QUALITY ENGINEERING TECHNOLOGY

BACHELOR OF SCIENCE PROGRAM

SELF STUDY FOR ACADEMIC PROGRAM REVIEW

Ferris State University
College of Technology
Big Rapids, Michigan 49307

September 16, 2001

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Program Review Panel

Program Faculty

Mark S. Rusco, Chair
Associate Professor of Manufacturing Engineering Technology
Gary L. Ovans
Associate Professor of Manufacturing Engineering Technology and Program Coordinator
Bruce M. Gregory
Associate Professor of Manufacturing Engineering Technology

Other Faculty

Sidney P. Sytsma
Professor, College of Business Graduate Office

Industry Representatives

William Mize
Director of Quality, Kraft Container
John Morrison
Quality Engineer, Steelcase Corporation

PREFACE

The Quality Engineering Technology (QET) BS program was selected for academic program review in the 2000-2001 cycle. This report, prepared by the QET Program Review Panel (PRP) and submitted to the Academic Program Review Council (APRC), responds to the requirements and guidelines established for the academic program review process.

Organization of the report follows the Council guidelines. Section 1 presents an overview of the program, including mission, history, impact, expectations, and plans for improvement. Sections 2 through 9 cover results and analyses of data collection activities. Section 10 reviews enrollment trends, and Section 11 presents program productivity and cost information. Section 12 contains conclusions based on the data analysis, and Section 13 has recommendations addressing program strengths and weaknesses.

Because of the continued close association between the QET program and the MFGE program this report borrows heavily from the MFGE report prepared in September of 1998, especially in terms of format. Credit is given with grateful appreciation to Jim Rumpf and the members of that PRP for allowing the QET program to benchmark their efforts.

Members of the committee and their primary responsibilities:

Mark Rusco (Chair)	Overview, Curriculum Evaluation, Conclusions, and Recommendations, Labor Market Analysis
Gary Ovans	Enrollment Trends, Program Productivity, Employer Survey
Bruce Gregory	Facilities & Equipment, Curriculum Evaluation
Sid Sytsma	Faculty Perceptions, Graduate Survey, Student Evaluations/
Bill Mize	Curriculum Evaluation, Industrial Advisory Board Perceptions
John Morrison	Curriculum Evaluation

Bill Mize and John Morrison graciously agreed to assist the QET program in this effort as Industry Representative and Sid Sytsma as Other Faculty, respectively. Their willingness to commit time and efforts beyond their own job's requirements is appreciated.

We also wish to express our appreciation and thanks to our students, alumni, and all other fellow faculty, staff, and industry representatives who contributed to this work. The QET PRP remains available to meet with the APRC to discuss this report.

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Section 1

Overview

SECTION 1

OVERVIEW

A. GOALS AND OBJECTIVES OF THE QET PROGRAM

The mission of Ferris State University is to be a national leader in providing opportunities for innovative teaching and learning in career-oriented, technological, and professional education. The very existence of the Quality Engineering program bears testament to the success of this mission. This program prepares graduates for careers in a traditional field (quality) that has experienced tremendous growth in the past two decades due to competitive pressure from overseas manufacturers, especially the Japanese automakers. The field of quality is technological in nature, depending heavily on statistics as its language and rigorous analysis skills for decision making. Graduates of the program start at a professional level in a variety of companies, and opportunities for progression up the management levels will be demonstrated in a later section.

The goal of the Quality Engineering program is to prepare graduates for success in a variety of quality roles, with a strong emphasis on Quality Engineers. The statement of objectives from the FSU – Grand Rapids website clearly shows this commitment.

> ***Ferris State University offers upper division (300/400 level) coursework for the Bachelor of Science degree in Quality Engineering Technology…for individuals employed in quality or quality related fields or who desire to become employed in a quality position within a manufacturing company. The program is designed for those who wish to expand and build upon the base of technical knowledge they have acquired through work experience and academic training.***
>
> ***Graduates of the program are prepared to assume technical and leadership positions in all areas of quality within manufacturing companies. Ferris has tailored the program for the part-time student by offering technical core coursework in the evenings.***

B. HISTORY OF THE QET PROGRAM

The QET program is relatively young, and can trace its origins quite easily. The program is a direct descendant of the MFGE program, currently enjoys a close relationship with that program, and will hopefully continue a symbiotic relationship with MFGE for a long time to come. The following chronology was provided by Paul Prins, recently retired as the Dean/Vice Chair of FSU – Grand Rapids, and an early participant in the development of the QET program.

QET Milestone Events

April 1992	Leadership of Grand Rapids section of American Society for Quality Control (now American Society for Quality – *MSR*) approach FSU at Applied Technology Center (ATC) regarding needs of West Michigan companies for education programs in quality
December 1992	Quality Engineering Technology Advisory Committee established and holds first meeting at ATC. Ferris proposes content for BS in Quality Engineering Technology including a four-course professional development certificate in Quality Technology
February 1993	FSU-GR announces Quality Technology Certificate series to Grand Rapids section of ASQC.
September 1993	First course offered in Quality Certificate offered at ATC.
May 1994	First graduating class of Quality Certificate receive diplomas at ATC ceremony. There are 19 graduates representing 14 local companies.
Spring 1994	BS Quality engineering Technology approved for implementation at Applied Technology Center.
June 1994	American Society of Quality Control/Automotive Division establishes Juran scholarships for BS Quality Engineering Technology Program with the assistance of Grand Rapids section of ASQC.
December 2000	First graduates complete BS Quality Engineering Technology program.
Spring 2001	Quality Engineering Technology curriculum completes five-year Institution program review

This history could be made more complete by including some of the more colorful characters and the struggles caused by conflicting goals and aspirations. However, I think Mr. Prins has gleaned facts from records and rightfully left the interpretation of events out of his milestones. It is left to the reader to imagine the work and efforts put forth by this committee to start a unique curriculum like Quality Engineering. A collection of the records used by Mr. Prins is included in Appendix A for those readers that would like more background information.

To date, this program remains unique. A search of the web using the popular search engine Google and the key words 'bachelor of science quality engineering' yielded no successful matches, not even the FSU program. A similar search using the Dogpile search engine did turn up the FSU – QET program first on the list, and no other programs awarding this degree. It seems there is an opportunity for FSU to market this program in the absence of any apparent competition.

C. QET CURRICULUM

The QET program is a "+2" program, meaning that we do not start at the freshman level with students; those wishing to enter our program must already have an associate degree (or equivalent) in a technology related program. However, due to the curriculum review performed for this program review, major changes have been proposed. More detail is provided in the curriculum review section, but further discussion here assumes that the proposed changes will be accepted in total. These changes serve to align the curriculum completely with the ASQ Certified Quality Engineer body of knowledge and make a strong program even stronger. These changes also serve to give the QET program a stronger identity be creating a unique prefix (QUET) for those classes that are either unique to the Quality Engineering program or that derive strongly from the traditional quality topics (such as statistics, metrology, etc.). Rather than remove QET from the MFGE program, however, it remains the goal of the entire MFGE faculty to maintain a close connection and even create projects to mutually benefit both the MFGE and QET students. Both programs will continue to share a significant number of classes. A complete checksheet and other details of the proposal are contained in the curriculum review section of this report.

A few of the unique aspects of the Ferris MFGE curriculum are:

- The strong focus on statistics and statistical applications. Statistics remains the language of variability and is also the language of the quality professional. The combination of statistical theory and application will enable FSU QET graduates to make significant contributions to their companies in terms of process improvement.
- The requirement that graduating seniors take the American Society of Quality (ASQ) Certified Quality Engineer (CQE) exam to benchmark our graduates against the requirements of the acknowledged leading quality organization.
- The cross-program project linking MFGE 411 Process Planning with QUET 447 Quality Planning (proposed new course). These two Grand Rapids sections will mutually plan the production and quality of a manufactured product and proceed to make a reasonable number of devices. This project has been implemented for two terms, joining the students from MFGE 443 Continuous Improvement with the 411 students, but the project is so large that a new class will be created just to manage the quality planning aspects of this project. Refer to the curriculum review section for more complete details.

D. CHALLENGES

The main challenges to the QET program are as follows, and are discussed elsewhere in this report:

- *Insuring the Strength of the Curriculum* – the QET curriculum was created several years ago, and although it was well thought-out and complete, it needs to be examined for completeness and to insure any changes in industry have been captured.
- *Marketing the Program* – FSU has a unique program, unique from almost all other schools in the United States. However, it remains small in terms of enrollment and significant work remains to grow a larger pool of students. Decisions still remain in terms of when and how to offer the program on the main campus.
- *Facilities and equipment* - no labs and scant resources for equipment.

We look forward to meeting these challenges head on, and offer this report as the next step in this continuing effort.

Section 2

Graduate Survey

SECTION 2

GRADUATE SURVEYS

A. INTRODUCTION

The purpose of this survey is to learn from the graduates their perceptions and experiences regarding employment based on program outcomes. The goal is to assess the effectiveness of the University and the program in terms of job placement and preparedness of the graduate for the marketplace.

Because of the limited number of students available in the QET program, as well as limited number of total graduates, a single focus group comprised of both current students and recent graduates was performed. Professor Sid Sytsma and Dr. Katherine Manley facilitated the group and garnered responses to questions germane to Section 2 Graduate Survey and Section 4 Student Evaluations. This section contains those elements of their report pertaining to the graduates, questions pertaining to current student topics are included in Section 4, and their complete report is contained in Appendix B.

B. SUMMARY AND CONCLUSIONS

This section summarizes the comments included in Section C. Numbers refer to specific questions in Section C.

Graduates feel the degree is an important asset in the quality field (4) and feel there are opportunities available (3). They have definite views on the current state of the program, voicing opinions about topics that could be dropped (1) as well as added (2), and also more general comments about various topics (6). Overall, they are very enthusiastic about the program and are willing to recommend the program to other students (5).

C. EXCERPTS FROM QET PROGRAM REVIEW FOCUS GROUP

I Other Questions

1. What topics may be unnecessary in the program and might be eliminated?

a. These concepts **MUST** be added and improved in the program--Lean mfg, Toyota Production System (TPS), one piece flow, value stream mapping, pull system, Kanban, Takt time, cellular mfg, standardized work, visual management, error proofing, SMED, 5S, OEE, problem solving, root cause analysis/tools, theory of constraints, cost reductions

b. QS/ISO and ASQ are the most important concepts required in the field and with statistics courses and the content from QS/ISO and ASQ and Lean Mfg. concepts incorporated into program, it would be more beneficial

c. Program needs to be more aligned to ASQ and students should be able to pass CQE immediately and possibly the CQA upon graduation without taking refresher courses
d. Juran's Quality book is **THE** most important book for passing CQE and this is the text used in Continuous Improvement course
e. Students must have theory but also must be able to be a team leader and team facilitator

2. What should be added to the program, if anything [e.g., team management and participation skills, problem solving skills, conflict resolution, written or verbal skills, leadership skills, information sources, additional QE skills, project management skills, process re-engineering skills, etc.] ?

a. Team management and participation (Mark does this in the first two courses) is important. (human aspects course could be included in industrial organization psychology course like one at community college)
b. Continuous learning and education should be introduced, taught and included. While many companies have requirement for training, some students may not be aware of opportunities for post-graduate learning)
c. Project management skills would be important (maybe only one week) and use project management software
d. Software type class (Introduction to Computers) only included MS package—if software packages are taught, they must be applied to real life examples. The use of MS Excel is essential but might include how to use the SPC add-ins
e. Introduction to personnel items might be important especially dealing with state laws including OSHA, personnel issues, etc.
f. Class that focuses on quality management *systems* might be important beyond only manufacturing, food and drug (FDA), hospitals, etc. This might increase enrollment as other students may see the program as useful to their professional career.

3. How did you find employment opportunities subsequent to graduating from the program?

a. Some courses in non-manufacturing quality might be important (such as different positions in the quality field) (mfg., pharmaceutical, food industry, ASQ, etc.)
b. Only one student not working and he is not looking for job yet. Most jobs looking for Bachelors with ASQ certification.
c. Many students already have jobs and get promoted once they earn degree
d. Recruiter might be important to let students see what else is available
e. Many businesses are increasing their requirement for hiring Quality personnel because some of the quality personnel are truly not qualified
f. Graduates must be able to save the company at least their salary

4. **How do you feel about your future career, educational, or certification opportunities, having taken this program?**

   a. All graduates agreed graduating from this program DOES enhance employment and success on the job
   b. No other program available at other universities in Michigan —this is a unique and VERY VALUABLE program
   c. Only alternative to entering this field is through field experience but with field experience, employees may miss certain concepts

5. **Would you recommend this program to perspective students?**

   a. Definitely!!!!
   b. Would recommend it now more than when program started—program has matured
   c. Be careful that the program is not built on individual faculty members
   d. The program is so versatile; can be taken anywhere in the world because everyone talks same language

6. **What other comments and suggestions would you like to make?**

   a. Would like to see FSU more involved with businesses in the GR community
   b. FSU could offer more certificates, such as in SPC, to attract more students to the program
   c. Recommended that FSU do customer analysis to see where the students are coming from to better focus on student recruitment
   d. This is better program than the community college program but students need to be recruited
   e. Important that the program survive—put it on the FSU website
   f. Focus group today was important and very good for seeking input from graduates—better than survey
   g. *Recommended* redo the focus group one year form now with new graduates added to the group

Section 3

Employer Survey

SECTION 3

EMPLOYER SURVEY

A. INTRODUCTION

This activity is intended to aid in assessing the employers' experiences with graduates and their perceptions of the program itself. A mailed instrument should be used to conduct the survey: however, if justified, telephone or personal interviews may suffice.

The Program Review Committee elected to take a slightly different route than usually taken with respect to the employer survey. The survey was not restricted to employers of QET graduates; it was sent to a large population of employers that would offer a high likelihood of employing QET graduates. This was done for the following reasons:

- Existing number of QET graduates is relatively small
- Contact information for graduates/employers was not current
- A market survey of this type was not initiated prior to implementation of the QET program

Two employer surveys were conducted. The first survey instrument was sent to alumni of the Manufacturing Engineering Technology program. It was requested of them that they pass along the survey to the individual responsible for the Quality function at their place of employment if they, in fact, were not responsible.

The American Society of Quality, Grand Rapids Chapter, permitted us to utilize their membership database. This provided us with an additional large number of survey sites. A second survey instrument was sent to these sites.

B. SURVEY RESULTS

First mailing (survey sent to MFGE alumni)
Return Date: April 30, 2001
Mailed: 415
Returned completed: 34 (8%)
Returned to sender: 9

Table 3-1

Question 1: How many Quality professionals do you employ?

Category	1	2	3	4	5	>5
Technicians	4	2	2	3	1	16**
Managers	17	0	1	2	0	5
Engineers	5	2	3	4	1	12
Directors	3	3	0	0	0	3
Other*	1	1	1	1	0	5

* Example (VP)

**Chart interpretation example: 16 respondents have more than 5 technicians at their facility

Question 2: What credentials (degree, certificates, experience, etc) are required at your company to fill these types of positions?

Credential	# of responses
Degree	30
Certification (CQE,Etc.)	10
Experience	15

Question 3: What improvements are needed in the preparation (undergraduate education) of that group? Refer to the enclosed checklist. ***See remarks under "Analysis and Comments".***

Response	# of responses
Yes	33
No	0

Question 4: Would you consider hiring a Quality Engineer with the credentials shown on the enclosed checklist?

Response	# of responses
Yes	33
No	0

C. SURVEY RESULTS
Second mailing (ASQ members)
Return Date: June 30, 2001
Mailed 1000 forms
Returned Completed: 83 (8.3%)

Question 1a: Are you actively involved with Quality Insurance?

Yes 80 No 3

Table 3-2

Question 1b: How many Quality professionals do you employ?

Category	1	2	3	4	5	>5
Technician	6	11	10	5	9	22
Managers	41	5	3	3	0	7
Engineers	4	12	11	5	0	16
Directors	21	4	0	0	1	0
Other*	6	4	5	0	1	6

* V.P., Auditor

Question 2: What credentials are required at your company to fill these types of positions?

Credential	# of Responses
Degree	55
Certification	45
Experience	33

Question 3: What improvements are needed in the preparation (undergraduate education) of that group? Refer to the enclosed checklist.

Response	# of Responses
OK as is	47
Improve	See remarks under "Analysis and Comments"

Question 4: Would you consider hiring a Quality Engineer with the credentials shown on the enclosed checklist?

Response	# of Responses
Yes	73
No	0
Maybe	8

D. ANALYSIS AND COMMENTARY

The survey was designed to be answered quickly and easily. The detailed information that a more sophisticated instrument would have provided was sacrificed. The goal was to enhance the likelihood of a respectable return rate. The percentage of returned surveys, however, turned out to be disappointingly low. However, some useful insight was gained as to the marketability of the program and the validity of its content. All of the organizations surveyed employ some number of Quality professionals of varying rank and responsibility. A Bachelor's degree is a highly desirable credential, although experience is also highly desirable. The employability of Ferris State Quality Engineering Technology graduates was given a ringing endorsement by those who responded. Every comment that was made with respect to curriculum content was dealt with by the current program or will be satisfied by proposed (see section 9) changes to the curriculum.

Some comments are as follows:

- The curriculum should be sufficient
- Improve problem solving (most frequent comment)
- Provide for work analysis, lean manufacturing
- Add conflict management
- Error proofing
- More emphasis on machining practices
- Less emphasis on machining practices

The survey respondents represented a Who's Who of industrial organizations in Michigan.

Ferris State University
Quality Engineering Technology
B.S. Program

Industry Survey
Spring 2001

Company Name:

Company Address:

Type of Business:

Contact Person:

Job Title:

Phone / FAX Numbers:

1. Are you actively involved with quality assurance?
_____Yes – Please continue survey
_____No – you may stop here

1. How many Quality professionals do you employ?
_____Techs
_____Managers
_____Engineers
_____Directors
_____Other

2. What credentials are required at your company to fill these types of positions? (degree, certificates, experience, etc.)

3. What improvements are needed in the preparation (undergraduate education) of that group? Refer to the enclosed checklist.

4. Would you consider hiring a Quality Engineer with the credentials shown on the enclosed checklist?

Thank you.

Please return by April 30, 2001

Manufacturing Engineering Technology
Ferris State University
915 Campus Drive, Swan 107
Big Rapids, MI 49307

Quality Engineering Technology
B.S. Program

Industry Survey

Company Name:

Company Address:

Type of Business:

Contact Person:

Job Title:

Phone / FAX Numbers:

1. Are you actively involved with quality assurance?
_____Yes – Please continue survey
_____No – you may stop here

1. How many Quality professionals do you employ?
_____Techs
_____Managers
_____Engineers
_____Directors
_____Other

2. What credentials are required at your company to fill these types of positions? (degree, certificates, experience, etc.)

3. What improvements are needed in the preparation (undergraduate education) of that group? Refer to the enclosed checklist.

4. Would you consider hiring a Quality Engineer with the credentials shown on the enclosed checklist?

Thank you.

Please return by June 30, 2001

Manufacturing Engineering Technology
Ferris State University
915 Campus Drive, Swan 107
Big Rapids, MI 49307

Bachelor of Science Degree in

Quality Engineering Technology

echnical Sequence

MFGE 321 Metrology
Exposes the student to the fundamentals of dimensional metrology, production gages and gaging techniques. Interpretation of geometric tolerances will also be covered with respect to their implications for inspection. Prerequisite: Enrollment in Manufacturing Engineering Technology. 2 credits.

MFGE 322 Production Processes
A survey course covering production machining, metal casting, powder metallurgy, bulk deformation, pressworking, and non-traditional machining. 3 credits.

MFGE 324 Tool Engineering
Includes lecture on tool engineering fundamentals as well as application of these fundamentals in the lab. Principles of cutting tools, machinability, tool life, power requirements, as well as high performance tool materials will be studied. Also included is special tooling applications and fixturing. Prerequisite: MFGE 313. 4 credits.

MFGE 341 Quality Science Statistics
This course is a detailed study of the applications of fundamentals of data analysis covering distributions, linear relationships, cause-effect, collection of data, probability, counts, proportions, sample means and inferences. Applications to illustrate concepts meaningful in a technological environment. Prerequisite: college level algebra (MATH 116 or quivalent). 3 credits.

MFGE 342 Statistical Process Engineering
This course is a detailed study of the application of data analysis to the statistical regulation of processes. It covers the techniques applicable to the analysis and regulation of industrial and business processes and products. Prerequisite: MFGE 341 or permission of the instructor. 3 credits.

MFGE 393 Internship in Manufacturing Engineering/ Quality Engineering
Place the student in an industrial setting to face the realities of the working world after completing their junior year. The unique experience that the student will receive is a combined effort of the training site, university, and student. Students will be involved in the industrial projects and daily activities of a manufacturing engineer/quality engineering for their employer. Prerequisite: junior status in Manufacturing Engineering/Quality Engineering. 4 credits.

MFGE 423 Engineering Economics
Designed to advance the student's knowledge in the subject of engineering economic analysis. Money and time relationships in respect to capital purchases and equipment justification are discussed in detail. Prerequisite: MATH 126 or equivalent. 2 credits

MFGE 442 Design of Experiments I
A detailed study of the design of experiments and the application of advanced quantitative data analysis techniques, well as common experimental design methodologies used in anufacturing industries to collect data for the purpose of the improving or better understanding of design process. Prerequisites: MFGE 341 or by permission of professor. 3 credits.

MFGE 443 Continuous Improvement
A detailed study of the continuous improvement of quality; engineering and management approaches necessary to achieve a broad and persistent refinement of business and manufacturing process in an industrial organization. Prerequisites: MFGE 341 or permission of professor. 3 credits.

MFGE 444 Quality Auditing
This course is a detailed study of the technology concerned with quality auditing with emphasis on the international ISO 9000 standards. Covered will be the types of quality audits, planning for the audit, conducting the audit, follow-up activities to improve operations, and reporting the results. Prerequisites: Quality Engineering majors with senior standing. 3 credits.

MFGE 445 Reliability Engineering
This course is a detailed study of the technology concerned with reliability prediction and assessment. Covered will be probability plotting, load-strength interference, reliability prediction and modeling, reliability in design of mechanical and electronic systems, reliability testing, maintainability and availability, and analyzing reliability data. Prerequisites: MFGE 341. 3 credits.

MFGE 446 Design of Experiments 2
This course is an advanced study of the technology concerned with the design of experiments. Covered will be comparing two treatments, comparing more than two treatments, measuring the effects of variables, and building and using models. Prerequisite: MFGE 442. 3 credits.

MATL 240 Introduction to material Science
Engineering materials; metals, polymers, and ceramics: atomic structure and bonding, properties selection, and testing of materials, failure modes, methods of production and fabrication, methods of changing properties including heat treatment of metals, alloying and surface treatments, mechanical working, composites and compound bonding. Common classification systems used to identify the various engineering materials. 4 credits.

MATL 341 Materials Selection Metals
Analysis and comparison of metals in engineering service applications. Evaluation of existing metal in design components and analysis of metallic alternatives. A comparison of alloying and heat treatment to determine the optimum materials. The effects of manufacturing and service environment on the metal selection process. Students submit case studies of existing metal applications. Prerequisites: MATL 240. 3 credits.

MECH 340 Statics & Strength of Materials
Statics and stength of materials is a part of physics known as mechanics: forces, components, resultants, equilibrium, friction, centroids, and stress/strain relationships. Dynamics will be introduced. Covers strength of materials; the concepts of stress and strain, axial stress and deformation, thermal stress and deformation, stress concentrations, factor of safety, torsional stress and deformation, beam stresses, combined stress, riveted joints, welded joints, and Mohr's circle. Prerequisite: Math 126

STQM 311 Continuous Improvement Tools &Techniques
A course designed to teach the basic graphical and statistical tools necessary for the successful implementation of a system of Total Quality Management (TQM). Topics include: an overview of continuous improvement; process measurement and analysis tools; management and planning tools; group and team tools; and other topics distinctive to TQM including: the role of organizational mission and vision statements, identification of critical process, Hoshin planning, quality function deployment, use of the P-D-C-A cycle, and benchmarking. The course will include the practical application techniques in team settings on real problems in manufacturing, health, engineering, and education to gain experience in using the tools. 3 credits.

Section 4

Student Evaluations

SECTION 4

STUDENT EVALUATIONS

A. INTRODUCTION

Student Evaluation of Instruction: Students are surveyed to obtain information regarding quality of instruction, relevance of courses, satisfaction with program outcomes based on their own expectations. The survey must seek student suggestions on ways to improve the effectiveness of the program and to enhance the fulfillment of their expectations.

Because of the limited number of students available in the QET program, as well as limited number of total graduates, a single focus group comprised of both current students and recent graduates was performed. Professor Sid Sytsma and Dr. Katherine Manley facilitated the group and garnered responses to questions germane to Section 2 Graduate Survey and Section 4 Student Evaluations. This section contains those elements of their report pertaining to the current students, questions pertaining to graduates are included in Section 2, and their complete report is contained in Appendix B.

