# SELF STUDY FOR ACADEMIC PROGRAM REVIEW

# MANUFACTURING ENGINEERING TECHNOLOGY BACHELOR OF SCIENCE PROGRAM

**College of Technology**
**Ferris State University**
**Big Rapids, Michigan 49307**

**May 23, 2011**

## Program Review Panel

### *Program Faculty*

**Bruce M. Gregory, Co-Chair**
**Professor of Manufacturing Engineering Technology**
**Gary L. Ovans, Co-Chair**
**Professor of Manufacturing Engineering Technology**
**and Program Coordinator**
**James A. Rumpf, and NEW Program Coordinator**
**Professor of Manufacturing Engineering Technology**
**Blaine R. Danley**
**Associate Professor of Manufacturing Engineering Technology**
**Joseph A. Wist**
**Associate Professor of Manufacturing Engineering Technology**
**Mark Rusco**
**Associate Professor of Manufacturing Engineering Technology**

### *Faculty from Outside the College*

**Steven Lyman**
**Associate Professor of Management**

### *Individual with Special Interest in the Program*

**Gregory Key**
**Interim Director/Professor Automotive & Heavy Equipment**

## Table of Contents

**Prologue**

The Manufacturing Engineering Technology Program graduated its first class in May, 1978. Fourteen students entered the program fall 1976. Fourteen students graduated, thanks to one man, Jensen Edwards Nicks. Jensen preferred his middle name Edward, shortened to Ed. Ed changed the lives of these people.

Ed had long been in industry holding various engineering management positions having to do with manufacturing. His practice, as was the general practice of the past, was hiring mechanical or industrial engineers and training them to do manufacturing engineering work (process design). Ed recognized a body of knowledge existed, that defined process design. He felt this could be taught at the college level. Ed sought out schools to find any that did. He found one school that he felt came close, Brigham Young in Utah.

Being a Michigan native, he was also aware of Ferris State College. He penciled out a Plus 2 (+2) year check sheet that built upon the intensive hands-on focus of Ferris' 2-Year associate degree programs that related to manufacturing (Drafting/Tool Design, Welding, Machine Tool, Plastics, Mechanical). The result was a 2 year AAS + 2 years manufacturing course work = BS degree in Manufacturing Engineering Technology.

Ed presented it to School of Technology's Dean circa 1974. The long and short of it: the first graduating class of Manufacturing Engineering Technology (May 1978) students had at least two job offers each at very good starting salaries. The Manufacturing Engineering Technology program graduates continue to rank at or near the top for starting-salary at Ferris. The 2004/2005 Graduate Follow-Up Survey Summary, posted an average salary of $58,975, which was the highest listed, absent the Dr. of Optometry and PharmD results.

It should always be remembered that Ed Nicks is the reason we have Engineering Technology degrees at Ferris. He must be remembered.

Something else worth remembering is the SUCCESS of the Manufacturing Engineering Technology Program spawned ALL 4 year Engineering Technology programs in the School of Technology (as it was then known). Many of the offspring still take MFGE prefixed courses owing to their pertinence to industry.

As long as there are products that are designed, there will be a need for the design of the processes that produce them. Hence, the need for manufacturing engineers will remain regardless of where production occurs.

# SECTION 1

# Program Overview

## Section I-A
## Program Goals

A. PROGRAM GOALS.

1) State the goals of the program.

    a. FSU MFGE Mission: "The mission of the Manufacturing Engineering Technology Program is to prepare career-ready manufacturing engineering professionals to serve Michigan, and the nation in a global economy."

2) Explain how and by whom the goals were established.

    a. This mission describes the operating principles of the program since it inception as defined by Ed Nicks. The faculty formalized this mission statement some years back and presented it to the advisory board who support it. This mission appears on the back of the program business card.

3) How do the goals apply to preparing students for careers in and meeting employer needs in the community/region/marketplace?

    a. Placement at relatively high salaries is our ultimate goal.

4) Have the goals changed since the last program review? If so, why and how? If not, why not?

    a. No; Placement remains at a virtual 100% along with salaries.

5) Describe the relationship of the program goals to the University's mission, and the departmental, college and divisional strategic plans.

    a. Ferris' Mission: Ferris State will be a national leader in providing opportunities for innovative teaching and learning in career-oriented, technological and professional education.

    The program goals support the University's.

## Section 2-B
## PROGRAM VISIBILITY AND DISTINCTIVENESS

1) Describe any unique features or components of the program.

    a) Blending theory with Hands-on.

2) Describe and assess the program's ability to attract quality students.

    a) Getting better. The improvements made by the primary on campus feeder program have made recruiting higher motivated students easier. More on this is discussed in Section

3) Identify the institutions that are the main competitors for prospective students in this program.

    a) Western Michigan, Grand Valley, Central Michigan, to name a few. These programs are traditional engineering programs which place their primary focus on the engineering fundamentals; math, physics, chemistry, statics, dynamics, etc.

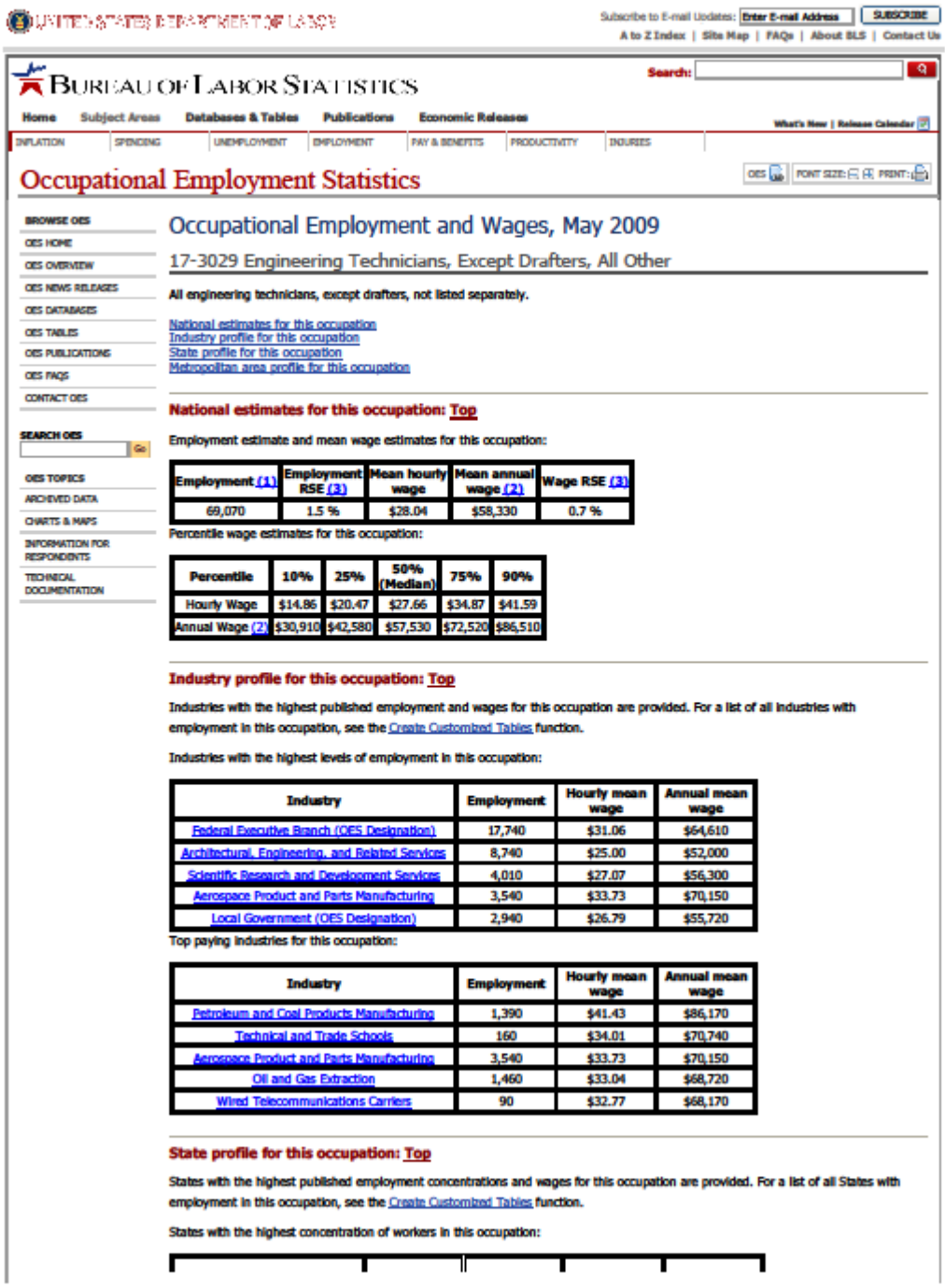
    b) How are these programs similar and different from the FSU program?
        a) FSU-MFGE does require some fundamental course work (MATH 216/220, PHYS 211, Statics and Strengths of Materials (MECH 340), but not to the extent these other schools do. The other schools lack a hands-on focus. Hands-on is FSU-MFGE's strength.

    c) What can be learned from them that would improve the program at Ferris?
        a) A question was put forward on the survey instrument to the FSU-MFGE Advisory Board about going to an engineering program as opposed to staying with the current engineering technology. They were split over the proposition. If the program could move to a pure engineering program and NOT lose its hands-on focus, many issues would abate. Primary among them is the ongoing need to answer the question, "What is the difference between engineering and engineering technology?" This would not be the only reason to make this move. Blending some of what these other schools do with our hands-on focus would improve our ability to recruit. Proof for this is only anecdotal.

## Section 1-C
## PROGRAM RELEVANCE.

1) Provide a labor market demand analysis: This activity is designed to assess the marketability of future graduates. Reports from the Department of Labor and from industry are excellent sources for forecasting demand on graduates. Request information from your Library Liaison.

    a. This can be easily verified by going to www.monster.com. A search was conducted using the key words: manufacturing+engineering and selecting "posted today" and within a 200 mile radius of 49307. The date of the query was August 30, 2010. The number of new postings for this date was 670. When the key words "entry+level" were added to the same search for the same 200 mile radius area the number is 66. However, the number of entry level positions posted nationally on this date exceeded 1000. This is quite dramatic given the state of the nation's current economy. Long-Term state (MI) Occupational Projections through 2016 for industrial engineers is +4180 (www.projectionscentral.com/lt_search.aspx). National Bureau of Labor Statistics for engineering technicians summary page appears next.



UNITED STATES DEPARTMENT OF LABOR

Subscribe to E-mail Updates: Enter E-mail Address SUBSCRIBE
A to Z Index | Site Map | FAQs | About BLS | Contact Us

BUREAU OF LABOR STATISTICS

Search:

Home Subject Areas Databases & Tables Publications Economic Releases
What's New | Release Calendar

INFLATION SPENDING UNEMPLOYMENT EMPLOYMENT PAY & BENEFITS PRODUCTIVITY INJURIES

Occupational Employment Statistics

OES PRINT: FONT SIZE:

BROWSE OES
OES HOME
OES OVERVIEW
OES NEWS RELEASES
OES DATABASES
OES TABLES
OES PUBLICATIONS
OES FAQS
CONTACT OES

SEARCH OES
Go

OES TOPICS
ARCHIVED DATA
CHARTS & MAPS
INFORMATION FOR RESPONDENTS
TECHNICAL DOCUMENTATION

## Occupational Employment and Wages, May 2009

### 17-3029 Engineering Technicians, Except Drafters, All Other

**All engineering technicians, except drafters, not listed separately.**

National estimates for this occupation
Industry profile for this occupation
State profile for this occupation
Metropolitan area profile for this occupation

**National estimates for this occupation:** Top

Employment estimate and mean wage estimates for this occupation:

| Employment (1) | Employment RSE (3) | Mean hourly wage | Mean annual wage (2) | Wage RSE (3) |
|---|---|---|---|---|
| 69,070 | 1.5 % | $28.04 | $58,330 | 0.7 % |

Percentile wage estimates for this occupation:

| Percentile | 10% | 25% | 50% (Median) | 75% | 90% |
|---|---|---|---|---|---|
| Hourly Wage | $14.86 | $20.47 | $27.66 | $34.87 | $41.59 |
| Annual Wage (2) | $30,910 | $42,580 | $57,530 | $72,520 | $86,510 |

**Industry profile for this occupation:** Top

Industries with the highest published employment and wages for this occupation are provided. For a list of all industries with employment in this occupation, see the Create Customized Tables function.

Industries with the highest levels of employment in this occupation:

| Industry | Employment | Hourly mean wage | Annual mean wage |
|---|---|---|---|
| Federal Executive Branch (OES Designation) | 17,740 | $31.06 | $64,610 |
| Architectural, Engineering, and Related Services | 8,740 | $25.00 | $52,000 |
| Scientific Research and Development Services | 4,010 | $27.07 | $56,300 |
| Aerospace Product and Parts Manufacturing | 3,540 | $33.73 | $70,150 |
| Local Government (OES Designation) | 2,940 | $26.79 | $55,720 |

Top paying industries for this occupation:

| Industry | Employment | Hourly mean wage | Annual mean wage |
|---|---|---|---|
| Petroleum and Coal Products Manufacturing | 1,390 | $41.43 | $86,170 |
| Technical and Trade Schools | 160 | $34.01 | $70,740 |
| Aerospace Product and Parts Manufacturing | 3,540 | $33.73 | $70,150 |
| Oil and Gas Extraction | 1,460 | $33.04 | $68,720 |
| Wired Telecommunications Carriers | 90 | $32.77 | $68,170 |

**State profile for this occupation:** Top

States with the highest published employment concentrations and wages for this occupation are provided. For a list of all States with employment in this occupation, see the Create Customized Tables function.

States with the highest concentration of workers in this occupation:

2) Describe and assess how the program responds to emerging issues in the discipline, changes in the labor force, changes in employer needs, changes in student needs, and other forces of change.

    a. Industrial Advisory Board input is the basis for modifying, deleting, or adding new content. These meetings occur if not annually, certainly biannually.

3) Assess why students come to FSU for the program. Summarize the results of the graduate exit survey and the student program evaluation.

    a. No data exists to support an objective answer. Anything stated would be anecdotal.

## Section 1-D
## PROGRAM VALUE

1) Describe the benefit of the program, facilities, and personnel to the University.

    a) As a program, the Manufacturing Engineering Technology program does not have any lab facilities of its own, however, the program utilizes others' labs and resources where possible. MFGE services many other program areas with its variety of course work. AET, WET, MET, PLT, EET, are examples of other curriculums that require coursework from the MFGE program.

2) Describe the benefit of the program facilities, and personnel to the students enrolled in the program.

    a) It contributes to their ability to be placed at relatively high salaries (consistently toward the top, competing with Welding Engineering Technology for the top spot).

3) What is the assessment of program personnel of the value of the program to employers? Explain how is this value is determined.

    a) N/A

4) Describe the benefit of the program, faculty, staff and facilities to entities external to the University (services that faculty have provided to accreditation bodies, and regional, state, and national professional associations; manuscript reviewing; service on editorial boards; use of facilities for meetings, etc.).

    a) All faculty have been involved with industry by way of training and consulting which not only benefits the faculty member, the industry being served, the University, but also the student because content is presented in a contemporary

5) What services for extra-University general public groups (e.g., presentations in schools or to community organizations) have faculty, staff or students provided? Describe how these services benefit students, program, and community.

    a) Primarily recruiting to high schools and career centers

# SECTION 2

# Collection of Perceptions

**SECTION 2-A**

**GRADUATE FOLLOW-UP SURVEY**

## RAW DATA WILL BE KEPT ON FILE BY THE PROGRAM COORDINATOR AND WILL BE AVAILABLE UPON REQUEST ONLY

Data from the mailed Alumni Questionnaires is tabulated. Comments regarding the survey follow immediately.

