (MFGT 110, 113) [160 co-req]	2	
MFGT	160	Basic Metrology	1	
PDET	122	Parametric Modeling	2	
MECH	122	Computer Applications	2	
MATH	115	Intermediate Algebra (ACT 19 or MATH 110)	3	
FSUS	100	FSU Seminar	1	
		Total	15	

YEAR 1 - SPRING SEMESTER			Crs	Gr
MFGT	130	Theory of Producing Fixture Assemblies (MATH 115)	3	
MFGT	131	Producing Fixture Assemblies (MFGT 110, 113, 114, 160; PDET 122, MATH 115)	3	
MFGT	140	Basic CNC Programming (MFGT 110, 113, 160; PDET 122; MATH 115)	2	
MFGT	141	CNC Machine Operation (MFGT 110, 113, 160; PDET 122; MATH 115) [MFGT 140 co-req]	1	
MATH	120	Trigonometry (ACT 24 or C- in MATH 115)	3	
ENGL	150	English 1 (ACT 14 or ENGL 074)	3	
		Total	15	

Submit Application for Graduation.

YEAR 2 - FALL SEMESTER			Crs	Gr
MFGT	210	Theory of Producing Metalform Tooling (MATH 115)	2	
MFGT	213	Producing Metalform Tooling (MFGT 130, 131, 140, 141) [MFGT 210 co-req]	2	
MFGT	220	Advanced CNC Programming (MFGT 140, 141)	2	
MFGT	222	CNC System Utilization (MFGT 140, 141; MFGT 220 co-req)	1	
MATL	240	Introduction to Material Science	4	
ENGL	250	English 2 (ENGL 150) OR	3	
ENGL	211	Industrial Career Writing (ENGL 150)		
		Cultural Enrichment	3	
		Total	17	

YEAR 2 - SPRING SEMESTER			Crs	Gr	
PLTS	325	Plastics Technology for MET	2		
MFGT	231	Producing Plastic Mold Tooling (MFGT 130, 131, 140, 141) [PLTS 325 co-req]	2		
CHEM	114	Intro to General Chemistry (ACT MATH 19 , CHEM 103 or H.S. Chemistry) OR	4		Preferred for B.S. MFGE
PHYS	211	Introductory Physics 1 (ACT MATH 25 or MATH 116 or 120)			Required for B.S. PDET
COMM	121	Fundamentals of Public Speaking	3		
MATH	130	Advanced Algebra & Analytical Trig (MATH 120)			Required for MFGE/PDET
		Social Awareness	3		
		Total	14		

Contact the Manufacturing Program office
for more information
Phone: 231-591-2511
Email:Manufacturing[illegible]artment@ferris.edu
www.ferris.edu/manufacturing

Fall 2015
8/7/15

FERRIS STATE UNIVERSITY
Imagine More

Associate in Applied Science

Manufacturing Technology

Processing Technology Concentration
Course Sequence Guide

Student:			
Email:		ID:	
Advisor:		Ph:	

YEAR 1 - FALL SEMESTER			Crs	Gr
MFGT	110	Theory of Producing Machined Components	3	
MFGT	113	Overview of Producing Machined Components (MFGT 110, 160 co-req)	1	
MFGT	160	Basic Metrology	1	
PDET	122	Parametric Modeling	2	
MECH	122	Computer Applications	2	
MATH	115	Intermediate Algebra (ACT19 or MATH 110)	3	
FSUS	100	FSU Seminar	1	
		Total	**13**	

YEAR 1 - SPRING SEMESTER			Crs	Gr
		Directed Technical Course	3	
		Directed Technical Course	3	
MFGT	140	Basic CNC Programming (MFGT 110, 113, 160; PDET 122; MATH 115)	2	
MFGT	141	CNC Machine Operation (MFGT 110, 113, 160; PDET 122; MATH 115; MFGT 140 co-req)	1	
MATH	120	Trigonometry (ACT 24 or C- in MATH 115)	3	
ENGL	150	English 1 (ACT 14 or ENGL 074)	3	
		Total	**15**	

Submit Application for Graduation.

YEAR 2 - FALL SEMESTER			Crs	Gr
		Directed Technical Course	2	
		Directed Technical Course	2	
MFGT	220	Advanced CNC Programming (MFGT 140, 141)	2	
MFGT	222	CNC System Utilization (MFGT 140, 141; MFGT 220 Co-req)	1	
MATL	240	Introduction to Material Science	4	
ENGL	250	English 2 (ENGL 150) **OR**	3	
ENGL	211	Industrial Career Writing (ENGL 150)		
		Cultural Enrichment	3	
		Total	**17**	

YEAR 2 - SPRING SEMESTER				Crs	Gr	
		Directed Technical Course		2		
		Directed Technical Course		2		
CHEM	114	Intro to General Chemistry (ACT MATH 19 , CHEM 103 or H.S. Chemistry, MATH 110)	**OR**	4		Preferred for B.S. MFGE
PHYS	211	Introductory Physics 1 (ACT MATH 25 or MATH 116 or 120)				Required for B.S.PDET
COMM	121	Fundamentals of Public Speaking		3		
MATH	130	Advanced Algebra & Analytical Trig (MATH 120)		4		Required for MFGE/PDET
		Social Awareness		3		
		Total		**18**		

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

Contact the Manufacturing Program office
for more information
Phone: 231-591-2511
Email:Manufacturing@ferris.edu
www.ferris.edu/manufacturing

Fall 2015
8/7/15

FERRIS STATE UNIVERSITY

Imagine More

Certificate In
Basic CNC Programming & Machine Operation

Manufacturing Technology Program

Program Academic Requirements

Student:								Location	Crs
email:			ID:					Ferris	
Advisor:			Ph:					Transfer	

REQUIRED COURSES			Cr	Gr	Pts	S	Yr	Notes
MFGT	140	140 Basic CNC Programming (C- in MFGT 150, PDET 122 & MATH 115)	2					
MFGT	141	CNC Machine Operation (C- in MFGT 150, PDET 122 & MATH 115; MFGT 140 co-req)	1					
MFGT	150	Manufacturing Processes or equivalent	2					
PDET	122	Parametric Modeling or equivalent	2					
		TOTAL REQUIRED	**7**					

A minimum of 50% of the total credit hours required must be earned through the completion of Ferris State University classes.

