Title: Improvement of Engineering Management Curriculum for the Software Industry

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Abstract: Attempts to improve the curriculum of Portland State University for the software industry. The results of the analysis identifies three areas of need restructuring.

Improvement of Engineering Management Curriculum for the Software Industry

A Sunardi G Jones
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EMP-P9807

QIT REPORT

IMPORVEMENT OF
ENGINEERING MANAGEMENT CURICULUM
FOR THE SOFTWARE INDUSTRY

Presented by

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Portland State University
Total Quality Management
EMGT560/ 660 - Spring Term 1998
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EXECUTIVE SUMMARY

Many hiring managers emphasize people skills as well as technical skills when selecting staff; a computer science degree no longer guarantees long-term, some management people without technical degrees are hired and/or promoted over people who have technical degrees. Computer science is still recommended as one of the best majors for college students interested in information-technology careers, but practical experience and computer knowledge in technological fields is not sufficient in today global business.

At present, many organizations involved in the software engineering field require diverse skills from software engineers such as analytical, communicating, marketing, planning and project development skills not just the technical skills. The problem has been found by managers that many software engineers have various obstacles in communicating and working with other people in other departments.

In order to meet the market needs, the purpose of this report is to improve the curriculum of Portland State University for the software industry. Currently, there are not specific courses related to the management of software engineering in the Engineering Management Program of Portland State University.

The data used in this analysis includes benchmarking other Universities and interviews of individual management/ engineers associated with the software industry. The benchmarking of current offerings between Engineering Management Program of Portland State University and the other Universities as well as the computer science department of other schools.

The data was analyzed and compared with the needs to determine an upgrade for Engineering Management Program for the software industry. The results of the analysis identified three areas the need restructuring. These product offerings are in the area of:

- Communication
- Product Development
- Project Management

The new product offerings are carried forward for cost analysis.

INTRODUCTION

The purpose of this study is to determine the needs and make recommendations for modifications of Engineering Management Program curriculum at Portland State University (PSU). These modifications are to address the needs of the software industry. Based on questionnaires and interviews, as well as benchmarking current offerings of other established universities against Portland State University, new product offerings are developed to improve the quality of the curriculum. The estimated costs to implement these recommendations are also included.

COMPUTER SCIENCE AND ENGINEERING MANAGEMENT BENCHMARK

Computer Science Benchmarking

The purpose of benchmarking is to compare the curriculum of other Universities as related to PSU, and the needs as identified by the surveys. From this benchmark, the relation between the curriculum that is offered and the type of curriculum that the software industry needs is analyzed. Seven universities were sampled to develop the benchmarking information (Figure 1). The Universities are:

- Assumption University
- Carnegie Mellon University
- Oregon Graduate Institute of Science and Technology
- University of Toronto
- University of Southern California
- University of Calgary
- University of Idaho

From the Universities curriculum information, the relevant courses were compared in terms of the relationship of the subject matter. In accordance to the purpose of this study, the courses from each University analyzed, are courses related to only business and management. Technical courses from the listings were omitted.

From the Universities sampled, two have business and management specialization in their computer science program. The programs from these two universities are very similar to Engineering Management. As a result, the computer science program appears to be more product management oriented and less technical. The courses offered by a majority of the computer science programs is product development, followed by project management, quality, economic analysis, marketing, and finance. This result indicates that the management related courses in computer science program focus on managing the development of software products. This focus is complemented with economic and financial analysis courses.

The least number of subjects offered by a program were operations research, strategic planning, expert system, and leadership. These courses are related to the whole of the company. In addition, only a few of universities offer managerial courses such as global

economics, government and international law, communication, organization, decision-making, accounting, ethic issues, and manufacturing.

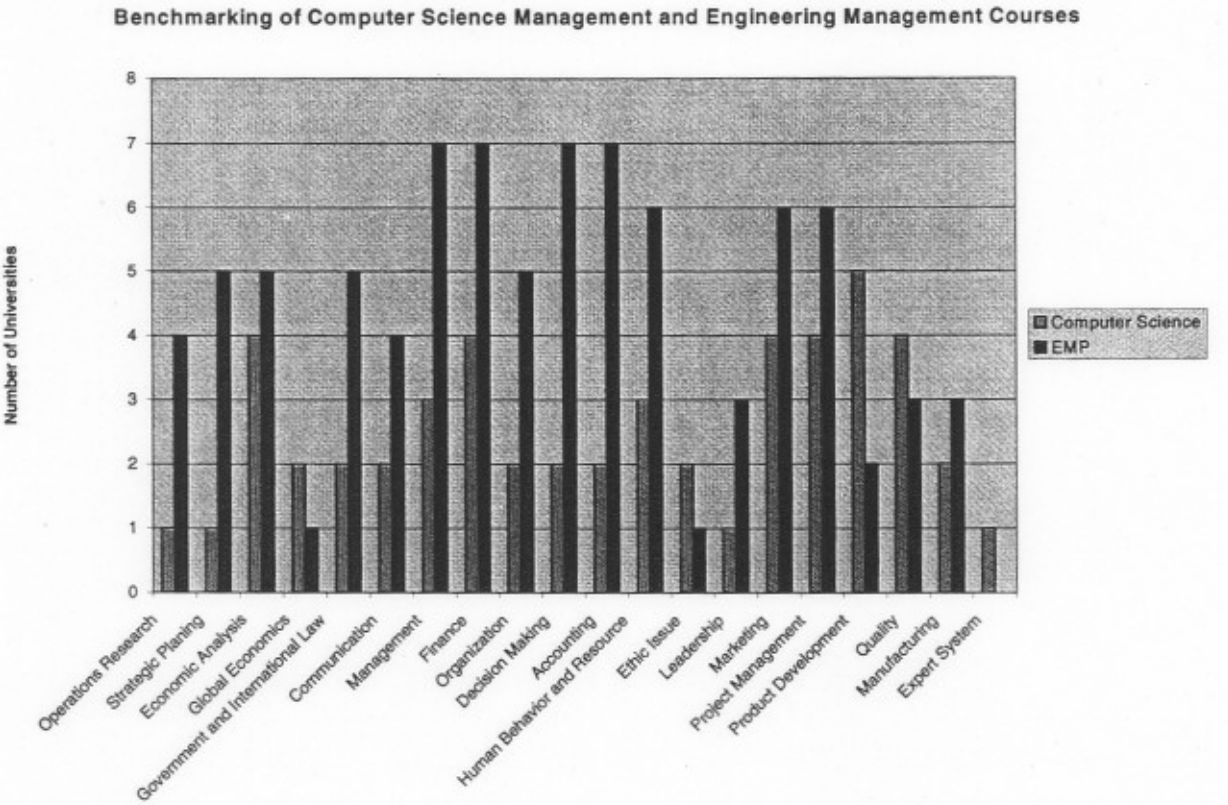

Figure 1

Engineering Management Benchmarking

Other Universities Engineering Management Program's courses were also benchmarked to determine how they compared to PSU. For benchmarking, seven engineering management programs were used as samples. The Universities are:

- University of Missouri-Rolla
- Northwestern University
- College of Business Cal Poly San Luis Obispo
- Massachussets Institute of Technology
- Washington State University
- University of Alaska Fairbanks
- University of Kansas Regents Center

The courses offered most frequently by the Universities are management, finance, decision-making, and accounting. Next are human behavior and resource, marketing, and project management. These subjects are the core skills in management. The least subjects offered are global economic and ethic issues, followed by product development.

Benchmarks Comparison

Comparing courses offered by EMP and computer science programs, leads one to conclude that over all most EMPs have strong offerings in planning, management, marketing, and product areas. However, computer science programs have strong offerings in the product development areas. Over all, the benchmark shows that computer science programs focus on project management, while engineering management programs focus on both short and long term management with general scope.

Needs Analysis

The results from the interviews of the people associated with the management and/or technical areas of software industry identified they are seeking more managerial skills, rather than technical skills (Appendix B). The needed skills identified by the survey are communication and product development. They identified the need for product development skills in accordance with their job responsibility. Communication skills are required to give them ability to communicate with different department in their company with different levels of job positions, and their peers in both a team and functional environment.

Technical level staff engineers were interviewed as well as management level. One interesting fact that emerged from the interviews is that the technical level engineers were more concerned about product development skills and the ability to communicate with their management. Management was more concerned about their employee's skill in communication and presentation.

MARKET NEEDS ANALYSIS

The market shortcomings are developed from the information obtained during the needs analysis. Figure 2 presents the data reduced to four major program areas – planning, management, marketing and project. The grouping of the subject areas into four major program areas allows for the analysis of the data to progress systematically into product offerings. The initial groupings placed the subject areas under the major heading of greatest influence. The cross-referencing of these subjects and their relative impacts are considered further in the market needs assessment.

Planning encompasses the corporate phase of business and includes subject areas such as strategic planning, research, economic analysis, etc. Management, also a corporate level function includes communication, finance, management, decision analysis as well as others. Marketing is a function that is required from a business aspect and included here to complete the engineering management program elements. Project encompasses project management, product development, quality, manufacturing, and expert systems.

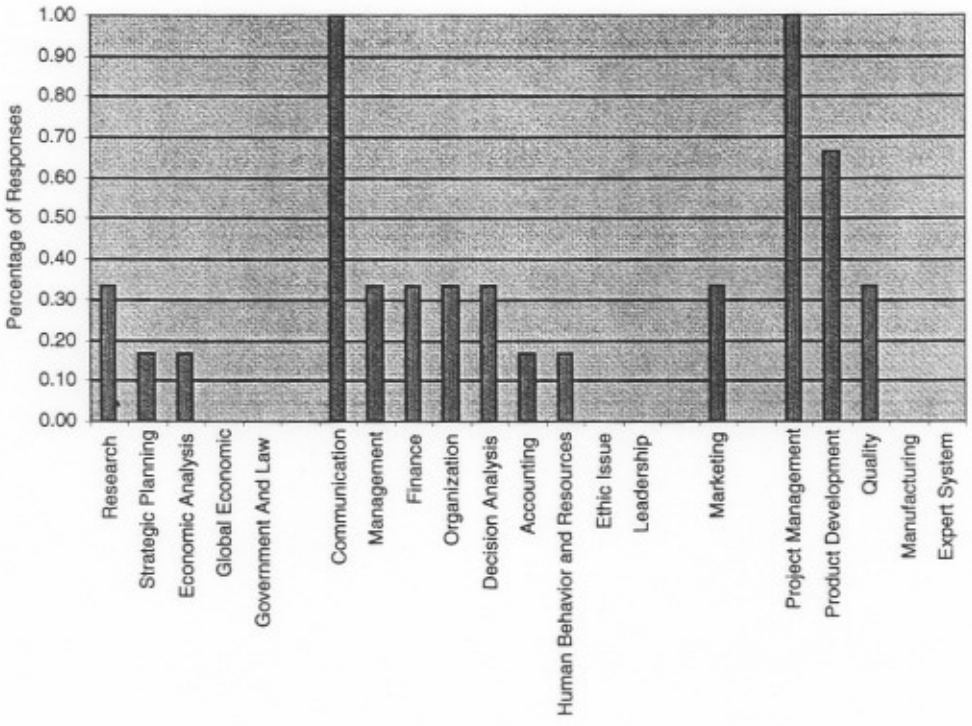

Figure 2 – Program Areas

The data indicates that from the percentage of the number of responses communication, project management, and product development are critical areas for formal training within an engineering management program.

In order to evaluate the relative influence these areas have on major subject areas, Table 1 was developed to review the relative interrelationship of the subjects. Table 1 presents the data, cross-referenced by program area and subject area and identifies areas for enhancement of the current program.

The areas that ranked as having the largest overall impact are:

- Management - Communication
- Project - Product Development

The group that ranks as having the next overall highest impact is:

- Planning
  - Research
  - Strategic Planning
- Management
  - Organization
  - Accounting
  - Human Behavior and Resource
  - Leadership
- Marketing - Marketing
- Project - Quality

TABLE 1
Program Area Versus
Subject Area

Major Area	*Subject Area*	*Planning*	*Management*	*Marketing*	*Project*	*Frequency* [1]
Planning	Research	X		X	X	0.75
	Strategic Planning	X	X	X		0.75
	Economic Analysis	X	X			0.50
	Global Economic	X	X			0.50
	Government And Law	X	X			0.50
Management	Communication	X	X	X	X	1.00
	Management		X		X	0.50
	Finance	X	X			0.50
	Organization	X	X		X	0.75
	Decision Analysis	X	X			0.50
	Accounting		X	X	X	0.75
	Human Behavior and Resources		X	X	X	0.75
	Ethic Issue		X		X	0.50
	Leadership	X	X		X	0.75
Marketing	Marketing	X	X	X		0.75
Project	Project Management		X		X	0.50
	Product Development	X	X	X	X	1.00
	Quality		X	X	X	0.75
	Manufacturing				X	0.25
	Expert System				X	0.25

Note: 1) The relative frequency in relationship to their cross-functional impact.

Normalization and ranking of the data from Figure 2 and Table 1 identifies the program areas and subject areas that would enhance the program the greatest. Appendix A presents the normalized data analysis. Figure 3 presents the ranking by subject.

The analysis has identified three subject areas that would have the greatest impact on the enhancement of the engineering management program at Portland State University. They are:

- Communication
- Product Development
- Project Management

The subject areas of greatest impact are developed further into product offerings.