- The graduate questionnaire supplement was segmented into 6 groups based on date of graduation. Questions were focused primarily on curriculum content with an opportunity to comment. A total of 62 questionnaires were returned.

    - 1978 – 1979graduates (n=5)
    - 1980– 1985graduates (n=11)
    - 1986 – 1991 graduates (n=17)
    - 1992 – 1997 graduates (n=14)
    - 1998– 2003 graduates (n=4)
    - 2004 – 2009 graduates (n=11)

      Sum = 62

**Discussion:**

Graduates are generally satisfied with the education they received from Ferris. The program provided a set of entry level skills upon which many have built very nice careers. Those graduating twenty or more years ago tend to suggest business oriented courses be added while more recent graduates tend to suggest adjustments to technical content.

Two examples of adjustments to technical content will be mentioned. As an example of what to increase, all graduates agree that LEAN CONCEPTS must be incorporated in the curriculum. We are already on top of this. Jim Rumpf developed and delivered the first LEAN class Winter-2009. It is an elective at present that most students opt to take. An example of what to decrease is material having to do with Cutting Tool Selection. This makes sense since the technology is built into tool inserts, and is not designed by tooling engineers, as it has been in the past. The treatment on this is limited to a 6 hour seminar delivered annually by Sandvik Coromant, Inc. representatives to students at the FSU main campus

As always, program faculty will review this material and, along with the Advisory Board recommendations, make the necessary changes to the program.

FERRIS STATE UNIVERSITY

Alumni Questionnaire **Manufacturing Engineering Technology**

In the following section, each question is to be answered in two parts. For each activity listed, please place an "X" in the box which best indicates the relevance of the subject area to your work. In the shaded section, indicate whether the Manufacturing Engineering Technology program should increase, decrease, or maintain the level of content of each activity in the program.

## 1978-1979 Graduates (%) n = 5

| ACTIVITY | Highly Relevant | Relevant | Somewhat Relevant | Not Relevant | Increase | Keep Same | Decrease |
|---|---|---|---|---|---|---|---|
| Ability to evaluate work methods | 75 | 25 | 0 | 0 | 50 | 50 | 0 |
| Ability to establish time standards/TAKT Time | 25 | 50 | 25 | 0 | 0 | 100 | 0 |
| Ability to estimate product costs related to manufacturing | 100 | 0 | 0 | 0 | 0 | 100 | 0 |
| Ability to perform economic evaluation of project | 50 | 50 | 0 | 0 | 0 | 100 | 0 |
| Application of statistical process control techniques | 0 | 50 | 25 | 25 | 0 | 100 | 0 |
| Application of facilities planning techniques | 0 | 75 | 25 | 0 | 0 | 100 | 0 |
| Ability to perform statistically designed experiments | 25 | 25 | 25 | 25 | 0 | 100 | 0 |
| Automation and systems design | 0 | 75 | 0 | 25 | 0 | 100 | 0 |
| Process planning/process design | 75 | 25 | 0 | 0 | 50 | 50 | 0 |
| Research manufacturing methods to support process design/improvement. | 50 | 25 | 25 | 0 | 50 | 50 | 0 |
| Ability to determine process dimensions and tolerances | 25 | 50 | 25 | 0 | 0 | 100 | 0 |
| Ability to apply clamping and locating principles | 25 | 75 | 0 | 0 | 0 | 100 | 0 |
| Ability to design and evaluate of measurement systems | 50 | 50 | 0 | 0 | 0 | 100 | 0 |
| Cutting tool selection and machinability of materials | 50 | 25 | 0 | 25 | 0 | 100 | 0 |
| Ability to apply Lean Manufacturing principles | 75 | 25 | 0 | 0 | 100 | 0 | 0 |
| Use of computer to simulate manufacturing activity | 0 | 75 | 0 | 25 | 0 | 100 | 0 |
| Parametric modeling | 25 | 50 | 0 | 25 | 0 | 100 | 0 |
| CAD/CAM | 50 | 25 | 0 | 25 | 0 | 100 | 0 |
| Metallurgy – material science | 0 | 50 | 25 | 25 | 0 | 100 | 0 |
| Production and inventory control | 50 | 25 | 25 | 0 | 100 | 0 | 0 |
| | | | | | | | |
| **Electives** | | | | | | | |
| Understanding of physics | 0 | 75 | 25 | 0 | 50 | 50 | 0 |
| Understanding of chemistry | 0 | 25 | 50 | 25 | 0 | 100 | 0 |
| Electronics | 50 | 50 | 0 | 0 | 50 | 50 | 0 |
| Write clear/concise technical reports | 50 | 25 | 25 | 0 | 50 | 50 | 0 |
| Give clear/concise technical presentations | 50 | 25 | 25 | 0 | 50 | 50 | 0 |
| Required math level | 0 | 100 | 0 | 0 | 0 | 100 | 0 |
| **Other elements of your educational experience** | | | | | | | |
| Internship | 0 | 25 | 25 | 50 | 0 | 100 | 0 |
| Plant visits | 25 | 50 | 25 | 0 | 0 | 100 | 0 |
| Facilities to support lab activities | 25 | 50 | 0 | 25 | 0 | 100 | 0 |

### Current Work Experience

Please list three job functions related to your current position:

1978-1979 Graduate COMMENTS:

1. Industry is becoming more technical. Hence the need to understand more about chemistry and physics is increasing in my opinion. Moreover, control systems are 50% or more of any MFG system. This calls for an increase in knowledge of electronics, programming (PLC's and A Language) and electrical components.
2. Making custom window treatment is a job shop type facility. Fit form and function is key. Communication with interior designers and their customers is a key element to success. Soon the people who know how to sew and fabricate window treatments will be gone. We don't teach sewing in HS or @ tech centers. All my sewers are Cuban. I will close my business in a few years for this reason. How do the furniture companies find sewers?

FERRIS STATE UNIVERSITY

Alumni Questionnaire **Manufacturing Engineering Technology**

In the following section, each question is to be answered in two parts. For each activity listed, please place an "X" in the box which best indicates the relevance of the subject area to your work. In the shaded section, indicate whether the Manufacturing Engineering Technology program should increase, decrease, or maintain the level of content of each activity in the program.

## 1980-1985 Graduates (%) n = 11

| ACTIVITY | Highly Relevant | Relevant | Somewhat Relevant | Not Relevant | Increase | Keep Same | Decrease |
|---|---|---|---|---|---|---|---|
| Ability to evaluate work methods | 18 | 64 | 18 | 0 | 14 | 86 | |
| Ability to establish time standards/TAKT Time | 18 | 64 | 18 | 0 | 37 | 63 | |
| Ability to estimate product costs related to manufacturing | 55 | 18 | 27 | 0 | 43 | 57 | |
| Ability to perform economic evaluation of project | 55 | 35 | 10 | 0 | 57 | 43 | |
| Application of statistical process control techniques | 16 | 43 | 25 | 16 | 28 | 72 | |
| Application of facilities planning techniques | 0 | 55 | 36 | 9 | | 100 | |
| Ability to perform statistically designed experiments | 27 | 27 | 36 | 10 | 50 | 50 | |
| Automation and systems design | 18 | 64 | 18 | 0 | 14 | 86 | |
| Process planning/process design | 33 | 58 | 9 | 0 | 28 | 72 | |
| Research manufacturing methods to support process design/improvement. | 0 | 81 | 19 | 0 | 28 | 72 | |
| Ability to determine process dimensions and tolerances | 45 | 36 | 19 | 0 | 43 | 57 | |
| Ability to apply clamping and locating principles | 0 | 45 | 45 | 10 | 25 | 75 | |
| Ability to design and evaluate of measurement systems | 19 | 54 | 27 | 0 | 14 | 86 | |
| Cutting tool selection and machinability of materials | 0 | 27 | 54 | 19 | | 72 | 28 |
| Ability to apply Lean Manufacturing principles | 60 | 30 | 10 | 0 | 72 | 28 | |
| Use of computer to simulate manufacturing activity | 0 | 46 | 27 | 27 | 14 | 86 | |
| Parametric modeling | 10 | 27 | 46 | 17 | | 100 | |
| CAD/CAM | 0 | 45 | 37 | 18 | | 86 | 14 |
| Metallurgy – material science | 0 | 36 | 54 | 10 | | 100 | |
| Production and inventory control | 18 | 27 | 45 | 10 | 28 | 72 | |
| | | | | | | | |
| **Electives** | | | | | | | |
| Understanding of physics | 37 | 45 | 18 | 0 | 28 | 72 | |
| Understanding of chemistry | | 37 | 45 | 18 | 28 | 72 | |
| Electronics | 27 | 27 | 36 | 10 | 42 | 42 | 16 |
| Write clear/concise technical reports | 56 | 36 | 8 | 0 | 38 | 62 | |
| Give clear/concise technical presentations | 72 | 18 | 10 | 0 | 75 | 25 | |
| Required math level | 0 | 80 | 20 | 0 | 14 | 86 | |
| **Other elements of your educational experience** | | | | | | | |
| Internship | 70 | 30 | 0 | 0 | 43 | 57 | |
| Plant visits | 22 | 55 | 23 | 0 | 57 | 43 | |
| Facilities to support lab activities | 20 | 40 | 30 | 10 | 17 | 83 | |

### Current Work Experience

Please list three job functions related to your current position:

1. Overall project/resource planning, total business case evaluation, cross functional team interviews
2. Strategic and quantifiable business growth plans for services, customer site visits/data collection of units, ability to propose technical solutions to issues

3. CAD analysis and sectioning , measuring, part compare, solving build issues
4. Analysis of people skills to support business, train and mentor all levels on fundamental waste elimination, effective written and verbal communication across CEO to shop floor.
5. Continuous improvement of equipment/process, mistake proofing, quality improvement
6. President with general manager duties. Primarily focus on sales and marketing activity, but also involved in engineering small facilities 50 people few million sales. Would consider intern assignment in the sunny, south! 2010. Mitch

## 1980-1985 Graduate COMMENTS:

1. Since graduation I have spent 90% of my career in operations and services with 10% spent in quality and sales. The technical background has served well in all roles and positions as I have worked in 6 different GE businesses. The machining, welding and processing has been critical. Technical understanding and communications skills, both written and oral, are absolutely necessary for career progression. Long term business planning is key for long term business success. The following are some bullets that are critical to business success: technical and analytical skills, systems, mechanical and electrical understanding, goal setting/accountabilities/teaming, free hand drawing/sketches for idea generation, written/oral communication and presentation skills, critical thinking/people evaluation, economic/ROI understanding for CADEX, commercial terms/contract negotiations, understanding politics/not playing them, world economics/international trade/legalities, labor situations/benefits, make us buy profitability, understand and dealing with all kinds of people, self-evaluation/self examination, coaching/mentoring skills, balanced living: work/play/family, stress management. Ferris was the right school for me!
2. Overall I feel I received an excellent education which prepared me well for opportunity – if there were areas in which more exposure was or would have been beneficial it would have been materials management. Additionally early on the ability to give presentation in public forum. Clearly lean and the Toyota production system is all the rage. Must have that and in 1985 we did not. I term chip removal in far less important as it disappears from the US. Mitch
3. Strongly recommend increased focus on communication, first verbal on face to face communication, then written. With so much use of emails, text messaging, the skills with one on one communication seem to be taking a back seat. Students who can show an ability to communicate to present themselves will find their road to success more rewarding.

FERRIS STATE UNIVERSITY

Alumni Questionnaire **Manufacturing Engineering Technology**

In the following section, each question is to be answered in two parts. For each activity listed, please place an "X" in the box which best indicates the relevance of the subject area to your work. In the shaded section, indicate whether the Manufacturing Engineering Technology program should increase, decrease, or maintain the level of content of each activity in the program.

## 1986-1991 Graduates (%) n = 17

| ACTIVITY | Highly Relevant | Relevant | Somewhat Relevant | Not Relevant | Increase | Keep Same | Decrease |
|---|---|---|---|---|---|---|---|
| Ability to evaluate work methods | 60 | 33.3 | 0 | 6.7 | 18 | 82 | 0 |
| Ability to establish time standards/TAKT Time | 31 | 25 | 38 | 6 | 18 | 82 | 0 |
| Ability to estimate product costs related to manufacturing | 66.7 | 25 | 0 | 8.3 | 45 | 55 | 0 |
| Ability to perform economic evaluation of project | 53 | 20 | 14 | 13 | 36 | 64 | 0 |
| Application of statistical process control techniques | 19 | 37 | 31 | 13 | 17 | 83 | 0 |
| Application of facilities planning techniques | 13 | 53 | 27 | 7 | 0 | 91 | 9 |
| Ability to perform statistically designed experiments | 25 | 3 | 25 | 13 | 34 | 58 | 8 |
| Automation and systems design | 38 | 30 | 25 | 7 | 19 | 81 | 0 |
| Process planning/process design | 47 | 37 | 16 | 0 | 36 | 64 | 0 |
| Research manufacturing methods to support process design/improvement. | 43 | 43 | 14 | 0 | 54 | 46 | 0 |
| Ability to determine process dimensions and tolerances | 50 | 31 | 13 | 6 | 30 | 61 | 9 |
| Ability to apply clamping and locating principles | 44 | 37 | 19 | 0 | 25 | 67 | 8 |
| Ability to design and evaluate of measurement systems | 44 | 3 | 25 | 0 | 25 | 67 | 8 |
| Cutting tool selection and machinability of materials | 20 | 7 | 40 | 33 | 10 | 73 | 17 |
| Ability to apply Lean Manufacturing principles | 50 | 13 | 30 | 7 | 46 | 54 | 0 |
| Use of computer to simulate manufacturing activity | 31 | 18 | 33 | 18 | 42 | 58 | 0 |
| Parametric modeling | 31 | 25 | 31 | 13 | 8 | 92 | 0 |
| CAD/CAM | 56 | 37 | 0 | 7 | 33 | 67 | 0 |
| Metallurgy – material science | 27 | 46 | 20 | 7 | 10 | 72 | 18 |
| Production and inventory control | 13 | 34 | 41 | 12 | 10 | 81 | 9 |
| | | | | | | | |
| **Electives** | | | | | | | |
| Understanding of physics | 31 | 31 | 31 | 7 | 8 | 83 | 9 |
| Understanding of chemistry | 9 | 29 | 44 | 18 | 0 | 92 | 8 |
| Electronics | 38 | 31 | 31 | 0 | 25 | 75 | 0 |
| Write clear/concise technical reports | 56 | 31 | 13 | 0 | 46 | 54 | 0 |
| Give clear/concise technical presentations | 62 | 18 | 20 | 0 | 47 | 53 | 0 |
| Required math level | 25 | 56 | 19 | 0 | 17 | 75 | 8 |
| **Other elements of your educational experience** | | | | | | | |
| Internship | 94 | 0 | 0 | 6 | 75 | 25 | 0 |
| Plant visits | 68 | 12 | 20 | 0 | 58 | 42 | 0 |
| Facilities to support lab activities | 50 | 31 | 13 | 6 | 58 | 42 | 0 |

