

ENGINEERING MANAGEMENT

The engineering management degree programs prepare students for leadership roles in today's complex environment as engineers, managers and educators. Graduates are capable of designing, implementing, operating and optimizing sophisticated high technology enterprises in manufacturing, government or service sectors of our global economy.

In today's economy there is a need to see the business unit as a complete, technology driven enterprise and to integrate system components thus ensuring that the company thrives in global competition. In such an environment engineers need both excellent technical and managerial skills to cope effectively with the continuous change that will take place during their careers.

The engineering management discipline prepares individuals to successfully integrate engineering and management knowledge while optimizing the use of people, equipment, money and information. The discipline also seeks to develop students into individuals with leadership potential who achieve results in an ethical and sustainable manner.

Missouri S&T's engineering management program has served the needs of students at the B.S., M.S., and Ph.D. level, enabling graduates to pursue career opportunities in the private sector, government, and academia. Furthermore, many alumni now occupy top executive positions in a variety of enterprises.

Mission, Educational Objectives and Student Outcomes

Mission

The mission of the engineering management and systems engineering department is to equip individuals with engineering, management and systems expertise to prepare them to be leaders in the identification and solution of technical and organizational problems that are complex and evolving.

Educational Objectives:

Graduates of the engineering management program will exhibit proficiency and excellence in the areas of technology, finance, human relations, communications, and professional behavior. Within these areas of proficiency, graduates will exhibit the explicit skills and knowledge as described below:

Technical Knowledge and Analytical Problem Solving: Graduates of the engineering management program are able to analyze and solve complex problems utilizing the following:

- a mastery of engineering management tools and techniques including those utilized in operations management, project management, management of technology and supply chain management
- in-depth knowledge in at least one emphasis area within engineering management
- an understanding of the fundamental principles and concepts of engineering
- sound business judgment
- relevant analytical and model tool such as statistics

Finance: Graduates of the engineering management program are responsible and financially aware managers and leaders who utilize basic

finance, accounting, engineering economy and risk analysis methods to manage and identify the financial impact of business opportunities.

Human Relations: Graduates of the engineering management program are competent leaders who can develop and utilize the skills and abilities of teams and individuals within the organization as evidenced by proficiency in:

- team building
- conflict resolution
- efficient and effective management of constituents with diverse skills
- empowering teams and individuals through coaching and mentoring
- conducting effective and efficient meetings.

Communication: Graduates of the engineering management program engage others through effective oral, technical and written communication evidenced by:

- active listening
- clarity and conciseness in presentation
- an ability to adjust content and presentation style to audience
- confidence and discernment in asking appropriate questions to obtain information vital to the project or task at hand.

Professional Behavior: Graduates of the engineering management program will continually grow in their awareness and understanding of the societal, ethical, cultural, legal and political issues prevalent in an increasingly global society.

Integration: Drawing on proficiencies in the areas described above, graduates of the engineering management program are able to integrate their skills and knowledge to:

- effectively manage people, talent, time and financial resources
- develop successful marketing strategies
- develop plans for projects and programs
- analyze problems, consider alternatives, and implement solutions

Student Outcomes

Engineering management graduates will:

- have an ability to apply knowledge of mathematics, science, and engineering in the solution of engineering management problems
- have an ability to design and conduct experiments related to operation, marketing, management and finance, as well as to analyze and interpret data
- have an ability to carry out the design of an operational system and its various components and processes for engineering management applications and within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- understand the importance of teams, know how to develop effective teams and have an ability to function on multidisciplinary teams
- have an ability to identify, formulate, and solve engineering management problems
- have an understanding of professional ethical responsibility
- have an ability to communicate effectively individually and in teams

- have the broad education necessary to understand the impact of engineering and enterprise solutions in a global, economic, environmental, and societal context
- recognize the need for and have an ability to engage in life-long learning
- have knowledge of contemporary issues related to engineering management
- have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Bachelor's Degree Components

The bachelor's program includes the basic chemistry, physics, mathematics and engineering science courses required by all engineering disciplines at Missouri S&T. These courses are followed by required core engineering management courses and students then specialize in focused emphasis areas with 18 hours of course work.