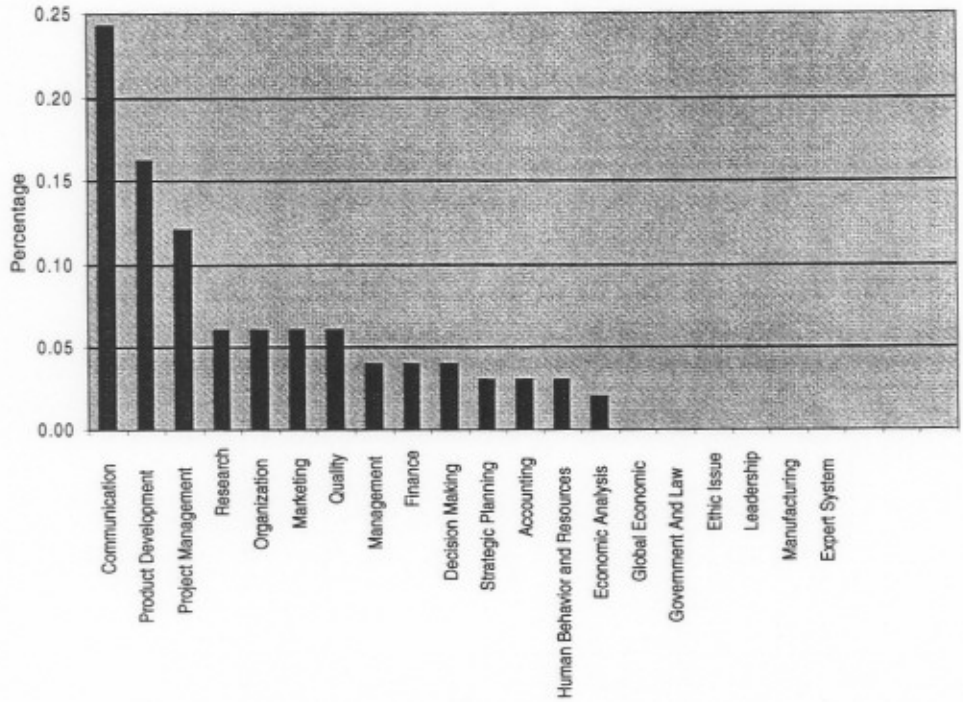

Figure 3 - Normalized Program Areas

PRODUCT OFFERINGS

The development of the product-offering combines the analysis of the market needs with the benchmarked offering of the other Universities with current offerings at Portland State University. Table 2 outlines the current offerings by subject area and the Universities with the offering.

TABLE 2
Product Offerings
By University

Subject Area	*Communication*	*Product Development*	*Project Management*
PSU	X	X	X
Idaho		X	X
Calgary		X	X
Oregon Graduate Institute		X	
Carnegie Mellon	X	X	
Assumption	X		
Southern California			X
Toronto		X	X

Table 3 presents the core offerings from other universities as previous developed in Competitive Benchmarking. Appendix C presents a partial listing of the offerings per university. These offerings are the basis for the development of offerings at Portland State University.

TABLE 3
Course Comparison and Development

Subject Area	
Communication	**Current Courses** Portland State University EMGT 522/622 Communication And Team Building: Description of the course: Developing high performance teams for the engineering - driven companies; fundamental concepts that make an effective team; building a high-performance team; the keys to high performance; converting risks into assets; the power of commitment and discipline, and constructive communication; getting results through team dynamics, creative problem solving, and measuring team performance; case studies, presentations, term projects, teamwork, and interactive exercises. OREGON GRADUATE INSTITUTE OF SCIENCE AND TECHNOLOGY CSE503 Software Process Practicum: The Software Process Practicum is designed to immerse the working student in topics relevant to software process improvement and quality management, and to introduce them to the supporting theory. Topics include quality management frameworks (Capability Maturity Model for Software, ISO 9000), measurement for process improvement, process definition, formal inspections, and key team skills necessary for effective collaborative software engineering efforts. At the end of the course the student will be able to demonstrate that the software development process can be managed and controlled, leading to increased software quality. The course is a mixture of lectures, readings, in-class activities, and individual and team homework. There is a mid-term project (team), an end-term project (team), and a final project (individual). There is one Saturday workshop. A recent syllabus can be found at http://www.cse.ogi.edu/~hook/practicum/practicum.html. The Software Process Practicum is the winner of the 1996 Software Quality Excellence Award. **Recommended Modified Course** **Communication And Team Building for Software Development:** Description of the course: Developing high performance teams for the software development - driven companies. Course includes fundamental concepts that make an effective team; building a high-performance team; the keys to high performance; converting risks into assets; the power of commitment and discipline, and constructive communication; getting results through team dynamics, creative problem solving; measurement for process improvement, process definition, formal inspections, and key team skills necessary for effective collaborative software engineering efforts, and measuring team performance. Case studies, presentations, term projects, teamwork, and interactive exercises.
Product Development	**Current Courses** Portland State University EMGT 510/610: New Product Development: Description of the course: This class focuses on the changing nature of new product development and new product introduction in high technology oriented companies in the recent years. The class will approach this subject from

TABLE 3
Course Comparison and Development

Subject Area	
	an Engineering Management perspective and will establish the factors those Engineering Managers or Managers in high tech environments can use as a checklist in new product development projects. OREGON GRADUATE INSTITUTE OF SCIENCE AND TECHNOLOGY CSE500 Introduction to Software Engineering: Software engineering characterizes software production and maintenance as a process to be managed. A software process includes specification, design, inspection and testing, and software evolution over a life cycle. Related topics include metrics, design reuse, techniques for quality improvement, and project management. This course emphasizes teamwork and collaboration, and is essential for anyone working in software development, quality control or management in a software organization. UNIVERSITY OF CALGARY SENG 613 Managing the Software Lifecycle. Further methodologies for requirements engineering. Applications of requirements engineering to the management of the lifecycle of software development from requirements elicitation through analysis, design, coding, testing, enhancement and reuse. UNIVERSITY OF IDAHO CS J485/J585 Software Process Management. Systematic software development from management perspective that centers on constituent tasks and their interrelationships; evaluation of software development process maturity and means to improve process maturity. **Recommended Modified Course** **Software Development** **Description of the course:** This course focuses on the changing nature of software development and software introduction. The course will approach this subject from an Engineering Management perspective and will establish the factors those Engineering Managers or Managers in high tech environments can use in the management of the lifecycle of software development from requirements elicitation through analysis, design, coding, testing, enhancement and reuse.
Project Management	**Current Courses** Portland State University EMGT 545/645 Project Management in Engineering and Technology: Description of the course: Critical issues in the management of engineering and high technology projects; analysis of time, cost, performance, parameters from the organizational, people and resource perspectives; project planning, evaluation and selection, including project selection models; project and matrix organizations; project teams; scheduling with CPM/PERT algorithms; budget and schedule control; termination of projects Case discussions and a term project are included in the course. Topical Outline: Project Management concepts; internal, competitive and environmental systems in project management; project life cycle project office; project and matrix organizations; project team; project selection and evaluation; project planning project scheduling; project tracking and control; project termination

TABLE 3
Course Comparison and Development

Subject Area	
	OREGON GRADUATE INSTITUTE OF SCIENCE AND TECHNOLOGY CSE500 Introduction to Software Engineering: Software engineering characterizes software production and maintenance as a process to be managed. A software process includes specification, design, inspection and testing, and software evolution over a life cycle. Related topics include metrics, design reuse, techniques for quality improvement, and project management. This course emphasizes teamwork and collaboration, and is essential for anyone working in software development, quality control or management in a software organization. CSE503 Software Process Practicum: The Software Process Practicum is designed to immerse the working student in topics relevant to software process improvement and quality management, and to introduce them to the supporting theory. Topics include quality management frameworks (Capability Maturity Model for Software, ISO 9000), measurement for process improvement, process definition, formal inspections, and key team skills necessary for effective collaborative software engineering efforts. At the end of the course the student will be able to demonstrate that the software development process can be managed and controlled, leading to increased software quality. UNIVERSITY OF IDAHO CS J482/J582 Software Project Management. Techniques for planning, organizing, scheduling, and controlling complex software system development and support projects. **Recommended Modified Course** **Software Project Management** **Description of the course:** Critical issues in the management of software development including; analysis of time, cost, performance; project planning, evaluation and selection, including project selection models; project and team organizations as related to software development; scheduling with CPM/PERT algorithms; budget and schedule control; quality and performance issues and techniques; termination of projects Case discussions and a term project are included in the course.

The recommended offerings are carried forward for the cost analysis.

COST ANALYSIS

Presented in Table 4 are the estimated costs associated with the recommendations outlined in Table 3 Course Comparison and Development.

TABLE 4
Financial Analysis

	Year 1	*Year 2*	*Year 3*	*Total*
Revenue				
Tuition	$0	$14,000	$21,000	$35,000
[redacted]	$0	$14,000	$21,000	$35,000
Expenses				
Direct Labor	$0	$5,000	$5,000	$10,000
Other Direct Expenses	$0	$200	$200	$400
[redacted]	$0	$5,200	$5,200	$10,400
Net Revenue	$0	$8,800	$15,800	$24,600
General and Administrative Expenses				
Indirect Labor	$15,000	$500	$500	$16,000
Communication	$500	$100	$100	$700
Supplies	$200	$100	$100	$400
Other Expenses	$200	$100	$100	$400
[redacted]	$15,900	$800	$800	$17,500
[redacted]	<$15,900>	$8,000	$15,000	$7,100

Assumptions:

1) *It will take one Professor ½ time per course to develop the modified curriculum.*
2) *Year 1 includes start-up development costs*
3) *Year 2 and 3 assumes 10 and 15 students per course offered, respectively*
4) *The courses are four credits hours each with tuition at $350 per credit hour.*

CONCLUSION

Like companies, Universities provide products and services for people. The products and services provided by academic institutes are in forms of education and campus facilities. Professors sell the products by educating their students. They service their learners by providing academic instruments such as computers, projectors, laboratories and so on. Unlike organizational goals, the university goal is generally not for a profit institute. The primary purpose of the University is based on how to enlighten and coach students to become qualified people, and how to improve the quality of current offerings for supporting today's business markets.

Two methods have had been used for the market analysis. First, this study has focused on the obvious voice of software/computer engineers, from management to technical personnel. In addition, Engineering Management Programs and Computer Science Program benchmarked.

From the result of questionnaires and interviews, two most important skills for software engineers are communication and product development. They perceived that managerial skills are as important as technical skills. Engineers need technical skills for communicating with computers and other kinds of equipment, whereas, they need communication skills for communicating with people. The problem shows that people working in technical fields at times cannot work and communicate well with other people. Likewise, engineers at different levels talk in different languages. Upper-level engineers talk in financial terms, while, lower-level engineers talk in technical terms.

Product development is another issue of discussion. Technological breakthrough and software development never stops. Therefore, software engineers should have the skills and wide insight to establish the factors used in the management of the lifecycle of software development from elicited requirement through analysis, design, coding, testing, enhancement and reuse.

The market needs analysis of the benchmarked University current offerings indicate the program areas and subject areas that are similar to the result of questionnaires and interviews. The normalized and ranking of data information presents three most subject areas that would have the greatest enhancement on the Engineering Management Program at Portland State University. These are communication, product development and project management.

From these three subject areas based on market needs and benchmarking analysis, three recommended modified courses are offered: Communication and Team Building for Software Development, Software Development, and Software Project Management. Consequently, the three new course offerings are carried forward for cost analysis for the Engineering Management Program at Portland State University.

APPENDIX A

- Normalized data analysis -

RESPONSE AND CROSS REFERENCE TABLE

Area	Subject	Response	Engineers	Area	Subject	Planning	Management	Marketing	Project	Cross Reference	A X B	Normalized Data
Planning		0.33	2	Planning	Research	X		X	X	0.75	0.25	0.06
Research	Strategic Planning	0.17	1		Strategic Planning	X	X	X		0.75	0.13	0.03
	Economic Analysis	0.17	1		Economic Analysis	X	X			0.5	0.08	0.02
	Global Economic	0.00	0		Global Economic	X	X			0.5	0.00	0.00
	Government And Law	0.00	0		Government And Law	X	X			0.5	0.00	0.00
Management	Communication	1.00	6	Management	Communication	X	X	X	X	1	1.00	0.24
	Management	0.33	2		Management		X		X	0.5	0.17	0.04
	Finance	0.33	2		Finance	X	X			0.5	0.17	0.04
	Organization	0.33	2		Organization	X	X		X	0.75	0.25	0.06
	Decision Making	0.33	2		Decision Making	X	X			0.5	0.17	0.04
	Accounting	0.17	1		Accounting		X	X	X	0.75	0.13	0.03
	Human Behavior and Resources	0.17	1		Human Behavior and Resources		X	X	X	0.75	0.13	0.03
	Ethic Issue	0.00	0		Ethic Issue		X		X	0.5	0.00	0.00
	Leadership	0.00	0		Leadership	X	X		X	0.75	0.00	0.00
Marketing	Marketing	0.33	2	Marketing	Marketing	X	X	X		0.75	0.25	0.06
Project	Project Management	1.00	6	Project	Project Management		X		X	0.5	0.50	0.12
	Product Development	0.67	4		Product Development	X	X	X	X	1	0.67	0.16
	Quality	0.33	2		Quality		X	X	X	0.75	0.25	0.06
	Manufacturing	0.00	0		Manufacturing				X	0.25	0.00	0.00
	Expert System	0.00	0		Expert System				X	0.25	0.00	0.00
										Total:	4.13	1.00

APPENDIX B

- Questionnaires -

QUESTIONNAIRE FOR MARKET NEEDS ANALYSIS (Interview I)

KEY QUESTION

What type of an engineering management program for the high technology industry is needed?

GENERIC QUESTION

COURSES

1. What type of courses would be required for a degree in EMP for software engineers:

- New Product Development?
- Project management? √
- Communication? √
- Specialized technical skills?
- Specialized corporation based skills?
- Others?

Notes: Colleges are turning out students that have sub parskills in this area. Students that we interview are lacking in this area. Main frame development accounts for 20-30% of necessitated project management skills, yet small business accounts for 80% of the work force. It seems to me that colleges need to get up to speed and emphasize these skills at EMP and all engineering skill levels.

2. Are there outside influences that would drive a course offering?

- As part of their career, are there requirements for an engineer to stay certified within the market area?
- Are there any areas that need certification training in your field?

Notes: Microsoft and Novel supply an excellent example of a method for providing continuing education and certification. With states looking at requiring licensing of technical professionals,the universities should work together to come up with common standards for the continuing education.

DELIVERY METHODS

1. What delivery methods do you prefer?

- Face to face
- Distance learning
- At your company
- Location (geographic)

Notes: Programs seem to indicate that people learn and retain the most information when peers give training. Higher education and management students need more training in peer education. They need to learn to teach other employees to train others.