A minimum grade of C- is required for each course in the certificate. Must complete the certificate requirements with an average GPA of 2.0 or higher.

Prerequisites are listed in parenthesis.

Contact the Manufacturing Technology Program Office
for more information.
Phone: 231-591-2511 Manufacturing Department@ferris.edu
www.ferris.edu/manufacturing

Fall 2015
8/7/15

Ferris State University
College of Engineering Technology
School of Design & Manufacturing

Course Syllabus

Course Title: MFGT-110, Theory of Producing Machined Components

Credit Hours: 3 Semester Hours

Contact Hours: 3 Hours/Week

Course Description:

In this course focus is placed on developing an in-depth understanding of the science and methodology used in producing machined components. This course covers process planning, speeds and feeds, an in-depth study of the core machining processes (i.e.: sawing, drilling, milling, turning, and grinding), indexable cutting tools, and metalworking fluids. Classroom discussions and related activities support the projects in the corresponding lab courses.

This course is for all Manufacturing Technology students (including articulating students), CNC certificate students, and students who minor in Manufacturing Technology.

Prerequisite: None

Corequisite: None

Textbook: Machine Tool Practices (Latest Edition)
Machinery's Handbook (Latest Edition)

Units of Instruction and Student Learning Goals for Each Unit:

I. Introduction and Orientation

A. Understand the course format, attendance policy, grading scale, and project requirements.

II. Process Planning

A. Define and use related terminology.

B. Identify the departments within a manufacturing organization that contribute to process planning and summarize each department's contributions.
C. Describe the key elements of a successful process planning procedure.
D. Perform print reviews.
E. Identify and state the value of various types of process documentation including: flowcharts, process sheets, operation sheets, set up sheets, tooling layouts, standard operating procedures, work instructions, and inspection reports.
F. Create process sheets and inspection reports.
G. Utilize flowcharts, process sheets, set up sheets, standard operating procedures, and inspection reports.

III. Speeds and Feeds

A. Define and use related terminology.
B. Select cutting speeds and feeds from tool manufacturers charts.
C. Calculate spindle speed for various applications.
D. Calculate feed rate for high-engagement applications.
E. Calculate feed rate for low-engagement applications.

IV. Sawing Technology

A. Define and use related terminology.
B. Defend relative safety rules.
C. Identify the applications, limitations, and capabilities of various sawing machines including: vertical contour band saws, scissor-type horizontal band saws, double column horizontal band saws, cold saws, and abrasive cutoff saws.
D. Select sawing machines for specific applications.
E. Select saw blades for specific applications.

V. Drilling Technology

A. Define and use related terminology.
B. Defend relative safety rules.
C. Identify various drilling operations and state the purpose of each including: spot drilling, center drilling, drilling, chamfering, countersinking, counterboring, spot facing, reaming, and tapping.
D. Identify the applications, limitations, and capabilities of specialized hole drilling processes including: gun drilling, BTA-STS drilling, and ejector drilling.

E. Identify the applications, limitations, and capabilities of various drilling machines including: sensitive/upright drill presses, radial arm drill presses, multi-spindle drill presses, and CNC drills.
F. Select drilling machines for specific applications.
G. Select work holding devices for specific applications.
H. Select cutting tools and holders for specific applications.

VI. Milling Technology

A. Define and use related terminology.
B. Defend relative safety rules.
C. Identify various milling operations and state the purpose of each including: facing, edging, slotting, pocketing, contouring, plunging, thread milling, and boring.
D. Identify the applications, limitations, and capabilities of various milling machines including: knee-type vertical mills, bed-type vertical mills, bed-type horizontal mills, boring mills, and CNC mills.
E. Select milling machines for specific applications.
F. Select work holding devices for specific applications.
G. Select cutting tools and holders for specific applications.

VII. Turning Technology

A. Define and use related terminology.
B. Defend relative safety rules.
C. Identify various turning operations and state the purpose of each including: turning, facing, grooving, parting, profiling, knurling, threading, and boring.
D. Identify the applications, limitations, and capabilities of various turning machines including: engine/toolmakers lathes, turret lathes, vertical lathes, swiss-style lathes, multi-spindle lathes, and CNC lathes.
E. Select turning machines for specific applications.
F. Select work holding devices for specific applications.
G. Select cutting tools and holders for specific applications.

VIII. Grinding Technology

A. Define and use related terminology.
B. Defend relative safety rules.
C. Identify various grinding operations and state the purpose of each including: flat surface grinding, O.D. grinding, I.D. grinding, shoulder grinding, plunge grinding, and profile grinding.
D. Identify the applications, limitations, and capabilities of various grinding machines including: types-1,2,3, and 4

surface grinders, blanchard grinders, O.D. / I.D. grinders, cylindrical grinders, centerless grinders, jig grinders, and CNC grinders.

E. Select grinding machines for specific applications.
F. Select work holding devices for specific applications.
G. Select grinding wheels for specific applications.

IX. Indexable Cutting Tools

A. Define and use related terminology.
B. Identify various indexable cutting tools and state the purpose of each.
C. Interpret insert specifications.
D. Select indexable cutting tools for specific applications.
E. Identify primary insert failure modes.

X. Metalworking Fluids

A. Define and use related terminology.
B. Identify various cutting fluids and describe the properties of each.
C. Identify cutting fluid application methods and state the advantages and limitations of each.
D. Describe the key elements of successful fluid maintenance.
E. Identify cutting fluid filtering methods and state the advantages and limitations of each.
F. Select cutting fluids for specific applications.