B. SUMMARY AND CONCLUSIONS

This section summarizes the comments included in Section C. Numbers refer to specific questions in Section C.

Overall the students are pleased with the program (I.4., II.1., II.2., II.3.) and with the Grand Rapids facility and staff (I.2., I.3.). As usual with the non-traditional students in Grand Rapids they have very strong opinions about the educational process and are willing to offer constructive suggestions to benefit the program (I.1., III.1.-4.). Many of the ideas and opinions voiced in this section are used in the curriculum review process to evaluate the usefulness of classes. The ideas for improvement have been incorporated into the new classes shown in the curriculum review section.

C. EXCERPTS FROM QET PROGRAM REVIEW FOCUS GROUP

I General Program Orientation and Overall Educational Experience

1. **Did you see evidence of a continuous improvement philosophy in the QET program? If so, how is it evident?**
   a. There does not seem to be a university wide philosophy of continuous improvement but the professors did seem to care about their students
   b. Students have not seen measurements in this program different than measurements in other programs
   c. Individual course evaluations do provide students with opportunity for input

d. FSU has met with ASQ and there is opportunity for "tweak" the program to better fit into field
e. Original program was built to fit into Mfg. Quality program but now it is recognized as own, separate program
f. Extra courses required in mfg. but could be substituted
g. In general, the program is not practicing its philosophy of continuous improvement as much as they could be
h. The fact that the program is only offered in GR implies that it is not important enough for on-campus programming ("Quality" is not offered at FSU and the program is not even listed on the FSU website)
i. Many of the courses have only been offered once—low numbers and not even sure what to measure

2. Was the FSU/COT/QET educational experience responsive to student needs?

a. Excellent support from FSU-GR; they worked with students in the program
b. The FSU-GR office are "top-notch" (Tracy, Nancy, Paul)
c. One student had problem with advisor from FSU campus—original program did not have sequence of courses in Quality Program and it was difficult to plan out courses. Students had semesters when they could not take any courses.
d. Little difficult with scheduling, enrolling
e. *Recommended* that they not overlap on same night with other courses—two required courses offered on same nights

3. Did you feel that you were treated as a customer?

a. Treated in FSU—GR as customer
b. Everyone wanted to see the program succeed

4. What did you feel was the most positive aspect of this program and educational experience?

a. Professors' knowledge and experience
b. Practical knowledge of the professors
c. They had experience in the field; appreciated the most
d. Students brought a great deal of experience to the course content also—the interaction of the faculty and student experience was tremendous
e. Small class size resulted in networking of students and social aspect
f. If courses were taught on-campus, there probably would not have been the interaction and much more theory based
g. In one Quality course, the professor listened and expanded on specific topics such as ISO and QS

5. What did you feel was the most negative aspect of the program and educational experience?

a. Focus of courses might be modified—recommended that it be based more on ASQ model, Quality Engineer (One student just passed CQE with no review course and attributed passing with only content from program)

II The QET Program

1. **What do you feel were the most beneficial QET courses?**
   a. MFGE 341, 342, 442, 446, 443 BEST
   b. Capstone course
   c. Both statistic courses
   d. DOE course
   e. STQM 311 course was not relevant (too much of a business perspective and not enough quality statistics required for students in this course) probably because of the poor instructors

2. **What is your opinion about QET teaching [including methods, strategies, providing feedback, competence of teachers, etc.]?**

   a. Bruce and Mark were both passionate about statistics and this was enthusiasm contagious to the students
   b. Good flavor of lecture and projects but only wish rounded more for the quality work
   c. Students felt that when they were in the MFG courses, they were treated as "step child" and some of the content was not relevant to QET students

3. **How effective was advising in the QET program?**

   a. Effective once program advisor were professors in the program
   b. In the beginning, welding professors advised students but it did improve once the program faculty became advisors
   c. Advising is more important for this program than on-campus student because of the type of students (working students) and schedules of these students who work

III Support Courses

1. **How effective and useful were the College of Technology support courses and teaching?**

   a. Good content—MATL 341, Materials Selection course
   b. Good and important content—MFGE 321, Metrology course

2. **Courses That Might be Looked At:**
   a. MFGE 322, Production Processes course—this is an all lecture course. Some concepts/topics are good but maybe it should not be a full semester. The book, MFG, Engineering, and Technology, is great and the students

recommended that all chapters be included; however, the professor only focused on certain sections such as machine tooling content.

b. MFGE 324, Tool Engineering course—students expected to program a CNC but prerequisite course not required for the students making the content difficult
c. An introduction to mfg course would be better that included all processes
d. MFGE 423, Engineering Economics should be lightened up—tie in with Continuous Improvement (more accounting class—maybe because of the person who taught it)
e. MFGE 393, Internship—many of the students came from the community college which also had an internship requirement. Could the internship in this program be waived and add another course in continuous improvement in QS/ISO and quality auditing (first piece submission, supplier audits, ISO audits, incoming quality, focus on quality systems)? However, if students did not come from community college, they should be required to do an internship. So the internship should be able to be waived.
f. Recommended a course in auditing skills, auditing, and reporting based on QS, ISO as example with case studies (course that required students to go to Plastic Company and actually perform an audit)

3. How effective and useful were the College of Arts and Science support courses and teaching?

a. Courses from FSU in General Education (very useful)
b. English (3 courses), Physics, and calculus are all important
c. Students felt that calculus is more important for auditing and reliability engineering, and even though they don't actually use it in their current jobs, overall, calculus should stay and should include use of computer-packages that do these functions.
d. Technical communication course is good depending on who taught it (some professors were "too" English types not enough real life—focus on teams in writing reports is important
e. Public speaking very important—one student just make a presentation to every employee in the organization yesterday

4. How effective and useful were the College of Business support courses and teaching?

a. MFMT 302, Organizational Behavior, on-campus was okay but the competency learned in the community college course is probably important because they deal with people
b. STQM 311, Continuous Improvement, was too "business" oriented

Section 5

Faculty Perceptions

SECTION 5

FACULTY PERCEPTIONS

A. INTRODUCTION

Faculty perceptions: The purpose of this activity is to assess faculty perceptions regarding the following aspects of the program: curriculum, resources, admissions standards, degree of commitment by the administration, processes and procedures used, and their overall feelings. Additional items that may be unique to the program can be incorporated in this survey.

A. INTRODUCTION

Faculty perceptions of the QET program were gathered from a relatively small group of faculty. Since the program is located only in Grand Rapids there are not many faculty that have any perception at all of the program. Professor Sid Sytsma conducted the poll and his report is pasted into Section B below.

B. FACULTY PERCEPTIONS REPORT

FROM THE COLLEGE OF TECHNOLOGY

- Professor Gary Ovans
  Manufacturing Department Program Coordinator, College of Technology
- Professor Mark Rusco
  Manufacturing Department Faculty Member, College of Technology
- Professor Bruce Gregory
  Manufacturing Department Faculty Member, College of Technology

EXTERNAL TO THE COLLEGE OF TECHNOLOGY

- Professor Sid Sytsma, College of Business Faculty Member
  [teacher in MS in the Information Systems Management quality track within the College of Business and a Malcolm Baldrige National Quality Award Lead Senior Examiner]
- Dr. Michael Cooper, Professor - College of Business Faculty Member
  [undergraduate and graduate teacher of statistics and quality courses in the College of Business]

PROGRAM STRENGTHS

- The degree is, and was designed, as an "applied" degree and thus can be attractive to many students who don't have extensive mathematical preparation. Elements of theory are, however, required in the curriculum. Many practitioners in industry share this level of theoretical preparation. Most quality engineers have degrees in other fields, and get on-the-job training because few "QET-like" programs exist.

- Graduates are highly sought after, as quality assurance functions are a very important and visible aspect of industrial and non-industrial enterprises. The demand for Quality Engineers continues to be strong and growing.
- The program has the potential for national recognition and *could*, with institution support, be a key niche for FSU.
- The Quality Engineering Technology program is important to industry; reasoning: Product Launch teams utilize Quality Engineers. This will not change in the foreseeable future.
- The program has an excellent reputation and clearly is congruent with the needs of industry.

OPPORTUNITIES FOR PROGRAM IMPROVEMENT

- The QET program appears to rely too heavily on the Manufacturing Engineering Technology program for content. It...
    - o needs to be more stand alone,
    - o should consider dropping some peripheral courses such as MFGE 324 and MATL 341 and,
    - o it should consider migrating to a 4-year program, as either a 2+2 or 0-4 program.
- The QET program is under-resourced. Laboratory opportunities are almost nonexistent. For the courses on the Ferris Campus, Manufacturing Engineering could share "quality laboratory" resources if they existed. This would allow the support of hands-on statistical process control and design of experiment activities. The lack of space within the College of Technology precludes creation of such a laboratory. This hinders accepting donations of equipment that could support this kind of laboratory activity.
- The program is currently offered only in Grand Rapids, and has no facilities of its own. A space for a "Quality Laboratory" should be created, and perhaps shared with Grand Rapids Community College. This would allow practical hands-on experience in statistical process control and design of experiment activities.
- The QET program should have one more full time faculty assigned to it to provide diversity in the classroom in Grand Rapids. With only one full time faculty dedicated to the program, a student could take 8 of the 14 core classes from only one faculty member. This has the potential to lead to a somewhat parochial view of the field. While adjunct faculty members can provide some diversity in Grand Rapids, controlling the quality level of their instruction is very difficult. The three quality courses that are taught on campus to manufacturing engineering technology students are taught by other faculty members, primarily manufacturing faculty members.
- The curriculum needs to be examined and consideration should be given to bolstering it in some key areas including the areas of problem solving and quality planning.
- Consideration should be given to adding a more theoretical track to the program that includes additional statistical theory. This would give graduates taking this option a more fundamental understanding of the underlying theory and would allow them to

perform advanced problem solving on the job when a statistical tool needed to be adapted to a unique situation. This would require mathematical preparation including the calculus sequence and at least one course in mathematical statistics.

- Consideration should be given to directly preparing graduates to sit for the American Society for Quality *Certified Quality Engineer* [CQE] and/or the *Certified Reliability Engineer* [CRE] certifications. These certifications are widely recognized in industry and would provide a substantial competitive advantage to graduates of the program. A high percentage of the requisite materials is already covered in the in the program. This could be accomplished through a CQE and CRE preparation course. The accounting program in the College of Business prepares potential Certified Public Accountants [CPA's] with a preparation course of this type.
- Quality professionals are in demand in other fields, including business, education, and the health professions. Consideration should be given to broadening the program to include tracks in these fields through collaboration with the College of Education, the College of Business, and the College of Allied Health Sciences.

Section 6

Industrial Advisory Board Perceptions

SECTION 6

INDUSTRY ADVISORY BOARD PERCEPTIONS

A. INTRODUCTION

Industry advisory board perception: The purpose of this survey is to obtain information from the members of the program advisory committee regarding the curriculum, outcomes, facilities, equipment, graduates, micro-and mega-trends that might affect job placement (both positively an adversely), and other relevant information. Recommendations for improvement must be sought out from this group.

The QET program has an active Industry Advisory Board (IAB). They meet with MFGE program faculty and administrators on an annual basis. Some members of the board were involved with the initial creation of the Quality Engineering Degree and provide very useful historical perspective.

The last IAB meeting was held on April 20, 2001 when it was already known that the Quality Engineering program would undergo Program Review. This meeting was used to discuss the current state of the program as well as suggested improvements. Excerpts from those meeting minutes are used her to illustrate the perceptions of the IAB. The complete meeting minutes are included in Appendix C.

B. IAB PERCEPTIONS

The QET enrollment needs to be expanded. The board feels this is an important program and would like to see enrollment numbers to guarantee a bright future. These ideas were discussed as some avenues to pursue.

- Get more community college students to support the four-year program at FSU
- GRCC's two-year program is a good feeder to FSU's +2-year program but GRCC counselors need to have a better understanding of FSU program. However, GRCC is encouraging students to follow through with their bachelor's degree
- LCC two-year program is very similar to GRCC program, this is possibly a way to grow the BS program. Meet with quality people from Lansing Community College and other community colleges offering quality in the area and try to recruit students that way.

The QET program needs to be more widely marketed to attract students other than those people already working in the Quality field.

- Recruit in high schools to get students excited about technology and specifically the quality field. Let students know the kind of salaries that quality engineers make, money is a good motivator to get students into the program

- More representation at the Governor's Pathways conference next year to promote all technology fields.
- Direct mailings to companies, high schools, etc. This should include information on typical salaries and types of positions available. Recruiting in industry may also be helpful. The target audience for this mailing would be quality technicians, not degreed employees.
- "Buy students" by giving scholarships to enroll in to the program.
- What is the need or interest level in quality programs for Big Rapids? Is demand strictly in Grand Rapids or is there a need in both places? An analysis needs to be done to see if there is a need. Would students have enrolled in program at initial admission if it were available in Big Rapids?
- Create an awareness and interest. Need to identify the resources available to us and utilize them.

The QET program needs to be refined. It has been in existence for several years and the original curriculum design, although strong, should be examined for areas of improvement.

- Eliminate unnecessary redundancies between the GRCC and FSU Designed Experiments courses? Meet with GRCC faculty and possibly start using the same software. Different software is currently being used, but the functions are similar.
- Does curriculum content flow? Two ways to evaluate program. Are there missing content areas, voids in what is being offered. Graduation requirements for both schools must be met.
- Do a survey of graduates to get some ideas on improving the program.
- The university needs to provide more resources to enhance and grow the program.
- Curriculum review committee – this committee is taking syllabi from each course in program to find possible holes in course content.
    - Potential for three new courses – Industrial Problem Solving, Quality Planning and Second Level Metrology (designing and gauging).
    - More processing type classes for knowledge and possibly some plastics processing (students in the program currently take MN 220 from GRCC).
    - Continuous Improvement – maybe something more intense for a master's level class. What are basic needs for the bachelor's? De-emphasize some offering areas and potentially group them in a master's degree program.
    - Currently there are no total quality management (TQM) classes in program. This could possibly be added to the Continuous Improvement class – maybe rename and rewrite the description of the course.
    - Create a class for industrial problem solving. Solve problems so they are not repeated – this should be taught in the class. Can't teach class without examples, where do case studies come from?
- What can be done to serve quality personnel in health care, business and industry, and banking fields? Problem in finding common ground between the different fields. Problem solving is a common field and could possibly link these fields.

C. SUMMARY

- Need to start recruiting at the high school level, do more college/job fairs, direct contact with companies.
- Enrollment is not doing well in certificate or bachelors degree. The Quality program is a good product, but the information needs to get around. The short-term solution is to focus on industry. The long-term solution is to make the program more compatible and have a smoother transition between the two colleges (GRCC and FSU).
- BS degree should be a Big Rapids based program and should not be restricted to only Grand Rapids. Continue to be aligned with MFGE and move on to main campus (long term).
- Ideal as a 2 + 2 program because of relationship with GRCC. But not well articulated with GRCC. Need to strengthen GRCC's program to help feed the FSU program.
- Business community could help support and develop a quality facility in the ATC so there is something more than the current measuring lab that is being used. A quality lab should have the following components: chem. lab, metrology lab, electronic testing lab, photo metrics lab, computer testing equipment, processing equipment and a compliance testing lab.

Section 7

Labor Market Analysis

SECTION 7

LABOR MARKET ANALYSIS

A. INTRODUCTION

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 sources for forecasting demand on graduates.

Quality Engineers and Managers are involved in planning, directing and coordinating the various elements of quality assurance activities in manufacturing operations.

It must be borne in mind that the knowledge/skills required in quality engineering technology have grown and developed over time. Individuals with backgrounds in industrial engineering, mechanical engineering, industrial or operations management, etc., hold many positions in the field, as well as individuals who have moved up through the ranks through promotion as a result of experience and formal education. Quality professionals are usually members of the American Society for Quality. Some of the typical job duties of quality engineers are as follows:

1. Assist design engineers with advanced quality planning.
2. Create control plans to insure the quality of manufactured products.
3. Design and qualify gauges for production material.
4. Facilitate groups for Failure Mode and Effect Analysis (FMEA)
5. Create and implement quality systems consistent with national and international standards.
6. Lead problem-solving activities for manufacturing issues.
7. Assist in disposition of nonconforming product.
8. Perform audits of quality systems at suppliers and internally.
9. Meet with customers on a regular basis for project planning and progress updates.
10. Perform statistical analysis of manufacturing data.

B. JOB MARKET OUTLOOK

"Quality assurance functions are associated with manufacturing activities". That is typically the view held by those not knowledgeable of the depth and breadth of responsibilities of those engaged in "Quality". "Quality" professionals have a role to play in all areas of public and private sector operations. Any organization providing a product or service has need for some individual or group of individuals to carry out its' quality assurance functions.

The job title of those engaged in quality assurance activities is based upon the nature of their responsibilities and their span of control if they assume responsibility over departments or major organizational functions.

This review of the market outlook will focus on those job titles/responsibilities that a graduate of the B.S.Q.E.T. program, would most likely assume, either as an entry-level position or as an individual with the B.S.Q.E.T. degree with additional appropriate experience.

Market data was obtained primarily from two sources: the Michigan Occupational System (MOIS), and the November 2000 issue of "Quality Progress". "Quality Progress" is the magazine of the American Society for Quality. The November issue provides extensive information concerning salary levels for individuals residing at all levels in the quality assurance field.

Table 7-1
Salary by Job Title

	Minimum	Mean	Max
Reliability Engineer	$40,000	$69,651	$135,000
Quality Engineer	$24,000	$55,048	$110,000
Auditor	$20,000	$51,263	$108,000

Source: ASQ "Quality Progress"

Table 7-2
Mean Salary by # of Years of Experience

Title	<1	1-3	3.1-6	6.1-10
Reliability Engineer	$55,000	$73,000	$56,500	$55,750
Quality Engineer	$49,800	$47,943	$51,706	$53,994
Auditor	$27,000	$37,878	$49,583	$50,412

Source: ASQ, "Quality Progress"

Table 7-3
Salary by Title and Level of Education

Title	AAS Degree	Bachelor's Degree	Masters
Reliability Engineer	$52,500[2]	$66,563[15]	$84,600[5]
Quality Engineer	$49,705[71]	55,745[338]	62,189[119]
Auditor	$50,896[23]	$54,841[86]	$63,536[32]

Source: ASQ, "Quality Progress"
Superscript denotes number of survey respondents

Table 7-4
Salary by Job Title and ASQ Certification

Title	Certified Quality Auditor	Certified Quality Engineer	Certified Reliability Engineer
Reliability Engineer	$73,350	$73,611	$82,489
Quality Engineer	$59,296	$59,769	$66,173
Auditor	$54,335	$65,782	--

Source: ASQ, "Quality Progress"

C. ANALYSIS AND COMMENTS

The "Quality Progress" salary survey issue provided extensive information regarding salaries of those engaged in Quality related activities. The salary categories extended far beyond those listed in the tables in this section. The tables support comments made in the publication with respect to education and certification. That is, that education and certification provide a payoff in terms of higher salaries.

"Quality Progress" did not provide insights into the job outlook. A call to ASQ representatives resulted in comments to the effect that the "outlook is great" and opportunities are flourishing.

The MOIS database was equally disappointing as a source of information. MOIS does not list any Quality related occupations under titles that are commonly accepted practice, other than "Manufacturing Inspector". Employment as a manufacturing inspector is expected to decline per MOIS through the year 2006. This makes perfect sense, as those familiar with the situation understand that these tasks are being accomplished by automated inspection techniques, and by operators. Quality engineers are tasked to specify the automated inspection techniques and the standard operations procedures (SOP's) that the operators follow to perform their duties.

The "Monthly Labor Review", November1999, Bureau of Labor Statistics, Revised May 2000, provided useful employment outlook data concerning "inspector" related titles. It did not provide any useful data concerning, again, the job titles commonly accepted as Quality related positions.

Section 4, Employer Survey, provides some insight as to the job outlook beyond the anecdotal.

Section 8

Facilities and Equipment

SECTION 8

FACILITIES AND EQUIPMENT

A. INTRODUCTION

Evaluation of facilities and equipment: An analysis of present facilities and equipment as compared to program needs must be conducted. This analysis should also include an assessment of the availability to the program of technologies used in the workplace.

The facilities and equipment available to the Quality Engineering Technology students for use in program course work are discussed in the attachments. The specific references include the following:

- Computer facilities and classroom areas
- Descriptions of existing course work that require lab space and equipment
- Descriptions of changes in lab work given adequate space and equipment where available.

B. BACKGROUND INFORMATION

There are several variables that the review panel should be aware of regarding the status of the quality program's "facilities and equipment." A brief review is given here.

It must be understood that the Quality Engineering Technology program does NOT have any facilities it can call its own. The program is located (currently) only in Grand Rapids and is entirely housed in the Applied Technology Center, a building shared with Grand Rapids Community College (GRCC). This building is mostly class rooms, office space, and computer labs. One area of the building is a machine shop lab, shared by GRCC and the Ferris State Manufacturing Engineering Technology (MFGE) program. Use of this machine shop area by the Quality Engineering Technology (QET) program is incidental only. A small portion of the machine shop is given over to measuring equipment, which is the traditional equipment used by quality personnel.

The ATC classrooms and computer lab facilities are well suited for the needs of the QET program. However, the program could use a dedicated lab space, i.e., a "Quality Lab" to complete the specific needs of the QET program.

The requirements for a good QET lab facility could be easily met. The following is a brief list of the type of equipment that is normally used in a "Quality" lab, with some comments regarding the use of that equipment. It is possible to develop this lab in conjunction with the needs of GRCC, splitting the costs and splitting the time available with the existing GRCC associates degree in quality. However, if the QET program is moved to the Big Rapids campus, additional work must be done to the minimal facilities available in the Swan Annex.

- Measuring tools – small, hand-held devices used to measure the size of parts. Most of this equipment is already available in the ATC, although scattered in several storage locations. This equipment is integral to most manufacturing locations, so the students learn the uses, limitations, and proper care and handling of many different devices.

- Measuring equipment – larger devices used to measure specific characteristics of parts, such as hardness, surface roughness, etc. Also included are larger pieces such as optical comparators and coordinate measuring machines that can be used to measure intricate parts. Some of this equipment is available, although mostly owned by GRCC. In some cases, this equipment is specific to industries, but a familiarity with many types of measurement is key for Quality Engineers.

- Calibration equipment – specialized master parts used to check the accuracy of the other measuring equipment. These come in a vast number of different configurations, depending on what equipment needs to be calibrated. Also, a PC is typically used to track the calibrations of the equipment using some type of commercially available database. This calibration is very important for a couple of reasons. First, students in the MFGE program in Grand Rapids use the measuring equipment in their classes, and they are used to using calibrated equipment at their jobs, so it is crucial to the integrity of the MFGE program that the gauging be calibrated. Also, it is key that Quality Engineering graduates recognize the important components of a good calibration program and this would be a good way to teach those concepts.

- Life cycle testing equipment – more specialized equipment used to specifically test a particular product by cycling it thousands of times under varying loads and environmental conditions. We would probably depend on industry to donate this type of equipment, or rely on visits to outside laboratories. This type of equipment is included only for completeness.

There is a consensus amongst the faculty that the lack of laboratory facilities and equipment affects our ability to teach certain topics in some courses. The Industrial Advisory Board does not share this view entirely. There is some sense that quality has always been taught by a few faithful, using 'paperclips and baler twine' to illustrate concepts like part variation and process variation. Nevertheless, they do recognize that hands-on experience is better than simple paperwork projects.

It must be noted that this lack of lab facilities has some advantage to the QET program. Necessity being the mother of invention, the lack of facilities and equipment has given rise to an incredible amount of creative ingenuity on the part of faculty in designing meaningful lab experiences for students. However, the limit to such creativity is not asymptotic and real limits are being approached.

C. EXISTING AND PROPOSED LAB ACTIVITIES

The following is a list of courses in the QET program that already have or should have dedicated lab periods that are under-supported or not supported at all with lab space and equipment. The designation "paperwork lab" indicates the exercise is not hands-on; rather, they are basically group or individual homework assignments. The designation "hands-on" indicates the students are actually performing a lab assignment on equipment even though that equipment belongs to another program area. The proposed lab activities listed are abbreviated for the sake of space in this report.

Course Name	Existing Lab Activity	Proposed Lab Activity
MFGE 321 - Metrology	• Paperwork gage design project (gage does not get built) • Desktop Gage R&R studies using sample parts from industry	• Add a requirement for calibrating the equipment used by the tooling lab. • Long term studies of gauge wear, 'drift', and other instabilities requiring good records. • Propose and carry out gage redesign work on gages failing R&R criteria
MFGE 342 - Statistical Process Engineering	• None	• Reinforce the Gauge R&R ideas learned in MFGE 321. • Investigate the impact of measurement on process control topics • Design and test statistically based process control plans
MFGE 442 - Design of Experiments I	• None	• Design and conduct industrial-type experiments for the purpose of trouble shooting and/or modeling manufacturing processes • A quality lab enables more complete measurement of the outputs of these experiments
MFGE 445 – Reliability Engineering	• Bend and break paperclips in a classroom setting. • Paperwork design labs using fabricated data.	• Build a simple test stand to cycle test commonly available parts. • Solicit contributions from industry of reliability testing equipment for a lab setting.