Engineering Management Core

- Economic Analysis of Engineering Projects
- Managing Engineering & Technology
- Engineering Accounting and Finance
- Introduction to System Engineering
- Marketing Management
- Operations and Production Management
- Introduction to Project Management
- Quality
- General Management Design & Integration
- Engineering Management Senior Design

As a senior you will take a capstone design course that integrates the technical and managerial skills acquired. Students complete their bachelor of science degree requirements by taking the fundamental in engineering exam.

Emphasis Areas in Engineering Management

Management of Technology focuses on the management aspects of system design, logistics, scheduling, budgeting, information development, legal aspects of technology management, managing people, and decision making for positions in supply chain logistics, project engineering/scheduling, operations management, cost control/estimating, technical marketing/procurement, sales engineering, engineering administration, information systems, and finance economic analysis.

Industrial Engineering focuses on productivity analysis and system optimization for manufacturing and service organizations. Industrial engineering includes a variety of quantitative and qualitative techniques to identify potential improvements in productivity, quality, safety, and other areas. This emphasis area prepares students for positions such as process engineer, project manager, quality engineer, safety engineer, supply chain manager, operations manager and consulting.

General Emphasis Area focus on the convergence of engineering, management, and innovation in high technology environments. A general engineering emphasis allows students to customize their degree program and create a unique engineering emphasis area that focuses on a

traditional engineering field or even a unique combination of engineering courses.

Bachelor of Science Engineering Management

Entering freshmen intending to study engineering management are admitted to the Freshman Engineering Program. They may, however, state an engineering management preference, which will be used as a consideration for available freshman departmental scholarships. The focus of the Freshman Engineering program is on enhanced advising and career counseling, with the goal of providing to the student the information necessary to make an informed decision regarding the choice of a major.

The bachelor of science degree in engineering management requires a minimum of 128 credit hours. These requirements are in addition to credit received for algebra, trigonometry, and basic ROTC courses. An average of at least two grade points per credit hour must be attained. At least two grade points per credit hour must also be attained in all courses taken in engineering management.

Each student's program of study must contain a minimum of 21 credit hours of course work in general education and must be chosen according to the following rules:

1. All students are required to take one American history course, one economics course, and ENGLISH 1120. The history course is to be selected from HISTORY 1200, HISTORY 1300, HISTORY 1310, or POL SCI 1200. The economics course may be either ECON 1100 or ECON 1200. All students must choose one additional humanities or social science course from "The Approved List of Humanities and Social Sciences Courses for Engineering Degrees" maintained by the Office of Undergraduate Studies.
2. Depth requirement. Three credit hours must be taken in humanities or social sciences at the 2000-level or above and must be selected from the approved list. This course must have as a prerequisite one of the humanities or social sciences courses already taken. Foreign language courses numbered 1180 will be considered to satisfy this requirement. Students may receive humanities credit for foreign language courses in their native tongue only if the course is at the 4000-level or above. All courses taken to satisfy the depth requirement must be taken after graduating from high school.
3. The remaining two courses are to be chosen from the list of approved humanities/social sciences courses and may include one communications course in addition to ENGLISH 1120.
4. Any specific departmental requirements in the general studies area must be satisfied.
5. Special topics, special problems and honors seminars are allowed only by petition to and approval by the student's department chair.

The engineering management program at Missouri S&T is characterized by its focus on the scientific basics of engineering and its innovative application; indeed, the underlying theme of this educational program is the application of the scientific basics to engineering practice through attention to problems and needs of the public. The necessary interrelations among the various topics, the engineering disciplines, and the other professions as they naturally come together in the solution of real world problems are emphasized as research, analysis, synthesis, and design are presented and discussed through classroom and laboratory instruction.

Free Electives Footnote:

Free electives. Each student is required to take three hours of free electives in consultation with his/her academic advisor. Credits which do not count towards this requirement are deficiency courses (such as algebra and trigonometry), and extra credits in required courses. Any courses outside of engineering and science must be at least three credit hours.