Grading Scale:

95-100	=	A	80-82	=	C
93-94	=	A-	77-79	=	C-
91-92	=	B+	74-76	=	D+
88-90	=	B	71-73	=	D
85-87	=	B-	69-70	=	D-
83-84	=	C+	0-68	=	F

Appendix B

Career and Labor Market Reports

Machinists and Tool and Die Makers

Summary

Machinists and tool and die makers set up and operate many different machines.

Quick Facts: Machinists and Tool and Die Makers	
2015 Median Pay	$42,110 per year $20.25 per hour
Typical Entry-Level Education	High school diploma or equivalent
Work Experience in a Related Occupation	None
On-the-job Training	Long-term on-the-job training
Number of Jobs, 2014	477,500
Job Outlook, 2014-24	6% (As fast as average)
Employment Change, 2014-24	29,000

What Machinists and Tool and Die Makers Do

Machinists and tool and die makers set up and operate a variety of computer-controlled and mechanically controlled machine tools to produce precision metal parts, instruments, and tools.

Work Environment

Machinists and tool and die makers work in machine shops, toolrooms, and factories. Although many work full time during regular business hours, overtime may be common, as is evening and weekend work.

How to Become a Machinist or Tool and Die Maker

Machinists train in apprenticeship programs, vocational schools, community and technical colleges, or on the job. Tool and die makers receive several years of technical instruction and on-the-job training. A high school diploma is necessary.

Pay

The median annual wage for machinists and tool and die makers was $42,110 in May 2015.

Job Outlook

Employment of machinists and tool and die makers is projected to grow 6 percent from 2014 to 2024, about as fast as the average for all occupations. Workers familiar with computer software applications and who can perform multiple tasks in a machine shop will have the best job opportunities.

Industrial Engineering Technicians

Summary

Industrial engineering technicians collect data to assist in process improvement activities.

Quick Facts: Industrial Engineering Technicians	
2015 Median Pay	$53,780 per year $25.86 per hour
Typical Entry-Level Education	Associate's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2014	66,500
Job Outlook, 2014-24	-5% (Decline)
Employment Change, 2014-24	-3,000

What Industrial Engineering Technicians Do

Industrial engineering technicians help industrial engineers implement designs to use personnel, materials, and machines effectively in factories, stores, healthcare organizations, repair shops, and offices. They prepare machinery and equipment layouts, plan workflows, conduct statistical production studies, and analyze production costs.

Work Environment

Most industrial engineering technicians work in manufacturing industries. Most work full time.

How to Become an Industrial Engineering Technician

Industrial engineering technicians typically need an associate's degree or a postsecondary certificate. Community colleges or technical institutes typically offer associate's degree programs, and vocational–technical schools offer certificate programs.

Pay

The median annual wage for industrial engineering technicians was $53,780 in May 2015.

Job Outlook

Employment of industrial engineering technicians is projected to decline 5 percent from 2014 to 2024. This is due in large part to projected declines in the manufacturing industries that employ them.

State & Area Data

Mechanical Engineering Technicians

Summary

Mechanical engineering technicians plan, produce, and assemble new or changed mechanical parts for products, such as industrial machinery or equipment.

Quick Facts: Mechanical Engineering Technicians	
2015 Median Pay	$53,910 per year $25.92 per hour
Typical Entry-Level Education	Associate's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2014	48,400
Job Outlook, 2014-24	2% (Slower than average)
Employment Change, 2014-24	900

What Mechanical Engineering Technicians Do

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.

Work Environment

Mechanical engineering technicians assist with manufacturing processes in factories, or with development phases in research and development labs before manufacturing takes place.

How to Become a Mechanical Engineering Technician

Most employers prefer to hire candidates with an associate's degree or other postsecondary training in mechanical engineering technology. Prospective engineering technicians should take as many science and math courses as possible while in high school.

Pay

The median annual wage for mechanical engineering technicians was $53,910 in May 2015.

Job Outlook

Appendix C
Faculty Information

David A. Borck

2792 4 Mile NW
Grand Rapids Mi 49544-9205
Home 616-784-0247

Summary

The wide variety of experiences I have received from my employment at Greenville Tool and Die, Western Michigan University, Indiana Vocational Technical College and Northwestern Michigan College qualifies me to teach in many areas.

Experience

2005-Present, Ferris State University- Big Rapids, Michigan

Taught a variety of classes for the Manufacturing Tooling Technology Program and the Manufacturing Engineering Program

1970-1974, 1980-2005, Greenville Tool and Die- Greenville, Michigan

My experiences have had a wide range at Greenville Tool & Die. I have been a special machinist, a die leader, die designer, CNC programmer, cad die designer, system manager, and computer programmer. I have been involved with training people on different controllers in the shop and on Computervision CADDS5 CAD CAM system Dassault's Catia V5 CAD CAM software in the engineering department.

I have worked with Fagor controllers on a CNC jig grinder, Charmilles Robofill 400 and 600 wire burn controller, Cincinnati 900 and 850 controllers and Okuma 5020 and 7000 controllers. Our latest Okuma mill also has multiple heads with it. My role with these has been to learn how to use them and then write training manuals and train new operators.

I have used Microsoft Office 97 products Word, Excel, Access and Power Point. I have worked on DOS, Windows 95, Windows 98, Windows NT and Unix operating systems. Programming software I have used includes Visual Basic, Borland's C++, CADDS5 CVMAC, Visual Dbase, Seagate's Crystal Reports along with older languages BASIC, Varpro and NewVar.

I did research on many topics from new machines too new machining methods, new cutters, die designs, and new software.

1979-1980, Northwestern Michigan College- Traverse City, Michigan

Taught machine shop classes and related classes.

1975-1979, Indiana Vocational Technical College- Muncie, Indiana

At IVTC I was Program Advisor of the Machine Tool Department. I was in charge of counseling and scheduling of our students. I also hired part time instructors as needed plus taught machine shop and related classes. I repaired the majority of machines. When I arrived at IVTC there were 40 students enrolled in the program when I left we had over one

hundred. The last two years in Indiana I was Chairman for the State Wide Curriculum Committee for Machine Tooling.