2. What are the best times for you?

- Season
- Month
- Day
- Time of the day

Notes: Typically 2 nights per week 2-3 hrs per night, 2 semesters a year. Most EMP related individuals in a continuing education for master's degrees or Ph.D. would be working class or very young and still in full time

education programs. Who cares about the full time students but the working class needs evening for classes.

3. What formats do you prefer?

- Multiple week courses
- 8-hour format
- 3-hour format √
- Other

KEY SUCCESS FACTORS (KSF'S)

1. What are the KSF's for an EMP degree?

Proper foundation skills. Basic EMP prep classes for undergraduate students preparing for EMP careers.

2. What constitutes a quality educational experience?

Smaller classrooms (lower numbers of students) better preparation for educators.

3. When looking for an engineering education, what are major factors that you consider in selecting the provider?

Cost and convenient class schedules.

ADDED VALUE

1. What is an engineer usually looking for in an EMP degree?

Project management and communications skills emphasis.

2. Tell me what your best and worst experience looked like?
3. How would an EMP degree impact your job?

The provided benefit of an EMP would add greatly to my company in a small company, 16-50 employees. The added benefit would mean in increase in salary and on status.

a. Skillwise

The provided benefit would mean a possible increase in company income. An EMP's time in billable cut to much higher rate for $150 per hour.

b. Promotionwise

Not much but the smaller company I work with would benefit as a whole.

c. Compensationwise

5-100 $ per hour salary increase.

d. Other

PROFILE OF ENGINEER

Please provide your personal background information:

1. Your name: *Kevin M Perkl*
2. What is your degree in? *Computer Science*
3. Where did you get your degree? *P.S.U*
4. What position do you hold in your company? *Systems Analyst / Programmer*
5. How many years have you been out of school? *10 years*
6. Company: *Trillium Software Inc.*

QUESTIONNAIRE FOR MARKET NEEDS ANALYSIS (Interview-II)

KEY QUESTION

What type of an engineering management program for the high technology industry is needed?

GENERIC QUESTION

COURSES

1. What type of courses would be required for a degree in EMP for software engineers:

- New Product Development?

Marketing research, product marketing and research, competitive analysis, information research. Product lifecycle: projecting, features, divergent cycle analysis, multistage planing

- Project management?

Interpersonal skills, presentation, training, personnel management, organizing projects / managing people.

- Communication?

Toastmasters / presentation / impromptu presentation/props

- Specialized technical skills?

Industry specialized training / senior management training

- Specialized corporation based skills?

Large US small company mentality / company growth */ pains*

- Others?

Risk assessment / capital investor relations / revenue acquisition (how to get investment capital)

2. Are there outside influences that would drive a course offering?

Technical company requirements / corporation needs

- As part of their career, are there requirements for an engineer to stay certified within the market area?

No / experience counts / however, I would agree that say, every 5-10 years refresher courses could be recommended, say a new educational status, like bachelors and continuing education.

- Are there any areas that need certification training in your field?

No / software industry, except in large companies is too in flux.

DELIVERY METHODS

1. What delivery methods do you prefer?

- Face to face

Class education – presentation by industry experts with technical experience.

- Distance learning

Difficult at best

- At your company

Great idea, may only work in large companies though

- Location (geographic)

Large population centers

2. What are the best times for you?

- Season

Any time but Christmas / seasonal holiday

- Month

Say one day, once a month

- Day

Early Saturday mornings 5.30 – 7.00, weeknights – right after normal working hours.

- Time of the day

Lunch time 1-2 times per week

3. What formats do you prefer?

- Multiple week courses √

Best cumulative effect

- 8-hour format

Hard to absorb sufficient information to use effectively.

- 3-hour format

Almost too long

- Other

1-2 hour course 2 to 3 days per week

KEY SUCCESS FACTORS (KSF'S)

1. What are the KSF's for an EMP degree?

Teach software engineers to be organized communicators, dealing with employees and managers.

2. What constitutes a quality educational experience?

Provides information which proves useful to EMP positions

3. When looking for an engineering education, what are major factors that you consider in selecting the provider?

Location/convenience, course offerings/time

ADDED VALUE

1. What is an engineer usually looking for in an EMP degree?

Some are just looking for a "piece of paper" others are looking for an avenue to get into management positions

2. Tell me what your best and worst experience looked like?

Academic, teachers who enjoy teaching, teachers whom could really care less about what they teach.

3. How would an EMP degree impact your job?
   a. Skillwise

   Improve planning and organization skills. Understand overall product development and planning and how it affects the software engineer.

   b. Promotionwise

   Could provide more avenues of entry to management.

   c. Compensationwise

   At present company – little or not at all. At a large company, much more likely

   d. Other

PROFILE OF ENGINEER

Please provide your personal background information:

1. Your name: *Keith Perkl*
2. What is your degree in? *Software engineering*
3. Where did you get your degree? *P.S.U*
4. What position do you hold in your company? *Senior software engineering*
5. How many years have you been out of school? *7-8 years*

QUESTIONNAIRE FOR MARKET NEEDS ANALYSIS (Interview III)

KEY QUESTION

What type of an engineering management program for the high technology industry is needed?

GENERIC QUESTION

COURSES

1. What type of courses would be required for a degree in EMP for software engineers:

- New Product Development? √

Software project management in 120 to 180 development cycle

- Project management? √

Small groups development. Groups at 10 or less people

- Communication? √

Vocabulary of different department. How to understand the different disciplines

- Specialized technical skills?
- Specialized corporation based skills?
- Others?

2. Are there outside influences that would drive a course offering?

- As part of their career, are there requirements for an engineer to stay certified within the market area? *No*

- Are there any areas that need certification training in your field? *Project management*

DELIVERY METHODS

1. What delivery methods do you prefer?

- Face to face √ *Teacher, classroom*
- Distance learning
- At your company
- Location (geographic) *Downtown, close to my work*

2. What are the best times for you?

- Season
- Month
- Day
- Time of the day *Nights*

3. What formats do you prefer?

- Multiple week courses √ *Multi week term course with homework*
- 8-hour format
- 3-hour format
- Other

KEY SUCCESS FACTORS (KSF'S)

1. What are the KSF's for an EMP degree?

A good understanding of management role in the successful role out of new technology within the work community.

2. What constitutes a quality educational experience?

The amount that I use remember in one year

3. When looking for an engineering education, what are major factors that you consider in selecting the provider?

Rating compared other schools in the area, professionals in the area that are taking the course

ADDED VALUE

1. What is an engineer usually looking for in an EMP degree?

Money

2. Tell me what your best and worst experience looked like?

Much book, not enough real life project management

3. How would an EMP degree impact your job?

Upward movement, project management

   a. Skill wise
   b. Promotion wise *management*
   c. Compensation wise *more money*
   d. Other *understanding and terminology of other groups within the company*

PROFILE OF ENGINEER

Please provide your personal background information:

1. Your name: ****Greg's brother***
2. What is your degree in? *Computer engineering / engineering management*
3. Where did you get your degree? *P.S.U*
4. What position do you hold in your company?

QUESTIONNAIRE FOR MARKET NEEDS ANALYSIS (Interview IV)

KEY QUESTION

What type of an engineering management program for the high technology industry is needed?

GENERIC QUESTION

COURSES

1. What type of courses would be required for a degree in EMP for software engineers:

- New Product Development?

Not relevant

- Project management?

Yes

- Communication?

Critical. Customer service / Sales

Relations – listen – pro-active – meet needs

- Specialized technical skills?
- Specialized corporation based skills?
- Others?

Systems that expands functional areas – meet all needs – more outside users

2. Are there outside influences that would drive a course offering?

- As part of their career, are there requirements for an engineer to stay certified within the market area? *No*
- Are there any areas that need certification training in your field? *No*

DELIVERY METHODS

1. What delivery methods do you prefer?

- Face to face *Very important*
- Distance learning
- At your company *Ideal*
- Location (geographic) *Local better*

2. What are the best times for you?

- Season
- Month
- Day √
- Time of the day *Depend on the person*

3. What formats do you prefer?

- Multiple week courses
- 8-hour format
- 3-hour format *Prefer – depends on the number of courses*
- Other

KEY SUCCESS FACTORS (KSF'S)

1. What are the KSF's for an EMP degree?

   To make it worth while

2. What constitutes a quality educational experience?

   Make sure it adds something new – skill level increase

3. When looking for an engineering education, what are major factors that you consider in selecting the provider?

Track record / quality of course work

ADDED VALUE

1. What is an engineer usually looking for in an EMP degree?

Higher skill level, broader horizon

2. Tell me what your best and worst experience looked like?

   Instructor that conveys a good message

Time wasting – busy work

3. How would an EMP degree impact your job?
   a. Skillwise *Yes*
   b. Promotionwise *Yes*
   c. Compensationwise *Yes*
   d. Other

PROFILE OF ENGINEER

Please provide your personal background information:

1. Your name: *John Peterson*
2. What is your degree in? *Computer Science*
3. Where did you get your degree? *Western Washington University*
4. What position do you hold in your company? *Supervisor of System Development*
5. How many years have you been out of school? *20±*
6. Company: *Blue Cross Blue Shield*

QUESTIONNAIRE FOR MARKET NEEDS ANALYSIS (Interview V)

KEY QUESTION

What type of an engineering management program for the high technology industry is needed?

One which emphasizes how to align engineering efforts to support business goals and strategies

GENERIC QUESTION

COURSES

1. What type of courses would be required for a degree in EMP for software engineers:

- New Product Development?

Yes

- Project management?

Very important

- Communication?

Yes, yes, yes. All types – presentation skills – this is a problem

- Specialized technical skills?

Only high to medium level

- Specialized corporation based skills?

All the fundamental business processes

Eg. Strategic planning, budgeting, prioritization

- Others?

Change control – product movement from test to production – change management – people issues – cost benefit analysis – ROI, etc

2. Are there outside influences that would drive a course offering?

- As part of their career, are there requirements for an engineer to stay certified within the market area? *No, only for a few specialized advancements*
- Are there any areas that need certification training in your field? *No*

DELIVERY METHODS

1. What delivery methods do you prefer?

- Face to face *Yes*
- Distance learning *For specialized subjects with small audience*
- At your company *As much as possible for economy*
- Location (geographic) *Local or at least regional (off-site is a benefit) (for economy)*

2. What are the best times for you?

- Season
- Month *Jan - July*
- Day
- Time of the day

3. What formats do you prefer?

- Multiple week courses
- 8-hour format *One day per week for several weeks works for some types of courses*
- 3-hour format
- Other *Concentrated (one shot)*

KEY SUCCESS FACTORS (KSF'S)

1. What are the KSF's for an EMP degree?
2. What constitutes a quality educational experience?

Knowledge and skills that are immediately adaptable or applicable to the job

3. When looking for an engineering education, what are major factors that you consider in selecting the provider?

References / reputation, curriculum, cost

ADDED VALUE

1. What is an engineer usually looking for in an EMP degree?

   To evolve from a purely technical perspective to a process and people perspective

2. Tell me what your best and worst experience looked like?
3. How would an EMP degree impact your job?

At his point – very little

   a. Skillwise
   b. Promotionwise

   It might contribute positively to promotion opportunities

   c. Compensationwise

   Only via promotion

   d. Other

PROFILE OF ENGINEER

Please provide your personal background information:

1. Your name: *Kip Stevenson*
2. What is your degree in? *Engineering, math*
3. Where did you get your degree? *University of Washington Reed College*
4. What position do you hold in your company? *Manager, Systems Development*
5. How many years have you been out of school? *27*
6. Company: *Blue Cross Blue Shield*

QUESTIONNAIRE FOR MARKET NEEDS ANALYSIS (Interview VI)

KEY QUESTION

What type of an engineering management program for the high technology industry is needed?

GENERIC QUESTION

COURSES

1. What type of courses would be required for a degree in EMP for software engineers:

- New Product Development?

Think like end users / not programmers

- Project management?

Need – big picture

- Communication?

Team building skills, run meeting

- Specialized technical skills?

Customer satisfaction / needs

- Specialized corporation based skills?

Yes

- Others?

Customer analysis skills – make it the customers choice, operation research

2. Are there outside influences that would drive a course offering?

- As part of their career, are there requirements for an engineer to stay certified within the market area?

Nice but not required

- Are there any areas that need certification training in your field?

MS has certification young can pass / older can't

DELIVERY METHODS

1. What delivery methods do you prefer?

- Face to face *Team building*
- Distance learning
- At your company √
- Location (geographic) *Local*

2. What are the best times for you?

- Season
- Month
- Day
- Time of the day

3. What formats do you prefer?

- Multiple week courses √
- 8-hour format *To much*
- 3-hour format √
- Other

KEY SUCCESS FACTORS (KSF'S)

1. What are the KSF's for an EMP degree?

Directly applicable, eg. today's technology networking LAN / WAN object oriented

2. What constitutes a quality educational experience?

3. When looking for an engineering education, what are major factors that you consider in selecting the provider?

Understand that the world is changing fast – discontinuous design

ADDED VALUE

1. What is an engineer usually looking for in an EMP degree?

Look for both continuous and discontinuous design

2. Tell me what your best and worst experience looked like?

   Componmters *now* **exc** *before*

3. How would an EMP degree impact your job?

To promote from programmer to systems analyst

   a. Skillwise
   b. Promotionwise
   c. Compensationwise
   d. Other

PROFILE OF ENGINEER

Please provide your personal background information:

1. Your name: *John Cassell*
2. What is your degree in? *Industrial Engineering, MBA*
3. Where did you get your degree? **Bachelor** *OSU,* **Masters** *UC*
4. What position do you hold in your company? *President*
5. How many years have you been out of school? *BS 72, MS 75*
6. Company: *Trillium Software*

APPENDIX C

- Complete offering listing per university -

ASSUMPTION UNIVERSITY

http://www.cem.au.edu/

COURSE DESCRIPTIONS

*CE 6501PRINCIPLES OF ENGINEERING MANAGEMENT I 3(3-0-0)Transition of the engineer to manager; planning and organizing technical activities; selecting and managing projects; team building and motivation; techniques of control and communication; time management.