MFGE 426 – Design of Experiments II	• Paperwork design labs	• Same as MFGE 442 DOE I • Create hands-on experiments to illustrate the more advanced topics presented in DOE II.
MFGE 409 – Industrial Problem Solving	• None	• This is a proposed course for the QET Program that may be included in the MFGE Degree. • A quality lab provides a location to store the parts used to illustrate various scenarios for good problem solving.

E. SUMMARY

It is the consensus of the Ferris MFGE faculty that our facilities and equipment *do not* meet the needs of the QET program. Although a very strong lab facility could be created in Grand Rapids with GRCC, the facilities in Big Rapids are woefully inadequate should the program be brought north. It is also difficult to have a joint lab in Grand Rapids if all of the resources are provided by GRCC. FSU must be willing to provide resources to purchase additional measuring and calibration instruments to stock this lab.

Section 9

Curriculum Evaluation

SECTION 9

CURRICULUM EVALUATION

A. INTRODUCTION

Curriculum review. The purpose of this activity is to determine through a comprehensive review of the curriculum whether it meets the needs of the market.

This evaluation of the QET curriculum is probably the most valuable portion of the Program Review process. The program is now about 7 years old (per Paul Prins the BS Quality Engineering Technology degree was approved in Spring, 1994), and only recently have graduates started to emerge through the program. (Remember that this is a program for non-traditional students in Grand Rapids, it typically takes 4 years or more to move through the program.) So now is the best time to evaluate the completeness of the curriculum as set in the original model. The FSU QET curriculum was compared against the body of knowledge requirements for the American Society for Quality (ASQ) Certified Quality Engineer (CQE). This peer recognition certificate is generally regarded as the major certification for people working in the Quality Engineering field. Our goal was to insure the FSU program completely covered the ASQ body of knowledge requirements, as well as extending into other, more specific topics known to the review board as being important in industry.

The body of knowledge used has been included in Appendix D and is also available for review at http://www.asq.org/cert/types/cqe/bok.html . A summary chart of the body of knowledge vs. FSU courses is presented at the end of this section. The curriculum review committee used this tool to evaluate each course, and to look for gaps in the material required by the body of knowledge.

B. SUMMARY OF CURRICULUM REVIEW

Based on our self-review, certain changes will be necessary to align the QET program with the ASQ body of knowledge, with other topics known to be important, and with FSU requirements for graduation.

The main stumbling block for FSU graduation requirements is simply the number of credits. The current checksheet used in Grand Rapids only requires a student to have 115 credits and all of the classes will be 'checked off.' Unfortunately, this number is below the FSU requirement of 120 credits, and the fact that almost all Grand Rapids students waive the 4-credit internship requirement (MFGE 393) only exacerbates the situation. Shown below are the modifications to the curriculum that will solve the deficiencies discovered during the curriculum review.

1. Insufficient number of credits to graduate.
   Several changes are proposed to the current curriculum that impact the number of credits required. (QUET is a proposed new prefix for quality classes.)
   - QUET 444 Quality Auditing– reduce from 3 credits to 2
   - QUET 445 Reliability Engineering – reduce from 3 credits to 2
   - STQM 311 Continuous Improvement Tools – delete this 3 credit course
   - QUET 307 Intro to Quality – a proposed new 2 credit course
   - QUET 409 Industrial Problem Solving – a proposed new 3 credit course
   - QUET 447 Quality Planning – a proposed new 3 credit course
   - QUET 448 Metrology II – a proposed new 3 credit course
   - Processing Elective – add a 3 credit requirement for a processing elective

The net effect of these changes is to reduce 5 credits and add 14 credits, which brings the current 115 credit requirement to 124. Therefore, even though many students waive the 4 credit internship, they will still satisfy the 120 credit graduation requirement.

2. Details of the class changes and proposals.

- QUET 444 Quality Auditing and QUET 445 Reliability Engineering – both of these classes are proposed to be reduced from 3 credits to 2. Based on input from the Industrial Advisory Board, these topics are over emphasized for the relative importance in real application. However, each is too important to be dropped. Also, each class has been taught twice now, and based on input from the students and faculty, the number of contact hours is more than adequate to cover the topics.
- STQM 311 Continuous Improvement Tools - delete this class from the checklist. This class is redundant with topics taught in other classes, and tends to pull many tools out of context and teaches them as stand alone topics. This suggestion is based on feedback from the students, mostly those that have graduated. Reference the Survey of Graduates section for more detail.
- QUET 307 Intro to Quality – add a new 3-credit course. Based on feedback from the graduates, a course is needed to introduce students to the field of quality. This course will also serve as a 'catch-all' for several topics from the body of knowledge that aren't covered in other classes, but will fit quite nicely into an intro course.
- QUET 409 Industrial Problem Solving – add a 3 credit new course. It is widely recognized in industry that the main job duties of Quality Engineers and Manufacturing Engineers revolve around solving problems on the shop floor. Based on feedback from the industry advisory boards for both MFGE and QET this is the most important class of all of the proposed new classes. This class would be based on case studies and would teach the foundation of problem solving used throughout industry.
- QUET 447 Quality Planning – add a 3 credit new class. This class would be linked to MFGE 411 Process Planning. As the 411 students plan a process to manufacture certain parts, the QET students will plan the entire process for

insuring good quality of the parts. We are currently doing this linked project, except using the students in the MFGE 443 Continuous Improvement course, and it is obvious now (after doing the project for two different terms) that there is way too much material to do both this project and work on continuous improvement materials. Splitting this project off into an entirely new class insures the students get a firm background in each important quality topic.

- QUET 448 Metrology II – add a 3 credit new class. MFGE 321 Metrology is currently a requirement of both MFGE and QET students. While the topics are germane to both fields, QET students require further study and need to know more about certain measurement topics that a good manufacturing engineer can skip. This class gives the opportunity to explore topics such as linearity, gauge design, and more elaborate gauge repeatability and reproducibility studies.
- Processing Elective – add a 3-credit requirement. Based on feedback from the graduates and from the opinions of the curriculum review board, exposure to different manufacturing processes is valuable experience. A requirement to take additional processing classes will be added. Suggested classes include PLTS 325, WELD 416, MFGE 312, or EEET 419. Other classes may be substituted by agreement with a student's academic advisor.

One more change to the graduation requirements is proposed. All students will be required to sit for the ASQ CQE certification exam prior to graduation. This step will link our program more strongly to the most widely recognized quality certification available, and provides an ongoing check of the effectiveness of our program.

These proposed changes have all been documented and will be properly sent through the University Curriculum Committee for adoption. Target implementation of the first new class is Winter 2002. An unapproved copy of the complete proposal packet is included in Appendix E

Quality Engineering Technology Curriculum Review

April 2000
MSR

Ferris State University

X - Material contained in Syllabus
O - Not shown in syllabus but still taught
Topics in italics have been added by the review team to the body of knowledge

Topics	MATL 341 - Material Selection Metals	MECH 240 - Statics and Strength	MFGE 321 - Metrology	MFGE 322 - Production Processes	MFGE - 341 Quality Science Statistics	MFGE 324 - Tool Engineering	MFGE 342 - Statistical Process Engineering	MFGE 393 - Internship	MFGE 423 - Engineering Economics	MFGE 442 Design of Experiments	MFGE 443 - Continuous Improvement	MFGE 444 - Quality Auditing	MFGE 445 Reliability Engineering	MFGE 446 Design of Experiments 2	STQM 311 Continuous Improvement Tools	MGMT 302 - Organizational Behavior	PSYC 326 - Industrial Organizational Psychology	COMM 121 - Fundamentals of Public Speaking	ENGL 311 - Advanced Technical Writing
MANAGEMENT AND LEADERSHIP																	X		X
Professional Conduct and Code of Ethics												X					X		
Management Systems for Improving Quality												X				X			
Leadership Principles and Techniques																	X		
Facilitation Principles and Techniques												X				X			
Training												X							
Cost of Quality								X				X							
Quality Philosophies and Approaches								X				X					X		
Benefits of Quality								X				X							
History of Quality								X											
Definitions of Quality								X											
Customer Relations, Expectations, etc.												X					X		
Supplier Relations and Management Methodologies												X					X		
Utilizing basic resources (internet, co. registries, etc.)				X	X											X			
Total Quality Management												X							
QUALITY SYSTEMS DEVELOPMENT, IMPLEMENTATION, AND VERIFICATION																			
Elements of a Quality System												X	O						
Documentation Systems												X	O						
Domestic/International Standard and Specifications												X	O						
Quality Audits												X	X						
Types and Purposes of quality audits													X						
Roles and responsibilities in the audit													X						
Quality audit planning, preparation, and execution													X						
Audit reporting and follow-up													X						
PLANNING, CONTROLLING, AND ASSURING PRODUCT AND PROCESS QUALITY																			
Processes for Planning Product/Service Development												X							
Classification of Quality Characteristics							X	X				X							
Design inputs and design reviews	X							X											
Validation and qualification methods							X	X				X							
Interpretation of technical drawings/specifications			X	X	X			X											
Determining product and process control methods			X			X		X				X							
Critical Process Parameters	X	X	X	X															
Material Selection	X	X										X							

Quality Engineering Technology Curriculum Review

April 2000
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Ferris State University

Topics	MATL 341 - Material Selection Metals	MECH 240 - Statics and Strength	MFGE 321 - Metrology	MFGE 322 - Production Processes	MFGE 324 - Tool Engineering	MFGE - 341 Quality Science Statistics	MFGE 342 - Statistical Process Engineering	MFGE 393 - Internship	MFGE 423 - Engineering Economics	MFGE 442 Design of Experiments	MFGE 443 - Continuous Improvement	MFGE 444 - Quality Auditing	MFGE 445 Reliability Engineering	MFGE 446 Design of Experiments 2	STQM 311 Continuous Improvement Tools	MGMT 302 - Organizational Behavior	PSYC 326 - Industrial Organizational Psychology	COMM 121 - Fundamentals of Public Speaking	ENGL 311 - Advanced Technical Writing
GD&T					X														
Surveys																X			
Material Control																			
Material ID, status, and traceability	X																		
Sample Integrity																			
Material Segregation																			
Material Review Board (MRB)																			
Acceptance Sampling								X											
General Concepts								X											
Definitions of AQL, LTPD, etc.								X											
ANSI/ASQ Z1.4 AND Z1.9 Standards								X											
Acceptance Sampling Plans								X											
Measurement Systems								X											
Terms and definitions					X			X											
Destructive and nondestructive measurements					O														
Selection of measurement tools, gauges, etc.					X			X											
Measurement system analysis					X			X											
Metrology					X		X	X								X			
Fixtures / Work Holding / Locating					X		X												
Economic Analysis / Industrial Practices												X							
Engineering Fundamentals		X																	
RELIABILITY AND RISK MANAGEMENT																			
Terms and Definitions																	X		
Reliability Life Characteristic Concepts																	X		
Design of Systems for Reliability																	X		
Reliability and Maintainability																	X		
Prediction																	X		
Prevention																	X		
Maintenance scheduling																	X		

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Reliability Failure Analysis and Reporting														X					
Reliability/Safety/Hazard Assessment tools														X					
Failure Mode/effects analysis (FMEA)						X	X	X						X					
Failure Mode/effects criticality analysis (FMECA)								X						X					
Fault tree analysis (FTA)														X					
PROBLEM SOLVING AND QUALITY IMPROVEMENT																			
Approaches													X				X		
Management and Planning Tools							O						X				X		
Quality Tools							O										X		
Corrective Action							O						X				X		
Preventive Action													X						
Overcoming Barriers to Quality Improvement													X						
Quality Improvement Process													X						
Benchmarking													X						
Quality Improvement Tools																	X		
Strategic Deployment													X						
QUANTITATIVE METHODS																			
Concepts of Probability and Statistics						X				O	X								
Terms and definitions						X	X			O				X					
Drawing valid statistical conclusions					O	X	X			O				X					
Central Limit Theorem and sampling distribution						X	X			O				X					
Basic Probability Concepts						X	X			O				X					
Time Value of Money									X										
Cash Flow Calculations / Comparisons									X										
Collecting and Summarizing Data					O	X	X				X				X				
Types of data					O	X	X			O									
Measurement scales			X		O	X	X												
Methods for collecting data					O	X	X			X	X				X				

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Descriptive statistics					O	X	X			O									
Graphical Methods					O	X	X			X	X		X		X				
Depicting Relationships						X	X						X						
Depicting distributions													X						
Properties/Applications of Probability Distributions						X				X	X		X						
Discrete Distributions						X	X			X			X						
Continuous Distributions					O	X	X			X			X						
Statistical Decision Making											X								
Point and Interval estimation					O	X													
Hypothesis testing					O					X									
Tests for means, variances, and proportions					O	X				X				X					
Significance level, power, type I/II errors						X				X									
Statistical vs. practical significance						X	X							X					
Paired Comparison tests						X								X					
Goodness-of-fit tests						X				X									
Analysis of Variance (ANOVA)					O	X				X				X					
Contingency tables														X					
Measuring Effectiveness of Variables														X					
Measuring/Modeling Relationships Between Variables											X								
Simple and Multiple least-squares regression						X	O			X									
Simple Linear correlation						X				X									
Basic time-series analysis																			
Designing Experiments										X	X			X					
Terminology										X				X					
Planning and organizing experiments					O					X				X					
Design principles										X				X					
Design and analysis of one-factor experiments					O					X				X					
Design and analysis of full-factorial experiments					O					X				X					
Design/analysis of two-level fractional experiments										X				X					
Taguchi robustness concepts																			

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Statistical Process Control								X				X							
Objectives and Benefits								X				X							
Selection of variable								X				X							
Relational subgrouping								X				X							
Selection and application of control charts								X				X							
Analysis of control charts								X				X							
PRE-control																			
Short run SPC																			
Analyzing Process Capability																			
Designing/conducting process capability studies								X				X							
Calculating process performance vs. specification								X				X							
Process Capability Indices								X				X							
Process Performance indices								X				X							

Appendix E

Proposed Curriculum Changes

Proposal Summary

Program review and input from the industrial advisory committee reveal a need to examine and refresh the curriculum. This proposal is the result of that review and involves several changes to the curriculum. One major issue discovered is that there are not enough credits offered in the program for a student to graduate without taking classes from outside the check-sheet. This proposal creates a new prefix specifically for Quality Engineering Technology (QUET), adds five (5) new classes, adds a three credit elective from existing FSU courses, deletes a course from the current checklist, revises credits for two existing classes, and adds an additional requirement for graduation. Specifically, students will be required to sit for the American Society for Quality (ASQ) Certified Quality Engineer (CQE) test prior to graduating.

2. Summary of All Course Action Required

a. Newly Created Courses to FSU:

Course Prefix	Number	Title
QUET	307	Introduction to Quality
QUET	393	Internship
QUET	409	Industrial Problem Solving
QUET	447	Quality Planning
QUET	448	Metrology II

b. Courses to be Deleted From FSU Catalog:

Course Prefix	Number	Title

c. Existing Course(s) to be Modified:

Course Prefix	Number	Title	Proposed Change
MFGE	321	Metrology	Prefix to QUET
MFGE	341	Quality Science Statistics	Prefix to QUET
MFGE	342	Stat. Process Engineering	Prefix to QUET
MFGE	442	Design of Experiments	Prefix to QUET
MFGE	443	Continuous Improvement	Prefix to QUET
MFGE	444	Quality Auditing	Prefix to QUET, credits to 2
MFGE	445	Reliability Engineering	Prefix to QUET, credits to 2
MFGE	446	Design of Experiments II	Prefix to QUET

d. Addition of existing FSU courses to program

Course Prefix	Number	Title
Processing Elective - Choose one from this list or approval of Advisor		
MFGE	312	CNC/CAM
PLTS	325	Plastics Processing
WELD	416	Production Welding Processes
EEET	419	Electronic Technology for Manufacturing

Removal of existing FSU courses from program

Course Prefix	Number	Title
STQM	311	Continuous Improvement Tools

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FORM A

PROPOSAL SUMMARY AND ROUTING FORM

Proposal Title: Quality Engineering Technology Program Review

Initiating Department: MFGE **College:** Technology

Date of Implementation: 1/1/02

X 1. Group I - A – New degree/major or major, or redirection of a current offering
☐ 2. Group I - B – New minors, tracks, concentrations, or options
☐ 1. Group II - A – Minor curriculum clean-up and course changes
☐ 2. Group II - B – New Course
☐ 3. Group III - Certificates
☐ 4. Group IV – Off-Campus Programs

Signatures, as appropriate	DATE Approved	Vote Results (optional)
Initiator(s)		Support *Support with concerns *No Support
Department/Program Faculty (Chair/Department Head)		Support *Support with concerns *No Support
Chair, College Curriculum Committee		Support *Support with concerns *No Support
Dean, College		Support *Support with concerns *No Support
Chair, University Curriculum Committee		Support *Support with concerns *No Support
President, Academic Senate (Senate Vote)		
Vice President, Academic Affairs		

* No Support or Support with Concerns must include a list of concerns.

To be completed by Academic Affairs

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

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FORM D

PROGRAM, MAJOR, OR MINOR CHECK SHEET(S)

Please attach a copy of your curriculum "check sheet" and/or "academic program requirements" list for Category I, I-A, II, II-A, III, or IV, per instructions AND LABEL CHECK SHEETS AS FORM D. Checksheet should indicate total credits, General Education requirements, and minimum number of 300 and 400 level courses. Also any special admissions or graduation requirements.

Two documents are attached. The first three pages are the checksheet format used in FSU - Grand Rapids, the only location where the Quality Engineering Technology degree is offered. This checksheet contains all core classes, related classes, general education requirements, and special admission and graduation requirements The last page is the checksheet format used at FSU - Big Rapids and is included with the idea that someday this program will be offered on campus.

FORM D

FERRIS STATE UNIVERSITY
GRAND RAPIDS

Quality Engineering Technology, B.S.

Grand Rapids Community College Transfer Plan

NAME: _____ SS#: _____ DATE: _____

Admission Requirements:

1. Applicants must have an associate's degree in a manufacturing-based technology (or 60 credit hours of college course work including technical courses, general courses, and technical related courses).
2. A materials science course (GRCC MN 234) is required for graduation. It is recommended that this requirement be met in the A.A.S. course work.
3. A 2.75 GPA in major courses and 2.5 in mathematics courses is required for admission.
4. Student must be prepared for calculus by winter semester of junior year.
5. All official college transcripts must be submitted at time of application.
6. To be considered for financial aid from Ferris, students must have earned an associate's degree or 64 semester hours.

Graduation Requirements:

1. To graduate students must have a 2.0 GPA in all FSU courses, a 2.50 GPA in the math courses, and a 2.75 in the major (FSU courses).
2. At least 30 FSU semester hours must be completed to fulfill FSU residency requirements.
3. A minimum of 120 semester hours must be completed for graduation.
4. All students must sit for the ASQ Certified Quality Engineer exam, or advisor approved equivalent, within one year prior to graduating. Students that have already passed the exam are exempt.
5. Students must meet the University General Education Hours requirements listed on the reverse side.

Required Courses	Course Title FSU Prerequisites Shown in Brackets ( )	GRCC Equivalent Courses	FSU S.H.	Grade
Major Courses				
MATL 341	Material Selection Metals		3	
MECH 340	Statics and Strength of Material		4	
QUET 307	Introduction to Quality		2	
QUET 321	Metrology		2	
MFGE 322	Production Processes		3	
MFGE 324	Tool Engineering (MFGE 313)		4	
QUET 341	Quality Science Statistics (MATH 116)		3	
QUET 342	Statistical Process Engineering (QUET 341)		3	
QUET 393	Internship (junior status)		4	
QUET 409	Industrial Problem Solving		3	
MFGE 423	Engineering Economics (MATH 126)		2	
QUET 442	Design of Experiments 1 (QUET 341)		3	
QUET 443	Continuous Improvement (QUET 341)		3	
QUET 444	Quality Auditing		2	
QUET 445	Reliability Engineering (QUET 341)		2	
QUET 446	Design of Experiments 2 (QUET 442)		3	
QUET 447	Quality Planning (QUET 321, QUET 342)		3	
QUET 448	Metrology II (QUET 321)		3	
			Total Major Hours Required: 52	
Related Courses				
Technical Elective	MFGE 312, PLTS 325, WELD 416, EEET 419, or advisor approved substitute		2-5	
MGMT 302	Organizational Behavior	BA 282	3	
			Total Related Hours Required: 5-8	

Last Updated: 8/16/01

GENERAL EDUCATION REQUIREMENTS

Required Courses	Course Title FSU Prerequisites Shown in Brackets ( )	GRCC Equivalent Courses	FSU S.H.	Grade
Communication Competence—12 Hours Required				
COMM	COMM 121, Fundamentals of Public Speaking	SC 131	3	
ENGL 150	English 1	EN 100 OR EN 101	3	
ENGL 250	English 2	EN 102	3	
ENGL 311	Advanced Technical Writing		3	
Scientific Understanding—7 to 8 Semester Hours Required Select two courses from the following areas: Astronomy, Biology, Chemistry, Geography 111, Geography 121, Geology, Physical Science, or Physics				
PHYS 211	Introduction to Physics 1 (MATH 115)	PH 125	4	
Science Elective		GRCC	3-4	
Quantitative Skills--This requirement can be completed by one of the following options: pass MATH 115 or higher, pass course proficiency exam in MATH 115 or higher, or ACT Math subtest score of 24 or higher.				
MATH 216	Applied Calculus (MATH 126)	MA 133 or MA 129	4	
Cultural Enrichment—9 Hours Required (one must be 200 level or higher and you must choose from two different areas) Select from the following subject areas: Art History, Art, French, German, Spanish, History, Humanity, Literature, Music, Theatre				
Cultural Enrichment		GRCC	3	
Cultural Enrichment		GRCC	3	
Cultural Enrichment		GRCC	3	
Social Awareness - 9 Hours Required One course must be 300/400 level non-economic.				
PSYC 150	Introduction to Psychology	PY 201	3	
Social Awareness		GRCC	3	
PSYC 326	Industrial Organizational Psychology		3	
			Minimum of 37 General Education Credit Hours Required for FSU B.S. Degree	

Note: GRCC equivalent courses are not taught at Ferris-Grand Rapids, therefore these requirements must be completed at GRCC or another accredited college or university.

Advisor: _____ Date: _____

MATL 341, Material Selection Metals
Analysis and comparison of metals in engineering service applications. Evaluation of existing metal in design components and analysis of metallic alternatives. A comparison of alloying and heat treatment to determine the optimum materials. The effects of manufacturing and service environment on the metal selection process. Students submit case studies of existing metal applications. 3 credit hours.

MECH 340, Statics & Strength of Materials
Mechanics: statics and strength of materials. Forces components, resultants, equilibrium, friction, centroids, and stress/strain relationships. Dynamics; strength of materials; the concepts of stress and strain, axial stress and deformation, thermal stress and deformation, stress concentrations, factors of safety, torsional stress and deformation, beam stresses, combined stress, riveted joints, welded joints, and Mohr's circle. Prerequisite MATH 126 concurrently. 4 credit hours.

QUET 307 Introduction to Quality
Students will become acquainted the various quality topics that will assist in a successful career in Quality. Students will learn the history of quality and the close relationship to manufacturing. Other topics covered include Ethics, Professional Attitudes and Actions, Team Skills and Facilitation, and other topics of interest to the Quality Professional. 2 credit hours.

QUET 321, Metrology
Fundamentals of dimensional metrology, production gages and gaging techniques. Interpretation of geometric tolerances will also be covered with respect to their implications for inspection. Prerequisite: enrolled in MET program. 2 credit hours

MFGE 322, Production Processes
A survey of Production machining, metal casting, powder metallurgy, bulk deformation, pressworking, and non-traditional machining. 3 credit hours.

MFGE 324, Tool Engineering
Tool engineering fundamentals as well as application of these fundamentals in the lab. Principles of cutting tools, machine ability, tool life, power requirements; high performance tool materials; special tooling applications and fixturing. 4 credit hours.

QUET 341, Quality Science Statistics
A detailed study of the application of fundamentals of data analysis covering distributions, linear relationships, cause-effect, collection of data, probability, counts, proportions, sample means and inferences. Applications to illustrate concepts meaningful in a technological environment. Prerequisites: college level algebra (math 116 or equivalent); junior standing or by permission. 3 credit hours.

QUET 342, Statistical Process Engineering
A detailed study of the application of data analysis to the statistical regulation of process. Techniques applicable to the analysis and regulation of industrial and business process and products. Prerequisite: QUET 341 or permission of the instructor. 3 credit hours.

QUET 393, Internship
Places the student in an industrial setting, after completing their junior year. The experience is a combined effort of the training site, university, and student. Students involved in the industrial projects and daily activities of a quality engineer. Prerequisite: junior status. 4 credit hours.