1973-1975, Western Michigan University- Kalamazoo, Michigan.

I worked as a Teaching Graduate Assistant and Part-time Instructor while working on my master's degree. I taught classes such as basic machining, die making and production tooling.

Education

August 1978	Western Michigan University- Kalamazoo, Michigan Master of Arts degree in Teaching Industrial Education
November 1974	Ferris State College- Big Rapids, Michigan Bachelor of Science degree in Trade-Technical Education
March 1970	Ferris State College- Big Rapids, Michigan Associate in Applied Science degree in Machine Tool

Also have attended many seminars and training sessions on Catia and Pro-e

Interests

Running, motorcycles, skiing, boating, camping and cooking are some of the varied avocation interests I involve myself in.

References

Promptly furnished upon request.

Personal Portfolio

(Modified from the CET Post-Tenure Portfolio)

Dean R. Krager
Associate Professor
Manufacturing Technology
School of Design and Manufacturing

Industrial Work Experience

Manufacturing Engineer

Newcor, Rochester Gear- Clifford, MI

March 1998 - August 1999

- Managed the development and launch of new manufacturing cells.
- Researched, ordered, ran-off, and implemented manufacturing equipment including: machining, gaging, and material handling equipment.
- Performed tool testing for high-precision machining operations.
- Designed and sourced special workholding fixtures and custom indexable tools.
- Evaluated current processes and established long-term goals.
- Researched, developed, and implemented new processes including: hard turning and dry machining.

Manufacturing Engineer

Orbital Fluid Technologies/Synerject- Saginaw, MI

June 1995 - March 1998

- Reviewed product designs for manufacturability and specified process prints.
- Developed process documentation including: process prints, flow charts, setup sheets, control plans, and FMEA's.
- Researched, ordered, ran-off and implemented manufacturing equipment including: machining, gaging, assembly, and test equipment.
- Evaluated future product designs and specified manufacturing requirements including: processes, equipment, capital, floor space, and personnel requirements.

Machinist/Tool Builder

R&S Tool & Die- Caro, MI

May - September, 1994

- Machined and inspected close-tolerance die details and special gages.
- Manufactured prototype parts from a wide variety of materials.
- Produced fixture assemblies and assisted in building special machines.

Tool Designer/Tool Builder

Thumb Group, Gemini Plastics & Lyntex Manufacturing- Ubly, MI

May - September, 1991, 1992, & 1993

- Designed and assisted in building injection molds, blow molds, and fabrication dies.
- Developed gaging and fixturing prints from 3-D CAD models.
- Evaluated, debugged, and programmed an NC replicator.

Mechanical Draftsman

Nortec Precision Plastics- Bad Axe, MI
September 1988 - June 1989

- Developed layout prints for quality assurance.
- Designed gages and CMM fixtures for injection molded parts.

Previous Teaching Experience

Technical Instructor

In addition to the hands-on industrial work experience previously listed, a combination of the following instructional work experience was part of both Manufacturing Engineer positions:

- Taught Basic Machining and Process Documentation classes to new production operators.
- Provided update training to experienced operators and maintenance staff when implementing new equipment and tooling.
- Taught G-code programming to new manufacturing technicians.

Technical Instructor

Ferris State University: College of Technology- Big Rapids, MI
September 1994 - May 1995

- Taught Introduction to CAD, Basic Machine Tools, and Advanced Machine Tools.
- Developed all quizzes, tests, and final exams for all courses.
- Compiled academic warnings and grades.
- Setup, evaluated, and integrated a new wire EDM programming package.
- Rewrote an NC post-processor to correspond with a wire EDM.

Student Teacher

Wexford Missaukee Technical Center- Cadillac, MI
March - May 1993

- Taught Mechanical Drafting using both manual equipment and Autocad.
- Provided group and individualized instruction for a combination of traditional and non-traditional students.
- Assisted in the development of new instructional materials.
- Compiled student evaluations and met with students parents during parent-teacher conferences.

FSU Teaching Experience

Programs:

Manufacturing Technology
Manufacturing Engineering Technology

Courses Taught:

MFGE-312, CNC and CAM
MFGE-324, Principles of Process Planning I (formerly Tool Engineering)
MFGT-110, Theory of Producing Machined Components
MFGT-111, Machine Tool Operations I
MFGT-113, Overview of Producing Machined Components
MFGT-114, Producing Machined Components
MFGT-121, Machine Tool Operations II
MFGT-122, CNC Manual Part Programming
MFGT-131, Producing Fixture Assemblies
MFGT-150, Basic Machine Tools
MFGT-212, CAD / CAM for CNC Machinery
MFGT-221, Plastic Mold Construction
MFGT-252, Advanced Machine Tools

Courses Developed:

MFGT-110, Theory of Producing Machined Components
MFGT-113, Overview of Producing Machined Components
MFGT-114, Producing Machined Components
MFGT-130, Theory of Producing Fixture Assemblies*
MFGT-131, Producing Fixture Assemblies*
MFGT-140, Basic CNC Programming*
MFGT-141, CNC Machine Operation*
MFGT-160, Basic Metrology*
MFGT-220, Advanced CNC Programming*
MFGT-222, CNC System Utilization*
MFGT-231, Producing Plastic Mold Tooling*

Note: An asterisk (*) identifies courses developed as a team effort between another faculty member and myself.

Seminars, Workshops, Etc.:

"The Effects of Design on Producing Precision Machined Components"

This 2-3 day workshop is the result of personal consulting. Approximately 3 years ago I was approached by the Society of Manufacturing Engineers to develop a machining overview course to provide a review of machining capabilities and associated costs for mechanical and design engineers. After working through a needs analysis with Kulick and Soffa Industries (KNS) of Philadelphia, PA, this course evolved into an immersive workshop involving an overview of core machining operations as well as an in-depth team-based review of company specific components. The workshop is dynamic in that the team-based review of company specific components can be adjusted from one to two days depending on what the company wishes to accomplish.