### Current Work Experience

Please list three job functions related to your current position:

1. New product launch, new equipment launch, maintain current tools and equipment
2. Business cases, production planning, process improvements

3. Process design from quote to launch to continued improvement, decisions made quickly and critically, cost impact and risk assessment of decisions
4. Dimensional measurement, statistical analysis, reverse engineering
5. Business planning, market analysis, P&L
6. APQP/PPAP, supplier quality, mini tab evaluation- DOE
7. ERP system design, business process analysis, project management
8. Project planning, cost evaluation, customer liaison
9. General management, entrepreneurship business planning

## 1986-1991 Graduate COMMENTS:

1. Additional improvements I would recommend is some focus on project planning timelines (microsoft project) and all critical steps to successfully launch a project. Creation of equipment specifications or SOW's (statement of work) for quoting equipment. Establishing buy-off criteria for equipment to be run-off at supplier and on production floor relating to safety, ergonomics, productivity, quality, etc.
2. Calculus may not be needed as a requirement.
3. I have my own business now since being in industry for 18 years after graduation. I would like to see an increase in awareness of "Reverse Engineering". About 65-70% of yearly revenue for my business comes directly from reverse Engineering services. I would like to offer more feedback verbally if anyone from staff would entertain the discussion. Feel free to call anytime (616) 218-4259 Jeff Mass Diverse Dimensions
4. Too much emphasis on Japanese Taguchi methods – more focus needed on more relevant Shannin methods. One significant trend I see is the complexity and criticality of teaching how engineers need to understand their area of scientific discipline while being humble and sensitive enough to neighboring disciplines. An inability here is problematic in the rapidly trending mechatronic product industry in automotive and consumer goods industries. Mechatronic Engineers <product and process> are in highest demand globally. These understand the interrelationships of mechanics, electronics and software, beyond multi-disciplinary knowledge, young engineers need to open their minds and learning to be sensitive to the importance to multiphysics – mechatronics our world is moving here at light speed! Dennis Hawver ; Take care G.O. Another thought – so much manufacturing of product today revolves around electronics processing <pcb> you really need to offer coursework on PCB manufacturing <placement, soldering, ETC> Ring me if you wish 616-566-79900 (cell)
5. The BS manufacturing Engineering Technology degree has been highly relevant and practical in my career. It was an excellent mixture of theory and applied knowledge and allowed me to hit the ground running. Unfortunately unless there is a dramatic shift in our national trade policy and in our societies understanding of the fundamental relationship between manufacturing and our economic health, the need for this degree is in question for the near term 5-10 years. After our economy has balanced itself with the global competition and our wages have met somewhere in the middle along with some radical change in health care and legal costs and debt we will have an opportunity to enjoy the profession of manufacturing again. That is if we can have the moral courage and discipline to stop shopping at wal mart and driving cars made in other countries. As a father of two boys aged 10 and 13 and a boy scout leader of 23 young men I am convinced that we should and must make strategic plans to bring manufacturing back to the USA and to west Michigan. I would be happy to join a taskforce committed to addressing this issue. Contact me: Kraig Schultz, CEO Schultz Engineering, LLC
   11919 Mill Lane, Grand Haven, MI 49417 (616) 296-0362
   www. SchultzEngineering.US
6. Back when I was in the program there was too much emphasis on machining. There needs to be more related to stamping and assembly such as spot and mig welding with robots. Work cell design installation of rivets, pins springs, etc. Need a lot of emphasis on lean manufacturing, poke-yok/error proofing for all processes all of our assy cells have to have error proofing. Understanding cmm measuring techniques has been critical for me. It is surprising how few people have a strong grasp of this. Free state vs. restrained without a holding fixture tue cmm uses average plane for datums which gives a completely different result than the actual high point which is how the

product actually functions. This can mean the difference between praping on time or spending countless money chasing a problem around. I feel like this has been my #1 asset that has kept me employed the past 20 years.

7. See attached typed letter from Lee Dollison.

FERRIS STATE UNIVERSITY

Alumni Questionnaire **Manufacturing Engineering Technology**

In the following section, each question is to be answered in two parts. For each activity listed, please place an "X" in the box which best indicates the relevance of the subject area to your work. In the shaded section, indicate whether the Manufacturing Engineering Technology program should increase, decrease, or maintain the level of content of each activity in the program.

## 1992-1997 Graduates (%) n = 14

| ACTIVITY | Highly Relevant | Relevant | Somewhat Relevant | Not Relevant | Increase | Keep Same | Decrease |
|---|---|---|---|---|---|---|---|
| Ability to evaluate work methods | 71 | 21 | 8 | 0 | 9 | 81 | 9 |
| Ability to establish time standards/TAKT Time | 33 | 67 | 0 | 0 | 10 | 90 | 0 |
| Ability to estimate product costs related to manufacturing | 57 | 43 | 0 | 0 | 23 | 70 | 7 |
| Ability to perform economic evaluation of project | 57 | 29 | 7 | 7 | 27 | 54 | 19 |
| Application of statistical process control techniques | 21 | 36 | 43 | 0 | 0 | 90 | 10 |
| Application of facilities planning techniques | 7 | 43 | 43 | 7 | 10 | 72 | 18 |
| Ability to perform statistically designed experiments | 14 | 50 | 28 | 8 | 20 | 80 | 0 |
| Automation and systems design | 35 | 43 | 14 | 8 | 46 | 54 | 0 |
| Process planning/process design | 50 | 50 | 0 | 0 | 36 | 64 | 0 |
| Research manufacturing methods to support process design/improvement. | 54 | 46 | 0 | 0 | 50 | 50 | 0 |
| Ability to determine process dimensions and tolerances | 29 | 50 | 14 | 7 | 18 | 82 | 0 |
| Ability to apply clamping and locating principles | 27 | 43 | 43 | 0 | 10 | 90 | 0 |
| Ability to design and evaluate of measurement systems | 14 | 43 | 43 | 0 | 10 | 90 | 0 |
| Cutting tool selection and machinability of materials | 20 | 40 | 20 | 20 | 0 | 80 | 20 |
| Ability to apply Lean Manufacturing principles | 71 | 21 | 18 | 0 | 50 | 50 | 0 |
| Use of computer to simulate manufacturing activity | 14 | 50 | 22 | 14 | 30 | 60 | 10 |
| Parametric modeling | 0 | 31 | 38 | 31 | 10 | 60 | 20 |
| CAD/CAM | 20 | 36 | 36 | 8 | 40 | 60 | 0 |
| Metallurgy – material science | 18 | 57 | 7 | 18 | 23 | 77 | 0 |
| Production and inventory control | 28 | 36 | 28 | 8 | 20 | 50 | 30 |
| | | | | | | | |
| **Electives** | | | | | | | |
| Understanding of physics | 7 | 62 | 23 | 8 | 11 | 78 | 11 |
| Understanding of chemistry | 0 | 31 | 53 | 16 | 10 | 70 | 20 |
| Electronics | 7 | 77 | 8 | 8 | 17 | 83 | 0 |
| Write clear/concise technical reports | 47 | 41 | 6 | 6 | 12 | 88 | 0 |
| Give clear/concise technical presentations | 54 | 46 | 0 | 0 | 45 | 55 | 0 |
| Required math level | 15 | 61 | 24 | | 10 | 90 | 0 |
| **Other elements of your educational experience** | | | | | | | |
| Internship | 70 | 30 | 0 | 0 | 30 | 70 | 0 |
| Plant visits | 54 | 38 | 8 | 0 | 40 | 60 | 0 |
| Facilities to support lab activities | 54 | 46 | 0 | 0 | 40 | 60 | 0 |

### Current Work Experience

Please list three job functions related to your current position:

1. Process planning for NPI
2. Capital equipment – design, concept, justification, and implementation
3. Toyota lean principles – A3, TAKT, continuous improvement, standard work

4. CMM, APQP, SPC, FMEA, MSA, equipment design, hydraulics
5. Scrap reduction, continuous improvement, solve validity issues
6. Financial overview – P&L management, people selection, leadership and development, use of lean tools
7. Product development, process development, estimating process
8. Keep project on time, within budget and customer happy
9. DFA/DFM, process FMEA, labor estimating
10. Process planning and equipment, clamping and tooling, statistical analysis

## 1992-1997 Graduate COMMENTS:

1. With automotive work in Michigan evaporating – some focus or shift could be made into sheet metal fabrication. Tube/sheet metal processing – while similar to croc machining can vary greatly and further training in this area would make for a very well rounded engineer candidate. Overall the MFGE program is spot on and has made a great impact at Haworth. Currently we at least 10 FSU grads in the Big Rapids plants – and all have climbed up very quickly to become impact players for the company. Cory Ericsson
2. Internship credit hours should be increased. Electrical controls design should be added. Electrical issue problem solving should be added.
3. Hi Gary, Overall I still think this program is and was excellent! Keep up the good work! I recommend the program all the time. Lets hope the manufacturing environment only improves for everybody's sake in this country! I hope all is well in your world. Jim Owens.
4. Thank you for following up. When I graduated most students were either focusing on automotive or furniture. Today's environment is much different. By moving from automotive plant mfg. engineering into sales out of necessity due to the plant shutting down I have been exposed to many industries throughout the world and students should broaden their job search to include consumer products companies, food industry , solar, medical device, munitions, etc. When I was going through the program it seemed to be geared toward auto. It would be very good to expand the teachings to include some of the industries I described above. Maybe you already have since…. Best regards, Bill Maynard.
5. I feel the program focuses too much on machining and CAD/CAM and not enough on other manufacturing aspects.
6. As a manufacturing engineer all of the success will also depend on their people skills. Your technical ability will only get you so far. They will need to be able to persuade others that their ideas are the way to go. Some people are able to give you theory, but can't show how to apply it to real world.

Unemployed: 1

FERRIS STATE UNIVERSITY

Alumni Questionnaire **Manufacturing Engineering Technology**

In the following section, each question is to be answered in two parts. For each activity listed, please place an "X" in the box which best indicates the relevance of the subject area to your work. In the shaded section, indicate whether the Manufacturing Engineering Technology program should increase, decrease, or maintain the level of content of each activity in the program.

## 1998-2003 Graduates (%) n = 4

| ACTIVITY | Highly Relevant | Relevant | Somewhat Relevant | Not Relevant | Increase | Keep Same | Decrease |
|---|---|---|---|---|---|---|---|
| Ability to evaluate work methods | 75 | 25 | 0 | 0 | 33.3 | 66.7 | 0 |
| Ability to establish time standards/TAKT Time | 50 | 50 | 0 | 0 | 33.3 | 66.7 | 0 |
| Ability to estimate product costs related to manufacturing | 75 | 25 | 0 | 0 | 66.7 | 33.3 | 0 |
| Ability to perform economic evaluation of project | 0 | 75 | 25 | 0 | 33.3 | 66.7 | 0 |
| Application of statistical process control techniques | 0 | 50 | 50 | 0 | 33.3 | 66.7 | 0 |
| Application of facilities planning techniques | 0 | 25 | 75 | 0 | 33.3 | 33.3 | 33.3 |
| Ability to perform statistically designed experiments | 0 | 50 | 50 | 0 | 33.3 | 66.7 | 0 |
| Automation and systems design | 0 | 25 | 75 | 0 | 33.3 | 33.3 | 33.3 |
| Process planning/process design | 50 | 50 | 0 | 0 | 33.3 | 66.7 | 0 |
| Research manufacturing methods to support process design/improvement. | 25 | 50 | 25 | 0 | 33.3 | 66.7 | 0 |
| Ability to determine process dimensions and tolerances | 0 | 100 | 0 | 0 | 33.3 | 66.7 | 0 |
| Ability to apply clamping and locating principles | 25 | 75 | 0 | 0 | 66.7 | 33.3 | 0 |
| Ability to design and evaluate of measurement systems | 0 | 75 | 25 | 0 | 33.3 | 66.7 | 0 |
| Cutting tool selection and machinability of materials | 50 | 25 | 25 | 0 | 33.3 | 66.7 | 0 |
| Ability to apply Lean Manufacturing principles | 0 | 100 | 0 | 0 | 50 | 50 | 0 |
| Use of computer to simulate manufacturing activity | 0 | 25 | 25 | 50 | 33.3 | 66.7 | 0 |
| Parametric modeling | 0 | 50 | 25 | 25 | 33.3 | 66.7 | 0 |
| CAD/CAM | 0 | 75 | 25 | 0 | 50 | 50 | 0 |
| Metallurgy – material science | 0 | 25 | 75 | 0 | 0 | 100 | 0 |
| Production and inventory control | 0 | 25 | 75 | 0 | 0 | 100 | 0 |
| | | | | | | | |
| **Electives** | | | | | | | |
| Understanding of physics | 0 | 50 | 50 | 0 | 0 | 100 | 0 |
| Understanding of chemistry | 0 | 25 | 50 | 25 | 0 | 100 | 0 |
| Electronics | 25 | 0 | 75 | 0 | 0 | 100 | 0 |
| Write clear/concise technical reports | 50 | 25 | 0 | 25 | 0 | 66.7 | 33.3 |
| Give clear/concise technical presentations | 25 | 75 | 0 | 0 | 0 | 100 | 0 |
| Required math level | 25 | 50 | 25 | 0 | 0 | 100 | 0 |
| **Other elements of your educational experience** | | | | | | | |
| Internship | 50 | 50 | 0 | 0 | 0 | 100 | 0 |
| Plant visits | 50 | 50 | 0 | 0 | 33.3 | 66.7 | 0 |
| Facilities to support lab activities | 0 | 50 | 50 | 0 | 0 | 100 | 0 |

### Current Work Experience

Please list three job functions related to your current position:

1. ERP/MRP, business presentations, manufacturing execution systems, SCM/PP
2. Cost estimator, creating standard operating procedures SOP's, designing processes to make parts

# NO COMMENTS 1998-2003 GRADUATES

FERRIS STATE UNIVERSITY

Alumni Questionnaire **Manufacturing Engineering Technology**

In the following section, each question is to be answered in two parts. For each activity listed, please place an "X" in the box which best indicates the relevance of the subject area to your work. In the shaded section, indicate whether the Manufacturing Engineering Technology program should increase, decrease, or maintain the level of content of each activity in the program.