QUET 409 Industrial Problem Solving
Problem solving in an industrial setting is covered. Each element of good problem solving is described and practiced and the overall process is reinforced through case studies and outside examples. Topics are extended to provide tools for preventing similar problems from occurring in other processes. 3 credit hours.

MFGE 423, Engineering Economics
Engineering economic analysis. Money and time relationships in respect to capital purchases and equipment justification are discussed in detail. Prerequisite: Math 126 or equivalent. 2 credit hours.

QUET 442, Design of Experiments 1
A detailed study of the design of experiments and the application of advanced quantitative data analysis techniques, as well as common experimental design methodologies used in manufacturing industries to collect data for the purpose of improving or better understanding a design or process. Prerequisites: QUET 341 or permission of professor.
3 credit hours.

QUET 443, Continuous Improvement
A detailed study of the continuous improvement of quality; engineering and management approaches necessary to achieve a broad and persistent refinement of business and manufacturing processes in an industrial organization. Prerequisites: QUET 341 or by permission of professor. 3 credit hours.

QUET 444, Quality Auditing
This course is a detailed study of the technology concerned with quality auditing with emphasis on the international ISO 9000 standards. Covered will be the types of quality audits, planning for the audit, conducting the audit, follow-up activities to improve operations, and reporting results. 3 credit hours.

QUET 445, Reliability Engineering
This course is a detailed study of the technology concerned with reliability prediction and assessment. Covered will be probability plotting, load-strength interference, reliability prediction and modeling, reliability in design of mechanical and electronic systems, reliability testing, maintainability and availability, and analyzing reliability data. Prerequisite: QUET 341. 3 credit hours.

QUET 446, Design of Experiments 2
This course is an advanced study of the technology concerned with the design of experiments. Covered will be comparing two treatments, comparing more than two treatments, measuring the effects of variables, and building and using models. Prerequisite: QUET 442. 3 credit hours.

QUET447 Quality Planning
Students learn to manage the complete process for quality planning regarding a particular product. Steps include Design and Process FMEA, pre-production parts layout, preliminary capability analysis, and other steps required to prepare a part submission packet similar to those used in industry. This course is closely connected to MFGE 411 and students should be prepared to spend significant amounts of time on a major project both in-class and outside of regular class times. Prerequisite: QUET 321, QUET 342. 3 credit hours.

QUET 448 Metrology II
Advanced topics in metrology are explored with an emphasis on industrial issues. Gauge repeatability and reproducibility are explored in more depth. Additional topics are added to lead to a complete description of measurement uncertainty. Measurement system design issues are revealed and solved. Prerequisite: QUET 321. 3 credit hours.

FORM D

FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY

QUALITY ENGINEERING TECHNOLOGY
BACHELOR OF SCIENCE DEGREE

Curriculum Guide Sheet

Name of Student _____ Student I.D._____

Total Semester hours required for graduation: 73

NOTE: Meeting the requirements for graduation indicated on this sheet is the responsibility of the student. The student is also responsible for meeting all FSU General Education requirements as outlined in the university catalog. Your advisor is available to assist you.

		Proposed (new classes are BOLD)		
THIRD YEAR – FALL SEMESTER				
MFGE 321	Metrology	*QUET 321*	*Metrology*	2 (1+3)
MFGE 341	Quality Science Statistics (MATH 116)	*QUET 341*	*Quality Science Statistics (MATH 116)*	3 (3+0)
MFGE 423	Engineering Economics (MATH 126)	*MFGE 423*	*Engineering Economics (MATH 126)*	2 (2+0)
STQM 311	Continuous Improvement Tools and Techniques		*(Deleted from Program)*	~~3~~ (3+0)
MGMT 302	Organizational Behavior (MGMT 301)	*MGMT 302*	*Organizational Behavior (MGMT 301)*	3 (3+0)
ENGL 311	Advanced Technical Writing	*ENGL 311*	*Advanced Technical Writing*	3 (3+0)
		QUET 307	***Introduction to Quality***	2 (2+0)
		PSYC 150	*Introduction to Psychology*	3 (3+0)
THIRD YEAR – WINTER SEMESTER				
MFGE 342	Statistical Process Engineering (MFGE 341)	*QUET 342*	*Statistical Process Engineering (QUET 341)*	3 (3+0)
MFGE 322	Production Processes	*MFGE 322*	*Production Processes*	3 (3+0)
MFGE 324	Tooling Engineering (MFGE 313) (W.I.)	*MFGE 324*	*Tooling Engineering (MFGE 313) (W.I.)*	4 (3+3)
MATH 216	Applied Calculus I (MATH 126)	*MATH 216*	*Applied Calculus I (MATH 126)*	4 (4+0)
_____ ___	Cultural Enrichment Elective (G.C.)	_____ ___	*Cultural Enrichment Elective (G.C.)*	3 (3+0)
		_____ ___	***Technical Elective***	3 (3+0)
THIRD YEAR – SUMMER SEMESTER				
MFGE 393	Internship	*QUET 393*	*Internship*	4
FOURTH YEAR – FALL SEMESTER				
MFGE 442	Design of Experiments I (MFGE 341)	*QUET 442*	*Design of Experiments I (QUET 341)*	3 (3+0)
MFGE 444	Quality Auditing	*QUET 444*	*Quality Auditing*	~~23~~ (2+0)
MATL 341	Material Selection Metals (MATL 240)	*MATL 341*	*Material Selection Metals (MATL 240)*	3 (3+0)
_____ ___	2nd Scientific Understanding	_____ ___	*2nd Scientific Understanding*	4 (3+3)
PSYC 150	Introduction to Psychology		*(moved to Third Year – Fall Semester)*	~~3~~ (3+0)
		QUET 409	***Industrial Problem Solving***	3 (3+0)
		QUET 447	***Quality Planning (QUET 321, QUET 342)***	3 (3+0)
FOURTH YEAR – WINTER SEMESTER				
MFGE 446	Design of Experiments II (MFGE 442)	*QUET 446*	*Design of Experiments II (QUET 442)*	3 (3+0)
MFGE 445	Reliability (MFGE 341)	*QUET 445*	*Reliability (QUET 341)*	~~23~~ (2+0)
MFGE 443	Continuous Improvement (Capstone) (MFGE 341)	*QUET 443*	*Continuous Improvement (Capstone) (QUET 341)*	3 (3+0)
PSYC 326	Industrial Organization Psychology (PSYC 150)	*PSYC 326*	*Industrial Organization Psychology (PSYC 150)*	3 (3+0)
_____ ___	Cultural Enrichment Elective (200 level)	_____ ___	*Cultural Enrichment Elective (200 level)*	3 (3+0)
		QUET 448	***Metrology II (QUET 321)***	3 (2+2)

FORM E

NEW COURSE INFORMATION FORM

See Sample: Limit to One Page.

Course Identification:

Course Prefix:	Number	Title
QUET	307	Introduction to Quality

Course Description:
Students will become acquainted the various quality topics that will assist in a successful career in Quality. Students will learn the history of quality and the close relationship to manufacturing. Other topics covered include Ethics, Professional Attitudes and Actions, Personal Financial Planning, Team Skills and Facilitation, and other topics of interest to the Quality Professional. Prerequisites: None 2 credit hours.

Course Objectives:
1. To familiarize students with the history of quality and why it has become so vital in today's market.
2. To familiarize the students with role of the Quality Professional.
3. To insure the student can be successful in the Quality field by exposing them to various topics.

Course Outline including Time Allocation:
I. Introduction to Quality Fundamentals (2 hours) - History of Quality and Manufacturing, Shewhart, Deming and Juran - The Quality Triumvirate, Ethical issues in Quality.
II. Professional Attitudes and Actions (4 hours) - Time management, Project management tools, Written and Oral communication
III. Inspection Techniques (4 hours) - typical tools, checks, and documentation used to insure quality on the shop floor.
IV. Team Skills (8 hours) - The role of teams in industry, Your role on a team, Facilitating a team, Acting as scribe, Creating an impact without creating enemies
V. Discovering Quality Roles (4 hours) - Field trips to local companies help define the different roles of Quality Engineers and the wide variety of other opportunities for Quality Professionals.
VI. Fundamental tools for Quality (8 hours) - Data gathering, Simple graphical analysis, inspection fundamentals,

FORM E

NEW COURSE INFORMATION FORM

See Sample: Limit to One Page.

Course Identification:

Course Prefix:	Number	Title
QUET	393	Internship

Course Description:

After achieving junior status in the QUET program, the student is responsible for finding a job in industry equivalent to an entry-level quality engineering position. The student gains work experience while performing the daily activities of a quality engineer and broadens his/her base of knowledge while investigating assigned topics of present and future interest in the quality engineering field. When possible, the internship coordinator will visit the student at the work site.

Course Objectives:

I. Weekly investigation topics
   - A. Be able to investigate the application/implementation of the assigned manufacturing engineering concepts at the work site by identifying and interviewing appropriate plant personnel.
   - B. Understand how the application/implementation of the assigned manufacturing engineering concepts at the work site relates to course material presented in the MFGE program.
   - C. Be able to report findings and conclusions on each topic in succinct, concise, and grammatically correct business letters.

II. Term paper
   - A. Be able to summarize work experiences in a properly formatted term paper suitable for formal presentation to upper management.

Course Outline including Time Allocation:

I. Weekly investigation topics (nine will be assigned) (360 work hours)

A. Summarize the overall quality system structure
B. Describe the use of (or potential use for) DFMEA's and PFMEA's
C. Participate in a Gauge R&R study. Summarize the results
D. Describe the role of quality in process planning
E. Perform and summarize a short-term capability study
F. Describe how key process characteristics are selected, monitored, and improved
G. Describe the gauge design process.
H. Perform an audit of some aspect of the quality system.
I. Describe the corrective and preventive actions systems used by the company.
J. Develop a control plan for a current production part.
K. Investigate the sampling plans in use and comment on suggested improvements
L.. Future industry trends
M. Other topics as appropriate

II. Term paper (40 work hours)
   - A. Summary of overall work experiences

FORM E

NEW COURSE INFORMATION FORM

See Sample: Limit to One Page.

Course Identification:

Course Prefix:	Number	Title
QUET	409	Industrial Problem Solving

Course Description:
Problem solving in an industrial setting is covered. Each element of good problem solving is described and practiced and the overall process is reinforced through case studies and outside examples. Topics are extended to provide tools for preventing similar problems from occurring in other processes. Prerequisites: None. 3 credit hours.

Course Objectives:
1. To familiarize students with the basic elements of good problem solving.
2. To reinforce the need for irreversible corrective actions to problems encountered.
3. To familiarize students with the overall process of good problem solving.

Course Outline including Time Allocation:
I. Introduction to Problem Solving (3 hours) - Fads and fundamentals, overview of industry attitudes, solving quality problems.
II. Problem solving fundamentals (15 hours) - Role of teams in problem solving, problem identification, short term corrective actions, root cause analysis, long term corrective actions, prevention, rewarding the team
III. Types of Quality Problems (12 hours) - conformance, unstructured performance, efficiency, process design
IV. Case studies (15 hours) - group solutions for case studies of industrial type problems.

FORM E

NEW COURSE INFORMATION FORM

See Sample: Limit to One Page.

Course Identification:

Course Prefix:	Number	Title
QUET	447	Quality Planning

Course Description:
Students learn to manage the complete process for quality planning regarding a particular product. Steps include Design and Process FMEA, pre-production parts layout, preliminary capability analysis, and other steps required to prepare a part submission packet similar to those used in industry. This course is closely connected to MFGE 411 and students should be prepared to spend significant amounts of time on a major project both in-class and outside of regular class times. Prerequisites: QUET 321, MFGE 342. 3 credit hours

Course Objectives:
1. Students learn fundamental tools of quality planning, such as Failure Mode and Effect Analysis (FMEA), Control Plan development, and other common tools.
2. Students use skills to develop the quality plan for the product used in MFGE 411 - Process Planning. QUET students will develop the entire quality plan and submit a production part approval package similar to those used in industry.

Course Outline including Time Allocation:
1. Plan and Define Programs (3 hours) - The voice of the customer, Preliminary Process Flow Chart, Special product and process characeristics
2. Product Design and Development (9 hours) - DFMEA, Design Reviews, Gages/Testing equipment planning
3. Process design and development (15 hours) - Process flow chart, PFMEA, Measurement system analysis plan, Preliminary Process capability studies,
4. Product and Process Validation (15 hours) - Measurement system evaluation, Process capability, Control plan, Production part approval
5. Feedback and Assessment (3 hours) - Plans for reducing variation, customer feedback, and service.

FORM E

NEW COURSE INFORMATION FORM

See Sample: Limit to One Page.

Course Identification:

Course Prefix:	Number	Title
QUET	448	Metrology II

Course Description:
Advanced topics in metrology are explored with an emphasis on industrial issues. Gauge repeatability and reproducibility are explored in more depth. Additional topics are added to lead to a complete description of measurement uncertainty. Measurement system design issues are revealed and solved. Prerequisites: QUET 321. 3 credit hours

Course Objectives:
1. To refresh students in the material learned in Metrology I.
2. To extend the topic of Gauge Repeatability and Reproducibility (R&R) so students understand the underlying calculations in the typically 'cookbook' method of analysis.
3. To familiarize students with the basic elements of measurement uncertainty.
4. To present to the students difficult measurement problems for resolution.
5. To instruct the students in proper gauge design principles.

Course Outline including Time Allocation:
I. Introduction to Metrology (6 hours) - Terms and definitions, Review of typical handheld measuring instruments, Fundamentals of Gauge R&R, Introduction to CMM and Optical Comparators,
II. Gauge Measurement Studies (9 hours) - Types of measuring system variation, Analyzing and quantifying Bias, Stability, Repeatability, Reproducibility, and Linearity,
III. Measurement Uncertainty (12 hours) - Components of uncertainty, Data gathering and quantifying the magnitude of uncertainty, combining uncertainty elements, Making a Statement of Measurement Uncertainty, Monte Carlo simulation of the effects of Gauge Uncertainty
IV. Advanced Topics in Gauge R&R (9 hours) - Treating a Gauge R&R as a Designed Experiment, ANOVA Analysis of Gauge R&R, Gauge R&R for non-traditional method.
V. Case studies (9 hours) - group solutions for case studies of measuring problems, Principles of Gauge Design.

Appendix F

Overview References

ADMINISTRATIVE PROGRAM REVIEW: 2000

Program/Department: Quality Technology / Quality Engineering Technology
Date Submitted: November 1, 2000 Dean: George Waldheim

Please provide the following information:

Enrollment

	Fall 1996	Fall 1997	Fall 1998	Fall 1999	Fall 2000
Tenure Track FTE	N/A	N/A	N/A	N/A	N/A
Overload/Supplemental FTEF	N/A	N/A	N/A	N/A	N/A
Adjunct/Clinical FTEF (unpaid)	N/A	N/A	N/A	N/A	N/A
Enrollment on-campus total*	0	N/A	N/A	N/A	N/A
TBA	7	7	0	0	0
Freshman	3	0	3	0	1
Sophomore	0	0	1	1	1
Junior	1	1	3	1	4
Senior	2	1	7	4	7
Masters	N/A	N/A	N/A	N/A	N/A
Doctoral	N/A	N/A	N/A	N/A	N/A
Pre-Technical Students	N/A	N/A	N/A	N/A	0
Enrollment off-campus*	13	9	14	6	14
Traverse City	N/A	N/A	N/A	N/A	N/A
Grand Rapids	13	9	14	6	14
Southwest	N/A	N/A	N/A	N/A	N/A
Southeast	N/A	N/A	N/A	N/A	N/A

*Use official count (7-day)
If there has been a change in enrollment, explain why:

Capacity:
Estimate program capacity considering current number of faculty, laboratory capacity, current equipment, and current levels of S&E. What factors limit capacity?
__25____students

What factors limit program capacity? 1. Physical Space 2. Equipment 3. S& E Funds 4. Number of faculty

Financial : ***THE QUALITY CERTIFICATE/QUALITY ENGINEERING TECHNOLOGY PROGRAMS ARE FUNDED BY THE MANUFACTURING ENGINEERING TECHNOLOGY ACCOUNT***

Expenditures*	FY 96	FY 97	FY 98	FY 99	FY 00
Supply & Expense	N/A	N/A	N/A	N/A	N/A
Equipment					
Voc. Ed. Funds	N/A	N/A	N/A	N/A	N/A
General Fund	N/A	N/A	N/A	N/A	N/A
In-Kind	N/A	N/A	N/A	N/A	N/A
Non-General Fund	N/A	N/A	N/A	N/A	N/A
Revenues					
Net Clinic Revenue	N/A	N/A	N/A	N/A	N/A
Scholarship Donations	N/A	N/A	N/A	N/A	N/A
Gifts, Grants & Cash Donations	N/A	N/A	N/A	N/A	N/A
Endowment Earnings	N/A	N/A	N/A	N/A	N/A
Institute Programs/Services	N/A	N/A	N/A	N/A	N/A

ADMINISTRATIVE PROGRAM REVIEW: 2000

*Use end of fiscal year expenditures.

Other

	AY 95/96	AY 96/97	AY 97/98	AY 98/99	AY 99/00
Number of Graduates* - Total	17	6	11	6	3
- On campus	N/A	N/A	N/A	N/A	N/A
- Off campus	16	8	11	6	14
Placement of Graduates	16	8	11	6	14
Average Starting Salary	N/A	N/A	N/A	N/A	N/A
Productivity - Academic Year Average	N/A	N/A	N/A	N/A	N/A
- Summer	0	0	0	0	0
Summer Enrollment	N/A	N/A	N/A	N/A	N/A

* Use total for full year (S, F, W) **Note: Graduates include individuals who have completed the Quality Science Certificate series.**

1. a) Areas of Strength:
   - *First if its kind in the nation.*
   - *Uniqueness.*
   - *Support by professional groups and industry, such as ASQ (American Society of Quality) Automotive Division.*

   b) Areas of Concern and Proposed Action to Address Them:
   - *Questionable administrative support.*
   - *No facilities and labs to the extent they are needed to support the curriculum.*
   - *Vacant faculty position needed to serve B.S. QET and BS MET not filled.*
   - *Low enrollment (recruiting-promotion through ASQ)*

2. Future goals (please give time frame)
   - *Curriculum refinement (2000-2002)*
   - *Offer at main campus (?)*
   - *Increase enrollment at ATC Grand Rapids (On-going)*

3. Other Recommendations:
   - *This degree is offered by the Manufacturing Engineering Technology faculty group and is closely aligned with the Manufacturing Engineering Technology B.S. degree. It needs to have "meat put on the bones" – in essence, resources to support the degree. Need facility and labs to support both programs.*
   - *Enrollment needs to be increased. Will promote program through auspices of ASQ and recruitment efforts.*
   - *Extended to community colleges and industry*

4. Does the program have an advisory committee? *YES*

   a) If yes, when did it last meet? *Spring 2000*

   b) If no, why not? By what other means do faculty receive advice from employers and outside professionals?
   Affiliation with American Society of Quality

   c) When were new members last appointed? *1999*

   d) Are there non-alumni/ae on the committee? How many? *YES - 6*

ADMINISTRATIVE PROGRAM REVIEW: 2000

5. Does the program have an internship or other cooperative or experiential learning course? *YES*

   a) If yes, is the internship required or recommended? *REQUIRED*

   b) If no, what is the reason for not requiring such an experience?

6. Does the program offer courses through the web? *NO*

   a) Please list the web-based (fully delivered through the internet) courses the program offered last year?

   b) Please list the web-assisted (e.g., WebCT) courses the program offered last year.

7. Is this a program with state, regional, and/or national recognition?

   a) For what special strengths or characteristics is it recognized?

   b) If not, what are some strategies that could lead to recognition?

- *ASQ – Automotive Division has indicated an interest in promoting this program nationally – if and when it is brought to the FSU Big Rapids campus.*

Form Completed by_____
Gary Ovans, Department Chair

Reviewed by Dean_____
Date

Mark S. Rusco

16383 Warner Street
Grand Haven, MI 49417
(616) 846-9773 (H)
e-mail mrusco@novagate.com

Education

May 1988

Central Michigan University
Mt. Pleasant, MI
Masters of Business Administration G.P.A. 3.6/4.0

March 1983

Michigan State University
East Lansing, MI
Bachelors of Science in Mechanical Engineering G.P.A. 3.2/4.0

June 1978

Grant Public High School
Grant, MI
University Preparatory Diploma

Work Experience

Ferris State University
Big Rapids, MI

January 1998 - Present

Assistant Professor -- I am a tenure track professor in the Manufacturing and Design Department. I teach classes with an emphasis on quality and manufacturing systems, such as Statistics, Continuous Improvement, Metrology, and others.

May 1997 - December 1997

Adjunct Faculty -- I have taught Management Science 341 -- Quantitative Analysis and MFGE-341 -- Quality Science Statistics.

GHSP
Grand Haven, MI

September 1992- January 1998

Quality Assurance Manager -- I was responsible for all quality throughout three separate facilities. I had four Quality Supervisors reporting to me for a total of 22 people in the Quality Department. I wrote and implemented systems to satisfy GM's Targets for Excellence and most recently, for QS-9000. I was instrumental in writing a Project Management Procedure Manual, implemented a Lot Traceability System to include all manufactured and purchased parts, and headed a three person team that successfully registered GHSP to the QS-9000 standard (ISO 9001). I have also been instrumental in implementing the Toyota Production System of Lean Manufacturing through my involvement with the manager's team. I edited the Lean Manufacturing Guidelines, a booklet of standards used at GHSP to implement Lean Manufacturing on the shop floor, developed a set of summary charts to track the implementation by workcenter, and have actively managed the implementation through the MBO process.

May 1990 - September 1992

Supplier Development Supervisor --- I supervised two Receiving Inspectors and two Supplier Development Facilitators. My responsibilities were to insure the quality of all purchased parts and services. I conducted supplier quality audits, helped suppliers with problem solving and implemented a supplier certification program.

October 1988-
May 1990

Manufacturing Engineer -- I was responsible for upgrading the productivity of the equipment and the quality of the finished parts in the Stamping Department. I facilitated a quick die change program that reduced set-up time by an average of 50% on eight presses and installed a new die lubrication system that paid for itself in six months of oil savings alone.

Muskegon Community College

Muskegon, MI

May 1991 -
April 1997

Adjunct Faculty -- I have presented various training seminars at company sites for the college.

September 1989 -
May 1994

Holland Community Education

Holland, MI

SPC Instructor - I taught Statistical Process Control, level I and level II, each a 36-hour course.

October 1983 -
June 1988

Hitachi Magnetics Company

Edmore, MI

Manufacturing Engineer -- I was responsible for all aspects of bringing a new magnetic material from Research and Development to full production. I trained employees, purchased new equipment, developed and documented processes, and solved manufacturing and quality issues. This product went from shipping samples to shipping $300K/Month within one year.

Manufacturing Engineer -- (Valparaiso, IN division) I was responsible for all aspects of manufacturing, maintenance, and quality at this small ferrite magnet plant. This company was a Ship-to-Stock supplier to GM and had a historical first-time yield of over 98%.

Michigan State University Custodial Department

September 1979 -
December 1982

East Lansing, MI

Custodian - This was a 20 hour per week job to help pay school expenses.

Professional Memberships

April 1993 - Present
American Society for Quality Member

June 1994 - Present
American Society for Quality Board Member (currently Education Chair)

June 1993
American Society for Quality Certified Quality Engineer

Additional Training

SPC Level I and Level II (Instructor)

8-D Problem Solving (Instructor)

Quick Die Change (Instructor)

Push vs. Pull Manufacturing Simulation (Instructor)

ASQ CQE Refresher Course (Instructor)

Designed Experiments (Instructor)

Failure Mode and Effect Analysis (Instructor)

Dale Carnegie

References

References are available upon request.