I have presented this workshop on three occasions for KNS. Twice at the companies world headquarters in Philadelphia where they design and test specialized machines used in the production of microchips and once in Singapore at their manufacturing facility. Class size ranged from 12 to 25 engineers per workshop.

Although I've received additional interest in this workshop from other companies, I decided to put my personal consulting on hold until some long-awaited changes have been implemented in the Manufacturing Technology program.

"The Fundamentals of CNC Milling"

This course is designed to provide a well-rounded educational experience for individuals working with production-type CNC milling applications. Focus is placed on developing an understanding of the science and methodology involved in producing machined components using CNC machining centers. This course covers process planning, work holding systems, cutting tools and holders, speeds and feeds, coordinate data input, EIA coding systems, G-code program development, program verification / simulation, machine startup, and machine operation. Class discussions and related activities reference the company's actual components and equipment.

This 20 hour course is the result of personal consulting. It was originally developed for implementation at Simonds Industries in Big Rapids, MI.; however, as a result of both changes in management and corporate finances its implementation has been delayed.

Recent Related Work Experience

During the past five years I've committed the majority of my time outside the classroom to the continued development of the Manufacturing Technology program affording little time to work in industry. The following experiences represent my personal consulting activities since my last promotion.

5/25/05 Facilitated a 2-day technical workshop titled "The Effects of Design on Producing Precision Machined Components" to a group of 12 mechanical/design engineers at Kulick and Soffa Industries in Philadelphia, PA. In conjunction with this workshop I performed a complete DMA print review, process analysis, and identified potential corrective actions for several of the companies "problematic" components.

7/26/05 Presented the "Effects of Design ...." technical workshop to a group of 15 mechanical/design engineers at Kulick and Soffa Industries in Philadelphia, PA.

10/7/05 Proctored a Michigan Occupational Competency Assessment certification exam through Occupational Research Associates in Big Rapids, MI.

1/4/06 Presented the "Effects of Design ...." technical workshop to a group of 25 mechanical/design engineers at Kulick and Soffa Industries in Singapore.

5/9/06 Proctored a Michigan Occupational Competency Assessment certification exam through Occupational Research Associates in Big Rapids, MI.

12/8/06 Proctored a Michigan Occupational Competency Assessment certification exam through Occupational Research Associates in Big Rapids, MI.

2016 Working part-time through the CPD as a process consultant reviewing, evaluating, and improving CNC machining processes for Belding Tool & Machine in Belding, MI.

2016 Working part-time through the CPD as the coordinator for a series of machinability tests for the American Iron and Steel Institute (AISI) in Southfield, MI.

Recent Educational Experience

Non-Credit Coursework:

6/6/05	MasterCam Mill Level-3 Programming,	40 Hours
2/21/06	Hurco Lathe Programming with WinMax,	24 Hours
5/8/06	Fast Track to Pro/ENGINEER Wildfire 3.0,	40 Hours
7/23/07	Catia V5: Introduction to Modeling,	40 Hours
8/23/07	Catia V5: Introduction to Prismatic Machining,	16 Hours
2/12/08	Catia V5: Introduction to Surface Design,	16 Hours

Contributions to Ferris Beyond Teaching

Program Responsibilities:

- Serving as the coordinator of strategic planning. This includes scheduling and facilitating planning meetings, documenting an annual strategic plan, and compiling an annual development report.

- Serving as the program articulation specialist. This includes reviewing articulation agreements and researching articulation options. Currently working on redefining all first-semester projects to so as to create new, more simplified course articulation requirements.

- Working to further develop industrial partnerships and advance the financial status of programs by negotiating major discounts and donations. Over the past ten years I've secured Gift-in-Kind contributions of over $500,000 in Equipment and Related Tooling and $250,000 in Software for a grand total of $750,000.

- Advising both MFGT and MFGE students.

Curriculum Development:

- Co-authored the 1st major curriculum action in 20 years. This action included: reducing the overall credit count from 68 credits to 64 credits; splitting six combined lecture/lab courses into separate lecture and lab courses; creating additional (lesser-credit) lab courses; replacing a traditional blueprint reading course with a 3-D solid modeling course; rebalancing the credit weight of CNC courses; renumbering all MFGT major courses; updating all course documentation. Combined, these changes have redefined the program and allow the program to better meet the needs and goals of all stakeholders.

- Co-authored the 2nd major curriculum action in 20 years. This action included: establishing a dual concentration associates degree in Manufacturing Technology; reducing the overall credit count from 64 credits to 61 credits; adjusting the credit weight of manufacturing lecture and lab courses; redefining course outcomes; and replacing a traditional handbook calculations course with an applied metrology course. Combined, these changes have significantly improved the operational efficiency of the program.

- Co-authored a curriculum action to create a new certificate program in Basic CNC Programming and Machine Operation.

- Currently investigating developing two additional CNC certificate programs to provide condensed, summer sessions to regional manufacturing companies.

Committee Participation:

- University Strategic Planning Committee, 2013 - 2014
- College of Engineering Technology Sabbatical Committee, 2006 – Present
- College of Engineering Technology Scholarship Committee, 2005 – Present
- Dave Borck's Tenure Committee, 2004 – 2009
- Hurco Scholarship Committee, 2005 – 2009
- Manufacturing Technology APR Committee, 2005, 2011, 2016
- Manufacturing Technology Program Curriculum Committee, 1999 – Present
- Michigan EMIT Pathways Machine Tool Standards Committee, 2006 – 2008

Department Responsibilities:

- Providing marketing and recruitment services such as presentations, group tours, and off-site secondary program visits.

- Serving as the primary contact to several of our major industrial partners such as Hurco, Sandvik, and most MFGT advisory board members.

- Coordinating a bi-annual trip to Chicago for the International Manufacturing Technology Show.

- Serving as the technology co-advisor. This includes coordinating software and hardware upgrades and troubleshooting CAD/CAM software and CNC equipment.