## 2004-2009 Graduates (%) n = 11

| ACTIVITY | Highly Relevant | Relevant | Somewhat Relevant | Not Relevant | Increase | Keep Same | Decrease |
|---|---|---|---|---|---|---|---|
| Ability to evaluate work methods | 36 | 55 | 9 | 0 | 20 | 80 | 0 |
| Ability to establish time standards/TAKT Time | 27 | 64 | 9 | 0 | 10 | 90 | 0 |
| Ability to estimate product costs related to manufacturing | 27 | 55 | 18 | 0 | 20 | 80 | 0 |
| Ability to perform economic evaluation of project | 27 | 46 | 27 | 0 | 30 | 70 | 0 |
| Application of statistical process control techniques | 27 | 46 | 27 | 0 | 0 | 100 | 0 |
| Application of facilities planning techniques | 9 | 73 | 9 | 9 | 0 | 90 | 10 |
| Ability to perform statistically designed experiments | 9 | 55 | 36 | 0 | 10 | 90 | 0 |
| Automation and systems design | 0 | 55 | 45 | 0 | 10 | 70 | 20 |
| Process planning/process design | 45 | 27 | 27 | 0 | 40 | 60 | 0 |
| Research manufacturing methods to support process design/improvement. | 19 | 36 | 45 | 0 | 10 | 80 | 10 |
| Ability to determine process dimensions and tolerances | 27 | 45 | 28 | 0 | 0 | 100 | 0 |
| Ability to apply clamping and locating principles | 36 | 27 | 27 | 10 | 10 | 90 | 0 |
| Ability to design and evaluate of measurement systems | 9 | 73 | 18 | 0 | 20 | 80 | 0 |
| Cutting tool selection and machinability of materials | 18 | 27 | 37 | 18 | 10 | 60 | 30 |
| Ability to apply Lean Manufacturing principles | 73 | 18 | 9 | 0 | 50 | 50 | 0 |
| Use of computer to simulate manufacturing activity | 9 | 36 | 55 | 0 | 0 | 90 | 10 |
| Parametric modeling | 30 | 30 | 10 | 30 | 12 | 88 | 0 |
| CAD/CAM | 28 | 36 | 36 | 0 | 20 | 80 | 0 |
| Metallurgy – material science | 18 | 45 | 27 | 10 | 10 | 90 | 0 |
| Production and inventory control | 18 | 45 | 27 | 10 | 40 | 50 | 10 |
| | | | | | | | |
| **Electives** | | | | | | | |
| Understanding of physics | 16 | 64 | 10 | 10 | 10 | 90 | 0 |
| Understanding of chemistry | 9 | 9 | 73 | 9 | 10 | 70 | 20 |
| Electronics | 28 | 27 | 45 | 0 | 50 | 50 | 0 |
| Write clear/concise technical reports | 45 | 45 | 10 | 0 | 10 | 90 | 0 |
| Give clear/concise technical presentations | 45 | 45 | 10 | 0 | 40 | 60 | 0 |
| Required math level | 27 | 55 | 18 | 0 | 0 | 100 | 0 |
| **Other elements of your educational experience** | | | | | | | |
| Internship | 64 | 18 | 0 | 18 | 25 | 63 | 12 |
| Plant visits | 45 | 37 | 18 | 0 | 37 | 63 | 0 |
| Facilities to support lab activities | 46 | 36 | 18 | 0 | 50 | 37 | 13 |

### Current Work Experience

Please list three job functions related to your current position:

1. Manage new product launch activity
2. Procure check fixtures/gages.
3. Propose and implement cost savings, process and quality improvements.

4. Continuous improvement
5. Processing (process planning and changing)
6. General troubleshooting.
7. Work holding, SPC, tooling, purchasing, documentation, layout, etc.
8. CNC Programming
9. Process improvement and documentation
10. Process reliability
11. Evaluate stamping dies
12. Write and manage capitol projects
13. Process improvement projects/reduce downtime
14. Eliminating labor, manage budgets of parts and tooling
15. Evaluating capability of gauges and machines based off CPK, then determine what needed to be changed
16. Review cutting tools to find more efficient ways to cut parts
17. Plan replacement projects for machining centers, prepare justification, facilitate as project lead, program new machines and validate new process
18. Monitor layout reports and ensure process continues running well.
19. Layout new departments
20. Work instructions
21. Part routings
22. Tooling design with CI focus (modeling)
23. Development of Interdepartment reference and standard documentation of participant on implementation team for SAP factory wide software.
24. Student networking for future interaction in the workplace
25. Leadership
26. Lean manufacturing
27. Facilities planning

Unemployed: 2

Additional Comments:

1. Feel free to contact
   Kyle Dutcher
   11521 Boulder Drive Apt. 293
   Lowell, MI 49331
   Previously employed at Besser company in Alpena, MI; from may 2006 to October 2009; laid off. Found new employment at Autocam in Lowell, MI; started March 2009.
2. The Ferris program did an excellent job preparing me for my current job. I was well prepared for every aspect of my job. I do CNC programming with ESPRIT, but was well prepared with Mastercam. I understand you have added Catia. This sounds like a great idea.
3. I am in a CI role in regards to design of current products. Understanding SAG and GAGE R&R is critical, especially when working with suppliers. The DOE and CI classes should be mandatory, part of the new ISO standard of focuses on CI. The format to write reports is good, in my role being able to write reports similar to Rusco's is critical. The summary for higher level managers is especially important. I am also working with design of engines so I recommend adding physics and chemistry you never know where someone may end up. I have used a lot of the teamwork skills as well. The exposure (hands on) is another key of attending Ferris. The plant visits with exposure to different industries would be good for future students.
4. The machines in the lab were very old. Learning to program a cnc in conversational was not helpful at all. But there were new cnc's we weren't allowed to use. Hopefully this has been changed. Things that could be covered: buffer size calculations, material presentation to operators, benefits/drawbacks of using small lot sizes, designing a material handler (assembly line stocker) route. The focus on lean makes these key topics. Eric Johnstin. Eric.johnstin@nexteer. com

**SECTION 2-B**

**EMPLOYER SURVEY**

The two primary questions asked were:

1. Are you actively involved in Manufacturing? **n = 37**

   16% No 84% Yes

2. Would you consider hiring a Manufacturing Engineer with the credentials shown on the enclosed list? **n = 31**

   7% No 93%Yes

Companies that responded "Yes" to question 2:

1. Witzenmann USA
2. N/A no business card attached
3. Musashi and Parts
4. Hydro Aluminum
5. Flex-Tec
6. GKN Sinter Metals
7. John Deere Dubuque Works
8. Steelcase
9. Means Industries, Inc.
10. S&S Cycle, Inc.
11. John Deere Thibodaux
12. Herman Miller Inc.
13. Tennant Company
14. Emerson Climate Technology
15. General Motors (Powertrain) – Dan O'Neil
16. Amway
17. GHSP
18. Trelleborg Automotive
19. Mahle Enaine Components (Local plant – global company)
20. Quality Tool & Stamping
21. BLN Technical Services
22. Whirlpool Corporation
23. Cameron International
24. Sonoco Products
25. GM Powertrain
26. Paulstra CRC
27. Haworth
28. Woodbridge Group
29. GE Energy

# Discussion:

Companies are enthused by the skill set MFGE students receive at Ferris. Companies represented are small, medium, and large. They include regionally and internationally recognized companies.

# Bottom line:

Manufacturing companies will, and do, hire Ferris State's Manufacturing Engineering Technology graduates.

## SECTION 2-C&D

## STUDENT EVALUATIONS

Input was solicited from:

- MFGE students (on campus) at the completion of their 3rd year, May 2010.
- MFGE students (on campus) at the completion of their 4th year, May 2010.
- MFGE students enrolled in the evening program at the Applied Technology Center in Grand Rapids, May 2010.

The quantitative results for each group surveyed follow discussion.

**Discussion:**

For main campus students, the primary conduit for recruiting high school students is teachers! Over 50% of the reason students chose Ferris and, specifically the MFGE program, was because teachers recommended it. Therefore, initiatives that introduce/educate high school teachers regarding our program should be regular and strategic. This was not the case for students at the Grand Rapids campus. They chose the MFGE program only after sitting down with a counselor, likely Mark Rusco or Joe Wist who serve as advisors on the Grand Rapids campus.

Students from all campuses are generally satisfied with their program faculty and overall experience. Students on the Grand Rapids Campus are concerned about their getting as rigorous a program as those on the main campus. It is suspected the number of adjunct teachers is the primary feeder of this concern.

An area of concern to the student that continues to arise is the need to improve laboratory facilities. Third year students have not had the full set of lab courses and, hence, are not as frustrated with lab equipment and space. Fourth year students on the main campus realize that the facilities are not entirely adequate and could and should be much better. By the way, this is still true after this third iteration of Annual Program Review the first of which the program received "enhance" status.

Grand Rapids students were more likely to prefer the current 2+2 structure while on-campus students tended to lean a bit more toward a 0+4 year program.

The use of adjunct faculty on the GR campus may be the reason for the sour comment by one student regarding faculty "living up to the tuition cost". The three mentioned in the same comment are full time faculty who received a positive accolade from the same student.

**Program Self Study for Academic Program Review**
**Manufacturing Engineering Technology**
**Survey of 3rd and 4th Year Students**
**2009/2010 Academic Year**

Program Enrolled in: _____ Age: _____ Sex: M F

Campus: Big Rapids Grand Rapids ATC

High School (name & location): _____

High School Graduation Year: _____

Transfer Students:

School transferred from: _____

Program transferred from: _____

What are your plans after completing your B.S. Manufacturing Engineering Technology degree?

_____ Work (where? _____)

_____ Work and school part-time (where? _____)

_____ Enter M.S. degree program (where? _____)

_____ Enter another B.S. degree program (where? _____)

_____ Transfer (where? _____)

_____ Undecided

# 3rd Year MFGE Main Campus Student Evaluation Summary; n = 10

| | Counselor 1 | Teacher 2 | Parent 3 | Friend 4 | Advertisement 5 | Sibling 6 | Other (Explain) |
|---|---|---|---|---|---|---|---|
| 1. Who/what helped you decide to attend Ferris State University (check all that apply) | 9% | 45% | 1% | 18% | 9% | 0% | 18% |
| | | | | | | | |
| 2. Who/what helped you decide to enroll in the MFGE program (check all that apply) | 8% | 56% | 0% | 0% | 0% | 0% | 36% |

| | Very Favorable 1 | Favorable 2 | Neutral 3 | Unfavorable 4 | Very Unfavorable 5 | Other (Explain) |
|---|---|---|---|---|---|---|
| 3. Your impression of the application/admissions/financial aid/registration process | 27% | 36% | 27% | 10% | 0% | 0% |
| | | | | | | |
| 4. Your impression of the Manufacturing Engineering Technology program faculty | 45% | 45% | 0% | 0% | 0% | 10% |
| | | | | | | |
| 5. What is your impression of the laboratory facilities and equipment for your courses | 9% | 64% | 27% | 0% | 0% | 0% |
| | | | | | | |
| 6. What is your impression of the Manufacturing Engineering Technology program course of study | 36% | 55% | 9% | 0% | 0% | 0% |

| Use the attached list of proposed courses to answer question 7 | Very Favorable 1 | Favorable 2 | Neutral 3 | Unfavorable 4 | Very Unfavorable 5 | Other (Explain) |
|---|---|---|---|---|---|---|
| 7. Would you have preferred a 4 year program for the BS MFGE degree (as opposed to a 2 year AAS + 2 year BS MFGE)? | 28% | 0% | 27% | 18% | 0% | 27% |
| | | | | | | |

**No Additional Comments (Main Campus Juniors)**

**Program Self Study for Academic Program Review**
**Manufacturing Engineering Technology**
**Survey of 3rd and 4th Year Students**
**2009/2010 Academic Year**

Program Enrolled in: _____ Age: _____ Sex: M F

Campus: Big Rapids Grand Rapids ATC

High School (name & location): _____

High School Graduation Year: _____

Transfer Students:

School transferred from: _____

Program transferred from: _____

What are your plans after completing your B.S. Manufacturing Engineering Technology degree?

_____ Work (where? _____)

_____ Work and school part-time (where? _____)

_____ Enter M.S. degree program (where? _____)

_____ Enter another B.S. degree program (where? _____)

_____ Transfer (where? _____)

_____ Undecided

# 4rd Year Main Campus MFGE Student Evaluation Summary; n = 14

| | Counselor 1 | Teacher 2 | Parent 3 | Friend 4 | Advertisement 5 | Sibling 6 | Other (Explain) |
|---|---|---|---|---|---|---|---|
| 1. Who/what helped you decide to attend Ferris State University (check all that apply) | 7% | 57% | 7% | 7% | 0% | 0% | 14% |
| | | | | | | | |
| 2. Who/what helped you decide to enroll in the MFGE program (check all that apply) | 7% | 50% | 14% | 7% | 0% | 0% | 21% |

| | Very Favorable 1 | Favorable 2 | Neutral 3 | Unfavorable 4 | Very Unfavorable 5 | Other (Explain) |
|---|---|---|---|---|---|---|
| 3. Your impression of the application/admissions/financial aid/registration process | 7% | 50% | 21% | 0% | 14% | 7% |
| | | | | | | |
| 4. Your impression of the Manufacturing Engineering Technology program faculty | 7% | 71% | 21% | 0% | 0% | 0% |
| | | | | | | |
| 5. What is your impression of the laboratory facilities and equipment for your courses | 0% | 29% | 29% | 43% | 0% | 0% |
| | | | | | | |
| 6. What is your impression of the Manufacturing Engineering Technology program course of study | 21% | 57% | 14% | 7% | 0% | 0% |

| Use the attached list of proposed courses to answer question 7 | Very Favorable 1 | Favorable 2 | Neutral 3 | Unfavorable 4 | Very Unfavorable 5 | Other (Explain) |
|---|---|---|---|---|---|---|
| 7. Would you have preferred a 4 year program for the BS MFGE degree (as opposed to a 2 year AAS + 2 year BS MFGE)? | 14% | 21% | 57% | 7% | 0% | 0% |
| | | | | | | |

**Aditional Comments (Main Campus Seniors):**

1. Get rid of Catia – use AutoDesk Inventor!
2. Finding a job would've been easier from an accredited program.
3. Some of the faculty are not impressive.
4. I was extremely disappointed with the MFGE 324 Xxxx Xxxxxx. The class had no structure and no useful information relayed in class. Have someone else teach it. That is well organized and good at providing relevant information.

**Program Self Study for Academic Program Review**
**Manufacturing Engineering Technology**
**Survey of 3rd and 4th Year Students**
**2009/2010 Academic Year**

Program Enrolled in: _____ Age: _____ Sex: M F

Campus: Big Rapids Grand Rapids ATC

High School (name & location): _____

High School Graduation Year: _____

Transfer Students:

School transferred from: _____

Program transferred from: _____

What are your plans after completing your B.S. Manufacturing Engineering Technology degree?

_____ Work (where? _____)

_____ Work and school part-time (where? _____)

_____ Enter M.S. degree program (where? _____)

_____ Enter another B.S. degree program (where? _____)

_____ Transfer (where? _____)

_____ Undecided

# Grand Rapids Campus Student Evaluation Summary; n = 19

| | Counselor 1 | Teacher 2 | Parent 3 | Friend 4 | Advertisement 5 | Sibling 6 | Other (Explain) |
|---|---|---|---|---|---|---|---|
| 1. Who/what helped you decide to attend Ferris State University (check all that apply) | 11% | 6% | 0% | 28% | 17% | 0% | 39% |
| | | | | | | | |
| 2. Who/what helped you decide to enroll in the MFGE program (check all that apply) | 44% | 6% | 0% | 6% | 6% | 6% | 33% |

| | Very Favorable 1 | Favorable 2 | Neutral 3 | Unfavorable 4 | Very Unfavorable 5 | Other (Explain) |
|---|---|---|---|---|---|---|
| 3. Your impression of the application/admissions/financial aid/registration process | 17% | 39% | 39% | 0% | 0% | 1% |
| | | | | | | |
| 4. Your impression of the Manufacturing Engineering Technology program faculty | 22% | 67% | 11% | 0% | 0% | 0% |
| | | | | | | |
| 5. What is your impression of the laboratory facilities and equipment for your courses | 6% | 50% | 28% | 11% | 0% | 6% |
| | | | | | | |
| 6. What is your impression of the Manufacturing Engineering Technology program course of study | 11% | 56% | 33% | 0% | 0% | 0% |

| Use the attached list of proposed courses to answer question 7 | Very Favorable 1 | Favorable 2 | Neutral 3 | Unfavorable 4 | Very Unfavorable 5 | Other (Explain) |
|---|---|---|---|---|---|---|
| 7. Would you have preferred a 4 year program for the BS MFGE degree (as opposed to a 2 year AAS + 2 year BS MFGE)? | 0% | 11% | 50% | 33% | 6% | 0% |
| | | | | | | |

**Additional Comments (GR Campus):**

1. I would like to teach this – 25 yr in cad. 6 yr of Catia ideas, Icem, CADDS5 – In regard to Parametric Modeling course equivalent to PDET 122. In regard to MFGE421 and MFGE422 – These need to be full semester classes not 8 week – 2 days per week classes. Most of the GR students work full time. These are supposed to be the prove all classes. I have had 2 instructors that have not lived up to the tuition cost. GR campus – we tend not to have the tools needed compared to the BR main campus. Most of the instructors do a good job – they get to know their students (Joe Wist, Dave Borck and Mark Rusco).
2. Understanding is a three edge sword.
3. Course registration should be revised to allow for prerequisites taken at GRCC
4. The only reason was that the degree directly transfers into Ferris and the location is entirely here in GR to obtain the BS degree.
5. I have been told that certain classes are taught at a different level on the main campus. I would like to think we are given the same opportunities as other people in the program.