VITA

Bruce Gregory
11179 15 Mile rd
Rodney, Michigan 49342
616/867-3345

Personal: Married
Three children
Birth date: 4/14/55

Education:

AAS degree; Ferris State College, Big Rapids, MI
1975; Major: Machine Tool

BS degree; Ferris State College, Big Rapids, MI
1978; Major: Manufacturing Engineering Technology

MS degree; The Rochester Institute of Technology; Rochester, NY
1993; Major: Applied and Mathematical Statistics

MS degree; Ferris State University, Big Rapids, MI
1997; Major: Occupational Education

Industrial and Related Experience:

9/75-5/76; Michigan Truck Plant; Wayne, Michigan
Line assembler; assembled Ford pickup trucks

6/78-6/82; Sealed Power Corporation; Muskegon, Michigan
Manufacturing Engineer; Developed new and optimized older manufacturing processes

8/82-6/83; Covenant High School; Unalakleet, Alaska
Volunteer Christian service; served a one year short term mission assignment along with my wife. Worked in maintenance, taught a small engines class, and substitute taught math on occasion

9/83-Present; Ferris State University; Big Rapids, Michigan
Associate Professor, Manufacturing Engineering Technology
Major Subjects taught include Statistics, Design of Experiments, Principles of Process Planning, Tolerance Control, Engineering Economics

Services to Industry (5 year window)

- Assembly Tolerance Analysis seminar - Rexair, Inc., Cadillac, MI; summer 1996.
- Delivered "Quality Engineering Essentials" seminar along with two colleagues sponsored by the Society of Automotive Engineers (SAE); (fall 1996, winter 1997, fall 1997, winter 1998).
- Statistics Review and Experiment Design - Fridgidaire, Greenville MI, Summer 1995 & '96

Service to Industry Continued

- Delivered the seminar titled, "Manufacturing Engineering Essentials" along with two colleagues for Grand Valley State University (winter 1998)
- Developed and deliveried a customized Statistics/Design of Experiments course for Rexair, Inc., Cadillac, MI. (summer/fall 1998)
- Devloped and delivered a basic Process Capability training course for Frigidaire, Greenville, MI (winter 1999)

Services to University (5 year window)

- Tenure Policy Review Committee. Helped in streamlining and rewriting the department tenure policy; 1997-1998.
- Tenure Track Faculty Tenure Committees:
  - Larry Langell (current)
  - Served on Larry Shult's tenure committee. Larry was granted tenure winter 1998.
  - Mark Rusco (current)
  - Serve as Joe Wist's tenure committee chair (current)
  - Blaine Danley (current)
- Mentored: Mark Rusco (1999-2000), Blaine Danley (2000-2001), Joe Wist (2001-2002);
- ***Active*** Advisor to the student chapter of the Society of Manufacturing Engineers (SME); (current)
- Serving on curriculum review committee for manufacturing engineering technology program; (current)

Scholarly Activity (5 year window)

- Presented paper entitled, "Integrating Course Work in Manufacturing Engineering Technology" , at the Annual Region Conference of the American Society for Engineering Educators (ASEE); April, 1998)

Services to Community

- Director of Adventure Ministries at Trinity Fellowship Church, Big Rapids, MI. (current)
- Hire 25 Jr. & Sr. high school students annually (May-June) to hand harvest 50 acres of asparagus

Workshops and Seminars Attended, College Course Work Completed

- Programmable Logic controllers; Allen Bradley Corp. Sponsored by Grand Valley State University. Fall 1997.
- Response Surface Methods; StatEase Corporation. Minneapolis, MN. Summer 1997.
- Differential Equation; (MATH 330); Ferris State University (winter '99); Grade: A-
- Linear Algebra; (MATH 322); Ferris State University (fall '99); Grade: A
- Three Dimensional Solid and Parametric Modeling (CDTD 390); Ferris; (winter '01); Grade A
- Introduction to Chemistry; (CHEM 103); Ferris; (fall '01; current)

Home:
17315 Outer Drive
Big Rapids, MI 49307-9049
(231)796-0962
jim_rumpf@hotmail.com

Office:
Swan 108, 915 Campus Drive
Big Rapids, MI 49307-2291
(231)591-3591
rumpfj@ferris.edu

JAMES A. RUMPF

EDUCATION

June 1982 — Bachelor of Science in Mechanical Engineering
General Motors Institute (now Kettering University), Flint, MI.
Thesis topic: "Computer-based Energy Management System Requirements for Fisher Body - Pittsburgh"

April 1988 — Master of Science in Electrical Engineering,
University of Pittsburgh, Pittsburgh, PA.
Thesis topic: "An Assembler for the Texas Instruments TMS32010 Digital Signal Processor"

Additional coursework in Ph.D. program in Industrial Engineering at Western Michigan University, Kalamazoo, MI.

EXPERIENCE

August 1990-present — Ferris State University, Manufacturing Engineering Technologies Dept.
Swan 108, 915 Campus Drive, Big Rapids, MI 49307-2291

Employed as Associate Professor in the Manufacturing Engineering Technology program.

Main responsibilities include teaching junior- and senior-level courses such as Automation & System Design, Computer Applications for Manufacturing Engineering, Industrial Engineering, Plant Layout, Metal Stamping Processes, Cost Estimating, and Engineering Economics, as well as consulting with industry through Ferris' Technology Transfer Center. Student advising, lab development/maintenance, course development, and applied research/ publishing are other major duties. I have been the internship coordinator for nine years, and have been an SME student chapter faculty advisor for eleven years. I was also the initial project director of a new multi-disciplinary metal stamping program delivering coursework to clients via distance-learning technology. Since 1995, I have also taught the "Manufacturing Engineering Essentials" and "Quality Engineering Essentials" seminars with two colleagues for SAE.

August 1987-April 1990 — Society of Automotive Engineers, Inc.
400 Commonwealth Drive, Warrendale, PA 15096

Employed as Staff Engineer-Land & Sea Technical Division.

Responsibilities included providing staff engineering services to technical committees for various areas of the ground vehicle industry (particularly manufacturing technologies), overseeing referee materials, engineering aids, and product performance review programs (such as the Lubricant Review Institute), and reporting on SAE activities to various directing boards and other organizations such as ISO and ANSI. Also worked with several board-level committees on such topics as computerization and international harmonization. This position required an understanding of all aspects of the ground vehicle design and production, as well as extensive travel for meetings with all levels of auto- and aerospace company executives from design engineers to vice presidents of engineering.

May 1982-
August 1987

General Motors Corp., Buick-Oldsmobile-Cadillac Group,
Pittsburgh Manufacturing (formerly Fisher Body - Pittsburgh)
PO Box 158, McKeesport, PA 15134.

Employed as Manufacturing Engineer.

Responsibilities included planning and initiating factory automation and plant facilities projects, then performing the duties associated with project conception and design through equipment specification, fabrication, and installation to start-up and troubleshooting. All phases of project management, as well as mechanical and electrical design, were performed. Traveled to many different GM and vendor sites and became familiar with many different aspects of manufacturing. Made numerous presentations to senior managers for information update and business planning. Worked concurrently with GM Tech Center staffs on a variety of subjects including automation, robotics, production process/DFMA, project appropriations and budgets, and plant modernizations. Also assumed duties of Area Manager of Rear Door and Tailgate Assembly, responsible for production, maintenance, technical support, and direct supervision of hourly personnel.

August 1977-
April 1982

Fisher Body Division, General Motors Corporation, Pittsburgh Plant.

Employed as a Cooperative Education Student.

Gained experience through work assignments in each department of the plant and the Manufacturing & Development Staff at the GM Tech Center in Warren, MI. This provided me with thorough exposure to many business aspects of the auto industry.

PROFESSIONAL SOCIETIES

Society of Manufacturing Engineers, Senior Member and Faculty Advisor
Society of Automotive Engineers, Full Member
Institute of Industrial Engineers, Full Member

REPRESENTATIVE SAMPLE OF MAJOR PROJECTS FOR INDUSTRIAL CLIENTS WHILE AT FERRIS STATE UNIVERSITY (PROPRIETARY WORK NOT INCLUDED)

Types of Projects	Companies
Plant layout/rearrangement for improved product flow and space utilization	Nicholas Plastics, Grand Haven Furniture Products, Transmatic
Custom course development and delivery	
• Waste Reduction/Lean Manufacturing	Frigidaire
• CAD	IBM
• FMEA	Diesel Technology, Frigidaire, Grand Traverse Stamping, Dura Automotive
• Motion & Time Study	Lacks, Knoll Group
• Robotics	Sandmold Systems, Donnelly
• Metalworking processes	IMI
• Automation systems (via CBT)	Fiamm
• Poka-Yoke/Problem Solving	Dura Automotive
• Quality Function Deployment	Fastco
ISO 9000 documentation of production process procedures	Haworth

GARY L. OVANS

15882 Belmont Drive
Big Rapids, MI 49307 616/796-6582

PROFESSIONAL OBJECTIVE:

To teach and contribute to academic leadership in the disciplines of Engineering Technology and Education.

EDUCATION:

Master of Science Degree in Occupational Education: November 1991. Highest distinction.

Bachelor of Science: Industrial Technology, 1976, University of Wisconsin-Stout, Menomonie, WI

Bachelor of Science: Sociology and Physics, 1975, University of Wisconsin-Eau Claire, Eau Claire, WI

Non-Degree Course Work:
Innumerable workshops and seminars, 1984 to present
Quality Science Certificate, Advanced Technical Studies 4 semesters,
12 Credits, May 1997, Ferris State University, Applied Technology Center
Groundwater and Distribution, Wastewater Management, Wastewater Lab & Disinfection, 1983, Waukesha County Technical Institute, Pewaukee, WI
Lifecycle Cost Analysis, 1981, North Central Technical Institute, Antigo, WI
Graphic Design, 1978, Milwaukee School of Engineering, Milwaukee, WI

U.S. Airforce Military Schools:
Airforce Supervisor/Management Training, 1972
Aircraft Loadmaster/Scanner, 1971
Electronic Monitoring and Analysis, 1964-65
Basic Survival, Arctic Survival, Water Survival courses, 1974-1976

INDUSTRIAL EXPERIENCE:

1985 to present:
Consulting, training seminars, and workshops
1976-1985:
Wauskesha Bearing Corporation, Manufacturing Engineer
Harley Davidson Motor Co., Process Engineer
FMC-Rolens Corp., Production Engineer
Chrysler Corp./Chrysler Marine, Process Engineer

Ferris State University and Community Service

Ferris State University – Program Coordinator, Manufacturing Engineering Technology, Quality Engineering Technology

Member: Academic Program Review Council of the Academic Senate
Member: Arts & Lecture Committee through 1997
Participant: Autumn Adventure, College of Technology
Member: Department Tenure Committee, formerly Chair
Coordinator: Society of Manufacturing Engineers, Student Chapter field trips
Proctor: SME Certified Technologist Examination

Community Service

Boy Scouts of America, Troop 114, Big rapids, Michigan. Assistant Scout Leader
4-H, Mecosta County, Adult Leader, Aerospace / Rocketry

Continuing Education – Workshops and Seminars Attended

1993 Stata Matrix ISO-9000 Lead Assessor workshop, Minneapolis, MN, one week
1995 Metrology Seminar, Burton Precision, Grand Rapids, MI, one day
1995 Material Handling Teachers Institute, Montana State University, Bozeman, MT, one week
1996 Summer Faculty Institute, Ferris State University, Big Rapids, MI
1997 Experimental Design Made easy, Stat-Ease, Inc., Minneapolis, MN, one week

Service to Industry – Workshops and Seminars Instructed

1993 ISO 9000 Executive Overview Seminar through Ferris State University, Technology Transfer Center
1994 Statistical Process Control Workshop, Fitzsimmons Manufacturing, through Ferris State University, Technology Transfer Center
1995 Statistical Process Control Workshop, Lobdell Emery Corporation, through Montcalm Community College
1996 Industrial Engineering Workshop, The Knoll Group Office Furniture Division, Grand Rapids, MI
Currently Conducting Quality Engineering Essentials and Manufacturing Engineering Essentials Seminars through the Society of Automotive Engineers and Grand Valley State University

MILITARY EXPERIENCE:

Completed 21 years of Active and Reserve Duty in the United States Airforce World-Wide Service

Four years as an Electronic Intelligence Collector and Analyst

Seventeen years as a Combat Aircrewman on C-130 Hercules Aircrew

PROFESSIONAL:

Society of Manufacturing Engineers, Senior Member, Certified Manufacturing Engineer

HOBBIES:

Fishing, canoeing, scuba diving, reading, traveling, hunting, hiking, opera and theatre, gardening

Blaine R. Danley

14399 McCaslin Lake Rd.
Linden, MI 48451
(810) 735-1647

OBJECTIVE

Apply my educational and professional experience to teach material science, welding and manufacturing engineering to undergraduate students.

EDUCATION

May 1991 **M.S., Metallurgical and Materials Engineering**
Michigan Technological University, Houghton, MI

May 1988 **B.S., Metallurgical and Materials Engineering**
Michigan Technological University, Houghton, MI

EXPERIENCE

June 1997 – present

Delphi Automotive Systems
Flint, MI

Senior Manufacturing Engineer

- Developed materials and manufacturing process for solid oxide fuel cells
- Evaluated fuel cell designs for reliability, cost, and ease of manufacturing
- Developed plasma spray process to apply protective coating on oxygen sensor elements
- Designed, installed, and qualified plasma spray equipment for oxygen sensor production
- Evaluated accelerated durability test results for oxygen sensors

June 1995 – June 1997

General Motors Corporation
Delphi Automotive Systems, Flint, MI

Senior Experimental Metallurgist

- Developed and taught beginning and advanced courses on welding engineering to process engineers within General Motors
- Evaluated and specified equipment for metallurgical laboratory and supervised lab personnel
- Performed failure analysis on automotive components from accelerated tests and field failures
- Developed materials and procedure to weld nodular cast iron to stainless steel for exhaust application
- Specified and evaluated materials for automotive exhaust systems

June 1992 – June 1995

General Motors Corporation
AC Rochester Division, Flint MI

Process Development Engineer

- Troubleshoot welding processes involving GMAW, GTAW, plasma, and resistance welding
- Programmed robots for various welding and part handling applications
- Applied "Design of Experiments" methodology to study various manufacturing processes
- Performed metallurgical analysis of components to qualify production equipment/processes

EXPERIENCE, continued

June 1991 – June 1992

General Motors Corporation
AC Rochester Division, Flint, MI

Associate Engineer

- Assigned to National Institute of Standards and Technology (NIST) in Boulder, CO to co-develop a system to monitor GMAW and GTAW processes
- Implemented GMAW and GTAW process monitoring on production equipment
- Presented paper at AWS Conference "Commercialization of Advanced Joining Technology Through Industry-Government Partnering"

September 1989 – June 1991

Michigan Technological University
Houghton, MI

Graduate Research Assistant

- Completed thesis on *"A TEM Study on the Morphological Stability of Polycrystalline Thin Films"*
- Performed TEM and SEM analysis of thin films
- Produced thin films using sputtering and CVD techniques

November 1988 – August 1989

Howmet Corporation
Wichita Falls Casting Div., Wichita Falls TX

Plant Metallurgist

- Responsible for calibration and certification of metallurgical lab equipment to commercial and military aircraft engine specifications
- Supervised metallurgical laboratory personnel
- Responsible for vacuum heat treatment department

June 1988 – November 1988

Howmet Corporation
Whitehall Casting Div., Whitehall, MI

Associate Metallurgist

- Trained in manufacturing methods to produce super alloys for investment casting
- Trained in all aspects of investment casting equiaxed, directionally solidified, and single crystal aircraft engine turbine parts including molding, casting, heat treatment and inspection

ADDITIONAL TRAINING

- Moderated graduate level courses for General Motors "Technical Education Program"
  - Materials in Design and Manufacturing, *University of Michigan*
  - Welding and Joining, *Massachusetts Institute of Technology*
  - Manufacturing Processes, *Columbia University*
- DFMEA, PFMEA
- Design of Experiments (DOE), Shanin
- Statistical Process Control
- Robotics (Motoman, Fanuc, Panasonic)
- Member ASM International
- Member American Welding Society

Joseph A. Wist

905 Fairmount
Grand Rapids, MI 49506
(616) 233-4733 home

Objective:

To obtain a teaching position utilizing my Mechanical, Manufacturing, and Metallurgical Engineering Backgrounds

Education:

Michigan Technological University
Houghton, MI

Master of Science in Metallurgical Engineering - received April 1992
Bachelor of Science in Mechanical Engineering - received May 1989

Experience:

Manufacturing Engineer
BentelerAutomotive (June 1999 – Present)

- Provided front line support for the high volume production of side impact door-beams for General Motors, Chrysler, Ford, Toyota, etc.
  - ⇒ Increased productivity in the 12 weld cell assembly stations ~ 7 % through improvement in assembly tooling, floor management, and troubleshooting to keep production running.
  - ⇒ Provided support to General Motor's product development team to increase first time success for launches and to initiate cost cutting.
  - ⇒ Involved in all production related corrective actions, including determining the root causes and implementation of corrective measures
  - ⇒ Trouble-shooting of tooling and assembly components and processes on a daily basis to ensure acceptable assemblies were being produced.
  - ⇒ On a daily basis reviewed all scrap produced and initiated corrective actions and poka-yokes to decrease scrap
- Lead tooling design and build for BMW Seat Belt Anchor tooling.
  - ⇒ Determined new clamping and component presentation schemes to increase tool repeatability
  - ⇒ Worked with quality engineers to increase tolerances where it seemed appropriate to aid in manufacturability, without effecting customer quality.
- Lead person to determine and implement process improvement to decrease scrap generated in the heat treating of DB200 tubing
  - ⇒ Evaluated process and has initiated purchase of process control devices (pyrometers, flow controls, meters, laser measurement system) to gain process control and the ability to measure quality
  - ⇒ Implemented process tracking logs and scrap recording sheets to correlate quality with process settings.

Manufacturing Engineer
MacDonald Industrial Products (March 1998 – June 1999)

- Performed all aspects of engineering support for low pressure and high pressure aluminum die cast and secondary operations
  - ⇒ Reduced low pressure die cast scrap 30% on largest low pressure product
  - ⇒ Daily involvement in resolution of quality and production issues

- ⇒ Eliminated the need to 100 % inspect parts at 2 operations for the largest aluminum die cast customer, through continuous improvement and error proofing
- ⇒ Determined and implemented root cause error & mistake proofing for Corrective Action Requests
- ⇒ Increased polishing productivity for zinc window surround from 460 pieces per cell to 530 pieces per cell

  Implemented standardized polishing practices and mechanisms to deal with varying incoming product

  Established and utilized auditing to evaluate compliance to systems by operators and production supervision

- Core team member in preparing for QS9000 certification and subsequent 3rd edition certification
- Managed tool room helping facilitate die repair and preparation for production.
- Purchased Visi-Trak shot monitoring and control to aid in die cast process control

Manufacturing Engineer - G.M. Powertrain Bay City (Sept. 1995 – Feb. 1998)
Welding Engineer- G.M. Lansing Automotive Div.
Aerotek Contract Engineering Services

Die Cast

- Provided all aspects of engineering support for production of die cast transmission components
  - ⇒ Determined and implemented process and process monitoring systems
  - ⇒ Initiated the use of new die cast lubricant resulting in increases of productivity of 25%
  - ⇒ Initiated Pareto scrap analysis
  - ⇒ On a daily basis determined root causes of scrap and implemented corrective actions
  - ⇒ Supported tool room in determining degree of die repair required and interpretation of CMM results
  - ⇒ Performed all aspects of purchasing for replacement tooling, equipment, and stores setup
- Assisted in developing and implementing a die repair and approval process to meet QS 9000 requirements.
- Developed Uniform Best Practices for numerous operations within the die cast area
- Managed the pre-production approval of die cast dies
  - ⇒ Coordinated die sampling, gage room CMM data collection for dimensional analysis, and machining of samples to facilitate PPAP approval of dies
  - ⇒ Initiated outside sampling of dies, thereby eliminating the need to break into production schedules
  - ⇒ Tracked die build, die approval, and visited vendor sites to review progress and resolve open issues.

Welding

- Performed tooling verification of resistance spot welding (RSW) robotic, hard tooling, and manual welding stations within construction sources
  - ⇒ Aided in troubleshooting of integrated weld tool equipment
  - ⇒ Interacted with process engineers and build sources to facilitate tool construction and compliance to General Motors weld tooling standards
  - ⇒ Developed and authored weld tool verification procedures
- Determined algorithms for the development of a database management system for weld tool design and process documentation
- Audited weld gun suppliers for compliance to gun buy off testing procedures

Manufacturing Research Associate (June 1993 -July 1995)
Ohio State & Michigan Technological Universities
Columbus, OH; Houghton, MI

- Developed RSW experimental testing methods and equipment
  - ⇒ Instrumented a resistance spot welder to determine tendency of various electrode materials to stick during the RSW process
  - ⇒ Performed testing, data analysis, and aided in experimental design for graduate students.
  - ⇒ Identified and aided in proposal to study the wear related to RSW of aluminum (funding was granted)

Advanced Manufacturing Development Engineer (August 1992 - May 1993)
Ford Motor Company
Detroit, MI

- Determined critical weld/weld bonding process variables and their optimum levels for the high volume production of an aluminum intensive body in white
  - ⇒ Lead and coordinated DOE testing occurring at 4 testing sites
  - ⇒ Evaluated and directed equipment and facilities for a temperature controlled RSW laboratory
  - ⇒ Provided technical support to product and materials groups concerning welding issues

References & Publications

Available Upon Request

Publications

"Electrode-Work Piece Sticking on Electrogalvanized Steel," J.A. Wist, C.L. White, M.D. Gugel and F. Liu; Sheet Metal Welding Conference VII; American Welding Society; Detroit, MI; Oct. 9, 1996.

'The Influence of Resistance Spot Welding Electrode Alloy Type on the Nature of Electrode Wear and Tip Life," J.A. Wist, C.L. White, M.D. Gugel, and F.E. Goodwin: 4th International Lead Zinc Coated Sheet Conference; Paris, France; Intergalva Conference Proceedings, June 8, 1994.

"Progression of Electrode Wear During the RSW of EG Steel", M.D. Gugel, J.A. Wist, C.L. White; Paper#A3; Sheet Metal Welding Conference V; American Welding Society; Detroit, MI; Oct. 7, 1992.

"Comparison of Electrode Wear in DSC Electrodes Having Different Hardnesses", Paper#A4; M.D. Gugel, J.A. Wist, and C.L. White; Sheet Metal Welding Conference V; American Welding Society; Detroit, MI; Oct. 7, 1992.

"The Metallurgical Aspects of Electrode Wear during the Resistance Spot Welding of Zinc Coated Steels", J.A. Wist and C.L. White; Sheet Metal Welding Conference IV; American Welding Society; Detroit, MI; Oct. 10, 1990.

Section 10

Enrollment Trends

SECTION 10

ENROLLMENT TRENDS

A. INTRODUCTION

The Quality Engineering Technology B.S. is offered at the Applied Technology Center in Grand Rapids on an evening basis. The enrollment is restricted to part-time students; that is, those who are working in industry and are pursuing a degree as an evening-college offering.

QET students typically fall into the following categories:

- Students who intend to transfer into QET yet may be listed with their former program, as they may have AAS requirements to fulfill. This is rare.
- Pre-technical students-taking QET courses out of the main sequence until they can be formally admitted to the program.
- Part-time students who primarily reside in the Grand Rapids area. Some commute from as far away as Kalamazoo and Lansing. These individuals constitute the majority of students taking QET course work.
- A few MFGE majors from on and off campus (evening students at Grand Rapids) who elect to take an additional course (MFGE 443-Continuous Improvement), which is not part of the manufacturing engineering technology core curriculum. Taking this course in combination with 3 courses offered in the MFGE core provides an opportunity to earn a **Quality Technology Certificate**. These students would not appear as certificate enrollees. Table 10-1 shows our various counts for the last five academic years.

Table 10-1
Student Enrollment in QETO per Academic Year

	Academic Year								
Category		**1996-97**	**1997-98**	**1998-99**	**1999-00**	**2000-01**			
QT		5	2	1	1 (0?)	1			
QETO		8	7	13	6	13			
MFGE		120	103	103	101	107			
PRE MFGE		1	2	3	3	3			
MFGE total		134	114	120	111	124			

Table 10-1 Key
QT-quality certificate student
QETO-off-campus quality engineering technology majors
MFGE-on and off-campus manufacturing engineering technology majors
PRE MFG-on-campus pre-manufacturing students

Source: FSU Fact Book, Institutional Research And Testing, 2000-2001

B. ON-CAMPUS ENROLLMENT

This is non-applicable, as the program is not currently offered on campus.

C. OFF-CAMPUS ENROLLMENT

The B.S. QET was fully integrated into the program offerings at the Applied Technology Center in Grand Rapids in 1996. Since it is offered only to evening-college students, its market is essentially restricted to individuals who are working full-time, and are picking up a bachelors degree as a means improving their knowledge base, and as a vehicle to gain a promotion. The lack of residence halls, and the fact that a full complement of degree courses are not available each semester to these students, restricts student participation to those who are able to commute. The maximum commuting distance, based upon our knowledge of the location of student residences, is approximately 70 miles.

The aforementioned factors impose a limit upon the pool of potential students from which the QETO Grand Rapids program can draw. Since, however, there is a robust industrial base within a 70 mile radius of the ATC, one might ask the question as to the adequacy of the marketing of the QETO offering. The large number of manufacturing organizations employ large numbers of individuals engaged in quality assurance functions. Existing methodologies with respect to programmatic marketing need to be evaluated as to their effectiveness in getting the word out to those who may be qualified to enter the program, and have a desire to improve their credentials. Other mechanisms, such as, promoting the program through the auspices of The American Society of Quality, should be explored.

Section 11

Program Productivity

SECTION 11

PROGRAM PRODUCTIVITY

A. INTRODUCTION

Productivity information was obtained from the Office of Institutional Studies. The tabulations are organized under University, College, Department, and course prefix headings. The data listings include the following:

- Student Credit Hours (SCH)
- Full Time Equated Faculty (FTEF)
- Ratio of Student Credit Hours per Full-Time Equated Faculty (SCH/FTEF)

Ranked listings for the SCH/FTEF ratio are presented for the following categories.