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*CE 6502PRINCIPLES OF ENGINEERING MANAGEMENT II3(3-0-0)Prerequisite : CE 6501 Productivity improvement including energy, manufacturing, and personnel management. Management of technology including technology forecasting and planning. Overview of system analysis and design including statistical process control, production control, and system engineering. Overview of general management including marketing, finance, and human resource.

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*CE 6503ACCOUNTING FOR ENGINEERING MANAGEMENT 3(3-0-0)Study of accounting principles, procedures, and the application of accounting principles to management planning, control, and decision making. Includes financial statement analysis and cost and budgetary procedures.

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*CE 6504COST ACCOUNTING3(3-0-0)Analysis of job, process, and standard cost accounting methods.

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*CE 6505FINANCIAL MANAGEMENT 3(3-0-0)Principles of financial organization and management in technological enterprise; demands for funds; internal and external supply of funds; budgetary control; reserve and dividends policy. Emphasize systems approach and problems of engineering design and automation as they influence financial decisions.

---

*CE 6506 COMPUTER AND ENGINEERING ECONOMY3(3-0-0)Comprehensive treatment of computer and engineering economy including effects of taxation and inflation; sensitivity analysis; decisions with risks and uncertainty; decision trees and expected value, normally includes solutions on personal computer and student problem report.

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*CE 6507ENGINEERING ECONOMY 3(3-0-0)The analysis of capital expenditures, multioutcome considerations; risk and uncertainty, and cost of risk. The study of utility theory, dispersed service lives, expansion and economic package concepts, implementation, control and follow up of capital expenditures, mathematical programming, uncertainty, game theory, model building, and simulation, gueving evaluations of capital planning.

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*CE 6508HUMAN RELATIONS IN TECHNICAL MANAGEMENT3(3-0-0) Human behavior in technical managerial situations, influencing and motivating performance, improving morale and discipline, and self-praisal and analysis.

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*CE 6509PERSONNEL MANAGEMENT3(3-0-0)Current practices of procurement and maintenance of technical personnel in research, development, and design organizations. Adaptation of such personnel to the technological enterprise, current practices in personnel administration, labor-management relationships.

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*CE 6510INDUSTRIAL MARKETING SYSTEMS ANALYSIS 3(3-0-0) An analysis of the factors of engineered products, customers, communication; promotion, personal selling, persuasion, and management within a dynamic industrial sales environment.

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*CE 6511MARKETING MANAGEMENT 3(3-0-0)Study of marketing decision areas in technically based firm, including product selection and development, marketing research, market development, distribution, advertising, and promotion. Pricing policies including legal aspects and problems in selecting training, and

controlling field sales force. Examination of interaction within consumer and industrial marketing environments.

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*CE 6512CASE STUDIES IN GENERAL MANAGEMENT 3(3-0-0)A quantitative study of engineering management problems related to the functioning of industrial enterprise through case studies.

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*CE 6513OPERATIONS IN SERVICE INDUSTRIES 3(3-0-0)Study of the design and control of the service operations in industries including all aspects of management, such as, capacity planning, quality, queving, material, site location, and related strategies.

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*CE 6611COMPUTER INTEGRATED MANUFACTURING SYSTEMS MANAGEMENT3(3-0-0)Study of the design and use of computer-based integrated manufacturing management systems in the allocation and control of plant, equipment, manpower, and materials.

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*CE 6614 PACKAGING MANAGEMENT 3(3-0-0) Provides a comprehensive background in the field of packaging and its place in productive systems. Emphasizes the design or economics of the system. Analyzes the management of the packaging function and interrelationship with other functions of an enterprise.

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*CE 6616PROJECT MANAGEMENT3(3-0-0)Organization structure and staffing; motivation, authority, and influence; conflict management; project planning; network systems; pricing estimating, and cost control; proposal preparation; project information systems, international project management.

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*CE 6620PRODUCTION MANAGEMENT3(3-0-0)Examination of responsibilities of production manager in the technological enterprise for providing finished goods to meet the quality, price, quantity and specification needs of the market place. Study of functions of production manager. Quantitative approach to decision making in production management.

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*CE 6623 PRODUCTIVITY ENGINEERING AND MANAGEMENT3(3-0-0)Study of various models, methods to improve the productivity of manufacturing and service organizations.

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*CE 6701STATISTICAL PROCESS CONTROL3(3-0-0)An integrated analysis of the quality assurance function. Quality engineering, sampling, inspection, and design review are discussed and related. Quantitative aspects of statistical quality control are introduced in context along with a review of Deming's principles of productivity improvement.

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*CE 6702MANAGEMENT OF QUALITY ASSURANCE3(3-0-0)Advanced topics of quality assurance will be covered; including the economic design and use of acceptance sampling and control charting, and Toguchi's method. Emphasis is on the applications of modern statistical theory and modern conceptual models in the quality assurance.

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*CE 6704 MAINTENANCE MANAGEMENT3(3-0-0) Maintenance functions and the role of the technical manager in designing, supervising, and implementing maintenance program. Topic includes human aspects of maintenance, preventive maintenance, and computers in maintenance.

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*CE 6705DETERMINISTIC MODELS IN OPERATIONS RESEARCH3(3-0-0)Introduction to linear programming, transportation and assignment problems, dynamic programming and deterministic inventory models.

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*CE 6706STOCHASTIC MODELS IN OPERATIONS RESEARCH3(3-0-0)Stochastic processes, Markov chains, queving theory and queving decision models, probabilistic inventory model; PERT/CPM; simulation and output analysis.

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*CE 6803TECHNOLOGY, POLICY, AND SOCIETY3(3-0-0)The role and implications of technology and technological thinking on society. The nature of public policy with respect to science and technology. The

international technology transfer. World modeling and simulation, with special emphasis on third world issues.

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*CE 6804ENERGY MANAGEMENT3(3-0-0)Appraisal of energy conservation management, economic efficiency of energy sources and energy productivity analysis. Principles of energy efficiencies and energy balance analysis interfaced with engineering management theory.

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*CE 6805ENVIRONMENTAL MANAGEMENT3(3-0-0)Technical, economic, political, administrative, and social forces influencing the quality of the environment and the use of resources. Review of government and industrial programs to combat pollution of the air, land and water. Review of existing and pounding legislation involving environmental and related energy matters, theoretical aspects of specific management problems, procedures for promoting public participation.

CARNEGIE MELLON UNIVERSITY

http://www.cs.cmu.edu

Business Specialization Track

Master of Software Engineering (MSE) students whose career goals include business management within a computer-related technology company, developing or managing information systems, and/or starting a software-related company, can acquire fundamental business skills by pursuing the Business Specialization Track. This track is similar to a minor in bussiness.

All students who complete the Business Specialization Track will be able to read and interpret primary financial statements such as the balance sheet, the income statement, and the cash flow statement. They will understand basic cost and budgeting concepts used to analyze and report the performance of business operations and will learn how to make intelligent financial decisions regarding these operations. Other knowledge and skills that they will acquire depend on the courses that they select to match their career goals.

All students who pursue the Business Specialization Track will take the following two courses:

•Financial Accounting (45-700)
•Managerial Accounting (45-701)

Students will select six other half-semester (6-unit) courses or the equivalent number of full-semester courses from the Graduate School of Industrial Administration or from an approved list.

Example career goals that students might choose are the following:
1.Busimess Management in a Computer Technology Company
2.Information Management
3.Entrepreneurship

Career Goal 1: Business Management in a Computer Technology Company

Skills Acquired:
•Leadership and decision-making.
•Formulation and communication of business objectives.
•Employee motivation and achievement of company objectives.

Knowledge Areas:
•Basic marketing strategy.
•Profitability of capital ventures.
•Political, social, and legal issues that affect company policy.

Required Courses:
•Financial Accounting (45-700)
•Managerial Accounting (45-701)

Recommended Courses:
Select the equivalent of at least six half-semester (6 unit) courses from those listed below.
•Finance (45-710)
•Marketing Management (45-740)
•Managerial Environment (45-740)
•Business, Government and Strategy (45-742)

•Managerial Economics (45-749)
•The Changing Global Environment and the Wealth of Nations (45-753)
•Business Communications (45-790)
•Human Behavior in Organizations (45-792)
•Technology Development, Manufacturing and Marketing in the Computer Industry (45-846)
•Organizational Structure, Strategy and Innovation in the Computer Industry (45-847)
•Ethical Issues in Bussiness (45-849)
•Interpersonal Negotiation (45-904)
•Organizational Management: Theory and Practice (90-800)
•Leadership: Innovation and Organization Change (90-810)
•Advanced Topics in Leadership (90-845)

Career Goal 2: Information Management (management and/or systems development)

Skills Acquired:
•Management of an information systems or a computing facilities department.
•Role of a Chief Information Officer.
•Technical and business communications.

Knowledge Areas:
•Information infrastructure of a company.
•Generation, processing, storage, and communication of data.
•Important financial, political, social, and ethical concepts.
•Information and telecommunication systems development.
•Social interactions and their impact on company operations.

Required Courses:
•Financial Accounting (45-700)
•Managerial Accounting (45-701)

Recomended Courses:
Select the equivalent of four half-semester (6 unit) courses from those listed below.
•Finance (45-710)
•Management of Information Systems (45-970)
•Marketing Management (45-720)
•Business Communications (45-790)
•Human Behavior in Organizations (45-792)
•Technology Development, Manufacturing and Marketing in the Computer Industry (45-847)
•Organizational Structure, Strategy and Innovation in the Computer Industry (45-847)
•Ethical Issues in Business (45-849)
•End-User Programming for Virtual Business (45-859)
•Electronic Commerce and Virtual Bussiness (45-865)
•Information and Communications Technologies in Management (45-870)
•Telecommunications for Business (45-871)
•Information Resources Management (45-872)
•Information Systems Project Course (45-874)
•Expert Systems (45-963)

Career Goal 3: Entrepreneurship (high technology company start-up)

Skills Acquired:
•Understanding the relationship between: product idea, market demand, required technology, business plan, and funding.
•Constructing a good business plan.

Knowledge Areas:
•Factors that contribute to the success of a startup company.
•Financial aspects of founding a start-up company.
•Marketing principles.
•Organizational, ethical and legal issues.

Required Courses:
•Financial Accounting (45-700)
•Managerial Accounting (45-701)

Recomended Courses:
Select the equivalent of at least six half-semester (6 unit) courses from those listed below.
•Enterpreneurship I (45-880)
•Enterpreneurship II (45-979)
•Finance (45-710)
•Marketing Management (45-720)
•Managerial Economics (45-749)
•The Changing Global Environment and the Wealth of Nations (45-753)
•Business Communications (45-790)
•Human Behavior in Organizations (45-792)
•Technology Development, Manufacturing, and Marketing in the Computer Industry (45-846)
•Organizational Structure, Strategy, and Innovation in the Computer Industry (45-847)
•Ethical Issues in Business (45-849)
•End-User Programming for Virtual Business (45-859)
•Electronic Commerce and Virtual Business (45-865)
•Interpersonal Negotiation (45-904)
•Organizational Management: Theory and Practice (90-800)
•Leadership: Innovation and Organizational Change (90-810)

OREGON GRADUATE INSTITUE OF SCIENCE AND TECHNOLOGY

http://www.cse.ogi.edu

Course Descriptions

Department of Computer Science and Engineering

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*CSE518 Software Design and Development
Techniques of contemporary software design, including component-based design, component integration, encapsulation, composition, software architectures, software specification, software prototyping, design reuse, abstraction and modularity, design before implementation, and design refinement. Principles are applied in a class project of modest complexity. Tasks of design, design inspection, and design documentation are assigned to student teams.
3 credits

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*CSE570 Introduction to the Principles of Modern Finance
This course is an introduction to the six most important concepts in modern finance: net present value, conservation of value, the capital asset pricing model, efficient markets hypothesis, option pricing theory, and agency theory. Topics include capital budgeting/capital structure, mean-variance portfolio theory, arbitrage pricing theory, Black-Scholes option pricing, and dynamic hedging strategies. In addition, students learn how to construct investment portfolios and manage portfolio risk using options and futures.
3 credits

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*CSE571 Options and Futures
This course examines the pricing of options and management of options portfolios. Emphasis is on the pricing of various options since Black-Scholes, including exotics and their dynamic hedging. Topics covered include stochastic calculus, partial differential equations, stochastic volatility, portfolio insurance, dynamic hedging strategies, Monte Carlo pricing, Cox-Rubinstein model, and neural network methods.
3 credits

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*CSE573 Global Markets, Foreign Exchange, and Global Risk Management
This course explores the central issues in international finance including foreign exchange pricing and risk management. Topics include purchasing power parity, interest rate parity, theories of exchange rate determination, international asset pricing theory, global portfolio management, investing in emerging markets, and foreign exchange forecasting. In addition, the pricing of foreign exchange options and futures is discussed with emphasis on dynamic hedging strategies. Finally, the course gives substantial coverage to value at risk analysis and risk management strategies.3 credits

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*CSE577 Financial Time-Series Analysis
This course reviews advanced time-series techniques to the analysis and forecasting of financial time series data including martingales and random walks. Emphasis is given to multivariate and nonlinear methods. Topics include ARIMA models, unit root tests, trend reversion, fractional integration, regime-switching models, GARCH models, vector autoregression, error-correction models, volatility tests, and nonparametric tests. Designed for the practitioner and the researcher, the course goal is for students to gain expertise in the empirical modeling of regular and high-frequency financial time series.
3 credits

EMP

UNIVERSITY OF MISSOURI-ROLLA

WWW.UMR.EDU

Eng Mg 400: Special Problems
Credit: Variable
Problems or readings on specific subjects or projects in the department.
Consent of instructor required.

Eng Mg 401: Special Topics
Credit: Variable
This course is designed to give the department an opportunity to test a new course. Variable title.

Eng Mg 408: Advanced Engineering Economy
Credit: Lect 3.0
The analyses of capital expenditures, multioutcome considerations: risk and uncertainty, and cost of risk. The study of utility theory, dispersed service lives, expansion and economic package concepts, implementation, control, and followup of capital expenditures, mathematical programming, uncertainty, game theory, model building and simulation, queueing evaluations for capital planning.
Prerequisite: Eng Mg 208 or 308.

Eng Mg 410: Seminar
Credit: Variable
Discussion of current topics. (This course may be used by all graduate degree granting curricular designations).