## SECTION 2-E

## FACULTY PERCEPTIONS

### MFGE Faculty Perceptions of the Manufacturing Engineering Technology Program

Faculty were surveyed using the instrument, "Faculty Perceptions". Comments follow the results.

The BS-MFGE Program has six tenured faculty. The table below summarizes well the breadth of experience and rank of each. All have worked in industry. One does have a BS in MFGE from Ferris, the others have undergrad degrees in Mechanical Engineering, Electrical Engineering, or Physics from elsewhere. Years of service at Ferris fall into two categories, those with twenty something years of experience and those with ten or so years of experience. Based on this, these professors are qualified to make credible claims about the program and the field in which they teach.

| Name | Rank | Years of Service at FSU | Highest Degree Earned | Typical Annualized Work Load (cr) |
|---|---|---|---|---|
| Ovans, Gary | Professor | 26 | MS; FSU, Mich. | 22-26 overloads periodic |
| Rumpf, James | Professor | 20 | MS; UOP; PA | 12 (Jim is FFA pres) |
| Gregory, Bruce | Professor | 27 | MS; RIT, New York | 22-26 overloads periodic |
| Rusco, Mark | Associate Professor | 12 | MS; MI State; Mich. | 24-26 overloads common |
| Wist, Joseph | Associate Professor | 10 | MS; MI Tech; Mich. | 24-30 overloads common |
| Danley, Blaine | Associate Professor | 10 | MS; MI Tech; Mich. | 24-30 overloads common |

**Discussion:**

The best discussion is represented in the faculty comments at the end of this section.

## SECTION 2-E
## FACULTY PERCEPTIONS
## MFGE Faculty Perceptions of the Manufacturing Engineering Technology Program

| n = 6 faculty (values are %) | Strongly Agree 1 | Agree 2 | Neutral 3 | Disagree 4 | Strongly Disagree 5 | Unknown U |
|---|---|---|---|---|---|---|
| 1. The FSU BS-MFGE Program is consistent with the FSU Mission. | 100% | | | | | |
| | | | | | | |
| 2. The FSU BS-MFGE Program is consistent with the FSU, College of Engineering Technology Mission | 100 | | | | | |
| | | | | | | |
| 3. The FSU MFGE faculty supports the BS-MFGE Program. | 83 | 17 | | | | |
| | | | | | | |
| 4. The FSU administration supports the FSU BS-MFGE Program. | | 33 | 50 | 17 | | |
| | | | | | | |
| 5. Equipment available for use in MFGE lab courses is sufficient to support a high quality program. | | 17 | | 67 | 17 | |
| | | | | | | |
| 6. A programming language (for example, C,C++, Visual Basic, etc.) should be included in the MFGE program. | | 33 | 33 | 17 | 17 | |
| | | | | | | |
| 7. Juniors transfering into the MFGE program from ON-CAMPUS are academically prepared for the MFGE program. | 17 | 50 | 33 | | | |
| | | | | | | |
| 8. Juniors transferring into the MFGE program from OFF-CAMPUS are academically prepared for the MFGE program. | 17 | 50 | 33 | | | |
| | | | | | | |
| 9. The MFGE program's utilization of technology, regardless if it is software or hardware, needs to increase. | 33 | 67 | | | | |
| | | | | | | |
| 10. The facilities available for non-lecture MFGE courses are adequate. | | 17 | 17 | 33 | 33 | |
| | | | | | | |
| 11. The equipment available for MFGE lab courses is adequate. | | 17 | 17 | 33 | 33 | |
| | | | | | | |
| 12. The BS-MFGE Program should consider an "engineering" track, while maintaining its "engineering technology" track, to recruit potential students, to maintain enrollment, and satisfy employer demand for graduates. | 17 | 17 | 50 | | 17 | |
| | | | | | | |
| 13. In order to hold down student tuition costs, a maximum of six credit hours each for Social Awareness and Cultural Enrichment should be required. Note: if more or less is required; please state your opinion of what the total credit count should be. | 33 | 50 | 17 | | | |
| | | | | | | |
| 14. The student laptop initiative has been successful. | 50 | 33 | 17 | | | |
| | | | | | | |
| 15. Computer labs are still essential given the laptop initiative | | 67 | 33 | | | |

**Faculty Comments:**

Consider Engineering Track?……"Key word"
Reduce Cultural Enrichment and Social Awareness to 6 credits?....."Discuss further"

"MFGE faculty are a relatively cohesive group
-ethical
-exhibiting integrity
-making decisions with the best interests of the students in mind
-well prepared for their roles
-professional"

"Recent reorganization of the CET has diminished the effectiveness of the operation of the program"

Industry is getting more technical every day. Hence, the need to increase MFGE's science base exists. This includes the addition of a programming language such as C++.

## SECTION 2-F

## INDUSTRY ADVISORY BOARD PERCEPTIONS

The BS-MFGE Program has an active Industry Advisory Board. They meet with BS-MFGE Program faculty and administrators on regular basis, usually annually, certainly not more than two year interval. Current board membership is attached.

Results are included on the survey instrument that was used.

**Observations:**

- It is clear the Advisory Board supports the program and believes it is crucial in its support of Michigan industry
- 100% would hire a graduate of this program
- The Board overwhelmingly support becoming ABET accredited
- Half are in support of a Masters option
- Interestingly, some feel the level of science should be increased while some disagree
- The Board is split over offering two tracks; a "technology" track and an "engineering" track.

The next advisory board meeting will discuss these bullet points further to gain more insight. For example, the last survey question, as it stands, can be interpreted as, "if you go with engineering, you are going to cut technical content to do it…" We can sort this out in our next meeting.

**INDUSTRY ADVISORY BOARD PERCEPTIONS**

**MANUFACTURING ENGINEERING TECHNOLOGY**

**Spring 2010**

# Sample Size = 6

## Summary

| | | Strongly Agree | Agree | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1. | The Manufacturing Engineering Technology Program provides education and training essential to many Michigan industries | 83 | 17 | | |
| 2. | The Manufacturing Engineering Technology program provides skills useful to your company. | 83 | 17 | | |
| 3. | Your company would hire a Manufacturing Engineering Technology program graduate. | 100 | | | |
| 4. | The program curriculum is appropriate to industry needs. | 40 | 60 | | |
| 5. | The program could be strengthened by building more lab experiences into the curriculum. | 20 | 60 | 20 | |
| 6. | ABET certification should be pursued provided that the core curriculum is not compromised. | 17 | 83 | | |
| 7. | A master's degree program at Ferris State would fulfill the need for advanced studies in Manufacturing Engineering. | 50 | 33 | 17 | |
| 8. | The MFGE program should emphasize more science without sacrificing technical core | 33 | 50 | 17 | |
| 9. | The MFGE program should create a 2-track pathway-Manufacturing Engineering Technology and Manufacturing Engineering | 33 | 17 | 50 | |

# SECTION 3

# Program Profile

## Section 3
## PROGRAM PROFILE

A. PROFILE OF STUDENTS.

1) Student Demographic Profile.

a) Gender, race/ethnicity, age (use annual institutional data).

| | | Gender | | Ethnicity | | | | | | | Enrollment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Term | Enrolled | Male | Female | Unkn | Black | Hispanic | Ind/AK | Asi/P.I. | White | Foreign | Full | Part |
| 2005 | 95 | 89 | 6 | 15 | 1 | 1 | 1 | 2 | 74 | 1 | 36 | 59 |
| 2006 | 84 | 79 | 5 | 11 | 0 | 0 | 1 | 2 | 68 | 2 | 31 | 53 |
| 2007 | 80 | 76 | 4 | 4 | 1 | 0 | 1 | 3 | 71 | 0 | 36 | 44 |
| 2008 | 78 | 74 | 4 | 4 | 1 | 2 | 0 | 1 | 69 | 1 | 42 | 36 |
| 2009 | 81 | 79 | 2 | 4 | 1 | 2 | 1 | 0 | 72 | 1 | 35 | 46 |

The manufacturing faculty group's diversity plan is simple. We accept any and all, up to 25 per year on the BR campus, who are academically prepared. Their ability to remain in the program depends on whether or not they are motivated (not lazy!). We do not recruit based on demographics.

b) In-state and out-of-state.
   a) No data

c) Full-time and part-time.
   a) Split at about 50%

d) Attend classes during the day, in the evenings, and on weekends.
   a) Big Rapids campus students attend during the day and are full time; Grand Rapids students attend in the evening and are part time.

e) Enrolled in classes on- and off-campus.
   a) Roughly 50% of students attend at the Big Rapids campus, the other 50%, Grand Rapids.

f) Enrolled in 100% on-line and/or mixed delivery courses.
   a) No on-line course offerings

g) Discuss how the information presented in (a) through (f) impacts the curriculum, scheduling, and/or delivery methods in the program.
   a) Effectively

2) Quality of Students.
   a) What is the range and average GPA of all students currently enrolled in the program? ACT? Comment on this data.

| Term | Residency | | | Average Age | FSU GPA | | | ACT | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Resident | Midwest Compact | Non Resident | | AVG | MIN | MAX | AVG | MIN | MAX |
| 2005 | 95 | 0 | 0 | 29 | 3.16 | 1.29 | 4.0 | 19.76 | 12 | 27 |
| 2006 | 83 | 0 | 1 | 29 | 3.23 | 1.20 | 4.0 | 20.09 | 14 | 28 |
| 2007 | 80 | 0 | 0 | 28 | 3.24 | 2.25 | 4.0 | 19.83 | 15 | 28 |
| 2008 | 77 | 0 | 1 | 27 | 3.17 | 1.78 | 4.0 | 20.35 | 15 | 29 |
| 2009 | 78 | 2 | 1 | 28 | 3.2 | 1.86 | 4.0 | 20.18 | 14 | 30 |

   b) In addition to ACT and GPA, identify and evaluate measures that are used to assess the quality of students entering the program.

      a. Entry requirements are 2.5 GPA overall and 2.75 in major. Remember this is a +2 so all of our students are transfer students.

   c) Identify academic awards (e.g., scholarships or fellowships) students in the program have earned. Comment on the significance of these awards to the program and students.

      a. ?

   d) What scholarly/creative activities (e.g., symposium presentations, other presentations or awards) have students in the program participated in? Comment on the significance of these activities to the program and students.

      a. COE

   e) What are other accomplishments of students in the program? Comment on the significance of these accomplishments to the program and students.

      a. There has been at least one MFGE student who has been involved with FormulaSAE each of the past few years who has played a key role in the design, manufacture, and presentations at international competitions held at the Ford Proving Grounds and The Michigan International Speed Way. An example of the type of car that the Ferris team builds and competes with each year can be viewed on Ferris' web site using the key words: Formula SAE video. This video highlights the 2007 car as it was preparing to go to the Ford Proving Grounds.

3) <u>Employability of students.</u>
   a) <u>How many graduates have become employed full-time in the field within one year of receiving their degree? Comment on this data.</u>

      a. Virtually 100%

b) What is the average starting salary of graduates who become employed full-time in the field since inception (for new programs) or the last program review? Compare with regional and national trends.

   a. The last university data we have is for 2005. It has the average starting salary for the MFGE program at about $58,000. Anecdotal evidence suggests it has dropped slightly, but seems to be moving back up.

c) How many graduates have become employed as part-time or temporary workers in the field within one year of receiving their degree? Comment on this data.

   a. No data was collected for this

d) Describe the career assistance available to the students. What is student perception of career assistance?

   a. NONE

e) How many graduates continue to be employed in the field? Comment on this data.

   a. No data was collected for this

f) Describe and comment on the geographic distribution of employed graduates.

   a. No data for this, however, graduates range all over the US

g) How many students and/or graduates go on for additional educational training? (Give annual average.) Comment on this data.

   a. No data was collected for this

h) Where do most students and/or graduates obtain their additional educational training? Comment on this data.

   a. No data was collected for this

B. ENROLLMENT.

1) What is the anticipated fall enrollment for the program?

a. The best indicators for fall enrollment in the program are the courses MFGE-311 and 411. They represent courses that only students in Manufacturing Engineering Technology take.

| | Course (as of 8-26-2010) | |
|---|---|---|
| Campus | MFGE-311 | MFGE-411 |
| Big Rapids | 15 | 15 |
| Grand Rapids | 23 | 12 |

Source: Fact Book 2009-2010

2) Have enrollment and student credit hour production (SCH) increased or decreased since the last program review? Supply a table and comment on any enrollment trends.

a. Fairly stable as seen below

| Year | 2006-2007 | 2007-2008 | 2008-2009 | 2009-2010 |
|---|---|---|---|---|
| Pre-MFGE | 8 | 8 | 8 | 6 |
| BS MFGE | 84 | 80 | 78 | 81 |

Source: Fact Book 2009-2010

5) Since the last program review, how many students apply to the program annually?

a) Between 15 and 20 on the BR campus. Applicants rarely fail to meet entry requirements, hence, just about all are accepted.

6) Of those who apply, how many and what percentage are admitted?

a) Estimated at 95%

7) Of those who are admitted, how many and what percentage enroll?

a) Again, estimated at 95%

8) What are the program's current enrollment goals, strategy, and efforts to maintain/increase/decrease the number of students in the program? Please explain.

a) 25 students on campus and 25 students in GR starting each fall. See Program Capacity

C. PROGRAM CAPACITY

1) What is the appropriate program enrollment capacity, given the available faculty, physical resources, funding, accreditation requirements, state and federal regulations, and other factors? Which of these items limits program enrollment capacity? Please explain any difference between capacity and current enrollment.

   a) Capacity is 25 juniors and 25 seniors at each campus (total is 100). The primary constraint is the lack of dedicated lab facilities. The primary facility used by the MFGE program is belongs to another program. Depending on their enrollment, access to the lab is limited to the MFGE program.

D. RETENTION AND GRADUATION

1) Give the annual attrition rate (number and percent of students) in the program.

   a. Historically, not an issue nor is it anticipated. Those that start finish if they choose. No data was collected for this. It's estimated to be less than 1% since the start of the program.