- College
- Course Prefix

B. PRODUCTIVITY DATA FOR THE MFGE (QETO) PROGRAM

Table 11-1
Student Credit Hours Generated (MFGE+MATL prefixes)

Year	Summer	Fall	Winter	Fall+Winter
1995-96	192	1694	1381	3075
1996-97	252	1653	1218	2871
1997-98	234	1639	1116	2755
1998-99	251	1403	1185	2588
1999-00	213	1564	1460	3024

Table 11-2
Full Time Equated Faculty (MFGE+MATL prefixes)

Year	Summer	Fall	Winter	Avg (Fall/Winter)
1995-96	1.17	6.97	7.00	6.99
1996-97	1.75	6.71	5.81	6.26
1997-98	1.75	7.28	7.26	7.27
1998-99	1.92	6.72	7.17	6.95
1999-00	1.75	6.38	7.44	6.91

Table 11-3
SCH/FTEF ratio (MFGE+MATL prefixes)

Year	Summer	Fall	Winter	Fall+Winter
1995-96	164.41	234.04	197.29	431.33
1996-97	144.	246.35	209.64	455.99
1997-98	133.71	22514	153.72	378.86
1998-99	130.73	208.78	165.27	374.05
1999-00	121.71	245.14	196.24	441.38

Over the period reported, statistical data for SCH, FTEF, and SCH/FTEF ratios for the MFGE program are as follows:

Table 11-4
Statistical data for SCH, FTEF, and SCH/FTEF Ratio, 1995-2000

Category	Mean	Standard Deviation	95% Confidence Interval
SCH	2862.60	198.883	2464.83 to 3260.37
FTEF	6.88	.372	6.14 to 7.624
SCH/FTEF	416.32	37.473	341.37 to 491.27

The standard deviation calculation assumed that the data were samples of the population, and was calculated using the "nonbiased" or "n-1" method. The 95% confidence interval for mean values is equivalent to ±2 standard deviations.

The productivity report rank orders the colleges, departments, and programs within the university for the 1999-2000 (Fall + Winter) school year.

Table 11-5
College of Technology
Ranking of Programs by SCH/FTEF Ratio for 1999-2000

Rank	Program Name	Prefix	SCH/FTEF*
1	Construction Management (BS)	CONM	582
2	Manufacturing Engineering Technology (BS)	MFGE	441
3	Automotive and Heavy Equipment Management (BS)	AHEM	386
4	Welding Engineering Technology (BS)	WELD	349
5	HVACR Engineering Technology (AAS/BS)	HVAC	347
	College of Technology	**COT**	**332**
6	Plastics Engineering Technology (BS)	PLTS	303
7	Surveying Engineering (BS)	SURE	262
8	Printing Management (BS)	PMGT	239

* - ratio rounded to nearest whole number

This data shows that the MFGE program ranks as second best program overall in the College of Technology, the best of all engineering technology programs, far above the College of Technology aggregate productivity level.

D. PRODUCTIVITY ATTRIBUTED TO QUALITY SPECIFIC COURSES

During the course of obtaining a QET degree, students take many courses that are coincident to the Manufacturing Engineering Technology degree. Similarly, Manufacturing students wishing to earn a certificate in Quality are required to take a course unique to the Quality Engineering Technology program (Continuous Improvement, MFGE 443). There are six courses that are considered to be unique to the QET offering. Examining the student #'s in these courses through the most recent cycle of their schedule, offers a better view of the productivity of the QET program.

Table 11-6
College of Technology
Student Credit Hours Generated by Program Specific Courses

Credits	Course	Prefix	SCH/ FTEF*
3	Continuous Improvement	MFGE 443	24
3	Quality Auditing	MFGE 444	33
3	Reliability Engineering	MFGE 445	27
3	Design of Experiments 2	MFGE 446	21
3	Organizational Behavior	MGMT 302	Not Offered
3	Continuous Improvement, Tools & Technology	*STQM 311	39
	Total		105

* Equivalent taken at Grand Rapids Community College

E. LIMITING FACTORS

The prime constraining factors that restrict the SCH's generated:

- Less than effective marketing
- Limited facilities – physical constraints on section sizes

Section 12

Conclusions

SECTION 12

CONCLUSIONS

A. THE QET PROGRAM GOALS AND OBJECTIVES ARE CENTRAL TO THE FERRIS MISSION

The QET program provides the kind of hands-on technical education central to the College's and University's stated mission. Its graduates have productive careers in industry. An unsolicited testimonial letter is included in this section. It is a letter from Anita Fagerman; a person that felt compelled to write to Gary Ovans upon receipt of the industry survey. Anita is very complimentary of the program, especially the technical content of the program as well as the hands-on aspects of FSU education.

B. THE QET PROGRAM IS UNIQUE

As stated earlier, the QET program at FSU seems to be one of four (4) baccalaureate degrees in some form of Quality Control/Engineering/Technology offered in the entire United States (per e-mail from Raymond Dickinson to Gary Ovans, dated 01/30/2001. A copy of this e-mail is included at the end of this Section). Further research on the web of these specific programs/institutions reveal programs that are an amalgamation of pre-existing business, engineering, and statistics classes. By modeling the ASQ CQE body of knowledge, the FSU QET program is uniquely positioned as the only program specifically designed to provide Quality Engineers with the exact tools they need to be successful in the burgeoning field of quality.

C. THE QET PROGRAM PROVIDES IMPORTANT SERVICES TO THE LOCAL COMMUNITY, THE STATE, AND THE NATION

QET alumni, faculty, and students provide services to the state and the nation. The program provides service by generating a supply of well-educated and trained Quality Engineers.

Genichi Taguchi, a well-known and widely respected Japanese quality guru who came to the U.S. to help such companies as Ford and Xerox, has a specific model for deviation in manufactured parts. He says that any deviation from print nominal, even if the parts are within specification, is waste. And not only waste to the manufacturing plant, but a waste to all of society (Taguchi Techniques for Quality Engineering, Philip J. Ross, McGraw-Hill, 1988). A traditional goal of quality is to minimize variability and to minimize variation from print nominal, and in this way contribute not only to the success of the company but also to the betterment of all of society. Grandiose thinking to most Americans, but an embodiment of the essence of Japanese thinking. Basically, a small

improvement made every day soon adds up to benefits for all, and it is the role of Quality Engineers to lead the way in reduction of process variation.

Ferris QET graduates help keep Michigan industry strong and prevent the export of jobs to other states or countries where the labor cost is much less. This helps maintain Michigan's tax base, and helps support other job sectors important to Ferris such as construction, education, business, and health services by providing expanded markets for their services. Ferris QET grads help make employment of other Ferris grads necessary and possible.

D. THE QUALITY OF INSTRUCTION OFFERED BY THE QET PROGRAM IS EXCELLENT

There are a number of elements involved that promote the quality of the instruction for QET students. These include factors relating to curriculum, laboratory exercises, faculty, and other resources of the College of Technology and the University.

The curriculum is modeled on the most widely accepted body of knowledge for Quality Engineers, the ASQ CQE certification. The current state of the curriculum can be monitored and the success of the presentation of the material to the student can be monitored with the additional requirement that all graduates sit for the ASQ CQE certification exam.

The QET laboratory exercises permit the student to enhance their classroom experiences. They learn to work together as teams and yet pull their own weight as individuals. They make individual and team presentations throughout their coursework, and apply their skills to situations very similar to those encountered in industry. Also, since the current students are all full time employees in the quality field, they can network to share experiences and solutions to real life issues beyond their time at FSU.

The QET faculty are well qualified. Present program faculty have more than ten years industrial experience and are constantly trying to increase their knowledge and experience in the field.

E. THE QET PROGRAM HAS LESS THAN ADEQUATE LABORATORY FACILITIES AND EQUIPMENT TO MAINTAIN A HIGH QUALITY PROGRAM

The laboratory facilities available to QET students include the following.

- Measuring tools in the ACT machine shop lab shared by the MFGE students in Grand Rapids and the QET students

- A small area in the ACT machine shop equipped with more elaborate measuring equipment which all belongs to GRCC.
- Communal computer lab (Room 220) in the ACT building.

These facilities, when accessible, provide a questionably adequate hands-on experience for the student due to lack-, condition-, and quantity of equipment. Since all Grand Rapids classes are held in the evening, the main competition for these facilities is with the FSU MFGE program and not with GRCC. Even though all MFGE faculty work to share the limited resources and conflicts are handled appropriately, there still seems to be an air of compromise in the two programs (MFGE and QET) which generate more FSU-Grand Rapids dollars to their programs than any three programs combined.

F. LIBRARY INFORMATION RESOURCES ARE LESS THAN ADEQUATE

Because the QET program is based solely in Grand Rapids, any library resources located in Big Rapids are virtually inaccessible to the Grand Rapids students. The MFGE program houses a small selection of quality related materials in the library in Gary's office, but the QET students have no access to them. We are fortunate that so much quality information is available on the web, and that the working students in Grand Rapids often have access to materials through their own work.

9107 E 30 RD
Cadillac, MI 49601
July 5, 2001
(231) 775-6390

Gary Ovans
College of Technology
Ferris State University
915 Campus Drive, SWN 109
Big Rapids, MI 49307
Ph: (231) 591-2511
Fax: (231) 591-2407

RE: INDUSTRY SURVEY

Dear Gary:

I am in receipt of your industry survey requesting review of the Bachelor of Science Degree in Quality Engineering Technology. Unfortunately I am unable to complete the survey since I have recently left employment in the manufacturing environment.

I am very impressed with your program, and feel compelled to write a short note to your attention with this in mind. I have served as Quality Manager for an automotive and furniture roll forming, stamping and welding shop for over six years. Prior to this position, I was a statistician and quality engineer for a different automotive manufacturing company. I am a member of the American Society of Quality and hold the Certified Quality Engineer certificate. I am currently studying for the Certified Quality Manager certificate. I feel I am qualified to comment about your program.

Upon receipt and review of your program summary, I felt an overwhelming sense of being out of touch with the world. I say this for the reason that I have always been a very strong advocate of continuing education and have constantly sought out programs of study such as yours. I have been oblivious to your program's existence. I have received numerous flyers and mailings regarding the field of quality engineering; I have contacted Northwestern Michigan College and Eastern Michigan University in search of such a program. I had no idea that Ferris provided this wonderful program.

In review of your program, I find that it follows the body of knowledge content of the American Society of Quality for the quality engineer certificate. The course content is precisely in line with the needs of the quality engineering function. I can identify the immediate application in manufacturing of each class offered in your program. I truly am in awe with the course content.

I have found, through actual experience, the significant importance of people skills. By this, I refer to teamwork, delegation, negotiation, facilitation, leadership, presentation and anything related to communicating to others. The role of quality engineer typically requires strong people communication skills. Skills of this nature may be a valuable addition to your program of study.

Your internship program, MFGE 393, is an excellent method of providing hands on experience. As Quality Manager I had looked for interns in quality engineering. In my own ignorance, I could not find any. I now recognize that I was looking in the wrong places.

Resultant of my comments above, I summarize my observations about the Quality Engineering Technology Bachelor of Science degree as follows:

- The body of knowledge is directly in line with the needs of manufacturing
- The internship is vital to build that body of knowledge

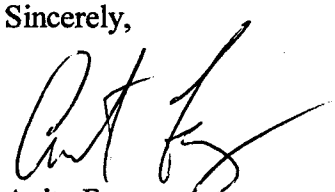
Suggestions for improvement are as follows:

- Build an awareness in industry about the program offered at Ferris
- Utilize the American Society of Quality to communicate your program offering
- Add people skills to your program (and make these skills real life skills)

As an added note, I have been given the privilege of teaching at Ferris this fall in the College of Business for Professor Mohammed El-Saidi as a statistics faculty. This is a nine-month assignment and I am very excited to have the opportunity to expand my experience.

I am hopeful that my comments will assist you with your quest for information. If you should have any questions or require any additional information, please feel free to contact me at (231) 775-6390 or afagerman@netonecom.net.

Sincerely,



Anita Fagerman

Raymond B Dickinson 01/30/2001 12:50 PM

To: Gary L Ovans/FSU@Ferris
cc:

Subject: Quality control/quality engineering/quality engineering technology schools

Gary,
I am not sure if you only wanted bachelor's degree institutions or not. Below is a list of those institutions around the country.

Quality Control
Indiana Institute of Technology
Baker College of Flint
Cleary College (MI)
Marquette University (WI)

Two colleges offer master's degrees in quality control:
University of Iowa
Northeastern University (MA)

Eleven colleges offer certificate degrees
Twenty-seven colleges offer associate degrees

Quality Engineering
No colleges offer a bachelor's degree

One offers a master's degree
University of Arizona

Two colleges offer certificate degrees
One college offers an associate degree

Quality Engineering Technology
Baker College of Flint
Ferris State Univ.

Seven colleges offer certificate degrees
Twelve colleges off associate degrees

So it looks like only four other institutions (Baker College of Flint is in two categories) offer baccalaureate degrees in some form of Quality control/engineering/technology.
Three offer master's degrees.
Twenty offer certificate degrees
Forty offer associate degrees

If you wish the names of the certificate and/or associate degree institutions, let me know.

Raymond B. Dickinson
Librarian
203 Timme Library
Ferris State University
(231) 591-3730

Section 13

Recommendations

SECTION 13

RECOMMENDATIONS

A. EXISTING PROGRAM STRENGTHS NEED TO BE MAINTAINED

- Faculty Recruitment

  The current QET faculty currently consists of one individual, Mark Rusco, whom teaches all of the QET classes and a limited number of MFGE classes. A limited amount of support is provided by Bruce Gregory, who is more than happy to do his share of night classes in Grand Rapids, but whose time is more useful in the MFGE core classes. There is a suitable number of adjunct faculty available in the Grand Rapids area. However, should the program grow significantly, or be duplicated at Big Rapids, the available faculty grows thin very quickly. The other risk of limited faculty is that students are exposed only to one viewpoint and the FSU QET program becomes, quite literally, the "Mark Rusco School of Quality." A diverse base of quality adjunct must be maintained to keep the QET program from becoming stagnant.

- Unique Program With Specific Ties to the ASQ CQE Body of Knoledge

  The program curriculum as originally designed is very complete and does a good job of modeling the ASQ CQE body of knowledge for quality engineers. This also makes the FSU program unique compared to other baccalaureate degrees which seem to be amalgamations of existing classes that are called Quality but don't provide the specific, rigorous statistical tools commonly used by Quality Engineers.

B. SOME PROGRAM AREAS NEED TO BE STRENGTHENED

- Program Marketing

  The enrollment numbers need to grow. It seems that those people who are exposed to the program are both impressed and excited about the curriculum. But specific audiences need to be targeted, ties to the associates degree from GRCC need to be strengthened, and a larger pool of students must be attracted to make the program become a strong partner to the MFGE program.

- Facilities & Equipment

  From the surveys from all of our customer groups, the QET group is doing an excellent job of insulating them from the inadequacies of our lab facilities. However, the insulation is wearing dangerously thin. It is not enough to merely not kill the goose that lays the golden eggs; the goose must occasionally be fed as well. A lab facility must be developed in Grand Rapids, and any hope of moving

the program to Big Rapids must be preceded by improvements to the weak metrology lab located in the Swan annex.

- Expand and Improve the Curriculum

  As noted, the original curriculum was very complete and well thought-out. However, in the interests of continuous improvement, it is time to revisit the curriculum and implement the changes proposed in the curriculum review section of the report.

In summary, we hope you appreciated the frank and open discussion of the high- and low-points of the QET program. By openly discussing the problems, we hope to come up with solutions to overcome them. We hope you agree that the material presented in this report supports a rating of "Enhance the Program" for the QET program. Thank you again for your time and consideration, and please feel free to contact any PRP member for more information.

Appendix A

Historical References

QUALITY ENGINEERING TECHNOLOGY PROGRESS
HISTORICAL INFORMATION

April 1992	Leadership of Grand Rapids section of American Society for Quality Control approach FSU at Applied Technology Center (ATC) regarding needs of West Michigan companies for education programs in quality.
December 1992	Quality Engineering Technology Advisory Committee established and holds first meeting at ATC. Ferris proposes content for BS in Quality Engineering Technology including a four-course professional development certificate in Quality Technology.
February 1993	FSU-GR announces Quality Technology Certificate series to Grand Rapids section of ASQC.
September 1993	First course offered in Quality Certificate offered at ATC.
May 10, 1994	First graduating class of Quality Certificate receive diplomas at ATC ceremony. There are 19 graduates representing 14 local companies.
Spring 1994	BS Quality Engineering Technology approved for implementation at Applied Technology Center
June 1994	American Society for Quality Control/Automotive Division establishes Juran scholarships for BS Quality Engineering Technology Program with the assistance of Grand Rapids section of ASQC.
December 2000	First graduates complete BS, Quality Engineering Technology program.
Spring 2001	Quality Engineering Technology curriculum completes five-year institution program review.

Prepared by: Paul W. Prins
03/06/2001

Ferris State University

Grand Rapids Center

April 14, 1992

Mr. Brian Horstmann
1545 Tremont Blvd. NW
Grand Rapids, MI 49505

Dear Mr. Horstmann:

Ferris State University and representatives of the West Michigan Chapter of ASQC invite you to attend an initial meeting on April 21 to discuss the feasibility of developing a B.S. degree in Quality Engineering Technology.

This has the potential of being the first Bachelor of Science degree in Quality Engineering Technology in the country.

The meeting is exploratory only and will cover the following topics:

1. An introduction to ASQC - their interest in curriculum development and why with Ferris.

2. An introduction to Ferris State University - College of Technology and their potential interest in a B.S. degree in Quality Engineering Technology.

3. Discussion of the broad terminal objectives of a B.S. program (what would the B.S. graduate be able to do, that the A.A.S. graduate can't do).

4. Validating the need for a B.S. curriculum:

    - Potential market for graduates.
    - Potential market for enrollees - full-time student vs. part-time student.
    - Michigan market vs. national market.

5. Relationship of a potential degree program to ASQC membership/association:

    - Curriculum Advisory Committee.
    - ASQC Certification requirement tie-in.
    - Potential donations for a model quality control lab both in Big Rapids and Grand Rapids.

6. The curriculum:

- Potential technical core course work.
- Total credit hour requirements and major components.
- Transferability from A.A.S. degrees (0 - 4 curriculum design vs. 2+2 curriculum design).
- Internship requirements/industry support.
- Possible satellite transmission of course work to other state/national locations.

7. Where do we go from here.

The meeting will take place on Tuesday, April 21 from 1:30 to 5:00 p.m. at the Applied Technology Center, Room 182.

FSU officials attending:

Joel Galloway, Dean, College of Technology
Ray Cross, Head, Manufacturing Engineering Technology Department
Bruce Gregory, Associate Professor, Manufacturing Engineering Technology
Steve Hickel, Associate Professor, Manufacturing Engineering Technology, Faculty Advisor for Student Chapter of ASQC
Paul W. Prins, Executive Director, Applied Technology Center

ASQC officials attending:

Mr. Andrew Grimm, Grand Rapids
Mr. Brian Horstmann, Grand Rapids
Miss Joann Kline, Grand Rapids
Dr. Ann O'Neill, Farmington Hills

We look forward to your participation.

Sincerely,

Paul W. Prins, Executive Director
FSU, Applied Technology Center

Quality Engineering Technology Degree Program Planning Meeting

Applied Technology Center
April 21, 1992
1:30 - 5:00 p.m.

AGENDA

1. An introduction to ASQC - their interest in curriculum development and why with Ferris.

2. An introduction to Ferris State University - College of Technology and their potential interest in a B.S. degree in Quality Engineering Technology.

3. Discussion of the broad terminal objectives of a B.S. program (what would the B.S. graduate be able to do, that the A.A.S. graduate can't do).

4. Validating the need for a B.S. curriculum:

    - Potential market for graduates.
    - Potential market for enrollees - full-time student vs. part-time student.
    - Michigan market vs. national market.

5. Relationship of a potential degree program to ASQC membership/association:

    - Curriculum Advisory Committee.
    - ASQC Certification requirement tie-in.
    - Potential donations for a model quality control lab both in Big Rapids and Grand Rapids.

6. The curriculum:

    - Potential technical core course work.
    - Total credit hour requirements and major components.
    - Transferability from A.A.S. degrees (0 - 4 curriculum design vs. 2+2 curriculum design).
    - Internship requirements/industry support.
    - Possible satellite transmission of course work to other state/national locations.

7. Where do we go from here.

Meeting: April 21, 1992 @ 1:30PM

Subject: Proposed BS in Quality Engineering Technology

Location: Advanced Technology Center
Grand Rapids, MI

Following are some elements proposed for addition to the meeting agenda.

1. Feasibility of a BSQET
2. Potential Advisory Board
3. Curriculum, including total number of credit hours
4. Market area
5. Feed through from area and state community colleges
6. Feed through to Masters degree level
7. Potential of satellite transmission courses to other locations in the state
8. Acceptance of correspondence courses from accredited schools (UofM, MSU, Wayne State, Western Michigan, U of Missouri, etc.)
9. Contacts to ASQC units interested in education
10. Contacts to Quality Forum, Subcommittee on Quality Education, now located at Proctor & Gamble
11. Potential Core and Elective Quality Control and Quality Engineering courses.
12. Tie in to ASQC Certification in Quality Engineering and Reliability Engineering
13. Transferable credits from Associates degree programs other than Quality Supervision and Quality Technology
14. Transfer of credits from other Baccalaureate programs
15. Common courses with other engineering technology programs
16. Potential of basic student program at Big Rapids

Proposed Quality Engineering Science
Technical Core Requirements As Presented By Andrew Grimm
At Joint ASQC/FSU Meeting April 21, 1992

Appraisal Methods Engineering - 6 credits

- Metrology (Advanced)
  - R & R Studies
  - Designing the Lab
- Mechanical Inspection and Test Equipment Design
- Electrical/Electronic Inspection and Test Equipment Design
- Computer Aided Inspection and Test Systems
- Inspection and Test Programming in Robotics
- Laboratory Design and Operation
- Process Control Instrumentation

Preventative Measures Engineering - 3 credits

- Advanced Quality Planning
- Inspection and Test Planning
- Control of Supplier Quality Systems
- Reliability Applications
- Problem Solving Measures
  - Statistical Analysis
  - Design of Experiments
  - Ishikawa Diagrams
  - Kepner/Tregoe
  - Pareto Analysis
- Designing Inspection and Test Stations in to the Work Process

Introduction to Quality Engineering - 3 credits

- Review of SPC Methods
- Probability Theory
- Statistical Quality Control
  - SPC - Statistical Sampling
  - Establishing Process Stability
  - Maintaining Process Stability
- Introduction to Inspection and Test Devices
- Introduction to Metrology
- Quality Control/Assurance Systems

Engineering Economy in Quality Engineering - 3 credits

- Methods Analysis of Inspections and Tests
    - Methods Measurement
    - Costing
- Cost Analysis of Inspection and Test Methods (Sampling/Control Charting)
- Cost of Controlling Process Stability
- Quality Cost Reporting
- Project Cost Analysis
- Quality Loss Function Theory (Taquchi)
- Pareto Analysis
    - Qualification Aspect (# of Defects)
    - Cost Aspect ($)
    - Lorenz Curves

Introduction to Reliability Engineering - 3 credits

- Life Cycle Diagrams
- The Weibull Distribution
- Life Cycle Testing
    - In Process
    - During Design Stage
- Using Weibull paper
- Markov Chains in Failure Analysis
- FMEA/FAMECA
- Mil-Std-702 Tables in Electronics Components Failure Analysis
- Multi-Vari

Product/Process Sampling Methods - 3 credits

- Mil-Std-105 Tables
- Mil-Std-414 Tables
- Skip Lot
- Relationships from Probability Theory
- Multiple Sampling Plans

Product/Process Control Charting Methods - 3 credits

- Variables Charts
    - Precontrol
    - X & R
    - X & S
    - X & R etc.
- Attributes Charts (p, c, u, np, etc)
- Control Chart Analysis
- Control Charts for Shortruns

Advanced Statistical Analysis for Quality Engineering - 3 credits

- Tests for Significance of Data
- Response Surface Analysis
- Stachastic Processes
- Lot Plot
- Evolutionary Operations
- Regression Analysis

Design of Experiments for Quality Engineering - 3 credits

- Survey of DOE types and categories
- Full Factorial Experiments
- Partial Factorial Experiments
    - Taguchi Method
    - Latin Square
    - Greco Latin Square

Quality Function Deployment - 3 credits

- Survey of the method
- The "House of Quality"
- Method Applications
- Team Project Assignment

Senior Project/Research - 6 credits

- Selection of Project or Research with Advisor
- Internship in Industry
- Project Presentation to Faculty

History of Statistical Quality Control & Reliability - 3 credits

- Walter Shewhart
- World War II & ABC Tables
- Developments in Aerospace
- Developments in Automotive
- Developments in Japan
    - Deming
    - Juran
    - Ishikawa
- Wiebull

Applications of Software Programs in Quality - 3 credits

- Analytical Software
- Test Sequence Programs
- Metrology Programs
- Control Chart Programs
- Sampling Programs

The Engineered Quality Plan (a capstone course) - 3 credits

- Total Quality Control/Assurance
- Management Responsibilities
- The Quality System Manual
- ISO 9000

PROPOSED TIMELINES

QUALITY SCIENCE CERTIFICATE

Completion Date	Task
September 9, 1992	Introduce concept to faculty
October 1, 1992	Present to ASQC Board
October 15, 1992	Submit semester courses for approval via College of Technology to Senate
November 22, 1992	End of Fall quarter - Senate approval
December 15, 1992	Develop marketing materials
January/February	Market certificate courses
March 3	Begin teaching first course spring quarter

QUALITY SCIENCE BACHELOR'S DEGREE
THIRD AND FOURTH YEAR BACHELOR'S DEGREE OPTION

Completion Date	Task
1992 Oct/Nov/Dec 30	Develop courses Develop curriculum Develop curriculum proposal Validate degree option
1993 Jan/Feb/March 30	Submit proposal for approval (department, College of Technology, Senate)
1993 April/May/June	Obtain Vice President approval Obtain Board of Control approval
1993 July/August 15	Market degree
1993 August 30	Begin classes

ASQC
Grand Rapids Section - 1001
P.O. Box 2324
Grand Rapids, MI 49501
616/776-0668

October 8, 1992

Mr. Paul Prins
Executive Director, FSU
Applied Technology Center
151 Fountain St. NE
Grand Rapids, MI 49503

Dear Paul,

It was a privilege to have you in attendance at our Section's Executive Committee meeting on September 24. Your presentation on the progress of the Bachelor of Science in Quality Engineering Technology Degree Program was very informative, and we are eagerly awaiting this March's initial course offerings as you described them.