Freshman Year			
First Semester	Credits	Second Semester	Credits
FR ENG 1100	1	MECH ENG 1720	3
CHEM 1310 ¹	4	MATH 1215 ¹	4
CHEM 1319	1	PHYSICS 1135 ¹	4
CHEM 1100	1	ECON 1100 or 1200	3
MATH 1214 ¹	4	COMP SCI 1972 ¹	2
ENGLISH 1120	3	COMP SCI 1982	1
HISTORY 1200, or 1300, or 1310, or POL SCI 1200	3		
	17		17
Sophomore Year			
First Semester	Credits	Second Semester	Credits
MATH 2222 ¹	4	MATH 3304 ¹	3
PHYSICS 2135 ¹	4	STAT 3115 or 3117 ¹	3
CIV ENG 2200 ¹	3	ENG MGT 2110 ¹	3
ENG MGT 1210 ¹	2	ENG MGT 2211 ¹	3
ENG MGT 2310 ¹	3	MECH ENG 2350	2
		PSYCH 1101	3
	16		17
Junior Year			
First Semester	Credits	Second Semester	Credits
ENG MGT 3310 ¹	3	ENG MGT 4710 ¹	3
CIV ENG 2210	3	MECH ENG 2527	3
CIV ENG 2211	1	ELEC ENG 2800	3
ENG MGT 3510 ¹	3	ENGLISH 3560	3
SP&M S 1185 or 2181	3	ENG MGT 3320 ¹	3
Humanities and Social Sciences ²	3		
	16		15
Senior Year			
First Semester	Credits	Second Semester	Credits
Emphasis Area Required Course	3	ENG MGT Technical Elective	3
Emphasis Area Required Course	3	ENG MGT Technical Elective	3
Emphasis Area Required Course	3	ENG MGT 4907 ¹	3
ENG MGT 4110 ¹	3	Upper Level Hum/SS ²	3
ENG MGT Technical Elective	3	Free Elective ³	3
	15		15

Total Credits: 128

Example Emphasis Area Programs for Engineering Management Students

One unique aspect of the engineering management degree is the student's ability to select an established emphasis area or create a specialized emphasis. Two examples of established emphasis areas are shown below.

Management of Technology

ENG MGT 5511	Technical Entrepreneurship	3
ENG MGT 5512	Legal Environment	3
ENG MGT 5410	Industrial System Simulation	3
ENG MGT 5614	Supply Chain Management Systems	3
ENG MGT Technical Electives (in consultation with your advisor)		6

Industrial Engineering

ENG MGT 4310	Materials Handling and Plant Layout	3
ENG MGT 4330	Human Factors	3
ENG MGT 5410	Industrial System Simulation	3
ENG MGT 5414	Introduction To Operations Research	3
ENG MGT Technical Electives (in consultation with your advisor)		6

General

Engineering Area Courses (Engineering Discipline)	15
ENG MGT-Technical Elective (in consultation with your advisor)	3

Note: All electives must be chosen in consultation with the student's advisor. Students must satisfy the common engineering freshman year course requirements in addition to the sophomore, junior, and senior year requirements listed above with a minimum of 128 hours.

- Must have a grade of "C" or better in these courses for graduation. MATH 1208 and MATH 1221 may be substituted for MATH 1214 and MATH 1215, respectively.
- Humanities and social science electives must be approved by the student's advisor. Students must comply with the general education requirements with respect to selection and depth of study. These requirements are specified in the current catalog.
- Each student is required to take three hours of free electives in consultation with his/her academic advisor. Credits which do not count towards this requirement are deficiency courses (such as algebra and trigonometry), and extra credits in required courses. Any courses outside of engineering and science must be at least three credit hours.
- Students are required to select an emphasis area and maintain a minimum 2.0 GPA for these courses.
- All engineering management students must take the fundamentals of engineering (FE) exam prior to graduation. A passing grade on this examination is not required to earn a B.S. degree. This requirement is part of the Missouri S&T assessment process as described in assessment requirements found elsewhere in this catalog.

Minor in Engineering Management

A student who receives a bachelor of science degree in an accredited engineering program from Missouri S&T may receive a minor in engineering management by completing 15 hours of the courses listed below.