2) What are the program's current goals, strategy and efforts to retain students in the program?
   a) Keep providing graduates with the tools they need to perform at a high level in order for them to acquire placement at relatively high salaries in the manufacturing field. Placement at relatively high salaries is the MFGE program's final metric and motivator.
3) Describe and assess trends in number of degrees awarded in the program.
   a) The number of degrees awarded:

| Year | 2006-2007 | 2007-2008 | 2008-2009 |
|---|---|---|---|
| Industrial Pract. Cert. | 1 | 3 | 2 |
| BS MFGE* | 21 | 31 | 24 |

Source: FACT BOOK 2009-2010

4) How many students who enroll in the program graduate from it within the prescribed time? Comment on any trends.
   a) Data for this was not collected. However, students who transfer from other two year schools may not have all the general education credits they should and require an extra semester (or trip to Italy) to get them. Most in this situation complete the core courses for the major in the two year time frame and not more than a semester later, complete their general education requirements.

5) On average, how long does it take a student to graduate from the program? Please comment.
   a) Four semesters plus one semester for internship. Remember this program is the +2 side of a BS degree.

E. ACCESS

1) Describe and assess the program's actions to make itself accessible to students. Use examples such as off-site courses, accelerated courses or other types of flexible learning, use of summer courses, multiple program entry points, e-learning, mixed delivery courses, scheduling.

    a. We have two campuses, the main campus and the Grand Rapids campus. Students who wish to complete the program in two years come to the main campus. Those who are working and/or living in the Grand Rapids area may choose to take courses at the Applied Technology Center (ATC). Entry requirements are the same for both locations. The MFGE program has recently began accepting, officially, students who have an abundance of technical credit (at least 30 credit hours), but who do not have an AAS degree. This allows for flexibility on the part of the student. For them, the manufacturing program is a 'zero-four' program with roughly half of their courses being transferred in from another campus.

    An agreement was reached with the MFGT group on campus to create a track in their program that allows students who do not want the very specific tooling degree to take a track that is much more broad in terms of manufacturing.

2) Discuss what effects the actions described in (1) have had on the program. Use examples such as program visibility, market share, enrollment, faculty load, computer and other resources.
    a. It remains to be seen how effective this is in terms of students enrolling in the MFGE program.

3) How do the actions described in (1) advance or hinder program goals and priorities?

    a. It can only help, it cannot hinder.

F. CURRICULUM. The curriculum review section must also contain appropriate check sheets and example syllabi, which may be attached as an appendix.

1) Program requirements. Describe and assess the program-related courses required for graduation.

MFGE Check Sheet:

FERRIS STATE UNIVERSITY
Imagine More

Bachelor of Science Degree

**Manufacturing Engineering Technology**

**Course Sequence Guide**

| | | | | | |
|---|---|---|---|---|---|
| Student: | | | | | |
| Email: | | | ID: | | |
| Advisor: | | | Ph: | | |

| YEAR 3 - FALL SEMESTER | | | Crs | Gr | |
|---|---|---|---|---|---|
| MFGE | 311 | Industrial Engineering (MATH 116 or 120) | 4 | | |
| MFGE | 312 | CNC & CAM (MFGT 110, 114 or equivalent) | 4 | | |
| MFGE | 341 | Quality Science Statistics (MATH 116 or 120 or 126 or MATH ACT 24 or SAT 500) | 3 | | |
| PHYS | 211 | Introductory Physics I (MATH 116 or 120) | 4 | | |
| | | Cultural Enrichment Elective | 3 | | |
| | | Total | 18 | | |
| **YEAR 3 - SPRING SEMESTER** | | | **Crs** | **Gr** | |
| MFGE | 321 | Metrology (MATH 116 or 120 or MATH ACT 24 or SAT 500) | 3 | | |
| MFGE | 322 | Production Processes | 3 | | |
| MFGE | 324 | Principles of Process Planning I (MFGE 311, 312; MFGE 321, 326 co-req) | 3 | | |
| MFGE | 326 | Pres Tolerance/Design Analysis (MATH 116 or 120) | 2 | | |
| MFGE | 342 | Statistical Process Engineering (MFGE 341) | 3 | | |
| | | Social Awareness | 3 | | |
| | | Total | 17 | | |

Submit Application for Graduation.

| YEAR 3 -SUMMER SEMESTER | | | Crs | Gr | |
|---|---|---|---|---|---|
| MFGE | 393 | Internship (Department Approval) | 4 | | |
| | | Total | 4 | | |
| **YEAR 4 - FALL SEMESTER** | | | **Crs** | **Gr** | |
| MFGE | 411 | Principle of Process Planning II (MFGE 322, 324, 342) | 2 | | |
| MFGE | 442 | Design of Experiments 1 (MFGE 321, 341) | 3 | | |
| MECH | 340 | Statistics & Strengths of Materials (MATH 126 or 130; PHYS 211) | 4 | | |
| MATH | 220 | Analytical Gemoetry and Calculus I (MATH 126 or 130) | 5 | | |
| WELD | 416 | Production Welding Processes (may be taken in alternative sequence) | 2 | | |
| | | Total | 16 | | |
| **YEAR 4 - SPRING SEMESTER** | | | **Crs** | **Gr** | |
| MFGE | 421 | Automation & System Design (MFGE 411) | 4 | | |
| MFGE | 422 | MFGE Facilities Planning (MFGE 411) | 3 | | |
| MFGE | 423 | Engineering Economics (MATH 126 or 130 or MATH ACT 24 or SAT 500) | 2 | | |
| PLTS | 325 | Plastics Processes | 2 | | |
| | | Social Awareness Elective (200 level or above) | 3 | | |
| | | Cultural Enrichment (200 level or above) | 3 | | |
| | | Total | 17 | | |

Bachelor of Science General Education Requirements:
One Global Consciousness Course (3cr), One Race - Ethnicity - Gender(REG) Course (3cr), and One Foundation Course(3cr) –
Multiple requirements may be satisfied by a single course.
Cultural Enrichment – 9 credits (3 credits in course > 200 level); Social Awareness - 9credits (3 credits in course > 200 level)
Students must complete 40 credits at or above the 300. [Reference: http://www.ferris.edu/htmls/academics/gened/gen_edspecific.html ]

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

09F
8/17/2009

A sample syllabus is included in the Appendix for the committee's review. The manufacturing faculty use this format across all courses. Syllabi include grading scale and attendance policies. Faculty include other information as they see fit. Academic freedom encourages faculty to meet performance

objectives through a variety of means. Though no hard data are in hand regarding this, however, anecdotally, it is not rare to find MFGE faculty discussing unique and new ways to meet these objectives. Program requirements for graduation are in conformance with university requirements. Faculty Advisors, working with Dean's office staff, assure that general education requirements are met.

a) As part of the graduation requirements of the current program, list directed electives and directed General Education courses. Provide the rationale for these selections.

    i) Directed general electives include PSYC-150, PHYS-211, and MATH 220. PHYS-211 is a prerequisite for MECH-340, Statics and Strengths of Materials. MATH-220 is a calculus course that provides students with an appreciation of calculus, something all engineers should have. PSYC-150 satisfies R and F general education ratings, which few courses do, and it is relevant to the relational side of engineering.

b) Indicate any hidden prerequisites (instances where, in order to take a program-required course, the student has to take an additional course. Do not include extra courses taken for remedial purposes).

    i) There are no known or intended hidden prerequisites in the program.

2) Has the program been significantly revised since the last review, and if so, how?

    a) No major changes to the program since last review

3) Are there any curricular or program changes currently in the review process? If so, what are they?

    a) No significant curricular or program changes are currently in the review process.

4) Are there plans to revise the current program within the next three to five years? If so, what plans are envisioned and why?

    a) No major revisions, other than the possible addition of an Engineering Track and ABET Accreditation are anticipated in the next three to five years.

G. QUALITY OF INSTRUCTION

1) Discuss student and alumni perceptions of the quality of instruction.

   a) SEE SECTION 2-A & C & D.

2) Discuss advisory committee and employer perceptions of the quality of instruction.

   a) See Section 2-F.

3) What departmental and individual efforts have been made to improve the learning environment, add and use appropriate technology, train and increase the number of undergraduate and graduate assistants, etc.?

   a) Lecture classrooms that have been upgraded with computer projection and internet access are vastly better than those that have not been. The faculty would that all class rooms have at a minimum: computer, projection, screen situated in such a way that it is not blocking the "white-board", and a document camera that is tied to the projector as well.

4) Describe the types of professional development have faculty participated in, in efforts to enhance the learning environment (e.g. Writing Across the Curriculum; Center for Teaching and Learning, etc.).

   a) Seminars, users-groups, periodicals, papers, etc. are the primary means faculty use to stay abreast of changes in their areas.

5) What efforts have been made to increase the interaction of students with faculty and peers? Include such items as developmental activities, seminars, workshops, guest lectures, special events, and student participation in the Honors Program Symposium.

   a) The MFGE group supports two professional organizations on the BR Campus. The Society of Manufacturing Engineers (SME) and the Society of Automotive Engineers (SAE). These two organizations foster a high level of participation between the faculty advisors and the organizations themselves.
   b) Significant team projects that span upwards of four courses simultaneously encourage discussion and consultation with faculty. The primary example of this is the Amerikam Project (Appendix C).

6) Discuss the extent to which current research and practice regarding inclusive pedagogy and curriculum infuse teaching and learning in this program.

   a) It is not known what "Inclusive Pedagogy" is. Nevertheless, students complete a variety of tasks some of which are individual and many are within a team. Teams are assigned without bias excepting the Amerikam Project where teams are assigned based on their current GPA. Those with

low gpa's are group with others with low GPA's and vice-versa. This has worked well over the years.

7) What effects have actions described in (5) and (6) had on the quality of teaching and learning in the program?
a)

H. COMPOSITION AND QUALITY OF FACULTY. Describe and assess the composition of the faculty teaching courses in the program.

1) List the names of all tenured and tenure-track faculty by rank.

a) Summary Table; Faculty Profiles appear in Appendix A-2

| Name | Rank | Years of Service at FSU | Highest Degree Earned | Typical Annualized Work Load (cr) |
|---|---|---|---|---|
| Ovans, Gary | Professor | 26 | MS; FSU, Mich. | 22-26 overloads periodic |
| Rumpf, James | Professor | 20 | MS; UOP; PA | 12 (Jim is FFA pres) |
| Gregory, Bruce | Professor | 27 | MS; RIT, New York | 22-26 overloads periodic |
| Rusco, Mark | Associate Professor | 12 | MS; MI State; Mich. | 24-26 overloads common |
| Wist, Joseph | Associate Professor | 10 | MS; MI Tech; Mich. | 24-30 overloads common |
| Danley, Blaine | Associate Professor | 10 | MS; MI Tech; Mich. | 24-30 overloads common |

b) The current ranks appear in the table above. Three were promoted to Associate Professor from Assistant within the last review cycle.

c) Not known.

2) Work Load

a) What is the normal, annualized teaching load in the program or department? Indicate the basis of what determines a "normal" load. On a semester-by-semester basis, how many faculty have accepted an overload assignment?

i) The normal semester load is 12 credits and/or 18 contacts and/or 356 student credit hours generated. The basis is the union contract. See table above for summary.

b) List the activities for which faculty receive release time.

i) Program coordinator receives ¼ load reduction

3) Recruitment

a) What is the normal recruiting process for new faculty?

i) Advertise through normal routes: professional societies, for example Society of Manufacturing Engineers, the news papers in larger cities, for example, Grand Rapids.

b) What qualifications (academic and experiential) are typically required for new faculty?

i) 5 years industrial experience and a technical Masters Degree.

c) What are the program's diversity goals for both gender and race/ethnicity in the faculty?

i) To Hire the most qualified applicant

d) Describe and assess the efforts being made to attain goals in (c).

i) The faculty group is not bigoted and will hire the most qualified individual for any position it is responsible for filling.

4) Orientation. Describe and assess the orientation process for new faculty.

Newly hired tenure track faculty are assigned a mentor for a one year period. This mentor is tenured and committed to making the new faculty successful. It has been ten years since the program has hired a new faculty member. There is strong potential for one faculty's retirement, which would invoke hiring his replacement. However, the support for replacing this needed position has not been forth coming.
The tenure process also serves as a help for the newly hired faculty. The COET requires a tenure committee for each new faculty. It is up to this committee to see that the college is doing everything it can to make the new faculty successful.

5) Reward Structure: e.g., salary, professional development funds, travel funds, UCEL and FSUGR incentive money.

N/A

a) Describe the reward structure in the program/department/college as it relates to program faculty. Indicate the type of reward and eligibility criteria.

N/A

b) Does the existing salary structure have an impact on the program's ability to recruit and retain quality faculty?

Unknown

c) Is the reward structure currently in place adequate to support faculty productivity in teaching, research, and service? If not, what recommendations would you make to correct the situation.

Unknown

d) Is enhancing diversity and inclusion a component of the reward structure? Please explain.

Unknown; It is not understood what is meant by "inclusion". The MFGE faculty have never been an "exclusive" group.

6) Graduate Instruction (if applicable)

N/A

7) Non-Tenure-Track and Adjunct Faculty.

a) Please provide a list for the last academic year of full-time non-tenure-track and adjunct faculty who taught courses in the program. For full-time non-tenure track faculty, indicate the length of their appointments and the number of years of service at the University. Comment on the program's ability to retain non-tenure-track faculty.

The MFGE faculty use adjuncts on an as needed basis, typically at the GR Campus. It is estimated to be one adjunct per year teaching at most two classes.

b) What percentage of program courses is taught by the faculty in (a)? What courses are they teaching? Please comment.

Virtually 100%

c) Describe the required qualifications (academic and experiential) for faculty listed in (a). Indicate if all faculty have met the criteria, and if not, what is being done to resolve the situation?

Industrial experience in the field and an academic background sufficient to support the theory behind the material to be covered.

d) Does the program consider the current use of non-tenure-track faculty to be appropriate? Why or why not?

No; Non-Tenure track faculty have no “Skin-in-the-Game” as it were. They are hired guns so to speak. They do not advise students or take part in the active monitoring and improvement of the program.

e) If the program is accredited, what position if any does the accrediting body have regarding the use of non-tenured and adjunct faculty?

N/A

I. ASSESSMENT AND EVALUATION. *Describe and evaluate the program's assessment mechanisms.*

**Note -** Each program review must be accompanied with a TracDat report that is designed for Program Review that provides information about the results of assessment implementation at the program level. The TracDat system has the APR Report available to all within the university, and this report must be included. Program Review panels may also elect to produce additional TracDat reports that demonstrate the effectiveness of the program.

MFGE-NOTE: Placement rate is the manufacturing program's key metric. According to Jim Rumpf, unofficial graduate/alum placement stats keeper, "All graduates of the last five years who want to work in the field are working in the field." Throughout its history, Manufacturing Engineering Technology program graduates have found jobs in the field with only one known exception. Regardless, it can be said that placement stands at virtually 100% and is the program's ultimate ASSESSMENT METRIC.

1) List and describe student learning outcomes at the course level.

    i. They are contained in the performance objectives of each Unit of Instruction on each course syllabus.

2) List and describe student learning outcomes at the program level.

    i. Able to apply all concepts presented after successfully completing their junior year while serving an internship. Historically, companies that hire FSU-MFGE interns offer significant levels of praise and, more often than not, a full time job offer upon graduation if they have an open position.

    ii. Able to do entry level manufacturing engineering work upon graduation.