I am personally thrilled by the swift pace with which our respective organizations have together been able to develop this new degree program. I'm also delighted by the enthusiasm with which Ferris State University has embraced the BSQET concept, and by this Section's Executive Committee's vote of unanimous support for the program. It is very exciting to be a part of bringing this concept to reality.

Thank you for your efforts in providing this educational opportunity to the Greater Grand Rapids and West Michigan areas.

Sincerely,

Brian J. Horstman
Chairman

BH/bf

3367 Woodwind Drive NE
Grand Rapids, MI 49505

June 14, 1993

Mr. Paul W. Prins
Executive Director
Applied Technology Center
Ferris State University
151 Fountain Street NE
Grand Rapids, MI 49503

Dear Paul,

I want to convey to you a number of elements concerning the work of establishing a baccalaureate in Quality Engineering at Ferris State University. These elements have come together in my mind during and after my attendance at the Annual Quality Congress of the American Society for Quality Control in Boston a few weeks ago.

First, Brian Horstman arranged a meeting with Jack West, the incoming president of the ASQC. The meeting concerned questions about the quality profession's job structure and, in particular, a quality engineer's role now and into the 21st century. Our committee pointed out to Jack the lack of this information. We then indicated to him the specific need on the part of Ferris for this information in our work in establishing the baccalaureate program. We also indicated that other schools who are interested in establishing a baccalaureate in Quality Engineering would need this information. Further, this information, not only the information needed for educational purposes, but information concerning all areas of the profession could prove strategically important to the society's future long range planning as well as to the private and public sectors of the nation. Jack agreed with us. A number of strategies for obtaining this information were discussed. Jack said that if a national survey cost less than $10,000, he could personally authorize the project. However, he would have to obtain permission from the ASQC Board of Directors if the study cost was between $10,000 and $100,000. Jack indicated that he felt that it would not be a problem to get board authorization for such an important project. To speed the process for our purposes at Ferris, Jack indicated that the annual salary survey would be going out soon and that if our

Ferris team could compose a series of questions concerning our requirements, he would see to it that these questions would get on this year's survey.

Second, since this is a new program and would be the first of its kind in the United States, and in the world for that matter, (the University of California - Long Beach program that we thought was first is actually a BSIT-Quality Option) I would strongly recommend that the program be designed along the ABET format and we formally apply to ABET as a full four year baccalaureate program in Quality Engineering, not as a baccalaureate program in Quality Engineering Technology as we are currently thinking. Influencing this changed thinking are talks with prospective users of this product and in particular Ford Motor Company. I have been led to understand that they do not regard engineering technology as an engineering degree. Although they might hire these graduates, they would not do so to fill "engineering" jobs. Since this baccalaureate we are proposing at Ferris would be the first of its kind in the US, the sensitivity of the degree should be strongly considered. Therefore, the basis for my strong recommendation.

Third, In line with the development of the BSQE, I would recommend the development of a concurrent BSQE in Health Care. This can be done by substituting manufacturing specific courses with Health Science courses. This means that Ferris's College of Applied Health Sciences be involved in the process now. I was led to this recommendation by a conversation with the Chairman-Elect of the Health Care Division of the ASQC. Dr. Randy Spoeri is the Director of Quality Engineering for HCFA (Health Care Finance Agency) the financing arm of the US Department of Health and Human Services. HCFA is responsible for distribution of funds for Medicare as well as other governmental financial distributions. When I indicated to Randy the interest Ferris had in developing the BSQE in Health Care, his immediate and emphatic response was, " I will hire every person you graduate through that program!" Further, when I told Marianne Murdock, the new Chair of the ASQC's Health Care Division, about Ferris's interest in developing a Health Science BSQE, she promised support by stating that she would appoint a member of the HCD who lives in the Western Michigan area to work on the industry advisory committee for the degree. Dr. Murdock is Director, Systems and Quality Engineering, University of Virginia Health Sciences Center in

Charlottesville. As you can see, the entry of quality engineering into the health care field has been explosive in the last few years. I recommend that Ferris State University be in the vanguard of this phenomenon.

Finally, I want to relay a conversation I had with Edgar W. Dawes, a longtime colleague and friend of mine. Ed is associated with the State of Vermont Consortium of Community Colleges. I was telling Ed about my association with Ferris in the development of the quality engineering baccalaureate. I also told him about some of our committee discussions about satellite communications for extending the audience for the degree. Ed was excited about this revelation. He stated that the Vermont Consortium was looking for these types of programs in order to extend the opportunities for their two year graduates to continue their education for the baccalaureate. He wanted to make sure that when we finalized the degree at Ferris that we immediately contact him to see about contracting for an uplink/downlink program for their students. I am inclosing Ed's business card so that this could be further explored with Vermont.

Paul, as you can see, we had a brilliant and effective audience at the ASQC Annual Quality Congress. With the results from the questions we supply for the upcoming surveys, we should have proof positive of the need for this exciting new baccalaureate program. Just think, Ferris will be recognized as the vanguard institution in America in this type of higher education. I am sure that a broad based recognition of the institution as a leader in innovative higher education in both the national and international arenas would be a quite impressive achievement for the institution itself and for the State of Michigan.

Thank you for your time and support in this exciting and nationally important project, I remain,

Very truly yours,

Andrew F. Grimm, PE, CQE, CRE.
Fellow, ASQC

DIVISION INITIATES JURAN SCHOLARSHIP

After a year of study and deliberations, the 1993/1994 Executive Council of the Automotive Division voted to establish the Dr. Joseph M. Juran Endowment Scholarship at Ferris State University in Big Rapids, Michigan to help support their new BS degree program in Quality Engineering Technology. The Executive Council wanted to honor Dr. Juran on his visit to Detroit on April 11, 1994 during his final appearences tour of the U.S. An endowed scholaship established in his name was selected as the best means to permanently honor Dr. Juran for his many years of contributions to and work in the field of Quality Control.

This scholarship is intended to provide assistance to students at Ferris State who will be enrolling in Ferris' new degree program, the Bachelor of Science in Quality Engineering Technology. It is expected to be fully installed by the uinversity in 1995. This degree is believed to be the first purely quality engineering degree at the baccalaureate level offered in the country. As far as can be discerned, other baccalaureate degrees in quality have been or are being offered as options to Industrial Technology or Business Administration degrees, but none as true quality engineering degrees.

Ferris State University is Michigan's Applied Sciences University. Although liberal arts studies such as English, foreign languages, History, Psychology, Sociology, Economics, Art, etc. are included in the institution's course offerings, the vast majority of Ferris students are enrolled in applied science degree programs. They take these liberal arts courses as part of university requirements designed to provide students with a broadly based education. The Automotive Division's Executive Council felt that this setting would be ideal for establishing this type of scholarship.

On June 15, 1994, after application by the Automotive Division, the ASQC Board of Directors and the ASQC Awards Board approved the scholarship. The next step is for division representatives and university officials to sit down and work out the elements of the scholarship. The division representatives will work to have the scholaship fully established coincidentally with the final institution of the degree program. This reporter will keep you apprised of these future developments.

Andrew F. Grimm
Scholarship Chairman

MAY 10, 1994
HERITAGE RESTAURANT
5:30P.M. - 7:00 P.M.

DIVISION INITIATES JURAN SCHOLARSHIP

by ANDREW F. GRIMM
SCHOLARSHIP CHAIR

After a year of study and deliberation, the 1993-94 Executive Council of the Automotive Division voted to establish the Dr. Joseph M. Juran Endowment Scholarship at Ferris State University in Big Rapids, MI, to help support their new bachelor of science degree program in quality engineering technology. The Executive Council wanted to honor Dr. Juran on his visit to Detroit on Apr. 11, 1994, during his Final Word tour of the United States. An endowed scholarship established in his name was selected as the best way to permanently honor Dr. Juran for his many years of contributions to and work in the field of quality control.

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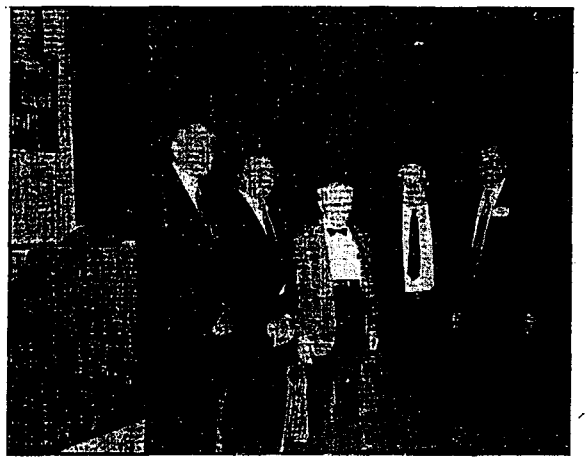

ABOVE: (from left to right) Paul Prins, Vordyn Nelson, Joseph Juran, Andy Grimm, and Ted Lowe.

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1994-95 CALENDAR OF EVENTS

AIAG AUTO-TECH '94 Conference & Exposition
August 30-September 1, 1994
Cobo Hall • Detroit, Michigan
ASQC Automotive Division:
Lloyd Brumfield (313) 429-6476

ASQC/AIAG "Standardization—A New Direction"
September 27-28, 1994
MSU Management Education Center • Troy, Michigan
ASQC Automotive Division:
Cathryn Girard (313) 373-7699
AIAG: Bill Flemming (313) 358-3570

SME 2nd Annual GAGETECH '94
October 24-27, 1994
Somerset Inn • Troy, Michigan
ASQC Automotive Division:
Lloyd Brumfield (313) 429-6476
SME: Marc LeDuc (313) 271-1500

ASQC 12th Annual Kitchener Quality and Productivity Conference
November 8-9, 1994
Kitchener, Ontario, Canada
ASQC Kitchener Section and Automotive Division
ASQC: Ahti J. Isolehto (519) 895-1000

SAE INTERNATIONAL CONGRESS
February 1995
Detroit, Michigan
Prakash Sathe (810) 977-5440

AICE
March 6-8, 1995 • Davenport, Iowa
Joan Conrad (319) 388-4465

ANNUAL QUALITY CONGRESS
May 22-24, 1995 • Cincinnati, Ohio

AQC - AUTOMOTIVE DIVISION DINNER
Monday, May 22, 1995

QUALITY & RELIABILITY WORKSHOP
June 6-7, 1995
MSU Management Center
Troy, Michigan
Karen Malmquist (313) 390-3765

AUTOMOTIVE DIVISION COUNCIL MEETINGS
MSU Management Center
Troy, Michigan
from 5:30 - 8:30 p.m. on:

August 29, 1994
November 28, 1994
February 20, 1995
June 12, 1995

Ferris State University

Applied Technology Center

To: William Winchell, Associate Professor, Manufacturing Engineering Technology

From: Paul Prins, Executive Director, Applied Technology Center

RE: BS Quality Engineering Technology

Date: April 3, 1995

This is intended to support your efforts in seeking necessary approval for the degree option.

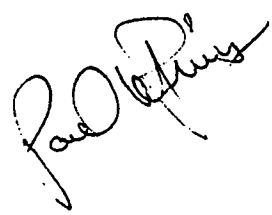
This program has been in the "development phase" for over three years. During this period we have received scholarship support from the Automotive Division of ASQC for the degree. A large number of individual inquiries about the availability of the degree have contacted our Grand Rapids office.

Both Grand Rapids Community College and Lansing Community College would like this program as an option for their two year graduates in Quality Technology.

Two years ago a four course certificate program was initiated. Sixty-three individuals have completed or are currently enrolled. The majority of enrollees in the certificate program have indicated their desire to continue and complete the proposed BS degree.

My concern is that potential customer interest will have peaked if too much additional time lapses prior to initiating the degree.

I unconditionally support the implementation of the BS Quality Engineering Technology Degree as quickly as possible.



AMERICAN SOCIETY FOR QUALITY CONTROL

AUTOMOTIVE DIVISION

3367 Woodwind Drive NE
Grand Rapids, MI 49505

April 20, 1995

Ferris State University
Big Rapids, MI 49307

Attn: Dr. Teshome Abebe
Vice President - Academic Affairs

Dear Dr. Abebe,

In a recent phone conversation with your Mr. Paul Prins, we were discussing the scope of the mission of the American Society for Quality Control. Originally, the society was almost entirely associated with the manufacturing sector of our economy and in particular enjoyed a close association with certain governmental units involved with controlling uniform quality of products sold to or produced within government facilities. However, this narrow vision has dramatically expanded over the last few years so that the society is now engaged in practically every sector of the economy. It has been projected that 70% of the society membership will be composed of members from the service sectors by the turn of the century.

Our discussion then evolved an idea of how higher education can define a position supporting this explosion of "Quality Thinking" within the economy. It is possible for a university to lead the vanguard of establishing a firm educational base for this "explosion" by employing its total capabilities with the cooperation of divisions of the ASQC. For example, FSU colleges have counterparts in the ASQC organizational structure:

FSU College	ASQC Organization(s)
Technology	Automotive Division Electronics Division Reliability Division Chemical and Processing Division (+ others)

Allied Health	Health Care Division Biomedical Division Energy and Environmental Division (+ others)
Business	Quality Management Division Software Quality Division (+ others)
Education	Education Division (+ others)

As you can see, there is a basic cooperative base that can be developed because of the similarity of the organizational structures. In fact, both Paul and I agreed that it would be possible for a university to capture the whole quality field! However, I would suspect for this to be accomplished, there would have to be a "passion for quality" within the educational institution.

I am taking the liberty to include a copy of the brochure of the upcoming ASQC's Annual Quality Congress. By your perusal of this information, you can get a feel for the scope of interest within the ASQC. I will be attending the Congress myself. Because my wife and I are both members of the ASQC and will be attending the AQC in May, we will have an extra copy of the transactions. I will give you my copy of the transactions so that you can obtain an in depth understanding of the subjects discussed.

Thank you for your interest in these matters, I remain,

Very truly yours,

Andrew F. Grimm
Scholarship Chairman

cc: Mr. Paul Prins

FERRIS STATE UNIVERSITY

Announcing Course Offerings
Quality Certificate Program
1995 Fall Semester

MFGE 341, Quality Science Statistics, 3 credits **Cost: $444**

This course is a detailed study of the applications of fundamentals of data analysis covering distributions, linear relationships, cause-effect, collection of data, probability, counts, proportions, sample means and inferences. Applications to illustrate concepts meaningful in a technology environment. (Prerequisite: MATH 116 Intermed. Algebra & Num. Trig. or equivalent or permission of the department).

Class meets Tuesday evenings 6:00pm - 9:00pm starting August 29 and ending December 12. Room 140A. Instructor: Bill Winchell

MFGE 442, Design of Experiments, 3 credits **Cost: $444**

This course is a detailed study of the design of experiments and is the application of advanced quantitative data analysis techniques, as well as, common experimental design methodologies used in the manufacturing industries to collect data for the purpose of improving or better understanding a design or process. (Prerequisite: MFGE 341 Quality Science Statistics or permission of the department).

Class meets Thursday evenings 6:00pm - 9:00pm starting August 31 and ending December 14. Room 220A. Instructor: Bill Winchell

To Obtain Registration Information, Call or Write:

Ferris State University
Applied Technology Center
151 Fountain Street NE
Grand Rapids, MI 49503
(616) 771-3770
1-800-998-3425
(616) 771-3775 fax

Appendix B

QET Program Focus Group Report

QET Program Review Focus Group
June 21, 2001

Participants:

Kevin See, 8 years in quality, various companies
Trisha Dirkse, Light Metals Corporation, 10 years, Quality Lab Supervisor
Brett Avery, Americam Corp., Quality Manager, 4 years
Emek Schab, Quality Engineer (new products and seeking ISO 9001), DeWys Mfg., Marn, MI
David Fossen, Shape Corp, Supply Quality Engineer (13 yrs in manufacturing business as process engineer)

Facilitators:

Professor Sid Sytsma	Professor of Information Management College of Business – Ferris State University
Dr. Katherine Manley	Professor of Occupational Education College of Education – Ferris State University

Focus Group Goals:

The primary focus group goal is to discuss program strengths and opportunities for improvement in the QET program.

General Program Orientation and Overall Educational Experience

1. **Did you see evidence of a continuous improvement philosophy in the QET program? If so, how is it evident?**
   - There does not seem to be a university wide philosophy of continuous improvement but the professors did seem to care about their students
   - Students have not seen measurements in this program different than measurements in other programs
   - Individual course evaluations do provide students with opportunity for input
   - FSU has met with ASQ and there is opportunity for "tweak" the program to better fit into field
   - Original program was built to fit into Mfg. Quality program but now it is recognized as own, separate program
   - Extra courses required in mfg. but could be substituted
   - In general, the program is not practicing its philosophy of continuous improvement as much as they could be
   - The fact that the program is only offered in GR implies that it is not important enough for on-campus programming ("Quality" is not offered at FSU and the program is not even listed on the FSU website)
   - Many of the courses have only been offered once—low numbers and not even sure what to measure

2. **Was the FSU/COT/QET educational experience responsive to student needs?**

- Excellent support from FSU-GR; they worked with students in the program
- The FSU-GR office are "top-notch" (Tracy, Nancy, Paul)
- One student had problem with advisor from FSU campus—original program did not have sequence of courses in Quality Program and it was difficult to plan out courses. Students had semesters when they could not take any courses.
- Little difficult with scheduling, enrolling
- *Recommended* that they not overlap on same night with other courses—two required courses offered on same nights

3. **Did you feel that you were treated as a customer?**
   - Treated in FSU—GR as customer
   - Everyone wanted to see the program succeed

4. **What did you feel was the most positive aspect of this program and educational experience?**

   - Professors' knowledge and experience
   - Practical knowledge of the professors
   - They had experience in the field; appreciated the most
   - Students brought a great deal of experience to the course content also—the interaction of the faculty and student experience was tremendous
   - Small class size resulted in networking of students and social aspect
   - If courses were taught on-campus, there probably would not have been the interaction and much more theory based
   - In one Quality course, the professor listened and expanded on specific topics such as ISO and QS

5. **What did you feel was the most negative aspect of the program and educational experience?**

   - Focus of courses might be modified—*recommended* that it be based more on ASQ model, Quality Engineer (One student just passed CQE with no review course and attributed passing with only content from program)

<u>The QET Program</u>

1. **What do you feel were the most beneficial QET courses?**
   - MFGE 341, 342, 442, 446, 443 BEST
   - Capstone course
   - Both statistic courses
   - DOE course

- STQM 311 course was not relevant (too much of a *business* perspective and not enough quality statistics required for students in this course) probably because of the poor instructors

2. **What is your opinion about QET teaching [including methods, strategies, providing feedback, competence of teachers, etc.]?**

    - Bruce and Mark were both passionate about statistics and this was enthusiasm contagious to the students
    - Good flavor of lecture and projects but only wish rounded more for the quality work
    - Students felt that when they were in the MFG courses, they were treated as "step child" and some of the content was not relevant to QET students

3. **How effective was advising in the QET program?**

    - Effective once program advisor were professors in the program
    - In the beginning, welding professors advised students but it did improve once the program faculty became advisors
    - Advising is more important for this program than on-campus student because of the type of students (working students) and schedules of these students who work

Support Courses

1. **How effective and useful were the College of Technology support courses and teaching?**

    - Good content—MATL 341, Materials Selection course
    - Good and important content—MFGE 321, Metrology course

Courses That Might be Looked At:

- MFGE 322, Production Processes course—this is an all lecture course. Some concepts/topics are good but maybe it should not be a full semester. The book, MFG, Engineering, and Technology, is great and the students recommended that all chapters be included; however, the professor only focused on certain sections such as machine tooling content.
- MFGE 324, Tool Engineering course—students expected to program a CNC but prerequisite course not required for the students making the content difficult
- An introduction to mfg course would be better that included all processes

- MFGE 423, Engineering Economics should be lightened up—tie in with Continuous Improvement (more accounting class—maybe because of the person who taught it)
- MFGE 393, Internship—many of the students came from the community college which also had an internship requirement. Could the internship in this program be waived and add another course in continuous improvement in QS/ISO and quality auditing (first piece submission, supplier audits, ISO audits, incoming quality, focus on quality systems)? However, if students did not come from community college, they should be required to do an internship. So the internship should be able to be waived.
- *Recommended* a course in auditing skills, auditing, and reporting based on QS, ISO as example with case studies (course that required students to go to Plastic Company and actually perform an audit)

2. **How effective and useful were the College of Arts and Science support courses and teaching?**

- Courses from FSU in General Education (very useful)
- English (3 courses), Physics, and calculus are all important
- Students felt that calculus is more important for auditing and reliability engineering, and even though they don't actually use it in their current jobs, overall, calculus should stay and should include use of computer-packages that do these functions.
- Technical communication course is good depending on who taught it (some professors were "too" English types not enough real life—focus on teams in writing reports is important
- Public speaking very important—one student just make a presentation to every employee in the organization yesterday

3. **How effective and useful were the College of Business support courses and teaching?**

- MFMT 302, Organizational Behavior, on-campus was okay but the competency learned in the community college course is probably important because they deal with people
- STQM 311, Continuous Improvement, was too "business" oriented

<u>Other Questions</u>

1. **What topics may be unnecessary in the program and might be eliminated?**

- These concepts **MUST** be added and improved in the program--Lean mfg, Toyota Production System (TPS), one piece flow, value stream mapping, pull system, Kanban, Takt time, cellular mfg, standardized work, visual management, error proofing, SMED, 5S, OEE, problem solving, root cause analysis/tools, theory of constraints, cost reductions
- QS/ISO and ASQ are the most important concepts required in the field and with statistics courses and the content from QS/ISO and ASQ and Lean Mfg. concepts incorporated into program, it would be more beneficial
- Program needs to be more aligned to ASQ and students should be able to pass CQE immediately and possibly the CQA upon graduation without taking refresher courses
- Juran's Quality book is **THE** most important book for passing CQE and this is the text used in Continuous Improvement course
- Students must have theory but also must be able to be a team leader and team facilitator

2. **What should be added to the program, if anything [e.g., team management and participation skills, problem solving skills, conflict resolution, written or verbal skills, leadership skills, information sources, additional QE skills, project management skills, process re-engineering skills, etc.] ?**

   - Team management and participation (Mark does this in the first two courses) is important. (human aspects course could be included in industrial organization psychology course like one at community college)
   - Continuous learning and education should be introduced, taught and included. While many companies have requirement for training, some students may not be aware of opportunities for post-graduate learning)
   - Project management skills would be important (maybe only one week) and use project management software
   - Software type class (Introduction to Computers) only included MS package—if software packages are taught, they must be applied to real life examples. The use of MS Excel is essential but might include how to use the SPC add-ins
   - Introduction to personnel items might be important especially dealing with state laws including OSHA, personnel issues, etc.
   - Class that focuses on quality management *systems* might be important beyond only manufacturing, food and drug (FDA), hospitals, etc. This might increase enrollment as other students may see the program as useful to their professional career.