- Serving as the cutting tool procurement and inventory specialist. This includes sourcing specialty and indexable cutting tools, creating master tool libraries and tracking tool inventory and usage.

- Serving as the primary program contact for the Swan Annex Renovation project since 2013.

- Serving as the program coordinator for both MFT and MFGT programs since 2013.

Involvement in Student Activities:

- Advised the Ferris State Tooling Technologists Association from 2000 until the group was incorporated into SME in 2008.
- Assisting special project teams (Formula, Baja, etc.) with process troubleshooting and problem solving activities in regard to manufacturing vehicle components.
- Assisted the Formula SAE team in securing a $500 project grant from Hurco USA.
- Co-Advising the F.I.R.S.T. Alumni RSO since 2014.
- Assisting the F.I.R.S.T. Alumni RSO in mentoring local F.I.R.S.T. Robotics teams from local high schools.

Involvement in Professional Organizations

Membership in Organizations:

• Michigan Machining Instructors Association, Member	2006 - 2011
• N.O.C.T.I, Subject Area Expert / Consultant	2003 - Present
• Skills USA, Professional Member	2003 - 2007
• Society of Manufacturing Engineers, Member	1995 - Present

Innovative Educational Activities

Classroom / Lab Activities:

Spring-08 Incorporated an industrial development project into my MFGT-221, mold building lab. This project consisted of producing several prototype plastic injection molds for Dan McKeon, President of Bad Dog Security Systems in Traverse City, MI. During the semester, the project was carried out as a real-world tool build project including preliminary design reviews, weekly production/status meetings with Bad Dog Security, and regular milestones on which progress was assessed. The project provided students a chance to experience the whole process of tool engineering from design through prototype run.

As a result of this project I began engineering a more-modular mold building system that will better incorporate industrial best practices, increase the operational efficiency of the course and lower course material costs.

Spring-09 Incorporated a community service project into my MFGE-324, process planning course. This project consisted of producing a low-volume run of specialized security nuts to be used by local businesses to better secure the embellished bulldogs from the recent "Leadership Mecosta" project. This project served as "Project-X", a preparatory project in process planning used to prepare students for the annual Amerikam project.

Spring-10 Incorporated a community service project into my MFGE-324, process planning course. This year's project will consist of producing a low-volume run of re-engineered stainless steel scraper blades for use in "The Rock" on the infamous Mongolian Grill.

Recent Publications and Presentations

Presentations:

11/12/04 Served as a guest speaker at the 2004 Ferris Foundation for Excellence Benefit Dinner in Grand Rapids.

11/8/06 Presented on "Careers in Manufacturing" to over 100 high-school students at the Huron Area Technical Center's annual Career Day.

11/7/07 Presented on "Careers in Manufacturing" to over 100 high-school students at the Huron Area Technical Center's annual Career Day.

11/3/08 Presented on "Careers in Manufacturing" to over 100 high-school students at the Huron Area Technical Center's annual Career Day.

Recent Community Involvement

Community Service and Support:

- Central Michigan Search and Rescue (Training Officer) 2006 - 2012
- Osceola Emergency Management Support Team 2006 - 2013
- Saint Mary's Catholic School Strategic Planning Comm. 2012 – 2014

Louis J. Nemastil

113 Park Avenue
P.O. Box 168
Hesperia, MI 49421
(231) 854-5015
lneme@verizon.net

CAREER OBJECTIVE

University-level educator with comprehensive knowledge and experience in the Manufacturing Tooling Field that includes: engineering management, manufacturing system operations, tooling operations, tool design, die design, automation and systems development, stamping operations, steel fabrication, engineering and manufacturing operations, manufacturing processing including roll forming methods and operations.

PROFESSIONAL PROFILE

Certified Vocational Educator with a B.S. in trade/Technical Education, with a MS in Career / Technical Education. Offers 26 years of comprehensive engineering and administrative experience in the manufacturing tooling field, with emphasis on the design and development of progressive dies, sheet metal operations, statistical process control, and design of experiment, manufacturing lines, automation and fixture design. Effective tooling and jig/fixture construction. Well-developed interpersonal and communication skills enhanced by excellent technical abilities and well versed in the areas of industrial management and operations.

EDUCATION

M.S., Career and Technical Education, Ferris State University, Big Rapids, Michigan
B.S., Trade/Technical Education, Ferris State University, Big Rapids, Michigan
A.A.S., Machine Tool, Ferris State University, Big Rapids, Michigan
Certified Tool & Die Maker, Certified by: U.S. Department of Labor, Bureau of Apprenticeship & Training
Certified Vocational Education Instructor, Provisional Certification, and State of Michigan.
Certified for grades 9-12, Vocational Training, Provisional Certification, and State of Michigan.
Certified for grades 7-8 all subjects, Provisional Certification, State of Michigan.
Licensed Aircraft Pilot, Certified by: U.S. Federal Aviation Administration.

CONTINUING EDUCATION:

- ***Dale Carnegie Course***, Certificate of completion "Effective Speaking and Human Relations".
- ***Society of Manufacturing Engineers***, Certificate of completion, "Proven Design Principles and Applications of Progressive Dies"
- ***Society of Manufacturing Engineers***, Certificate of completion, "Estimating Processing for Stamping Dies".
- **Society of Manufacturing Engineers**, Certificate of Completion, "Progressive Dies".
- ***Superior Metal Products***, Certificate of completion, "Techniques of Problem Solving".
- ***Superior Metal Products***, Certificate of completion, "Statistical Process Control".
- ***Superior Metal Products***, Negotiation Completed "Win-Win" Negotiation training.
- ***Cad Design Systems,*** Certificate of completion, "CDSI AUTOCAD Operations".