3) Submit a curriculum map and an explanation of how program outcomes are achieved through course curriculum.

    i. These are included on course syllabi; it is left up to the individual faculty to write exercises, tests, quizzes, projects that cause students to meet performance objectives.

4) Identify how learning outcomes at the course level are measured. Include analysis regarding how well students are meeting course level outcomes.

    i. Through a combination of projects, homework, quizzes, exams, papers designed by the teaching faculty to meet stated performance objectives listed in the outline.

5) Identify how learning outcomes at the program level are measured. Include analysis regarding how well students are meeting program level outcomes.
    i. Virtually 100% placement at reasonably high levels of pay.

6) Describe how assessment results at the course and program levels have assisted in making decisions about pedagogy, learning outcomes, and other course and/or program level actions.

    i. Faculty consult with one another in the design of exercises that meet various performance objectives.

7) List and describe what variables are tracked and why when assessing the effectiveness of the program (e.g. mastery of essentials of subject area, graduation rates, employment rates, pass rates on professional exams).

    i. Placement and Salary. Since the university no longer places the emphasis it once did on placement services, the publishing of annual objective data regarding salary, the MFGE program relies on anecdotal evidence or evidence it collects as it can. This is less than desirable.

8) Provide trend data for the variables listed in (1). Compare the data to accreditation benchmark standards if applicable, or provide some other type of assessment of the data.

    i. Data not collected for this

9) Describe how the trend data in (2) is used to assess the rigor, breadth, and currency of the degree requirements and curriculum.

    i. Data not collected for this

10) Describe how the trend data in (2) is used to assess the extent to which program goals are being met.
    i. Our over-arching program goal is to graduate students with the skill sets that place them in high demand positions and at relatively high salaries. Our ultimate metric can be summed up with these three words:
        i. Placement
        ii. Placement
        iii. Placement

J. SERVICE TO NON-MAJORS. *Describe and assess the impact that delivery of service courses offered by the program or the department has on the program.*

a) Identify and describe the General Education service courses provided by the program faculty for other departments at FSU.

i) N/A

b) Identify and describe any non-General Education service courses or courses required for other programs. Comment on your interaction with the departments or programs for which the courses are provided.

i) The only courses on the MFGE check sheet that are taken exclusively by manufacturing Engineering Technology students are: MFGE-311, 324, 326, 411, 421, 422. The remaining MFGE prefixed courses are heavily populated with students from AET, MECH, PLTS, EEET, ITM, OPM (COB) and WELD. This fact has given rise to the number and diversity of faculty backgrounds in the MFGE program. Many MFGE courses, for example, MFGE-423 (Engineering Economics), can be considered core engineering technology courses. That is why so many programs use these courses.

***Student Credit Hours Generated serving Non-Majors ( MATLdata excluded)***

| Year(FSS) | 2006-2007 | 2007-2008 | 2008-2009 | 2009-2010 | F2010 |
|---|---|---|---|---|---|
| SCH's | 913 | 1185 | 1018 | 1176 | 860 |

Source: Banner

c) Discuss the impact of the provision of General Education and non-General Education courses has on the program.

i) The greatest effect General Education courses have on the MFGE program is in keeping us from adding more rigor to the program. For example, there are twelve English credits and eighteen cultural and social awareness credits. That is thirty credits! If it were reduced by ne third, twenty would be required. Those ten credits could be used for more MATH, PHYSICS, and Engineering Fundamental course work. This would make it easier to move toward an engineering program while maintaining a hands-on emphasis.

d) Does the program plan to increase, decrease, or keep constant its level of service courses? Explain.

i) Maintain the same level. Unless more faculty are added, this load cannot be increased.

K. DEGREE PROGRAM COST AND PRODUCTIVITY DATA. *Submit Institutional Research and Testing data. Comment on the data.*

Based on Ferris State University Office of Institutional Research document, "Degree Program Costing 2007-2008 (Summer, Fall, and Spring) document (page 119), the cost to complete the program at that time was $19,451.27. It should be noted, however, that some of the numbers in that document are suspect. For example, the course MFGE-313 is said to have an instructor cost of $20,339,457 and, by the way, the class generates 122577 student credit hours. Hmmmmmmm……

| Year SFW | 2004-2005 | 2005-2006 | 2006-2007 | 2007-2008 | 2008-2009 |
|---|---|---|---|---|---|
| SCH's-MATL | 654.94 | 627.59 | 658.77 | 724.78 | 727.64 |
| SCH's-MFGE | 414.33 | 411.2 | 377.68 | 341.43 | 368.77 |

Source: PRODUCTIVITY REPORT F2004-S2009

L. ADMINISTRATION EFFECTIVENESS

1) Discuss the adequacy of administrative and clerical support for the program.

    i) Clerical support for the program is excellent based on the person in the position.

2) Are the program and/or department run in an efficient manner? Please explain.

    i) It is the OPINION of the MFGE faculty group that the move to "Directors" is a disaster. It is far less effective than the utilization of Program Chairs. These positions seem to create more unnecessary paper work, meetings than they do positively affecting the classroom. If they could raise their annual salary in terms of actual cash donations to the program areas, then these positions may be warranted. As they are now, they simply do the work the Dean's office does not want to do.

3) Are class and teaching schedules effectively and efficiently prepared? Please comment.

    i) Program Coordinator sets the schedules as judiciously and effectively as possible

4) Are students able to take the courses they need in a timely manner? Please comment.

    i) Yes, the core courses are offered as shown on the Program Check Sheet on Campus. Most on campus students complete the degree in two years. The GR site has core courses occurring over a 4 year period as opposed to a two year period (+2). Courses at the Grand Rapids site are rotated in a manner that allows a person with a two year degree or the requisite entry requirements should be able to finish the program there in four

years. Two program faculty perform all advising duties at the Grand Rapids campus. This has been an effective means for administering the program at that site.

## SECTION 4
## FACILITIES and EQUIPMENT

A- *Instructional Environment* (Items 1-5 are covered in composite)

Most classrooms are very adequate. Others are simply not. For example, SWAN 106 and 311 are examples of rooms that are NOT adequate. Swan 106 is crowded and the media/faculty station are strangely situated. If one does use an overhead projector, it will displace student note taking space in the first row. Swan 311 does not contain technology other than a white board and overhead projector.

As for lab space, the program has never had a production lab in which to work. When Ed Nicks proposed the program to Ferris in 1974, a lab where hands on experiences could be conducted was included. Ed was told to begin the program without the lab and that a lab could be added later. After the successful placement of graduates of the first graduating class (1978), Ed approached the Dean of the School of Technology about adding the lab. The response to Ed was simply, "Well, it appears you don't need a lab." Ed admitted that he never would have started the program if he had known this would be the outcome. Ed is now deceased and this story is only known by a hand full of people who worked closely with him. Perhaps now it will be documented and heard.

Fortunately, extensive use of the FSU Machine Shop has filled this gap somewhat. Many familiar with us suggest that we look like a degree focusing on machining. Well, this is because that is the only shop we have access to!

Manufacturing engineers design processes for ALL types of products and industries. Clothing, food processing, fabrication processes that utilize many different types of joining and cutting processes, production assembly, and, of course, a vast array of machined products and more, comprise the potential products our graduates will find themselves involved with.

While it is absolutely impractical to have an exhaustive lab that houses all possible types of manufacturing, it would be vastly better to have an area where principles learned in class could be applied. For example, LEAN concepts can be taught in a lecture environment. How much better could they be grasped if systems were actually set up, studied, and evaluated for their effectiveness. A foundry better equipped and sized than the one we now have and cannot use practically would give students a far better grasp of the various casting processes.

Administrative support simply does not exist for building an MFGE lab so it does no good to state goals for one.

B- *Computer Access and Availability*(Items 1-6 are covered with one statement below)

Students entering the program are required to obtain a laptop that meets required specifications. Therefore, access is not a problem. Software can be at times, but not computer time.

C-*Other Instructional Technology*

N/A

D *Library Resources* (Items 1-3 are covered in the next statement)

Library resources are very good. We use the library on an instructor by instructor basis and for meeting with our Advisory Board. The staff, technology, and facility exceed our requirements.

## SECTION 5

## CONCLUSIONS

### 5-A ***Relationship to FSU MISSION***

Ferris' Mission: Ferris State will be a national leader in providing opportunities for innovative teaching and learning in career-oriented, technological and professional education.

FSU MFGE Mission: "The mission of the Manufacturing Engineering Technology Program is to prepare career-ready manufacturing engineering professionals to serve Michigan, and the nation in a global economy."

### 5-B ***Program Visibility and Distinctiveness***

We have never made an effort to introduce ourselves to people who do not know about us. This may need to change. Our base of graduates (since 1978; >600) is doing a fair amount of this 'ambassador' work. Our distinctiveness is and always has been "Job Ready". Any action taken to improve the program must not detract from this.

### 5-C ***Program Value***

This program has enhanced the lives of over 600 people. (The person writing this paragraph speaks from personal experience!) Moreover, it has benefitted the State of Michigan. Graduates, (a safe estimate is that 75% stay in Michigan), increase the education of the available work force. They earn a higher salary and, hence, pay more taxes than those who may not have been allowed entry or able to 'cut-it' at one of the other state universities. Though we attract some very powerful students (high ACT's), we have spun a lot of 'gold from straw (students with much lower ACTs)' over the years by giving people who are good with their hands a chance.

### 5-D ***Enrollment***

Clearly, could be better. We have capacity for at least 10 more students entering each fall on both semesters than are entering now. New directions in recruitment, ABET Accreditation and the move to a full ENGINEERING level program may be required.

Fortunately, related courses are making the payments, as it were.

### 5-E ***Characteristics, Quality and Employability of Students***

Companies still want MFGE students as evidenced by the survey of employers. The longer a graduate has been in the field the more likely they are to have a management bent. This is evidenced by the difference in Alumni Survey comments made by those who graduated long ago and those who graduated more recently.

**5-F *Quality of Curriculum and Instruction***

Always improving and looking for ways to improve.

**5-G *Composition and Quality of the Faculty***

The faculty composition of this group is diverse, yet balanced in respect to educational background and experiences. They work very well together as a team. There are no 'prima donnas' in the group. One is confident that the others are doing their level best in the classroom and advising.

# APPENDICES

# Appendix A-1
# Sample Course Syllabus; This course is an example of a course taken by majors and non-majors

**COURSE SYLLABUS**

**FERRIS STATE UNIVERSITY** **COURSE: MFGE 341**
**COLLEGE OF TECHNOLOGY** **Fall 2010**
***Manufacturing Department***

COURSE TITLE: Quality Science Statistics

COURSE DESCRIPTION: This course is a detailed study of the applications and fundamentals of data analysis covering distributions, linear relationships, cause-effect, collection of data, probability, counts, proportions, sample means and inferences.

CREDIT HOURS: Three Semester hours

CONTACT HOURS: Lecture: 45 hours total
Laboratory; none

PREREQUISITE: College level algebra (Math 116 or equivalent) junior standing or permission of instructor.

RESOURCE MATERIALS: Elementary Statistics, 3rd ed., Larson and Farber

UNITS OF INSTRUCTION AND STUDENT LEARNING GOALS FOR EACH UNIT:
At the completion of each unit the student will:

I. Introduction
   a. Know the purpose of the course and its relationship to other courses in the program
   b. Know what the course objectives are and how they will be measured for completion
   c. Understand the grading scale

II. Statistics Defined
   a. Understand the difference between the fields of mathematics and statistics
   b. Understand what constitutes a Random Variable and what does not.

III. Describing Data
   a. Population vs. Sample
      i. Be able to recognize the difference between a population and a sample.
      ii. Be familiar with language pertaining to “population” and “sample” with regard to statistics.
         1. Know the difference between Parameters and Estimators
   b. Data Collection
      i. Be able to suggest ways that sample data should be collected in order to answer a practical question using the following general data collection methods:
         1. Random Sample
         2. Systematic Sample
         3. Stratified Sample
   c. Plot The data
      i. Be able to construct and interpret the following plots Statistics and Plots
         1. Stem Plot
         2. Box Plot
         3. Histogram
         4. Dot Plot
         5. Scatter Plot
         6. Pareto Chart
      ii. Be able to recognize the existence of an Outlier and have some idea of how to respond to them.
   d. Measures of Central Tendency

i. Be able to describe where the center of a data set is relative to a reference point using one or all of the following measures of central tendency:
    1. The Median
    2. The Mode
    3. The Arithmetic Mean
    4. The Weighted Mean

e. Measures of Variation
    i. Be able to calculate the following sample statistics regarding variation:
        1. The Range
        2. The Variance
        3. The Standard Deviation

f. Application
    i. Given sample data that is provided or collected on site during testing or lecture settings, be able to choose appropriate tools that describe the data set. This includes: Constructing Plots, Calculating Sample Statistics, and drawing conclusions.

IV. Counting and Probability Principles
- a. Be able to employ simple counting rules regarding the number of ways outcomes can occur relative to finite populations of discrete things.
- b. Know simple rules of probability that apply to occurrences (events) of random variables that fall into the classes of:
    - i. Mutually exclusive events
    - ii. Independent events
- c. Be able to construct probability statements that reflect the probability value associated with various elements of a random variable.
- d. Have a working knowledge of Chebychev's Theorem

V. Discrete Probability Distributions
- a. General Probability Distributions
    - i. Given the description of a Discrete Random Variable, be able to describe the domain of the random variable and the probabilities associated with values (outcomes) of the random variable.
    - ii. Be able to construct a table that describes a discrete random variable that shows the range of values and associated probabilities of the random variable.
    - iii. Be able to calculate the Mean and Variance of discrete random variables
- b. The Binomial Distribution
    - i. Know what constitutes a Binomially Distributed Random Variable.
    - ii. Be able to calculate the Mean and Variance of a Binomial Random Variable
    - iii. Be able to calculate probabilities for various outcomes of a Binomial Distributed Random Variable.
    - iv. Be able to construct Probability Histograms for Binomially Distributed Random Variables.
- c. The Poisson Distribution
    - i. Know what constitutes a Poisson Distributed Random Variable.
    - ii. Be able to calculate the Mean and Variance of a Poisson Random Variable
    - iii. Be able to calculate probabilities for various outcomes of a Poisson Distributed Random Variable.
    - iv. Be able to construct Probability Histograms for Poisson Distributed Random Variables.

VI. Continuous Random Variables
- a. Know the difference between Continuous and Discrete Random Variables
- b. Know what constitutes a Normally Distributed Random Variable.
- c. Be able to Estimate the Mean and Variance of a Normally Distributed Random Variable
- d. Be able to transform any Normal Distribution into a Standard Normal Distribution.
- e. Be able to determine Probabilities associated with ranges of values associated with Normally Distributed Random Variables.
- f. Be able to determine the value of a normally distributed random variable that is associated with a prescribed area under a normal curve.
- g. Be able to sketch Normal Distributions with area under the curve shaded that corresponds to the probability values sought.
- h. Approximation
    - i. Be able to approximate Binomial probabilities using the Normal Distribution.
    - ii. Be able to use the continuity correction factor

VII. Types of Errors
- a. Know the types of errors associated with decision making
    - i. Type I Error (and its associated risk known as alpha risk)

ii. Type II Error (and its associated risk known as beta risk)

VIII. Sample Means
- a. Understand and be able to apply the Central Limit Theorem for predicting outcomes of Sample Means.
- b. Be able to calculate Confidence Intervals for sample means
- c. Be able to calculate the minimum sample size required to achieve a desired level of Alpha Risk.