3. **How did you find employment opportunities subsequent to graduating from the program?**

- Some courses in non-manufacturing quality might be important (such as different positions in the quality field) (mfg., pharmaceutical, food industry, ASQ, etc.)
- Only one student not working and he is not looking for job yet. Most jobs looking for Bachelors with ASQ certification.
- Many students already have jobs and get promoted once they earn degree
- Recruiter might be important to let students see what else is available
- Many businesses are increasing their requirement for hiring Quality personnel because some of the quality personnel are truly not qualified
- Graduates must be able to save the company at least their salary

4. **How do you feel about your future career, educational, or certification opportunities, having taken this program?**

   - All graduates agreed graduating from this program DOES enhance employment and success on the job
   - No other program available at other universities in Michigan —this is a unique and VERY VALUABLE program
   - Only alternative to entering this field is through field experience but with field experience, employees may miss certain concepts

5. **Would you recommend this program to perspective students?**

   - Definitely!!!!
   - Would recommend it now more than when program started—program has matured
   - Be careful that the program is not built on individual faculty members
   - The program is so versatile; can be taken anywhere in the world because everyone talks same language

6. **What other comments and suggestions would you like to make?**

   - Would like to see FSU more involved with businesses in the GR community
   - FSU could offer more certificates, such as in SPC, to attract more students to the program
   - Recommended that FSU do customer analysis to see where the students are coming from to better focus on student recruitment
   - This is better program than the community college program but students need to be recruited
   - Important that the program survive—put it on the FSU website

- Focus group today was important and very good for seeking input from graduates—better than survey
- *Recommended* redo the focus group one year form now with new graduates added to the group

Appendix C

QET Industry Advisory Board Meeting Minutes

FERRIS STATE UNIVERSITY

QUALITY ENGINEERING TECHNOLOGY
INDUSTRY ADVISORY BOARD MEETING MINUTES
April 20, 2001

FERRIS FACULTY PRESENT: Bruce Gregory, Gary Ovans, Mark Rusco, Joe Wist

INDUSTRY ADVISORS PRESENT: Gary Camp, Jonathan Greer, Andy Grimm, Joe Hoffman, JoAnne Kline, John Morrison

PROGRAM COULD BE STRENGTHENED IN THE FOLLOWING MANNER

- GRCC's two-year program is a good feeder to FSU's four-year program
- Get more community college students to support the four-year program at FSU
- GRCC is encouraging students to follow through with their bachelor's degree
- GRCC counselors need to have a better understanding of FSU program.
- LCC two-year program is very similar to GRCC program, this is possibly a way to grow the BS program.
- Should program be expanded to other areas or should it be expanded "in house" to try to get somewhere with what is currently available.
- Meet with quality people from Lansing Community College and other community colleges offering quality in the area and try to recruit students that way.

PROGRAM COULD BE PROMOTED IN THE FOLLOWING WAYS

- Recruit in high schools to get students excited about technology and specifically the quality field. Let students know the kind of salaries that quality engineers make, money is a good motivator to get students into the program
- More representation at the Governor's Pathways conference next year to promote all technology fields.
- Direct mailings to companies, high schools, etc. This should include information on typical salaries and types of positions available. Recruiting in industry may also be helpful. The target audience for this mailing would be quality technicians, not degreed employees.
- Gary Camp has an ASQ Mailing list for both the Grand Rapids and Holland sections of ASQ. This would be helpful in sending out the direct mailings.
- Talk to people currently in quality positions.
- "Buy students" by giving scholarships to enroll in to the program.
- Suggest to employees that they may want to enhance their education in case a position comes up in the future. If a position in the quality field becomes available, they would be prepared.
- What is the need or interest level in quality programs for Big Rapids? Is demand strictly in Grand Rapids or is there a need in both places? An analysis needs to be done to see if there is a need. Would students have enrolled in program at initial admission if it was available in Big Rapids?
- Create an awareness and interest. Need to identify the resources available to us and utilize them.

PROGRAM COULD BE REFINED IN THE FOLLOWING MANNER

- These courses are taught during the second year – techniques, designed experiments, quality management and principles of quality assurance.
- Students are expected to take the following math courses – algebra and geometry, no trigonometry or calculus required.
- Eliminate unnecessary redundancies between the GRCC and FSU Designed Experiments courses?
- Meet with GRCC faculty and possibly start using the same software. Different software is currently being used, but the functions are similar.
- Look at a full-time four-year program.
- A two-year feeder program needs to be developed in Big Rapids before a four-year program can be developed. There is a common base between MFGE and QET.

- Physics should be part of the program, students should take course related to core programs. "Design oriented" program.
- Does course content flow well? Are there too many redundancies?
- Does curriculum content flow? Two ways to evaluate program. Are there missing content areas, voids in what is being offered. Graduation requirements for both schools must be met.
- A formal look at the program and the number of students needs to be done.
- Do a survey of graduates to get some ideas on improving the program.
- The university needs to provide more resources to enhance and grow the program.
- Curriculum review committee – this committee is taking syllabi from each course in program to find possible holes in course content.
    - Potential for three new courses – Industrial Problem Solving, Quality Planning and Second Level Metrology (designing and gauging).
    - More processing type classes for knowledge and possibly some plastics processing (students in the program currently take MN 220 from GRCC).
    - Continuous Improvement – maybe something more intense for a master's level class. What are basic needs for the bachelor's? De-emphasize some offering areas and potentially group them in a master's degree program.
    - Currently there are no total quality management (TQM) classes in program. This could possibly be added to the Continuous Improvement class – maybe rename and rewrite the description of the course.
    - Solve problems so they are not repeated – this should be taught in the class. Can't teach class without examples, where do case studies come from? Need to solve problems, maybe not create piece of machinery. Give students better ideas on how to apply what they've learned in case studies.
- Masters Level Program – these classes are now part of bachelors program, if a masters degree program is created, should these classes be moved to the masters program?
    - Quality Auditing – part of CQE Body of Knowledge
    - Reliability Engineering – in CQE Body of Knowledge
    - Continuous Improvement
    - Organizational Behavior
    - Management course
- What can be done to serve quality personnel in health care, business and industry, and banking fields? Problem in finding common ground between the different fields. Problem solving is a common field and could possibly link these fields.
- QET classes, if they were offered to other areas it would give the split between MFGE and QET, but they would still share some courses.
- Offer certificate program in "service" areas to get a feel for the need. How many people would be interested? What is the need for this type of program?
- Do audit of other programs to find areas that may need to be taught.
- Change quality course content to be more general to cover all areas of people the program may attract.

SUMMARY

- Centralized degree is convenient.
- Need to start recruiting at the high school level, do more college/job fairs, direct contact with companies.
- The Quality program is a good product, but the information needs to get around. The short-term solution is to focus on industry. The long-term solution is to make the program more compatible and have a smoother transition between the two colleges.
- BS degree should be a Big Rapids based program and should not be restricted to only Grand Rapids.
- Ideal as a 2 + 2 program because of relationship with GRCC.
- Strong support, stay focused on technology.
- Better alignment with GRCC (short term).
- Continue to be aligned with MFGE and move on to main campus (long term).
- Program is not set up for full-time day students, but if recruiting in high schools is going to be done, this is something that needs to be looked into.
- Make some contacts with the auto industry (Andy Grimm is looking into this), begin a dialog with them regarding plant space, facilities needed, etc. Get invited to one of their meetings. Present a model of what is needed for a quality facility and show them facts.

- Enrollment is not doing well in certificate or bachelors degree.
- Not well articulated with GRCC. Need to strengthen GRCC's program to help feed the FSU program.
- Need to expand the program. We do not want to lose the program, it needs to be redesigned to energize it
- Business community could help support and develop a quality facility in the ATC so there is something more than the current measuring lab that is being used. A quality lab should have the following components: chem. lab, metrology lab, electronic testing lab, photo metrics lab, computer testing equipment, processing equipment and a compliance testing lab.
- Linking more closely to GRCC would generate more students and promote awareness.
- The quality program has potential, but not in the current form.

Appendix D

Certified Quality Engineer Body of Knowledge

Quality Engineer Certification (CQE)
Body of Knowledge

Please Note: The Body of Knowledge for certification is affected by new technologies, policies, and the changing dynamics of manufacturing and service industries. Changed versions of the examination based on the current Body of Knowledge are used at each offering.

The following is an outline of the topics that constitute the Body of Knowledge for Quality Engineering.

I. MANAGEMENT AND LEADERSHIP IN QUALITY ENGINEERING (19 Questions)

A. **Professional Conduct and ASQ Code of Ethics**
Identify appropriate behaviors for situations requiring ethical decisions. (Evaluation)

B. **Management Systems for Improving Quality**
Define, select and apply elements such as policy deployment, benchmarking, goal setting, planning and scheduling, project management, quality information systems, etc. (Analysis)

C. **Leadership Principles and Techniques**
Describe and apply principles and techniques for developing, building, and organizing teams, and leading quality initiatives. (Application)

D. **Facilitation Principles and Techniques**
Describe facilitator roles and responsibilities in the team environment. Define and apply brainstorming, nominal group technique (NGT), conflict resolution, etc. (Application)

E. **Training**
Identify training needs, describe elements of training programs and material development, and apply methods for determining effectiveness. (Application)

F. **Cost of Quality**
Describe and apply cost of quality concepts, including quality cost categories, data collection, reporting, etc. Evaluate cost of quality and interpret results. (Evaluation)

G. **Quality Philosophies and Approaches (e.g., Juran, Deming, Taguchi, Ishikawa)**

1. **Benefits of quality**
Describe the advantages of managing for quality and using quality techniques, both in theory and in practice. (Comprehension)
2. **History of quality**
Describe how and why modern quality has evolved, with emphasis on the forces, significant events, and leading contributors that have shaped quality practices. NOTE: Specific dates will **not** be addressed. (Comprehension)
3. **Definitions of quality**
Differentiate between various definitions of quality such as fitness-for-use, the Taguchi loss function etc. (Comprehension)

H. **Customer Relations, Expectations, Needs, and Satisfaction**
Define, apply, and analyze the results of customer relation measures such as quality function deployment (QFD), customer satisfaction surveys, etc. (Analysis)

I. **Supplier Relations and Management Methodologies**
Define, select, and apply methodologies such as qualification, certification, evaluation, ratings, performance improvement, etc. (Analysis)

II. QUALITY SYSTEMS DEVELOPMENT, IMPLEMENTATION, AND VERIFICATION (19 Questions)

A. **Elements of a Quality System**
Identify and integrate the common elements such as design control, process control, quality costs, auditing, test procedures, etc. (Synthesis)

B. **Documentation Systems**
Identify, define, and apply the elements of a documentation system such as configuration management, document control, etc. (Application)

C. **Domestic and International Standards and Specifications**
Identify the content and applicability of ASQ and ISO quality standards. NOTE: Industry-specific standards will not be included. (Comprehension)

D. **Quality Audits**

1. **Types and purpose of quality audits**
Identify and apply the concepts and techniques of various types of quality audits such as product, process, system, registration, certification, management, compliance, 1st, 2nd, 3rd-party, etc. (Application)
2. **Roles and responsibilities of individuals involved in the audit process**
Identify and define roles and responsibilities for audit participants such as audit team, client, auditee, etc. (Comprehension)
3. **Quality audit planning, preparation, and execution**
Identify, describe and apply the steps of planning, preparation, and execution of a quality audit. (Application)
4. **Audit reporting and followup**
Identify, describe, and apply the steps of audit reporting and followup, including the need for and verification of audit corrective action, etc. (Application)

III. PLANNING, CONTROLLING, AND ASSURING PRODUCT AND PROCESS QUALITY (33 Questions)

A. **Processes for Planning Product and Service Development**

1. **Classification of quality characteristics**
Identify, define and classify quality characteristics, including seriousness classification of defects. (Application)
2. **Design inputs and design review**
Identify sources of design input such as customer needs, regulatory requirements, etc. Identify and apply common elements of the design review process, including roles and responsibilities of participants. (Application)
3. **Validation and qualification methods**
Identify and describe how validation and qualification methods are used for process, product, and service designs. (Application)
4. **Interpretation of technical drawings and specifications**
Interpret basic technical drawings including characteristics such as views, title blocks, dimensioning, tolerancing, GD&T symbols, etc. Interpret

specification requirements in relation to product and process characteristics. (Application)

5. **Determining product and process control methods**
   Identify and apply methods such as job instructions, process control points, etc. (Application)

B. **Material Control**

1. **Material identification, status, and traceability**
   Describe and apply these methods. NOTE: Product recall procedures will **not** be included. (Application)
2. **Sample integrity**
   Describe the importance of establishing and maintaining sample integrity and select the appropriate techniques for avoiding contamination, misidentification, etc. (Application)
3. **Material segregation**
   Describe the importance of and apply methods for material segregation. (Application)
4. **Material Review Board (MRB)**
   Describe the purpose and function of an MRB, including appropriate disposition decisions. (Analysis)

C. **Acceptance Sampling**

1. **General concepts**
   Use, interpret, and apply lot-by-lot protection, average quality protection, producer's and consumer's risk, operating characteristic (OC) curves, attributes and variables sampling plans, etc. (Application)
2. **Definitions of AQL, LTPD, AOQ, AOQL**
   Interpret and describe these terms. (Comprehension)
3. **ANSI/ASQC Z1.4, ANSI/ASQC Z1.9 Standards**
   Use, interpret, and apply these standards. (Analysis)
4. **Acceptance sampling plans**
   Use, interpret, and apply single, double, multiple, sequential, and continuous sampling, including Dodge-Romig. (Analysis)

D. **Measurement Systems**

1. **Terms and definitions**
   Interpret and describe precision, accuracy, metrology, etc. (Comprehension)
2. **Destructive and nondestructive measurement and test methods**
   Distinguish between these methods and apply them appropriately. (Analysis)
3. **Selection of measurement tools, gages, and instruments**
   Select and describe appropriate uses of inspection tools such as gage blocks, calipers, micrometers, optical comparators, etc. (Application)
4. **Measurement system analysis**
   Calculate, analyze, and interpret repeatability and reproducibility, measurement correlation, capability, bias, linearity, etc., including both conventional and control chart methods. (Analysis)

5. **Metrology**
   Interpret, describe, and evaluate traceability to calibration standards, measurement error, calibration systems, control and integrity of standards and measurement devices. (Evaluation)

IV. RELIABILITY AND RISK MANAGEMENT (11 Questions)

A. **Terms and Definitions**
   Identify and define basic reliability measures and terms such as MTTF, MTBF, MTTR, availability, failure rate, etc. (Comprehension)

B. **Reliability Life Characteristic Concepts**
   Identify and interpret elements of reliability life characteristics of the bathtub curve. (Comprehension)

C. **Design of Systems for Reliability**
   Compute and evaluate reliability for redundant, series, and parallel systems. (Evaluation)

D. **Reliability and Maintainability**
   1. **Prediction**
      Compute, classify, and apply reliability and maintainability characteristics such as MTTF, MTBF, MTTR, availability, failure rate, etc. (Application)
   2. **Prevention**
      Identify and apply methods to maintain and improve process and product reliability. (Application)
   3. **Maintenance scheduling**
      Identify, classify, and describe methods of predictive and preventive maintenance. (Application)

E. **Reliability Failure Analysis and Reporting**
   Analyze reliability failure information and evaluate possible actions to improve or correct performance. (Evaluation)

F. **Reliability / Safety / Hazard Assessment Tools**
   1. **Failure mode and effects analysis (FMEA)**
      Define, construct, and interpret FMEAs. (Application)
   2. **Failure mode and effects criticality analysis (FMECA)**
      Define, construct, and interpret FMECAs. (Application)
   3. **Fault-tree analysis (FTA)**
      Define, construct, and interpret FTAs. (Application)

V. PROBLEM SOLVING AND QUALITY IMPROVEMENT (25 Questions)

A. **Approaches**
   Describe and classify the implementation steps of quality improvement models such as Kaizen, PDSA, continuous improvement, etc. (Application)

B. **Management and Planning Tools**
   Select, construct, apply, and interpret affinity diagrams, tree diagrams, process decision program charts, matrix diagrams, interrelationship digraphs, prioritization matrices, and activity network diagrams. (Analysis)

C. **Quality Tools**
   Select, construct, apply, and interpret flowcharts, Pareto charts, and cause and effect diagrams. Select, apply, and interpret, control charts, check sheets, scatter diagrams, and histograms. [NOTE: The **mechanics** of these tools are covered in

Section VI as follows: control charts (VI.G.4 & 5), check sheets (VI.B.3), scatter diagrams (VI.B.6.a.), histograms (VI.B.6.b.)] (Analysis)

D. **Corrective Action**
Identify elements of the corrective action process including problem identification, root cause analysis, correction, recurrence control, and verification of effectiveness, and determine root causes and appropriate corrective actions. (Analysis)

E. **Preventive Action**
Describe and apply preventive action concepts and techniques such as error-proofing, poka-yoke, robust design, etc., and analyze the effectiveness of their implementation. (Analysis)

F. **Overcoming Barriers to Quality Improvement**
Identify barriers and their causes, evaluate their impact, and describe methods for overcoming them. (Evaluation)

VI. QUANTITATIVE METHODS (53 Questions)

A. **Concepts of Probability and Statistics**

1. **Terms**
Describe population, parameter, statistic, random sample, expected value, etc., and compute expected value. (Application)
2. **Drawing valid statistical conclusions**
Distinguish between enumerative and analytical studies and evaluate the validity of conclusions based on statistical assumptions and the robustness of the technique used. (Evaluation)
3. **Central limit theorem and sampling distribution of the mean**
Define and apply these concepts. (Application)
4. **Basic probability concepts**
Describe and apply concepts such as independence, mutually exclusive, multiplication rules, complementary probability, joint occurrence of events, etc. NOTE: Bayes' Theorem will **not** be included. (Application)

B. **Collecting and Summarizing Data**

1. **Types of data**
Identify, define, classify, and compare continuous (variables) and discrete (attributes) data. (Application)
2. **Measurement scales**
Define and apply nominal, ordinal, interval, and ratio measurement scales. (Application)
3. **Methods for collecting data**
Define and apply methods for collecting data such as check sheets, coding data, automatic gaging, etc. (Application)
4. **Techniques for assuring data accuracy and integrity**
Define and apply techniques for assuring data accuracy and integrity such as random sampling, stratified sampling, sample homogeneity, etc. NOTE: Sample integrity is covered in III.B.2, not here. (Application)
5. **Descriptive statistics**
Define, compute, and interpret measures of dispersion and central tendency, and construct and interpret frequency distributions and

cumulative frequency distributions. NOTE: Geometric and harmonic means will not be included. (Synthesis)

6. **Graphical methods**
   a. **Depicting relationships**
      Construct, apply, and interpret diagrams and charts such as stem-and-leaf plots, box-and-whisker plots, run charts, scatter diagrams, etc. (Analysis)
   b. **Depicting distributions**
      Construct, apply, and interpret diagrams such as histograms, normal probability plots, Weibull plots, etc. (Analysis)

C. **Properties and Applications of Probability Distributions**

1. **Discrete distributions**
   Describe and apply binomial, Poisson, hypergeometric, and multinomial distributions. (Analysis)
2. **Continuous distributions**
   Describe and apply uniform, normal, bivariate normal, exponential, lognormal, Weibull, Chi-square, Student's t, and F distributions. (Analysis)

D. **Statistical Decision-Making**

1. **Point and interval estimation**
   Define and interpret the efficiency and bias of estimators. Compute, draw conclusions from, and interpret statistics such as standard error, tolerance intervals, and confidence intervals. (Analysis)
2. **Hypothesis testing** (NOTE: Nonparametric tests will **not** be included.)
   a. **Tests for means, variances, and proportions**
      Apply parametric hypothesis tests for means, variances, and proportions, and interpret the results. (Analysis)
   b. **Significance level, power, type I, and type II errors**
      Apply and interpret these concepts as they apply to statistical tests. (Analysis)
   c. **Statistical versus practical significance**
      Define and distinguish between statistical and practical significance. (Evaluation)
3. **Paired comparison tests**
   Define, determine applicability, and apply paired comparison parametric hypothesis tests, and interpret the results. (Analysis)
4. **Goodness-of-fit tests**
   Define, determine applicability, and apply Chi-square tests, and interpret the results. (Analysis)
5. **Analysis of variance (ANOVA)**
   Define, determine applicability, and apply analysis of variance, and interpret the results. (Analysis)
6. **Contingency tables**
   Define, determine applicability, and construct a contingency table, and use it to determine statistical significance. (Analysis)

E. **Measuring and Modeling Relationships Between Variables**

1. **Simple and multiple least-squares linear regression**
   Calculate the regression equation. Apply and interpret hypothesis tests for regression statistics. Use the regression model for estimation and prediction, and analyze the uncertainty in the estimate. NOTE: Models that are nonlinear in their parameters will **not** be included. (Evaluation)
2. **Simple linear correlation**
   Calculate and interpret the correlation coefficient and its confidence interval. Apply and interpret a hypothesis test for the correlation coefficient. NOTE: Serial correlation will **not** be included. (Analysis)
3. **Basic time-series analysis**
   Apply basic time-series analyses such as moving average. Interpret time-series graphs to identify trends, seasonal, and cyclical variation, etc. (Analysis)

F. **Designing Experiments**
   NOTE: Mixture designs, data transformations, nested designs, and response surface methods will **not** be included.
   1. **Terminology**
      Define terms such as independent and dependent variables, factors and levels, response, treatment, error, and replication. (Knowledge)
   2. **Planning and organizing experiments**
      Describe and apply the basic elements of experiment planning and organizing, including determining the experiment objective, selecting factors, responses, and measurement methods, choosing the appropriate design, etc. (Evaluation)
   3. **Design principles**
      Define and apply the principles of power and sample size, balance, replication, order, efficiency, randomization and blocking, interaction, and confounding. (Application)
   4. **Design and analysis of one-factor experiments**
      Construct one-factor experiments such as completely randomized, randomized block, and Latin square designs, and apply computational and graphical methods to analyze and evaluate the significance of results. (Evaluation)
   5. **Design and analysis of full-factorial experiments**
      Construct full-factorial designs and apply computational and graphical methods to analyze and evaluate the significance of results. (Evaluation)
   6. **Design and analysis of two-level fractional factorial experiments**
      Construct two-level fractional factorial designs (including Taguchi designs) and apply computational and graphical methods to analyze and evaluate the significance of results. NOTE: Higher-order and mixed-level designs will **not** be included. (Evaluation)
   7. **Taguchi robustness concepts**
      Identify and describe Taguchi robustness concepts and techniques such as signal-to-noise ratio, controllable and uncontrollable factors, and robustness to external sources of variability. (Comprehension)

G. **Statistical Process Control (SPC)**

1. **Objectives and benefits**
   Identify and describe objectives and benefits of SPC such as assessing process performance, distinguishing special from common causes, etc. (Comprehension)
2. **Selection of variable**
   Identify and select characteristics for monitoring by control chart. (Application)
3. **Rational subgrouping**
   Define and apply the principle of rational subgrouping. (Application)
4. **Selection and application of control charts**
   Identify, select, construct and apply the following control charts: and *R*, and *s*, individual and moving range (ImR), moving average and moving range (MamR), median, p, np, c, and u charts. (Synthesis)
5. **Analysis of control charts**
   Interpret control charts and distinguish between common and special causes using rules for determining statistical control. (Evaluation)
6. **PRE-control**
   Define and describe PRE-control and perform PRE-control calculations and analysis. (Analysis)
7. **Short-run SPC**
   Identify, define, and apply short-run SPC methods and techniques. (Analysis)

H. **Analyzing Process Capability**

1. **Designing and conducting process capability studies**
   Identify, describe, and apply the elements of designing and conducting process capability studies, including identifying characteristics, specifications, and/or tolerances, developing sampling plans, establishing statistical control, etc. (Evaluation)
2. **Calculating process performance versus specification**
   Distinguish between natural process limits and specification limits and calculate process performance metrics such as percent defective. (Analysis)
3. **Process capability indices**
   Define, select, and calculate Cp, Cpk, Cpm, and CR and assess process capability. (Evaluation)
4. **Process performance indices**
   Define, select, and calculate Pp and Ppk and assess process performance. (Evaluation)

Six Levels of Cognition
based on Bloom's Taxonomy (1956)

In addition to **content** specifics, the subtext detail also indicates the intended **complexity level** of the test questions for that topic. These levels are based on "Levels of Cognition" (from Bloom's Taxonomy, 1956) and are presented below in rank order, from least complex to most complex.

Knowledge Level

(Also commonly referred to as recognition, recall, or rote knowledge.) Being able to remember

or recognize terminology, definitions, facts, ideas, materials, patterns, sequences, methodologies, principles, etc.

Comprehension Level

Being able to read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc.

Application Level

Being able to apply ideas, procedures, methods, formulas, principles, theories, etc., in job-related situations

Analysis

Being able to break down information into its constituent parts and recognize the parts' relationship to one another and how they are organized; identify sublevel factors or salient data from a complex scenario

Synthesis

Being able to put parts or elements together in such a way as to show a pattern or structure not clearly there before; identify which data or information from a complex set is appropriate to examine further or from which supported conclusions can be drawn

Evaluation

Being able to make judgments regarding the value of proposed ideas, solutions, methodologies, etc., by using appropriate criteria or standards to estimate accuracy, effectiveness, economic benefits, etc.