LOUIS J. NEMASTIL

CONTINUING EDUCATION:

- ***Grand Rapids Community College,*** Certificate of completion, "Geometric Tolerancing & Dimensioning".
- ***AGS, INC.,*** Certificate of completion, "Ground Instruction Federal Aviation Regulations".
- ***Axsys Incorporated,*** Certificate of completion, Master CAM IV
- ***Axsys Incorporated,*** Certificate of completion, Advanced Machining Master CAM IV
- ***PTC Incorporated,*** Certificate of completion, Fast Track to Pro/ENGINEER Wildfire 2.0.
- ***PTC Incorporated,*** Certificate of completion, Tool Operations Pro/ENGINEER Wildfire 2.0.
- ***Ferris State University,*** Completed, "MFGE Engineering Course CAD CAM".
- ***Catia/Delmia Incorporated,*** Certificate of completion, Catia Modeling.
- ***University of Milwaukee,*** Certificate of completion, Mold Tooling Operations
- ***Sandvik Inc,*** Certificate of completion, Cutting Tool Operations
- ***Ferris State University,*** Certificate of completion, Catia Parametric Modeling.
- ***Ferris State University,*** Certificate of completion, Catia Advanced Modeling.
- ***Ferris State University,*** Completed, "MFGT Tooling Course Advanced CNC Automation.

LOUIS J. NEMASTIL

EMPLOYMENT HISTORY

Ferris State University, Big Rapids, Michigan ***1997-Present***

Associate Professor, Manufacturing Tooling Technology Program, College of Technology. Lead educator of for the following courses: MFGT 112 Machinery Handbook and Calculations, MFGT 160 Basic Metrology, MFGT 130 Theory of Producing Fixture Assemblies, MFGT 131 Producing Fixture Assemblies, MFGT 210 Theory of Producing Metal form Tool, MFGT 213 Producing Metalform Tooling, MFGT 252 Advanced Machine Tools, MFGE 321 Metrology, MFGE 352 Design for Manufacturing, MFGE 451 Plant Layout and Automation. Requires extensive content research and preparation; design curricula and create course modules and lessons for lecture and lab activities; effective teaching methods; team coordination; strong interpersonal and communication skills; solid decision making and problem-resolution skills; and constant updating of knowledge and technical skills.

Louis Nemastil, Consulting and Design Services, Hesperia, Michigan ***1995-Present***

Design and development of tooling systems, manufacturing systems, engineering operations, and training programs. Services are directed toward engineering and training activities, which include: tool design, tool processing, tool manufacturing, cost estimating, and program development. Clients consist of business owners, engineers, managers, team leaders, supervisors, and manufacturing facility personnel. Tool Design and training services are custom designed to enhance customer efficiency and productivity, including the ability to assess client needs, create course modules and lessons designed to meet individual customer requirements. Implementation of Microsoft Office software programs, (Word, Excel, PowerPoint), and strong English communication and customer service skills. Technical training and manufacturing plant experience.

Superior Metal Products, Corporate Tooling Division, Spring Lake, Michigan ***1984-1997***

Design engineer, engineering administrator, and production coordinator with complete engineering capabilities. Responsible and accountable for ensuring the smooth day-to-day operations in all areas of engineering for twelve corporate divisions, including prototype development, manufacturing systems planning, troubleshooting, budgeting, quoting, and cost estimating. Emphasis on the design and development, from concept to implementation, of complete manufacturing lines using proper engineering methods and standards. Participated in Design of Experiments for product development and processes. Key player in initiating and maintaining corporate computer system. Functions as consultant and troubleshooting for twelve corporate divisions nationwide. Scope of responsibility and accountability increased greatly in final years.

Bendix/Warner & Swasey Research Division, Solon, Ohio ***1981-1984***

Manufacturing, design, and testing of all prototype tooling equipment for manufacturing operations.

Reed City Tool & Die, Reed City, Michigan ***1980-1981***

Tool & Die Construction for plastic injection molding systems. Implemented theoretical knowledge into practical application.

IEM Corporation, Rogers Heights, Michigan ***1980***

Tooling Operations and Machining, Fabrication.

LOUIS J. NEMASTIL

ACCOMPLISHMENTS AND AFFILIATIONS

- Graduate Studies; Highest Distinction; Ferris State University, Big Rapids, Michigan.
- President, St. Michael's School Board, Grand Rapids Diocese affiliation. Responsible for setting agendas; conducting meetings; setting budgets; coordinating and implementing programs and policies; motivating and encouraging in a proactive management style.
- Mechanical Advisor for Science Olympia, St. Michael School, Fremont, Michigan.
- Administration of grant monies, St Michael School, Fremont Michigan.
- Established educational program involving business skills directed toward enhancing math and science curriculum. Grant monies obtained through the Fremont area foundation, Fremont Michigan.
- Served on the Curriculum Committee for the Manufacturing Department, Ferris State University, Big Rapids, and Michigan.
- Founder and Chairperson of the Annual Giving Campaign for twelve years, Saint Michael School, Fremont Michigan. Total Endowment raised during my tenure $480,000.00
- Served on the Associate Deans Search Committee for the College of Technology, Ferris State University, Big Rapids, and Michigan.
- Served on the Conduct Review Committee: (CRC) in Judicial Services. Served as representative for the College of Technology, Ferris State University, Big Rapids, and Michigan.
- Served on the search committee for a tenure track position for the Manufacturing Tooling Technology Program, Ferris State University, Big Rapids, and Michigan.
- Author of reorganization plan for the Grand Rapids Diocese, Grand Rapids, Michigan. Implementation of School organizational and operational plan.
- Mentoring Appointment for the Manufacturing Tooling Technology tenure track faculty, Ferris State University, Big Rapids, Michigan.
- Served on The Manufacturing Tooling Technology Program Review committee, Ferris State University, Big Rapids, Michigan.
- Co-Contributor and Research Coordinator for the Hesperia Master Plan Committee. Appointed by the Hesperia Village Council to serve on the planning committee. Hesperia Master Plan Committee, Hesperia, MI.
- Elected Village Trustee for the Village of Hesperia, Hesperia Michigan. Serving a four year term on the village council, 2009-2013.