IX. Sample Proportions
- a. Be able to calculate Confidence Intervals for sample proportions
- b. Be able to calculate the minimum sample size required to achieve a desired level of Alpha Risk.

X. Hypothesis Testing
- a. Given the description of a Population, be able to construct Statistical Hypothesis statements regarding the values of parameters for the population.
  - i. The Null Hypothesis
  - ii. The Alternative Hypothesis
- b. Be able to conduct the following Hypothesis tests at stated alpha risks:
  - i. One Sample t-Test for Arithmetic Mean
  - ii. Two Sample t-Test for Arithmetic Means
  - iii. T-Test for Paired Data
  - iv. One Sample Z -Tests for Proportions
  - v. Chi-Square Test for Standard Deviations and Variances
- c. Know what a P-Value is as it relates to decision making risk.

XI. Two Variable Regression and Correlation
- a. Be able to construct a Scatter Plot and explore possible relationships between two variables
- b. Be able to propose a straight line equation in the form of y=mX + b, using least squares regression.
- c. After overlaying the calculated line on the associated scatter plot, be able to evaluate the fit of the line to the data.
- d. Know what a residual is with regard to linear regression.
- e. Be able to calculate the correlation coefficient
- f. Understand the difference between Correlation and Causation

ATTENDANCE POLICY: Regular attendance is strongly encouraged. However, absence will influence the final grade in this course only when the effects of such absence affects the student's level of competence.

Final Grade Based on a combination of unit exams and quizzes.

GRADING SCALE:
95 - 100 = A
93 - 94 = A-
91 - 92 = B+
85 - 90 = B
83 - 84 = B-
81 - 82 = C+
75 - 80 = C
73 - 74 = C-
71 - 72 = D+
70 = D
69 = D-
68 = F

# Appendix A-2

## Sample Course Syllabus; This course is an MFGE core course and is taken by MFGE majors only.

COURSE SYLLABUS

FERRIS STATE UNIVERSITY — COURSE: MFGE–326
COLLEGE OF TECHNOLOGY
Manufacturing Department — Bruce Gregory

COURSE TITLE: MFGE-326 Process Tolerance Design and Analysis

COURSE DESCRIPTION: Mechanical parts and assemblies may pass through many different operations during manufacture. Formal means of managing, analyzing and specifying process dimensions and tolerances are essential to the design of capable manufacturing processes. Tolerance Charting is a structured engineering tool that can be used to determine process dimensions and tolerances in light of product drawing tolerances and process tolerance stacks. This course teaches the Manufacturing Engineering Technology student the Tolerance Charting Method of process tolerance analysis.

CREDIT HOURS: Two Semester Hours

CONTACT HOURS: Lecture – 2hrs/week
Lab - none

PREREQUISITES: Manufacturing Engineering Technology majors only

TEXTBOOK REQUIRED: "Tolerance Charting Compiled Text"; located on the located on the L:/btc/brucegregory/mfge326
Down load it to your laptop

UNITS OF INSTRUCTION AND GOALS FOR EACH UNIT:

I. Introduction to course
   a. Pre-test
   b. Overview of course structure
   c. Purpose of Tolerance Design and Analysis in Manufacturing Engineering.

II. Features
   a. Be able to determine the number of Product Features a part has
   b. Be able to distinguish between Product and Process Features

III. Process Tolerance Analysis
   a. Given a simple process, be able to determine process dimensions and tolerances using conventional min/max tolerance analysis methods.

IV. Introduction to the Tolerance Chart
   a. Overview of Tolerance Chart of Anatomy
   b. Overview of column functionality

V. Number of Tolerance Charts
   a. Given a piece part drawing, be able to determine the number of geometric directions that require a process tolerance analysis.

VI. Part Sketching on the Process Tolerance Chart
   a. Be able to stretch, offset, compress, or modify part geometry in order to clearly represent part features distinctly on a tolerance chart.

VII. Process Representation
   a. Given a manufacturing process, be able to represent the process on a tolerance chart using tolerance charting symbols including symbols for:
      i. Locators
      ii. Cut-lines

VIII. Determine Machine to +/- Tolerances
   a. Be able to determine which operation was responsible for establishing Product Features
   b. Be able to detect direct or indirect cuts that establish Process and Product Features.
   c. Be able to create balance dimensions to represent a tolerance stack as needed.
   d. Be able to define the complete tolerance path associated with a balance dimension.
   e. Be able to derive Line-Equations for balance dimensions.
   f. Be able to distribute tolerances throughout a complete tolerance path as defined by Line-Equations.
   g. Be able to assign suitable tolerances to Cut-Lines not involved in any tolerance stack.

IX. Determine Machine to Mean Dimensions
   a. Be able to classify a Process Feature coming into an operation as having been created Directly or Indirectly.
   b. Be able to derive a Line Equation that defines stock removal for each Cut-Line that requires stock removal.
   c. Be able to determine stock removal tolerance for each cut line requiring a stock allowance based on Line-Equations.
   d. Be able to establish a target stock allowance, (called mean-stock) required in each operation to meet dimensional requirements while respecting the impact on cost in terms of material utilization, cycle time, and machine capability (tolerance holding).
   e. Be able to determine Machine-to Mean values based on stock adders.

X. Check Chart
   a. Given a completed T-chart, be able to check the chart by performing the operations defined in the Line-Equations column.

XI. Record Resultant Data
   a. Given a completed tolerance chart, be able to record the tolerance path and resultant Mean and Tolerance for every Product Feature.

XII. Multiple Tolerance Stacking Directions
   a. Be able to construct as many tolerance charts as needed to track concurrent tolerance stacks in multiple part directions

XIII. Angle Cut conditions
   a. Know what constitutes an angle cut condition
   b. Be able to determine Mean Rough +/- Tolerance given the other dimensional conditions relative to angle cut conditions.

XIV. Radius Break-Out conditions.
   a. Know what constitutes a radius break out condition.
   b. Be able to determine Mean Rough +/- Tolerance given the other dimensional conditions relative to radius break out conditions.

XV. Limit Stack Assembly Tolerance Analysis on the Tolerance Chart
   a. Given stack type static and/or dynamic assemblies, be able to predict final assembly dimensions and tolerances using the tolerance charting algorithm for assemblies.

Final grade is based on a series of homework, quizzes, and exams. The comprehensive final is not optional.

*ATTENDANCE POLICY:*

Regular attendance is <u>strongly</u> encouraged. However, absence will influence the final grade in a course only when the effects of such absence, affects the student's level of competence.

*GRADING SCALE:*

| | |
|---|---|
| 95 -100 | A |
| 93 - 94 | A- |
| 91 - 92 | B+ |
| 85 - 90 | B |
| 83 - 84 | B- |
| 81 - 82 | C+ |
| 75 - 80 | C |
| 73 - 74 | C- |
| 71 - 72 | D+ |
| 70 | D |
| 69 | D- |
| < 69 | F |

# Appendix B
# MFGE Personnel Profiles

## COLLEGE OF ENGINEERING TECHNOLOGY
## MANUFACTURING DEPARTMENT

## PERSONNEL PROFILES
## Manufacturing Engineering Technology

**Blaine R. Danley**
231/591-2943

Associate Professor, Manufacturing Engineering Technology
MS Metallurgical & Materials Engineering, Michigan Technological University
BS Metallurgical & Materials Engineering, Michigan Technological University
Areas of expertise: structure property relationships, welding metallurgy, failure analysis, heat treatment, thermal spray processes, quality control

**Bruce M. Gregory**
231/591-2955

Professor, Manufacturing Engineering Technology
MS in Applied & Mathematical Statistics, Rochester Institute of Technology
MS Occupational Education, Ferris State University
BS in Manufacturing Engineering Technology, Ferris State University
AAS in Machine Tool, Ferris State University
Areas of expertise: process planning, process tolerance design/analysis, statistical quality control, design of experiments, statistics

**James A. Rumpf**
231/591-3591

Professor, Manufacturing Engineering Technology
MS, Electrical Engineering, University of Pittsburgh
BS, Mechanical Engineering, General Motors Institute
Areas of expertise: automation, work measurement and design, ergonomics, plant layout, system simulation, green manufacturing, lean techniques for manufacturing, health care, and hospitality

**Mark S. Rusco**
231/591-2516

Associate Professor, Manufacturing Engineering Technology
MBA, Central Michigan University
BS, Mechanical Engineering, Michigan State University
Areas of Expertise: ISO 9000, lean manufacturing techniques, stamping, powder metal processing, magnetic materials, Statistical Quality Control, design of experiments, measurement uncertainty

**Joseph A. Wist**
231/591-2936

Associate Professor, Manufacturing and Engineering Technology
MS Metallurgical & Materials Engineering, Michigan Technological University
BS mechanical Engineering, Michigan Technological University
Areas of Expertise: Casting processes, resistance spot welding, Process control & improvement

**Gary L. Ovans**
231/591-2971

Professor
Manufacturing Department
MS Occupational Education, Ferris State University
BS Industrial Technology, University of Wisconsin-Stout
BS, University of Wisconsin-Eau Claire
Certificate-Advanced Studies in Quality
Certified Manufacturing Engineer, Society of Mfg. Engineers
Areas of expertise: Industrial engineering (methods design, methods analysis), plant layout, statistical quality control, process planning, metrology, ISO-9000, measurement uncertainty

**Sandy Morningstar**
231/591-2511

Department Secretary

---

**Direct Inquiries To:**

Manufacturing Engineering Technology Program Faculty
Ferris State University
College of Engineering Technology
915 Campus Drive, Swan 108
Big Rapids, MI 49307
Phone: 231/591-2511
FAX: 231/591-2407

# Appendix C
## NOTE: PART DRAWINGS NOT INCLUDED

The Amerikam Project
Tool Engineering and Process Tolerance Analysis Aspects
Mfge-324 & 326
Winter 2005

**Introduction**

Manufacturing engineers must have a view of the entire manufacturing realm they are involved in. Student projects are one way schools provide this view to their students. That is the overarching purpose of this project. This project is sponsored by Amerikam, Inc. which is located in Grand Rapids Michigan. This project requires knowledge of every discipline learned up to this point in the manufacturing program. Moreover, it integrates three, second semester manufacturing courses.

**Objective: (Tool Engineering)**

Design and specify commercially available tooling and work holding systems required to support your process' design (order and type of operations is accomplished in the 322 class). Moreover, an estimate of manufacturing cost is required using Amerikam's costing system.

**Objective: (Process Tolerance Design)**

Be able to evaluate your process design for tolerance stacks and arrive at process dimensions that must be held in order to make parts that meet specifications.

**Tasks**

1. Team assignment (based on GPA in Tool Engineering and possibly Production Processes)
2. Design work holding systems, in concept only, that support the processes you design in MFGE-322. Your concepts must be created using a CAD package. Standard work holding (e.g. vises and chucks) must still be sketched.
3. Perform complete tolerance analysis on proposed processes. This analysis must accurately reflect the work holding system. The diameters of holes do not need to be t-charted. However, hole-locations and depths do.
4. Specify all perishable tools and holders (inserts, drills, etc.) by manufacturer and part number. Choose all tool holders independent of the spindle they will be mounted to. In other words, do not be concerned with spindle adapters. Determine perishable tool cost only.
5. Respond to the Request for Quotation (RFQ) submitted to you by Amerikam. The RFQ is attached as Appendix A. Estimate the manufacturing cost of the component. Use a $65/hour shop rate.
6. Present an overview of your team's project to Amerikam engineers and managers, and Ferris Manufacturing faculty. This presentation will be made at the Amerikam facility in Grand Rapids on Wednesday, April 27, 2005. The first presentation will occur at 9:00 am sharp. Plan to be there no later than 8:30 am. Amerikam's address is: 1337 Judd Ave. SW, Grand Rapids, MI 49509.
7. The portfolio and order of the presentation will be in accordance with the attached template (see Appendix B)

**Processing Parameters:**

1. You are limited to using equipment that is specified with the exception that you can design a special if you wish....
2. Work holding devices can be manually or hydraulically actuated.
3. Live tooling is permitted.

**Equipment List:**

- Miyano, BNE-51SY CNC Turning Center
- Miyano , LE-25S CNC Turning Center
- Matsuura; MC-600VF VMC
- Matsuura; ES-450H HMC
- CNC rotary indexer
- Special equipment specified and/or designed by student

**Hand In:**

- Project Folder.
  - Arranged in the order of the template provided.
  - Folders are to be spiral bound (the FSU copy center can do this).
  - Cover page titled, "Amerikam Project." Below this, display the semester and year (e.g.: winter 2005) and list the team members. Members must sign the cover sheet next to their name.
  - Include an index immediately after the title page (use page numbers)
  - Number of copies
    - Provide four copies. One for each faculty member present
    - Provide five copies for Amerikam staff prior to presentation

**Grading Criteria:**

The tool engineering aspects and tolerance analysis of the project will be evaluated against the criteria listed below.

| Pts off | Criteria |
|---|---|
| 0 | This aspect of the assignment met or exceeded all requirements. |
| 1/2 | This aspect was acceptable but there are more appropriate ways |
| 1 | This aspect is NOT acceptable without one or two changes |
| 2 | This aspect of the assignment is totally unacceptable |
| 5 | An attempt to do this part of the assignment is not evident (this is the minimum amount of credit that will be lost) |
| 1-5 | Math, grammatical and spelling errors |

**Project Evaluation by MFGE 324 & 326 Instructor will include:**

**Work Holding System**

- Violation in the (plane):
  - Primary
  - Secondary
  - Tertiary
- Clamping principles
  - Cutting Forces
  - Potential part distortion/disfiguration
  - Concept

**Process Documentation:**

- Operations Sheets and Tool Layouts, where required, for each operation
  - Scaled Cad Drawings that show:
    - The part in its work holding system
    - The tool in the cut at each element of the operation
    - Parametric information (spindle speed, feed, insert/holder description, etc.) for each cut.
    - Part dimensioned and toleranced from locator/datum for each cut based on tolerance chart.
    - Rotation of cutter, if applicable, and direction of tool path.
- Tooling specified by make and model number where available

**Cost Estimate:**

- Material
- Labor
- Tooling (perishable)

**The Amerikam cost estimating method will be covered in 324 during lecture.**

## *Amerikam Presentation Story Board (Suggested)*

**Process Flow Diagram**

**As discussed in MFGE-311 or Process Characteristic Map as discussed in MFGE-324**

**Tool Layouts**

**Provide an overview of Tool Layouts for each operation. If your process has 3 operations then present 3 tool layouts.**

**Work Holding Devices**

**Show concepts for each operation as required. Show each of these along with the tool layout they support.**

**Process FMEA**

**Choose two failure modes to highlight during presentation that your group thinks are most crucial to the process.**

**Control Plan**

**Highlight how your control plan addresses those same two critical issues.**

**Capability Study**

**Measure one part feature on parts available to your group. Provide an overview of process capability using Pp and Ppk.**

**Measurement Systems Analysis**

**Provide an overview of your group's Gage R&R study for the same feature selected for process capability work.**

**Cost Summary**

**Brief overview of how much your group would sell this product for. Be sure to include values for each quantity and a total for tooling.**