Eng Mg 420: Technological Innovation Management
Credit: Lect 3.0
Technological innovation is new technology creating new products and services. This course studies the issues of managing technological innovation under four topics: 1) Innovation; 2) New Ventures; 3) Corporate Research & 4) R&D Infrastructure.
Prerequisite: Eng Mg 314.

Eng Mg 433: Advanced Management Information System
Credit: Lect 3.0
Advanced topics in management information systems such as information resource management, group decision support systems, knowledge based systems, and communication systems.
Prerequisite: Eng Mg 333.

Eng Mg 434: Advanced Manufacturing Systems Integration
Credit: Lect 2.0 and Lab 1.0
The integration of new technology and information processing concepts for controlling the manufacturing systems. Advanced topics in computer integrated manufacturing systems, industrial robots, CNC machine tools, programmable controllers, material handling systems, manufacturing planning and control.
Prerequisite: Eng Mg 334.

UNIVERSITY OF IDAHO

http://www.uidaho.edu/

University of Idaho 1997 General Catalog

Computer Science

Paul W. Oman, Chair, Dept. of Computer Science (B40 Janssen Engr. Bldg. 83844-1010; phone 208/885-6589).

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*CS J482/J582 Software Project Management (3 cr). Techniques for planning, organizing, scheduling, and controlling complex software system development and support projects. Additional projects/assignments reqd for grad cr. Prereq: CS 381 or 480 or perm.

*CS J484/J584 Software Quality Assurance (3 cr). Actions necessary to provide confidence that a software product conforms to established technical requirements; strategies for implementation and management of SQA, product reviews, test plans and procedures, audits, configuration management, and reliability assessment; concepts of software quality. Additional projects/assignments reqd for grad cr. Prereq: CS 381.

*CS J485/J585 Software Process Management (3 cr). Systematic software development from management perspective that centers on constituent tasks and their interrelationships; evaluation of software development process maturity and means to improve process maturity. Additional projects/assignments reqd for grad cr. Prereq: CS 381.

*CS 581 Software Engineering Analysis (3 cr). Intro to research in software engineering; strong emphasis on application of quantitative techniques in the software life cycle; students will develop a command of current software engineering literature; exploration of techniques of mathematical modeling and solutions to software engineering problems.

*CS 582 Software Project Management (3 cr). See CS J482/J582.

*CS 583 Software Engineering Measurement (3 cr). Measurement methodology is the foundaiton of the emerging discipline of software engineering; software products are constructed by people engaged in a software development process in a development environment; focus on learning to measure the attributes of these four measurement domains; examples of software measurement and the applications of these measurements; using these techniques as the basis for the design of software engineering experiments; application of the scientific method in evaluation of programming methods and models; extension of the measurement concepts into the area of statistical modeling. Prereq: CS 581.

*CS 584 Software Quality Assurance (3 cr). See CS J484/J584.

*CS 585 Software Process Management (3 cr). See CS J485/J585.

UNIVERSITY OF CALGARY

http://www.cpsc.ucalgary.ca

1997-1998 Degree Structure

Courses

There are 6 required quarter courses which form the core of the program. An additional 2 half courses are taken as options from defined lists. Quarter courses are specified by Q(x-y) where the number of class hours per week is x, and the number of lab hours is y.

The core quarter-courses are:

*•SENG 613 (Fall R 17:30-20:30) Managing the Software Lifecycle. Further methodologies for requirements engineering. Applications of requirements engineering to the management of the lifecycle of software development from requirements elicitation through analysis, design, coding, testing, enhancement and reuse. Prerequisite SENG 611. Q(3-2)
*•SENG 621 (Winter R 17:30-20:30) Software Process Management. Analysis of software process maturity models from repeatability, though definition and management to optimization. Q(3-1)
*•SENG 623 (Winter R 17:30-20:30) Software Quality Management. Analysis of applicable quality measures for software processes, the role of reviews, metrics, and tools for the automatic derivation of quantitative measures. Prerequisite SENG 621. Q(3-2)
*•SENG 691 (throughout year). Managing the Software Engineering Research Process. Research methods for software engineering in an industrial setting. (Students register for course in semester when they will complete it). Q(3S-0)
*•SENG 693 (throughout year). Trends in Software Engineering. Recent developments in various areas of software engineering. (Students register for course in semester when they will complete it). Q(3S-0)

Advanced credit may be given for recent courses taken in core topics. This must be approved as part of the offer of a place in the program.

In addition students can select the equivalent of two half-courses from the following options:
*•MOHR 621 (Fall MW 18:30 - 21:30, or Winter TR 18:30 - 21:30) Organizational Management
*•MOHR 691 (Winter M 19:00-22:00) Project Human Resources and Organizational Effectiveness
*•ENCI 691/POEN 691 (Fall W 19:00-22:00, or Winter M 19:00-22:00) Fundamentals of Project Management

Eng Mg 441: Case Studies in General Management
Credit: Lect 3.0
First Term Authorized: XX00 Last Term Authorized: DE99
A quantitative study of engineering management problems related to the functioning of the industrial enterprise through case studies.
Prerequisite: Preceded or accompanied by an Eng Mg 400 level course.

Eng Mg 451: Advanced Marketing Management
Credit: Lect 3.0
Study of marketing decision areas in the technically based firm, including product selection and development, marketing research, market development, distribution, advertising, and promotion. Pricing policies including legal aspects and problems in selecting, training and controlling field sales force. Examination of interaction within consumer and industrial marketing environments.
Prerequisite: Eng Mg 314, Econ 122.

Eng Mg 452: Advanced Financial Management
Credit: Lect 3.0
Principles of financial organization and management in the technological enterprize; demands for funds; internal and external supply of funds; budgetary control; reserve and dividends policy. Emphasizes systems approach and problems of engineering design and automation as they influence financial decisions.
Prerequisite: Eng Mg 322.

Eng Mg 454: Advanced Production Management
Credit: Lect 3.0
Examination of responsibilities of production manager in the technological enterprise for providing finished goods to meet the quality, price, quantity and specification needs of the market place. Study of functions of production manager. Quantitative approach to decision making in production management.
Prerequisite: Eng Mg 314, Cmp Sc 73, Stat 215.

Eng Mg 456: Advanced Personnel Management
Credit: Lect 3.0
First Term Authorized: XX00 Last Term Authorized: DE99
Current practices of procurement and maintenance of technical personnel in research, development, and design organizations. Adaptation of such personnel to the technological enterprise, current practices in personnel administration, labor management relationships.
Prerequisite: Eng Mg 314.

Eng Mg 462: Inventory Strategies
Credit: Lect 3.0
Topics to be covered will include the nature of inventory systems and the types of management problems encountered in the operation of such systems. Deterministic models with (and without) typical industrial constraints will be examined along with

periodic review models with stochastic demands.
Prerequisites: Stat 215 or Stat 343.

Eng Mg 476: Advanced Engineering Management Science
Credit: Lect 3.0
Solving of managerial problems utilizing management science techniques. Problems are analyzed, modeled and solved using such techniques as linear, goal, dynamic, programming, simulation, statistical analysis or other non-linear methods. Solutions will involve the use of personal or mainframe computers. A study of the current literature in management science will also be conducted.
Prerequisite: Stat 215, Cmp Sc 260 or 376.

Eng Mg 478: Advanced Manufacturing Through Neural Networks
Credit: Lect 3.0
Intelligent system architectures, advanced neural networks paradigms; ARTMAP, CMAC, fuzzy logic, associative memory, hierarchical networks, radial basis functions, adaptive heuristic critic for solving product design, process planning and control, scheduling, feature identification and assembly problems in building autonomous manufacturing systems.
Prerequisites: Eng Mgt 378 or equivalent Neural Network Course.

Eng Mg 485: Advanced Topics in Quality Assurance
Credit: Lect 3.0
Selected topics such as cost analysis, organizational structure, Ishikawa diagrams, Pareto analysis, Taguchi methods and other statistical procedures will be examined with regard to their underlying theoretical basis and problems in application
Prerequisite: Eng Mg 375 or 385 or 387.

Eng Mg 489: Advanced Research Methodology in Engineering Management
Credit: Lect 3.0
An advanced study of research methodology techniques and theories in conducting research activities. The research problems, hypotheses, literature search, data requirements and analyses, interpretation and presentation of results are examined.
Prerequisite: Graduate standing.

Eng Mg 490: Research
Credit: Variable
Investigations of an advanced nature leading to the preparation of a thesis or dissertation.
Consent of instructor required.

Eng Mg 490H: Research - Honors
Credit: Variable

Eng Mg 493: Oral Examination
Credit: 00.0 Hours
After completion of all other program requirements, oral examinations for on-campus students may be processed during the first two weeks of an academic session or at any appropriate time for off-campus students upon enrollment in 493 and payment of an oral examination fee. All other students must enroll for

credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

Eng Mg 495: Continuous Registration
Credit: Lect 1.0
Doctoral candidates who have completed all requirements for the degree except the dissertation, and are away from the campus must continue to enroll for at least one hour of credit each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.

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MEM Required Courses
Curriculum Changes Effective Fall 1998

The Degree is obtained after satisfactorily completing six required courses and six electives. The required courses are*:

•Prerequisite For Admission to MEM Program

- •Statistics (IE C01)
  Collecting data; summarizing and displaying data; drawing conclusions from data: probability background, confidence intervals, hypothesis testing, regression, correlation

•Basic Methodologies

- •Quantitative Methods for Decision Making (IE D07)
  Mathematical modeling techniques useful in managerial decision making. Topics include linear programming and its applications, regression analysis and simulation. The course makes extensive use of the case study method.

•Essential Business Skills

- •Accounting Issues for Engineers (IE D23)
  Basic accounting concepts such as "T" accounts, assets, liabilities, owner's equity, along with traditional cost accounting concepts such as product costing, cost terminology, job order and process costing, budgeting, cost-volume-profit-analysis, and standard costs as well as non-traditional cost accounting topics.

- •Marketing Issues for Engineers (IE D31)
  Topics include: strategic marketing, types of market and buyer behavior, product strategies, marketing decisions(price, channel, advertising, sales force), market research, and international marketing.

- •Financial Issues for Engineers (IE D25)
  Basic engineering economy along with capital asset pricing, debt versus equity decisions, cost of capital, financial leverage, and the management of working capital. Other topics include financial justification of operational "intangibles" such as shorter lead times, better quality, and improved customer responsiveness.

•Managing Technology-based Organizations

- •Field Research in Organization Theory (IE D11)
  Design of field studies and experiments in organization theory. Emphasis on integrating requirements or rigorous research methods with limiting conditions found in the field (e.g. industry, government, or other organizations).

- •Capstone Simulation(IE D90)
  This course provides students with a business laboratory environment. During the course, students will be given the opportunity to integrate their understanding of the various business disciplines in the creation of a comprehensive business plan. Students accomplish the course objectives by managing their own companies using a state-of-the-art computer simulation.

•Electives

- •Elective Track - These electives may be used to complete Certificate in Telecommunications

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College of Business: 1997-98 Catalog

Course Descriptions:
GSB - GRADUATE STUDIES - BUSINESS

Publication Date: February 4, 1997

GSB 502 Foundations for Quantitative Analysis (4)
Basic quantitative concepts used in the MBA program. Matrices, linear systems of equations, introduction to calculus. Probability, basic statistical concepts and regression. Use of computer software to solve problems. This course may not be used for credit toward graduation. 4 seminars.

GSB 511 Financial Accounting (4)
Financial accounting model and accounting systems concepts. Principles and concepts used in preparing published financial statements. Interrelationships among those statements. Analysis and interpretation of their content. 4 seminars.

GSB 512 Quantitative Analysis (4)
Introduction to matrices and the concepts of statistical analysis. Probability distributions, point and interval estimation of population means, proportions, and variances. Analysis of variance, regression, correlation, multiple regression, time series, and forecasting. Use of computers to solve problems. 3 seminars, 1 laboratory. Prerequisite: GSB 502 or equivalent.

GSB 513 Organizational Behavior (4)
Examination of major organizational behavior (individual, interpersonal, group, and organizational) concepts, theories and constructs. Presented from an applied perspective with the purpose of increasing one's effectiveness and skill in understanding, analyzing, and managing organizational processes. 4 seminars.

GSB 514 Business, Government and Society (4)
Analysis from social, economic, political, legal and ethical perspectives of the changing domestic and international environment within which the American business enterprise operates. 4 seminars.

GSB 521 Managerial Accounting (4)
Managerial accounting with emphasis on communication and information to assist management in planning and control. Development of an operational understanding of cost systems, budgeting concepts, performance evaluation and other quantitative accounting techniques to assist management in planning and control. Accounting data in computer modeling applications. 3 seminars, 1 activity. Prerequisite: GSB 511.

GSB 522 Management Science (4)
Concepts and techniques of management science. Mathematical programming, decision theory, queuing models, network models, Markov analysis. Game theory. Dynamic programming. Use of computers to solve problems. 3 seminars, 1 laboratory. Prerequisite: GSB 512.

GSB 523 Managerial Economics (4)

Microeconomic analysis and its application to business decisions. Topics include the use of calculus and other quantitative techniques in economic analysis, market structures, pricing strategies, cost analysis and input selection. Examination of the economic impact of various governmental policies on the business firm. 4 seminars. Prerequisite: GSB 512.

GSB 524 Marketing Management (4)
Introduction to marketing management. Concepts and principles necessary to plan, direct and control the product, promotion, distribution and pricing strategies of the firm. 4 seminars.

GSB 531 Managerial Finance (4)
Theories, practices and tools of financial decision making. Topics include financial statement analysis, financial forecasting, valuation, capital budgeting, capital structure, dividends, and an overview of financial markets and institutions. 4 seminars. Prerequisite: GSB 511 and GSB 512.

GSB 532 Information Systems (4)
Overviews of management information systems and decision support systems. Structure of organizational information systems. Process of information systems development. File processing and integrated data base concept. Data communication and on line distributed systems. Management decision making using computer software packages. Report generation using word processing system. Interactive financial planning systems and the decision support systems. 3 seminars, 1 laboratory. Prerequisite: GSB 511.