ENG MGT 2110	Managing Engineering And Technology	3
ENG MGT 2211	Engineering Accounting and Finance	3
ENG MGT 3310	Operations and Production Management	3
Eng Mgt 3000, 4000, or 5000-level course work chosen in consultation with minor advisor.		6
Total Credits		15

Randy Lawrence Canis, Adjunct Professor
JD University of Missouri-Columbia

Steven M. Corns, Associate Professor
PHD Iowa State University

Elizabeth Anne Fargher Cudney, Associate Professor
PHD Missouri S&T

Cihan H Dagli, Professor
PHD University of Birmingham, UK

David Enke, Professor
PHD University of Missouri-Rolla

Abhijit Gosavi, Associate Professor
PHD University of South Florida

Katie Grantham, Associate Professor
PHD University of Missouri-Rolla

Kellie Sue Grasman, Lecturer
MBA University of Michigan Ann Arbor

Stanley W Grzyb Jr, Adjunct Associate Professor
PHD University of Missouri-Columbia

Ivan Guardiola, Associate Professor
PHD Texas Tech University

Glenn L Haley, Lecturer
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Sheryl Hodges, Assistant Teaching Professor
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Stephen A Raper, Associate Professor
PHD University of Missouri-Rolla

Michael Stephen Schmidt, Adjunct Professor
MS University of Missouri-Rolla

Joan Barker Schuman, Assistant Teaching Professor
PHD University of Southern Mississippi

David G Spurlock, Lecturer
PHD University of Illinois Urbana

Zeyi Sun, Assistant Professor
PHD University of Illinois at Chicago

ENG MGT 1001 Special Topics (IND 0.0-6.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

ENG MGT 1100 Practical Concepts for Technical Managers (LEC 1.0)

This course introduces topics relevant to the technical manager in the 21st Century. Topics covered include management practices, leadership, communications, project management, working in the global environment, risk management, systems engineering, product development, and quality management.

ENG MGT 1210 Economic Analysis of Engineering Projects (LEC 2.0)

Engineering project analysis from an engineering economics perspective. Topics include: interest, equivalent worth, comparing alternatives, rate of return methods, depreciation and taxes, inflation and price changes, benefit-cost analysis and risk analysis. Prerequisites: Math 1214.

ENG MGT 2001 Special Topics (LAB 0.0 and LEC 0.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

ENG MGT 2002 Cooperative Engineering Training (IND 0.0-6.0)

On-the-job experience gained through cooperative education with industry, with credit arranged through departmental cooperative advisor. Grade received depends on quality of reports submitted and work supervisors evaluation.

ENG MGT 2011 Competition Team Leadership (LEC 1.0)

Students will participate in open lecture on team based management and leadership as it pertains to ongoing project activities. Project activity reports will be generated using real project data and assessed at the end of the semester through a project master plan and oral presentation. Prerequisite: Sophomore (or greater) standing and leadership role in an experiential learning design team or nomination by an experiential learning team advisor.

ENG MGT 2012 Competition Team Communication (LEC 0.50 and LAB 0.50)

Communication skills, both technical and promotional, will be covered. Students will practice both communication skills in written, oral and media-based modes. Specific activities will include writing a proposal for funding, developing a promotional media piece and speaking to external groups about a SDELC team. Assessment will be made on each of the deliverables. Prerequisite: Sophomore (or greater) standing and membership in an experiential learning design team.

ENG MGT 2013 Competition Team Design (LAB 1.0)

Students will participate in a significant design activity as part of one of the experiential learning design team projects. Design activity will be reported and assessed at the end of the semester through a design report and oral presentation. Prerequisite: Sophomore (or greater) standing and membership in an experiential learning design team.

ENG MGT 2110 Managing Engineering And Technology (LEC 3.0)

Introduces the management functions of planning, organizing, motivating, and controlling. Analyzes the application of these functions in research, design, production, technical marketing, and project management. Studies evolution of the engineering career and the transition to engineering management. Prerequisite: A grade of "C" or better is required in this course to meet Engineering Management degree requirements.

ENG MGT 2211 Engineering Accounting and Finance (LEC 3.0)

This course is designed to introduce the fundamentals of accounting and finance and provide the student with tools used in making financial decisions within a technically based enterprise. Prerequisite: Eng Mgt 1210, or understanding of engineering economic principles.

ENG MGT 2310 Introduction to System Engineering (LEC 3.0)

Provide an understanding of systems engineering and tools to manage system design, construction, and operation. Topics include systems thinking, modeling and simulation of systems, uncertainty in engineering, risk, and decision making in certain and uncertain environments. Prerequisites: Math 1208 or Math 1214.

ENG MGT 3310 Operations and Production Management (LEC 3.0)

Concepts of operations and production management are presented at an introductory level. Qualitative and quantitative tools and techniques used for the optimization of the operations component of the total enterprise are explored in the context of improved productivity and strategic competitiveness. Prerequisites: Eng Mgt 2110.