COMPUTER / SOFTWARE APPLICATIONS

- Microsoft Office: 2007
- AutoCAD: Version 2007
- Pro Engineer: Wildfire IV Design & Manufacturing.
- Master Cam: V9 Manufacturing
- Master Cam: V10 Manufacturing
- CATIA: VR19 Parametric Design
- CATIA: VR19 Manufacturing
- Electronic Library Fabrication and Tooling Operations

Appendix D
Advisory Committee Information

Manufacturing Programs Joint Advisory Committee

2016 Member List

Ms. Stephanie Leonardos
President
Amerikam
Grand Rapids, MI

Greg Bergman
Manufacturing Engineer
Bucher Hydraulics
Newaygo, MI

Don Graham
Manager Education/Technical Services
Seco Tools, Inc.
Troy, MI

Jon Hamm
Manufacturing Engineer
Oliver Packaging & Equipment Company
Walker, MI

Mr. Scott Slee
Manufacturing Systems Manager
John Deere Power Systems
Waterloo, IA

Ed Brown
Vice-President of Engineering & Manufacturing
Trans-Matic
Holland, MI

Andre Ey
President
Makino Die/Mold Technologies
Auburn Hills, MI

Jim Braun
Manager of Distribution Development
Hurco Companies Inc.
Indianapolis, IN

Dave Westphal
Executive Director, Alternative Energy & Agricultural Business Line
Nexteer Automotive
Saginaw, MI

Greg Butts
Instructor of Precision Machining & Engineering Technologies
Capital Area Career Center
Mason, MI

Dave Sniegowski, Manager
Advanced Tooling Technologies
Johnson Controls
Holland, MI

Joseph Tarajos Jr.
Product Specialist, Powder/Wear Parts
Sandvik Hard Materials
Auburn Hills, MI

Brian Cubitt
Executive Vice President - Plastics
Gemini Group
Bad Axe, MI

Appendix E

Degree Program Costing

Ferris State University
Degree Program Costing 2013-14 (Summer, Fall and Spring)

College: Coll of Engineering Technology
Department: Manufacturing Eng Tech

Program Name: Manufacturing Technology AAS (Processing Tech Concentration)

Program Credits Required (Total credits to graduate) 62

*Instructor Cost per Student Credit Hour (SCH) (average for program)	$201.59
**Department Cost per Student Credit Hour	$63.61
***Dean's Cost per Student Credit Hour	$30.74
Total Cost per Student Credit Hour (average for program)	**$295.94**
Total Program Instructor Cost (Assumes a student will complete program in one year)	$10,357.04
Total Program Department Cost	$3,396.03
Total Program Dean's Cost	$1,656.91
Total Program Cost (assumes a student will complete program in one year)	**$15,409.98**

Course ID	Level	Instructor Cost	Dept Cost	Dean's Cost	SCH's Produced	Instructor Cost/SCH	Dept Cost/SCH	Dean's Cost/SCH	Credits Required	Program Instructor Cost	Program Dept Cost	Program Dean's Cost
CHEM114	L	$138,912	$45,643	$19,345	1,740	$80	$26	$11	4	$319	$105	$44
COMM121	L	$313,327	$83,123	$35,589	3,201	$98	$26	$11	3	$294	$78	$33
CULTELE	E	$1,038,370	$248,303	$104,249	8,996	$115	$28	$12	3	$346	$83	$35
EEET201	L	$57,440	$28,292	$19,832	444	$129	$64	$45	3	$388	$191	$134
EEET301	U	$47,540	$17,205	$12,060	270	$176	$64	$45	3	$528	$191	$134
ENGL150	L	$547,147	$162,235	$59,504	5,352	$102	$30	$11	3	$307	$91	$33
ENGL250	L	$584,863	$145,957	$53,534	4,815	$121	$30	$11	3	$364	$91	$33
FSUS100	L	$144,424	$159,156	$103,470	1,569	$92	$101	$66	1	$92	$101	$66
ISYS105	L	$217,758	$84,565	$58,400	2,379	$92	$36	$25	3	$275	$107	$74
ISYS200	L	$128,008	$26,660	$18,411	750	$171	$36	$25	3	$512	$107	$74
ISYS204	N	$28,801,322	$7,419,525	$4,032,418	150,748	$191	$49	$27	3	$573	$148	$80
MATH115	L	$320,201	$100,349	$38,057	3,423	$94	$29	$11	3	$281	$88	$33
MATH120	L	$126,338	$41,072	$15,576	1,401	$90	$29	$11	3	$271	$88	$33
MATH130	L	$134,386	$23,922	$9,072	816	$165	$29	$11	4	$659	$117	$44
MATL240	L	$134,093	$91,651	$37,163	832	$161	$110	$45	4	$645	$441	$179
MFGT110	L	$18,406	$7,931	$3,216	72	$256	$110	$45	3	$767	$330	$134
MFGT113	L	$9,798	$2,644	$1,072	24	$408	$110	$45	1	$408	$110	$45
MFGT140	L	$14,574	$6,389	$2,591	58	$251	$110	$45	2	$503	$220	$89
MFGT141	L	$9,747	$3,084	$1,251	28	$348	$110	$45	1	$348	$110	$45
MFGT160	L	$5,077	$2,864	$1,161	26	$195	$110	$45	1	$195	$110	$45
MFGT220	L	$13,924	$3,745	$1,519	34	$410	$110	$45	2	$819	$220	$89
MFGT222	L	$13,924	$1,873	$759	17	$819	$110	$45	1	$819	$110	$45
PDET122	L	$10,962	$2,811	$2,769	62	$177	$45	$45	2	$354	$91	$89
SOCAELE	E	$1,363,192	$316,665	$213,537	14,046	$97	$23	$15	3	$291	$68	$46

*Instructor Cost –**Salary and Fringe** – the actual cost to teach a course

Department Cost – **Departmental Level Non Instructor Compensation, Supplies and Equipment – department average applied to all course prefixes within a department

***Dean's Cost – **Dean's Level Non Instructor Compensation, Supplies and Equipment** – college average applied to all course prefixes within a college