GSB 533 Aggregate Economics (4)
Theoretical framework and empirical dimensions of the aggregate economic environment in which business enterprise must operate. Understanding of national income accounting, monetary and fiscal policies, inflation, unemployment and balance of payments issues in static and dynamic contexts. Develops an ability to understand macroeconomic events in an evolving and interconnected world economy. 3 seminars, 1 activity. Prerequisite: GSB 523.

GSB 534 Production and Operations Management (4)
Production function and its interaction with other functional areas in an organization. Application of quantitative and statistical methods to planning, control and decision making in operations management. Topics include economics of plant location, logistics, material management, and quality control. 4 seminars. Prerequisite: GSB 522.

GSB 562 Seminar in General Management and Strategy (4)
Application of interdisciplinary skills to business and corporate strategy formulation and implementation. Analysis of interdependence between external environments and internal systems. Focus on responsibilities, tasks, and skills of general managers. Case studies, group problem solving. Integrating course of MBA core curriculum. Course satisfies comprehensive examination requirement. 4 seminars. Prerequisite: Must be taken within last 24 units prior to graduation and after completion of all MBA first-year required GSB courses or equivalent.

GSB 570 Entrepreneurship and Small Business Management (4)
Exploration in entrepreneurship with emphasis on the formation and management of new business ventures. Analysis of typical operating problems of these firms and application of appropriate techniques for their solution. 4 seminars. Prerequisite: GSB 513.

GSB 571 Organizations and Management (4)
Examination of major theories and conceptual constructs relating to the operating requirements of complex organizations, including manufacturing, service, and nonprofit organizations; historical development of theory and practice; managerial behavior functions and processes. Current issues and actual cases. 4 seminars. Prerequisite: GSB 513.

GSB 572 Seminar in Organization Design and Management (4)

Organization design approaches, configurations, principles, and processes. Diagnosis and redesign of a wide variety of complex organizations in the public, private, and international sectors. Organization design as an organization development technology. 4 seminars. Prerequisite: GSB 513.

GSB 573 Market Research and Planning (4)
Makes the student a knowledgeable user of marketing research information to develop and implement marketing plans. Emphasis on development of ability for using research information to formulate marketing objectives and strategies and to analyze marketing problems in depth. 4 seminars. Prerequisite: GSB 524.

GSB 574 Seminar in Labor-Management Relations (4)
Exploration of models of labor-management relationships from adversarial to cooperative, in both non-union and union, private and public sectors. Emphasis on labor-management relationships maximizing commitment and performance. Analysis of employee influence. Work organization, reward systems, conflict resolution. 4 seminars. Prerequisite: GSB 513.

GSB 575 Legal Aspects of Business (4)
Managerial approach to important legal issues affecting business and the market system. Focus on those aspects of law which affect managers directly including contracts, products liability and corporations in perspective; principles of partnership authority, liability, and control; managerial duty and liability to the corporation; public control of managerial activity. 4 seminars.

GSB 576 Seminar in Quality and Performance Management (4)
Principles and techniques of quality and performance management as applied to organizations in the private and public sector. Emphasis on competitive implications. Integration of fundamental management techniques, existing improvement efforts, technical tools, and new management technologies focused on continuous organizational improvement. 4 seminars. Prerequisite: GSB 513.

GSB 577 Advanced Quantitative Business Analysis (4)
Case studies using the concepts of GSB 512 Quantitative Business Analysis and GSB 522 Management Science, applied to selected problems in business and industry. These involve concepts of linear programming, quadratic programming, goal programming and advanced forecasting concepts. Solutions of these models obtained using computers. 3 seminars, I laboratory. Prerequisite: GSB 522.

GSB 578 International Business Management (4)
Managerial concepts and techniques appropriate for analysis and decision making within international businesses. Environmental and organizational factors influencing multinational operations. Assessing international market opportunities and entry modes. Complexities of multinational management strategy, structure and systems. Case studies and simulations. 4 seminars. Prerequisite: Second-year standing or consent of instructor.

GSB 579 Manufacturing Strategy (4)
Strategic role of manufacturing in the overall corporate competitive strategy. Matching manufacturing capabilities and marketing needs, capacity planning, matching process technology with product requirements. The experience curve, vertical integration, managing change, CIM, robotics, and managing international production. 4 seminars. Prerequisite: GSB 534.

GSB 580 Industrial Marketing (4)
Marketing of business goods and services to other businesses, governmental agencies and social institutions by the manufacturer. Market analysis, sales forecasting, product strategy, effective use of sales force and industrial advertising media. 4 seminars. Prerequisite: GSB 524.

GSB 581 Marketing Management Seminar (4)
Practice in the application of analytical tools and techniques to current and potential marketing problems. 4 seminars. Prerequisite: GSB 524.

GSB 582 High-Technology Marketing (4)
Emphasis on marketing of high-technology products, processes, systems and services. Strategic high-tech product planning and high-tech new product development in the context of marketing management. Market forecast for a non-existing new high-tech ~roduct. 4 seminars. Prerequisite: GSB 524.

GSB 583 Management of Human Resources (4)
Major functional areas of human resource management, including human resource planning, job analysis, recruitment, selection, performance measurement, employee training and career development, compensation, legal compliance and employee rights. Emphasis on analysis of human resource problems as they arise in real-world settin~s. 4 seminars. Prerequisite: GSB 513.

GSB 584 Seminar in Financial Policy (4)
Application of financial theory and models to a variety of financial problems. Analysis and formulation of financial plans developed primarily through the use of cases and other real world examples. Working capital management, investment decisions under conditions of risk, and financing and capital structure decisions. 3 seminars, 1 activity. Prerequisite: GSB 531.

GSB 585 Seminar in Investments (4)
Stock, bond and options market. Emphasis on operations of markets, the efficient markets hypothesis and ponfolio theory. Setting investment objectives and managing ponfolios given efficient capital markets. 4 seminars. Prerequisite: GSB 531.

GSB 586 Financial Institutions and Markets (4)
Structure of money and capital markets and the financial institutions that operate in these markets. Evaluation of contemporary thought on the evolving market and institutional arrangements. Emphasis on the management policies of the institution. 4 seminars. Prerequisite: GSB 531.

GSB 587 International Financial Management (4)
Analysis of the problems facing the financial manager of an international company. Topics include the intemational monetary system, mechanics of the foreign exchange market, determinants of exchange rates, financing and investment in foreign currencies, trade financing, international capital budgeting, and international working capital management. 4 seminars. Prere~uisite: GSB 531.

GSB 588 Cooperative Education Experience (6) (CR/NC)
Advanced study analysis and pan-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A maximum of 8 units can be used toward graduation. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor and advisor.

GSB 589 Accounting Policy (4)
Role of management in establishing and directing accounting policy. Coverage includes the impact of management decisions on external reponing and taxes and the impact of financial reporting requirements on management decisions. 4 seminars. Prerequisite: GSB 521.

GSB 590 Designing and Managing Sociotechnical Systems (4)
Designing organizations as sociotechnical systems. Manager's role and functions in managing technology. Organizations as sociotechnical systems. Sociotechnical system theory. Sociotechnical system analysis and design. Managing sociotechnical systems. Design experiments that foster the innovative process. 4 seminars. Prerequisite: GSB 513.

GSB 591 Industry Analysis (4)
In-depth study of major industry using analytical tools developed in first-year courses. Intensive investigation of the dynamic environment, markets, technology, financial and economic structures, history and other key factors. Further prospects for the industry explored through preparation of a comprehensive forecast. 4 seminars. Prerequisite: Second-year standing.

GSB 592 Cooperative Education Experience (12) (CR/NC)
Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A maximum of 8 units can be used toward graduation. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor and adviser.

GSB 593 Management and Control of Information Systems (4)
Overviews of information technology trends and implications. Information systems (IS) functions and organization. Strategic planning for information systems. Integration of IS plan with corporate strategy. IS administration and control. Management of IS development and computer operations. IS issues in a multinational environment. 3 seminars, 1 laboratory. Prerequisite: GSB 532.

GSB 594 Future of Business (4)
Examination of the techniques and conclusions of representative future studies by research institutions such as the Rand Corporation, Hudson Institute and The Club of Rome. Analysis of the implications of those conclusions for the operations and role of business in society. 4 seminars. Prerequisite: GSB 514.

GSB 595 Managing Change (4)
Managing planned change within complex organizations. Managing change and development models and interventions, including action research, team development, intergroup conflict, structural, and comprehensive approaches. Design and use of action programs to improve organizational effectiveness. 4 seminars. Prerequisite: Second-year st~nding.

GSB 596 Economic Forecasting (4)
Applications to business planning of selected economic forecasting techniques. Classical time series analysis, Box-Jenkins (ARIMA) models, adaptive (Kalman) filtering models, leading indicators and input-output analysis. Use of computers in solving problems. 3 seminars, 1 laboratory. Prerequisite: GSB 533. GSB 597 Seminar in Selected Economic Problems (4)Selected problems analyzed at an advanced level in a particular field, such as international trade, public finance, urban, industrial organization or transportation. 4 seminars. Prerequisite: GSB 533.

GSB 598 Graduate Internship in Business (2-8) (CR/NC)
To permit students to correlate experience and academic knowledge. Placement in a supervised work program in a business or public organization. Minimum forty hours of work experience per two units of credit. A maximum of 8 units can be used toward graduation. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor and adviser.

GSB 599 Individual Research (1-4)
Advanced individual research planned and completed under the direction of a member of the college faculty. Designed to meet the needs of qualified students who wish to pursue investigations which they cannot follow effectively in regularly offered elective courses. Prerequisite: Second-year standing.

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The curriculum has been structured to allow participants to complete a two-year course of study in twelve months.

Because the curriculum focuses on the fundamentals of technology management, the Program incorporates a unique blend of academic and applied state-of-the-art orientations.

Additional areas of study may be added through elective courses, drawing from the full resources of MIT.

Educational Framework

Strategic Aspects of Technology Management
The essence of the MOT Program is the awareness and appreciation of alternative strategies for managing global technology development, acquisition and commercialization. To be effective, it must be combined with the understanding of how to formulate and implement such strategies - linking external considerations, such as economy and government, with internal factors, such as resources and capabilities. Strategy is studied in the classroom, as well as through the perspectives and experiences of many international senior executives invited into the MOT seminars and visited in their own organizations.

Applied Economics for Technology Managers (Summer)
Manufacturing Management (Summer)
Managing Services: Concepts, Design and Delivery (Summer)
Strategic Management of Technology (Fall)
Corporate Strategies for Managing RD&E (Spring)
Seminar in the Management of Technology (Fall & Spring)
International Management Field Trip (January)

Managerial Decision Making
Effective managerial decision-making includes the ability to approach issues from a number of points of view. Studies in this area provide the participants with the analytical power to undertake the making of decisions objectively and systematically, bringing to bear a variety of tools, including accounting, finance and various quantitative methods.

Financial & Managerial Accounting (Summer)
Statistical Analysis for Technology Managers (Summer)
Manufacturing Management (Summer)
Managing Services: Concepts, Design and Delivery (Summer)
Managerial Finance (Fall)

Human and Organizational Factors in Technology Management
Managing people as individuals and in groups is key to attaining the goals of any organization. The technology-based organization is exceptionally dependent upon its human resources. This management challenge is made even more difficult by these resources being located in multiple countries and

encompassing diverse cultures. The focus on motivating, organizing and directing teams is pursued in several required parts of the MOT Program, and further studied by many participants in their elective and thesis choices.

Managing the Human Side of Technology (Summer)
Seminar in the Management of Technology (Fall & Spring)
International Management Field Trip (January)

Managing Product/Process Development
Developing new and improved products and processes, both for manufacturing and service industries, is the worldwide competitive challenge facing all organizations. Linking market insights to technological capabilities in research, engineering and manufacturing/operations demands the bridging of multiple functional areas; only in this bridging can innovative ideas be generated and brought effectively to the customer. Participants may study these areas in greater depth through elective or thesis work.

Manufacturing Management (Summer)
Managing Services: Concepts, Design and Delivery (Summer)
Managing Innovation and Technological Change (Fall)
Marketing Management (Fall)

Applied Research
Extending classroom studies of technology strategy and management to their practical applications is the objective of the thesis. Each participant in the MOT Program selects a problem area important to him/her (and to the sponsoring organization) and enlists the cooperation of one or two MIT faculty members to guide the project. The thesis offers an integrative opportunity that can be of direct and immediate value to the participant and the sponsoring organization during the participant's reentry and subsequent placement within the organization.

The Thesis (Fall and Spring)

Studies By Term

Summer Term
The summer term is extremely intensive. It is devoted primarily to the core of subjects that provide a background in general management principles and analytic methods. The orientation of the faculty and the background experience and goals of the MOT Program participants, however, combine to make the summer experience more than an opportunity to learn business fundamentals. The group projects, done in diversified teams, and immediate relevance of the subjects to the participants' organizational experience, make the summer term a critical underpinning of the entire year.

Managerial and Financial Accounting
As users of accounting information, technology managers must also understand the underlying concepts regarding the preparation and implications of the information being used. This is examined, as well as the ways in which accounting information can be useful to managers in decision-making and control within the organization.

Applied Economics for Technology Managers

A solid understanding of macroeconomic and microeconomic principles as they pertain to business and government is critical for technology leaders in today's global environment. In this intermediate-level course strong emphasis is placed on applications of economic theory to managerial decision-making.

Statistical Analysis for Technology Managers
The analysis of data for decision-making is critical in managing technology. This course provides participants with an introduction to probability and statistical data analysis with emphasis on applications in managerial decision-making.

Managing the Human Side of Technology
Key to any successful technology strategy is the management of personnel. This course examines the human side of management through application of behavioral science research findings. Emphasis is placed on professional individuals and groups in R&D, engineering and manufacturing organizations.

Manufacturing Management
Manufacturing policy is a link between operations and strategy. The lack of manufacturing policy has been at the root of the failure of many organizations over the last two decades. Most of the opportunities that lie ahead to transform manufacturing into a competitive weapon consist in exploring the interface of manufacturing with marketing, engineering, finance and other business functions. This course examines the role of manufacturing and operations within the firm, and provides a framework to design a manufacturing policy and to diagnose how well an organization is doing in that domain.

Managing Services: Concepts, Design and Delivery
The service sector now accounts for more than 68% of the U.S. GNP and 71% of employment. The sector is of similar high standing in many other countries. In order to manage this stake of the world economy effectively, several activities have to be uniquely and creatively tailored to meet the specific requirements of each segment of the service sector. This course examines critical issues in major service industries. It emphasizes issues that represent distinctive challenges for managers in organizations that produce services. It is designed to focus equally on the "macro" issues as well as on the "nuts and bolts" aspects of running and improving the day to day operation.

Fall Term

Managing Innovation and Technological Change
The understanding of successful product and process innovations, as well as the technological change process, has become increasingly important in today's technology-based organizations. This course examines successful product and process innovations in industry, as well as the effective organization and management of the technological change process in new ventures, multi-divisional and multinational enterprises.

Strategic Management of Technology
A solid foundation in the concepts and techniques of strategic management is critical for the technology leader. This course examines these concepts and techniques, taking the perspective of the general manager responsible for the long-term health of the enterprise. In addition to basic strategic methods, emphasis is placed on the use of technology for competitive advantage and the interaction of technology with other strategic issues.

Marketing Management
To be an effective technology leader, an understanding of the marketing function and how it relates to strategic management decisions in technological organizations must be developed. In this course, both conceptual and implementation issues are discussed. Studies include the major phenomena underlying marketing strategy formation and component decisions, such as pricing, product planning, advertising, promotion and distribution.

Financial Management

A basic understanding of organizational financial management is necessary for key strategic managers. This course surveys organizational investment theory (what to invest, where and how much), as well as the operation of financial markets and institutions. Emphasis is placed on the impact of organizational and Financial management upon technology decisions.

Seminar in the Management of Technology
The opportunity to meet with key executives from around the world is a fundamental element of the MOT educational process. This seminar, which meets during the fall and spring terms, complements classroom work by providing opportunities to discuss current practices and policies with senior executives from organizations where technology is of paramount importance. Seminars include a session of informal, off-the-record question and answer discussion for the entire class, followed by dinner and continuing discussion. The seminar provides the opportunity to probe guests regarding both the technical dimensions and the implications of executive decisions within and beyond their organizations.

Spring Term

Corporate Strategies for Managing Research, Development and Engineering
The understanding of alternative as well as traditional approaches to managing RD&E is critical to the technology manager. This course focuses on the development of major new product lines or new business areas, and includes comparative assessment of internal development, internal ventures, alliances, cooperative R&D, venture capital, and acquisitions.

Seminar in the Management of Technology
This is a continuation of the seminar begun in the Fall Term.

The Elective Requirement

Three graduate-level electives are required as part of the MOT course of study. Many participants find that several electives can be taken during the fall and the spring terms. The following courses have been found to be particularly interesting to prior MOT Program participants:

Management of Technological Change in Manufacturing
Manufacturing/Technology Interface
Manufacturing Policy
Management of Manufacturing
Product Development in the Manufacturing Firm
International Business Management
Economics for Technology Strategy
Technology Project Management
Technology Strategy
The Management of Research
Total Quality Management
Assessment of Emerging Technologies
Information Technology: Dynamics of the IT Industry
Management of Information Systems
System Dynamics for Business Policy
New Enterprises
Negotiation: Theory and Practice
Negotiation and Conflict Management
Planning and Managing Change
Financial Statement Analysis
Mergers and Acquisitions
Government and the Management of Technology
The Manager's Legal Function

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WSU Engineering Management Program
Course Descriptions

Core

E M 501 Management of Organizations 3 semester credits

The course explores issues dealing with individual behavior in work organizations. The major focus and goals of the course are to learn various approaches to motivation, leadership, and team-building and to illustrate how and when those approaches are appropriately used. A key focus will be on team management skills: how to organize groups for maximum effectiveness, how to motivate group members, and how to promote and reward team success.

E M 505 Financial Management for Engineers 3 semester credits

Today, it is nearly impossible for an engineer to perform without considering the financial implications of the design, manufacture, construction, sales, and the company strategic plan. Traditional accounting and financial decision making are not much help to the engineer who needs to cut through he paper works and get to the bottom line. As a result, engineering and cost accounting are usually at odds with each other. The engineer-manager who must constantly compromise between engineering issues and financial decisions is thwarted from doing the best things for the company,. A smart approach to finance, its implications to technical processes, and financial management of the technical firm are needed.

E M 540 Operations Research for Managers 3 semester credits

Applying linear, integer, goal programming; network optimization; queuing analysis; dynamic programming; simulation; Markov analysis; and forecasting to engineering management decisions. Mathematical models have been part of the decision-making process virtually since man learned to represent physical entities and relationships with an abstract system of numbers. In the engineering professions, we are intimately familiar with mathematical models of physical systems. The majority of engineering design work is based on the application of these models. It is conceptually simple, then to extend the modeling process to managerial and business systems. The models of operations research simply represent a collection of mathematically based models which help to rationalize and quantify the role of the manager. This course will introduce the student to a number of models which have proven to be effective in solving certain classes of managerial problems. The student will have the opportunity to apply these tools to various representative sample problems. The tools to be surveyed include linear programming, network models, scheduling models, integer and goal programming, dynamic programming, stochastic models, decision theory, queuing models, digital simulation and inventory systems. The course will also introduce the manner in which these models are integrated into decision support systems, heuristics, and expert systems.

E M 564 Project Management 3 semester credits; Prerequisite basic statistics

The use of projects and project management continues to grow in our complex society. Project management differs from more traditional organizational management because most projects are one-time, extremely focused efforts. Time, money, people, and other resources must be managed extremely well to achieve success, yet there is usually only one chance to do it right. This course will examine technical tools, (CPM, PERT, Cost and Schedule Control Systems), behavioral issues, and considerations of organizational

structure. The objective of the course is to enable the students to understand the strengths and pitfalls of project management. The ultimate goal is to improve the effectiveness of the students at all levels of project management: from project selection and chartering at the highest managerial levels, to day-to-day skills for the project manager, and meaningful contribution and participation for project team members.

E M 591 Strategic Planning of Technology and Innovations in Engineering 3 semester credits

This course focuses on the concepts, techniques and processes of management with direction and purpose. The perspective we take is that of the manager responsible for the long-term health of the enterprise. The use of technology for competitive advantage, and the interaction of technology with other strategic variables are central themes of the course. The objective of the course is to understand both the formulation of strategic decisions and the management of strategic processes; therefore we will be dealing with analytical, behavioral, and creative aspects of management--frequently simultaneously.

STAT 430 Statistical Methods in Engineering 3 semester credits

Engineering and technical managers are often confronted with problems and dealing with CERTAINTY and UNCERTAINTY. Basic analysis and design theory fits the first type of problem when initial design concepts are considered. However, when implementation and use is considered, then the second type of problems emerge. Statistical Methods in Engineering deals with this second type of problem and with decision making. The course assumes no background in statistics. Students learn to read and interpret statistical literature and to apply basic statistical methods in evaluating data.

E M 702 Master's Special Problems, Directed Study and/or Examination 2-4 semester credits [By arrangement only.]

Option I. E M 702 Project Guidelines

This non-thesis written project and oral presentation will showcase student learning and skills. The multidisciplinary nature of engineering management education is significantly addressed as students form teams to research on-the-job solutions. The project allows students to synthesize their knowledge and understanding. To be taken final two semesters

Option II. Comprehensive written examination taken the final semester. Questions will cover material from core requirements, but responses should reflect an integrated approach. Not available to all students; individuals should consult with academic advisor. Not to be taken in conjunction with any transfer semester credits.

Electives

EM 517 Simulation Modeling3 semester credits

The stochastic nature of complex systems makes them frequently too difficult to solve with traditional analytical methods. This class in systems simulation teaches how to describe, represent, validate and experiment with models of various types. Students test various generic models and create their own discrete simulation using state-of-the-art software.

E M 526 Constraints Management 3 semester credits

This course introduces the student to the Theory of constraints. Students learn the formal analysis techniques that find the limiting factor in any system. Students learn to clearly identify the goal and necessary conditions that must be met to achieve success in the system. Students learn to think logically and formulate cause and effect relationships that define the system. They learn to differentiate between the many annoying problems that exist the system to find the core problem or root cause of the many negative

effects. Students learn how to find breakthrough injections that open the way for solutions that eliminate the conflict that has always prevented the core problem from being solved. They also learn how to break down the obstacles that prevent near impossible tasks and how to cause change to occur within the system.

E M 545 Decision Analysis for Engineering 3 semester credits

Decision analysis provides engineers a structured discipline for describing, analyzing, and finalizing decisions involving uncertainly. Individuals and organizations make decisions every day. Almost all decisions involve some uncertainty about the outcomes of the decisions and future conditions. Most people handle this uncertainty in intuitive ways. Research has confirmed that intuition is miserably unreliable in accessing the influence of this uncertainty on the outcomes of current decisions. Decision analysis provides a structured discipline for describing, analyzing, and finalizing decisions involving uncertainty.

E M 560 Manufacturing and Operations Design and Strategy 3 semester credits

Concepts and techniques for design; managing manufacturing and operations. Facilities for development of world class organizations. Corporations are operating on an international basis and are found around the globe. The parent company provides equipment, sources of supply, procedures manuals, training and other operating resources. Successes in such globe-spanning businesses force changes in competing firms. The effects are direct, often immediate and far-reaching. The best concepts and techniques for design and managing manufacturing and operation facilities find their way into all world class organizations.

E M 570 Quality Management 3 semester credits

Overview of the total field of quality, including strategic quality management programs, quality assurance, quality control, and product design reliability. The purpose of the Quality Management course is to provide the technical manager with an overview of the total field of quality. The subjects addressed throughout the course are: statistics of quality, quality cost, quality improvement, world class quality, design for quality, vendor relations, Japanese manufacturing concepts, process control and capability, measurement systems, customer relations, product safety and liability, quality assurance, product design reliability, and strategic quality management. This is an application-oriented course and interrelationship between the various topics of quality management will be reviewed in case studies, readings and class discussion. Further investigation and a research project will be required of each student.

E M 575 Performance Management in Technical Organizations 3 semester credits

Management of high technology organizations; planning, measurement, and human factors in improving high technology organizations; productivity, motivation and performance systems. This course addresses the management of high technology engineering process based on the seven key dimensions: effectiveness, efficiency, quality, productivity, quality of work life, innovation, and profitability. The course is tailored to engineers. A critical element of the course is measurement and includes human performance management which is currently of interest in many engineering and high technology organizations. It addresses development of closed-loop measurement and control systems designed to provide information at the source of variation within the system, from an engineering and engineering management perspective. This course is to provide students a current view of philosophies and methods for engineering organizational improvement of high technology processes. Students will understand strategic and tactical planning methods to refine engineering organizational objectives and to measure achievement of the objectives on seven key engineering dimensions.

E M 580 Quality Control and Reliability Design 3 semester credits

Quality improvement analysis for process and product quality; statistical process control, capability studies; acceptance sampling concepts; reliability models for prediction and testing. This course addresses statistical methods as used in quality analysis; modeling process and product quality. It covers statistical process control; control charts and introduction to process capability studies. Traditional acceptance sampling, process sampling and sampling for quality audit; QC curves, sampling tables are included. The basic

concepts of reliability; definitions; failure models, reliability prediction, estimation and apportionment are covered as well as failure data analysis. Product design, development and production; design review, product testing. The final components are maintainability measures and prediction and preventive maintenance scheduling. The objective of this course is to strengthen and improve the ability of engineering managers in detail theory and the design of quality control systems and techniques of quality control and to utilize reliability considerations in engineering design.

E M 585 Quality Engineering Using Experimental Design 3 semester credits

Design of quality into products and processes using design of experiments including robust/parameter design and tolerance design techniques. Design of experiments is a systematic and efficient method of design optimization for performance, quality and cost in quality engineering. Statistical quality control improves the product and/or process quality for a given design. This course examines the design in order to acquire a better product/process quality. Other names for this include robust design, parameter design, or Taguchi Techniques. This course is to give engineers a current understanding of the techniques and applications of design of experiments in quality engineering design.

E M 590 Design for Manufacturing 3 semester credits

Various techniques to identify opportunities for improvement and development of a comprehensive product design will be explored. Key issues and competitive product development and design optimization will include topics such as: quality function deployment; design for assembly and product variation; failure modes and effects analysis; reliability/serviceability, concurrent engineering; statistical process control, six sigma process and flexible process selection; tolerances design; rapid prototyping; design and development management issues; reducing part cast with DFM; DFM team building and training

UNIVERSITY OF ALASKA FAIRBANKS

http://www.uaF.alaska.edu/

1997-98 UAF Catalog
Course Descriptions

Degrees and Programs Index

Engineering and Science Management

A $25.00 per semester student computing facility user fee is assessed for CSEM engineering courses. This fee is in addition to any lab/material fees.

ESM 401 (Credits Arr.) Fall
Construction Cost Estimating and Bid Preparation (3+0)

Compilation and analysis of the many items that influence and contribute to the cost of projects to be constructed. Preparation of cost proposals and study of bidding procedures. Laboratory fee: $20.00.

ESM 450W (3 Credits*) Fall, Spring
Economic Analysis and Operations (3+0)

Fundamentals of engineering economy, project scheduling, estimating, legal principles, professional ethics, and human relations. Laboratory fee: $20.00. (Not offered for credit toward the Master of Science in Engineering Management or Science Management. Prerequisites: ES 201 and senior standing in engineering or permission of instructor. Undergraduate engineering students who are taking graduate ESM courses as technical electives should have completed or be concurrently enrolled in ESM 450.) *2 credits meet the writing intensive requirement for the core curriculum.

ESM 601 (3 Credits) Fall
Engineers in Organizations (3+0)

The course offers a variety of management activities of special importance to engineering and scientific organizations, including organizational structures, planning, monitoring, directing, and controlling. In addition the tools of management are reviewed including schools of management theory, communications, conflict management and total quality management. Focus on developing managerial skills in Engineers and Scientists. Material Fee: $20.00 (Prerequisite: B.S. degree in engineering or physical science or consent of instructor.)

ESM 605 (3 Credits) Fall
Engineering Economy (3+0)

The science of fiscal decision-making with applications to capital investment selection. Graduate level studies of capital investment analysis techniques, including present worth, annual cash flow and rate of return. Applications to replacement problems, benefits/cost analysis and capital budgeting. Consideration

of impacts of depreciation accounting, income taxes and inflation. Materials fee: $20.00. (Prerequisite: Graduate standing.)

ESM 608 (3 Credits) Every Third Semester
Legal Principles for Engineering Management (3+0)

A course devoted to those aspects of law specifically related to technical management. Contracts, sales, real property, business organization, labor, patents, and insurance. Materials Fee: $20.00 (Prerequisite: Graduate standing.)

ESM 609 (3 Credits) Spring
Project Management (3+0)

Organizing, planning, scheduling and controlling projects. Use of CPM and PERT; computer applications. Case studies of project management problems and solutions. Materials Fee: $20.00 (Prerequisite: Graduate standing in Engineering or Science Management or permission of instructor.)

ESM 620 (3 Credits) Every Third Semester
Statistics for ESM. (3+0)

Forecasting applications and technique technological, time series, judgmental and regression; decision trees; Bayesian statistics; utility theory with trade-offs between expected value and risk in decision making; bidding strategies; data analysis. Materials Fee: $20.00. (Prerequisites: STAT. 301 and MATH 202.)

ESM 621 (3 Credits) Spring
Operations Research (3+0)

Mathematical techniques for aiding technical managers in decision making. Linear programming, transportation problem, assignment problem, network models, PERT/CPM, inventory models, waiting line models, computer simulation, dynamic programming, Emphasis on use of techniques in actual technical management situations. Computer applications. Materials Fee: $20.00.

ESM 623 (3 Credits) Fall and Spring
Computer Programming for Engineering Managers (3+0)

Basic FORTRAN programming, with applications to engineering problems. (Not offered for credit toward the M.S. in Engineering Management or Science Management.)

ESM 656 (3 Credits) Alternate Spring
Space Systems Engineering (3+0)
(Same as EE 656, ME 656)

A multidisciplinary team of students will perform a preliminary design study of a major space system. Design considerations will include requirements for project management, spacecraft design, power, attitude control, thermal control, communications, computer control and data handling. The students will present their final design in a written report and a public seminar. (Prerequisites: Graduate standing or permission of instructor.)

ESM 684 (3 Credits) Fall and Spring

Engineering Management Project (3+0)

Individual study of an actual engineering management problem resulting in a report which includes recommendations for action.

UNIVERSITY OF KANSAS REGENTS CENTER

http://kuemgt.cecase.ukans.edu

Brief Course Descriptions

CORE COURSES: <Picture: Top>

EMGT 806 - Finance for Engineers <Picture: Top>
(3 hours)

A study of finance designed to give the student an operational knowledge of financial analysis and planning in technology based enterprises, including publicly owned corporations and privately held consulting and engineering service companies. Topics include financial statement analysis (ratio analysis; financial markets, interest rates, and tax structures); present value cash flow analysis; risk and return; capital budgeting; capital structure; investment and replacement analysis and decision theory; cash flow budgets; financing of operations, and sources and uses of capital.

EMGT 809 - Personal Development for the Engineering Manager <Picture: Top>
(4 hours)

Includes the study of theories, tests for and objectives of engineering and management ethics. Explores personal values. Measures personality profile and preferred communication style for each student. Includes management of stress, time and career. The student prepares career and personal development plans. Managerial writing and communication skills are developed through weekly projects including: report and proposal preparation, internal correspondence concerning praise and reprimand as well as organizational policy preparation. Interpersonal and nonverbal communication styles are studied. Relies heavily on instructor-assisted peer mediation of topics after introduction of constructive techniques of interpersonal communication.

EMGT 810 - Applications of Quantitative Analysis in Decision Making <Picture: Top>
(3 hours)

This course introduces the student to the techniques of mathematical programming for linear and non-linear optimization. The primary emphasis is on the various methods and models for linear programming, but some coverage of non-linear methods is also presented. The theory behind the methods and models is presented, but the emphasis is on the practical application of the methods to decision making.

EMGT 811 - Engineering Systems Simulation <Picture: Top>
(3 hours)

Methods of developing, implementing, and using computer simulations for management processes such as capital investment decisions, project monitoring, waiting lines, equipment failure, risk analysis, and inventory control. Use of simulation languages for decision analysis. Engineering systems and management applications are studied under deterministic and stochastic conditions.

EMGT 813 - Design Project Management <Picture: Top>
(3 hours)

Comprehensive coverage of project management related to planning, staffing, budgeting and controlling design and construction projects. Emphasis includes cost control, profit monitoring, team development,

client satisfaction, and network scheduling. Additional topics encompass the project manager's role in delegation, motivation, performance reviews, and negotiation. A team-based project is required. A case study in the financial control of the profitability of a firm for multiple project operation is included.

EMGT 821 - Strategic Analysis of Technology Projects <Picture: Top>
(3 hours)

A study of the economic feasibility of competing engineering projects including the application of break-even analysis, decisions under uncertainty, decision trees, stochastic models, risk vs. return, and forecasting. A study of the financial figures of merit used to evaluate competing engineering projects including the DuPont rate of return model, the accounting rate of return, the operating return method, return on equity, earnings per share, margin on sales, selling price of stock, corporate credit rating, total sales, market share, market entry, and pro forma year end statements. The course will require preparation of project business plans.

EMGT 823 - Management of Internal Engineering Projects <Picture: Top>
(3 hours)

The purpose of this course is to introduce the student to all aspects of managing a project within a company or organization. The entire project life cycle will be covered from inception to close-out, and many practical considerations will be discussed like material procurement, working with contractors and consultants, selecting project management software, and managing the project team. The course will focus on how to manage project scope, schedule, budget, and resources using personal computer software.

EMGT 830 - Case Studies in Engineering Management <Picture: Top>
(2 hours)

A capstone course for the program which provides an integration of material presented in other courses through the utilization of several management case studies with a special emphasis on "lessons learned." Included is the development of an original case study and a comprehensive coverage of management theories and practices along with a number of student presentations. Each student also develops their Field Project proposal for EMGT 835 in this course.

EMGT 844 - Management of Software Development Projects [I] <Picture: Top>
(3 hours)

This course covers the area of managing software development presenting the management process as a means to optimize business considerations and project requirements. Uncertainties in product/service specifications, technology risks, cost and delivery requirements impact the management functions demanding significant early stage cross functional design strategies. Cost and schedule estimation techniques are presented together with project planning, risk management and measurement techniques.

ELECTIVE COURSES: <Picture: Top>

The courses listed below are categorized by areas of emphasis as follows:

G = General = Information systems and technology C = ConsultingM = Manufacturing and service industries

EMGT 802 - Statistical Analysis and Prediction of Engineering Systems [G] <Picture: Top>
(3 hours)

This course includes the application of statistical methods to engineering systems and operations. Emphasis is on regression analysis, analysis of variance, analysis of time dependence by smoothing, Bayesian methods, time series analysis, and autoregressive moving averages with applications of the various techniques to engineering systems and problems.

EMGT 803 - Technological Forecasting and Assessment [G] <Picture: Top>
(3 hours)

General topics include the need for forecasts, common forecasting mistakes, data sources and quality, and presenting and using forecasts. Quantitative topics include moving average, smoothing, curve fitting, regression, and Box-Jenkins. Qualitative methods include Delphi, scenario development, historical analogy, environment analysis, and normative methods. The technology assessment process is also covered.

EMGT 804 - Business Development and Marketing of Professional Services [C] <Picture: Top>
(3 hours)

Principles, theories, and practices of business development and marketing of consulting engineering and related services. The focus is in developing an integrated business development/marketing plan incorporating market research; preparation of a fact base; identification of problems and opportunities; forecasting; the service/price/place and the development of a promotion plan. A team-based project is required which includes the development of a marketing plan for a consulting firm, followed by a presentation of that plan.

EMGT 805 - Management of Innovation [G] <Picture: Top>
(3 hours)

Management of technology and technological change through innovation, imitation, and planned obsolescence. Topics covered include technological innovation, technology transfer, life cycles for innovation, and building an organizational climate to foster innovation. Additional topics include entrepreneurship, product decisions, and R&D strategies in small and large companies. The course requires the development of a business plan for a new start-up company.

EMGT 808 - Quality Management [G] <Picture: Top>
(3 hours)

The overwhelming challenge that faces the US today is the need to regain its competitive position in the world marketplace. This course offers a broad view of Total Quality Management in that it focuses on the managerial aspects of quality, rather than just the technical. For example, students will learn the Malcom Baldridge award criteria which focuses on leadership, data analysis, human resources, quality assurance, quality results and customer satisfaction. In addition, a review of the theory and approaches of the major quality leaders such as Deming, Juran, and Crosby will be covered. Practical applications of TQM concepts in a technological environment will be stressed throughout the course.

EMGT 812 - Law and the Design Professional [C] <Picture: Top>
(3 hours)

Sources of law and the legal basis for the duties of the owner, design professional and contractor in the design and construction process. Risk management by means of insurance, surety bonds, and contractual mechanisms. Common design professional activities and their legal implications, including the use of contract language. Risks, liabilities and problems common to the design professional's interrelationship with the construction industry.

EMGT 824 - Product Marketing for Engineering Managers [M, I] <Picture: Top>
(3 hours)

Basic principles of marketing as applicable to engineering managers in the production- or operations-based enterprise. Includes a broad overview of the major components of marketing (competition, product, price, promotion, and distribution). Also details the integration of those components into the marketing plan. Students develop a marketing plan for a product.

EMGT 840 - Systems Approach to Engineering [I] <Picture: Top>
(3 hours)

This course introduces the systems approach to engineering. It emphasizes the translation of customer needs into system requirements, the utilization of formal modeling and specification methods, economic evaluation, and life cycle analysis to evaluate systems. Management of systems used within a company, for example information systems as well as products and services produced by a company are covered. Course content is applicable to Consulting, Manufacturing and Information and Systems areas.

EMGT 848 - Information Technology for Management [I] <Picture: Top>
(3 hours)

This course is intended to bring the student up to date on developments in the field of information technology (IT) and to prepare the student to manage those technologies in the workplace. To this end, the course presents a combination of management and technical topics with assignments in both areas. Management topics provide current insight into management practice and guidance for administrative action to guide firms in the 1990's. Technical topics include enabling technologies such as relational databases, client-server architecture, the Internet, groupware.

EMGT 850 - Environmental Issues for Engineering Managers [C] <Picture: Top>
(3 hours)

A survey of the environmental issues, regulations, and challenges that must be dealt with by engineering managers regardless of their function or industry is presented. A historical perspective on society's environmental concerns is followed by discussion of federal environmental statutes, our regulatory system, approaches to preventing and mitigating environmental problems, and the elements of an effective environmental management system. Environmental issues are examined from the perspective of the regulator, the regulated community, the engineer, the manager, and the public.

EMGT 854 - Managing Business Intelligence and Security for Strategic Planning [G] <Picture: Top>
(3 hours)

Introduces the formal methods, concepts, and processes of competitive intelligence and security which are vital to both strategic business planning and business operations. Provides access to the tools used to identify what is happening in the business environment including legislation, economics, regulatory changes, competition and customers that affect business strategy and operations.

EMGT 860 - Special Problems in Engineering Management [G] <Picture: Top>
(3 hours)

Graduate-level investigation requiring original, independent research on problems or subjects of interest to a student or faculty member. Intended to develop a student's capability in coordinating two or more of the following: technology, finance, economics, applied mathematics, and managerial communication.

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*CSE579 Topics in Computational Finance
A projects-oriented course designed to enable students to develop and test models in various areas of computational finance using historical and live data from the world's major financial markets. Topic areas include portfolio optimization, derivatives pricing, global risk management, statistical arbitrage, and technical trading systems. Data is provided for the major equities, fixed-income, options, futures, and foreign exchange markets. Project development tools include MATLAB, S-PLUS, C, and C++. Students present, discuss, and critique aspects of their projects on a regular weekly basis. Recommended prerequisite: At least one of CSE570, CSE571, CSE573, or CSE577.
3 credits

CSE58X Special Topics
Under this number, we offer courses of particular relevance to the research interests of faculty or in state-of-the-art subjects of interest to the community. Some recent offerings include:
*•Software Engineering in Context: Markets, Strategies, and Requirements
*•Software Testing and Quality Assurance

UNIVERSITY OF TORONTO

http://www.cs.toronto.edu

Information Systems

*2527X (454) The Business of Software / Baecker
Overview of the software industry, and principles of operation for successful software enterprises. Software business definition and planning; market and product planning; management of innovation, research and software development; software marketing and sales management; software manufacturing and support; financial management and finance for high-technology ventures; human resource management and development in high-technology industries. Students will write business plans, working in teams.

UNIVERSITY OF SOUTHERN CALIFORNIA

http://www.usc.edu/dept/cs/

REQUIRED COURSES FOR MSCS-SE:
For students in the MSCS-SE program, they must satisfy the current core requirements for the MSCS plus the following required courses:

*CS 577a Software Engineering I (4)
*CS 577b Software Engineering II (4)
*CS 665 Advanced Software Engineering Project (3)

In addition to the above required courses, the SE specialization requires 3 additional courses to be selected from lists A and B. The courses in list A count toward both the MSCS and MSCS-SE requirements. Note that CS 577a covers one of the MSCS core course requirements.

List A:
CS 555 Advanced Operating Systems (3)
CS 585 Database Systems (3)

List B:

- *CS 510 Software Management and Economics (3)
- EE 554 Real Time Computer Systems (3)
- CS 588 Specification and Design of User Interface Software (3)
- CS 612 Software Analysis and Formal Methods (3)
- Additional Suggested Electives:
- CS 551 Computer Communication (3)
- CS 598 Knowledge Based Systems (3)
- * IOM 527 Managerial Decision Analysis (3)
- * IOM 536 Decision Support Systems (3)
- EE 656 Fault Tolerant Computer Systems (3)
- EE 657 Parallel Processing (3)
- ISE 562 Value and Decision Theory (3)