ENG MGT 3320 Introduction to Project Management (LEC 3.0)

This course covers the fundamentals of project management including project definition, project selection, project planning, estimating, scheduling, resource allocation and project control. Prerequisites: Junior or above standing.

ENG MGT 3510 Marketing Management (LEC 3.0)

Study of basic functions of marketing in the technological enterprise, including product selection and development, market research, market development, selection of distribution channels and advertising, marketing strategy. Prerequisites: Preceded or accompanied by Eng Mgt 2110.

ENG MGT 4000 Special Problems (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

ENG MGT 4001 Special Topics (LEC 0.0-6.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

ENG MGT 4099 Undergraduate Research (IND 0.0-6.0)

Designed for the undergraduate student who wishes to engage in research. Not for graduate credit. Not more than six (6) credit hours allowed for graduation credit. Subject and credit to be arranged with the instructor. Consent of instructor required.

ENG MGT 4110 General Management-Design and Integration (LEC 3.0)

Integrating and executing marketing, production, finance, and engineering policies and strategies for the benefit of an enterprise. Analysis, forecasting, and design methods using case studies and management simulation. Prerequisites: Eng Mgt 2210, 2211; preceded or accompanied by Eng Mgt 3310, 3320, 4710, and senior standing.

ENG MGT 4310 Materials Handling and Plant Layout (LAB 1.0 and LEC 2.0)

The design and objectives of materials handling equipment including diversity of application in industry from the viewpoint of efficient movement of materials and products from the receiving areas to the shipping areas. The layout of a plant to include materials handling equipment is considered throughout. Cost comparison of various systems will be made. Prerequisites: Junior standing.

ENG MGT 4312 Risk Assessment and Reduction (LEC 3.0)

Safe, secure manufacturing facilities protect the health of employees and the public, preserve the environment, and increase profitability. Methods for systematically identifying hazards and estimating risk improve the safety performance and security of manufacturing facilities. Prerequisite: Senior or Graduate Standing. (Co-listed with Chem Eng 5130).

ENG MGT 4330 Human Factors (LEC 3.0)

An examination of human-machine systems and the characteristics of people that affect system performance. Topics include applied research methods, systems analysis, and the perceptual, cognitive, physical and social strengths and limitations of human beings. The focus is on user-centered design technology, particularly in manufacturing environments. Prerequisite: Psych 1101. (Co-listed with Psych 4710).

ENG MGT 4710 Quality (LEC 3.0)

This course will provide an overview of quality tools and methodologies and how they apply to engineering management. Quality management methodologies will be explored as well as current and relevant tools and techniques used in the successful application of quality into various environments. Prerequisites: Stat 3115 or Stat 3117.

ENG MGT 4907 Engineering Management Senior Design (LEC 3.0)

Open-ended design projects will be addressed with small teams. The emphasis will be on solving industry-based projects that are broad in nature and which will require the students to incorporate the knowledge and skills acquired in earlier course work in the solution of the problems. Prerequisites: Preceded or accompanied by Eng Mgt 4110.

ENG MGT 5000 Special Problems (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

ENG MGT 5001 Special Topics (LEC 0.0-6.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

ENG MGT 5070 Teaching Engineering (LEC 3.0)

Introduction to teaching objectives and techniques. Topics include: using course objectives to design a course; communication using traditional and cutting-edge media; textbook selection; assessment of student learning; grading; student learning styles; cooperative/active learning; and student discipline. Prerequisite: Graduate standing. (Co-listed with Env Eng 5070, Comp Eng 5070, Elec Eng 5070, Civ Eng 5070).

ENG MGT 5099 Research (IND 0.0-15)

Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required.

ENG MGT 5110 Managerial Decision Making (LEC 3.0)

Individual and group decision making processes and principles for engineers and technical managers with emphasis on the limitations of human rationality and the roles of social influence and organizational contexts; principles and skills of negotiation. Prerequisite: Senior or graduate standing.

ENG MGT 5111 Management for Engineers and Scientists (LEC 3.0)

The transition of the engineer or scientist to manager; study of management roles and theory, organizational systems and behavior, managing and motivating technical personnel, leadership, communication, processes, and customer focus. Prerequisite: Graduate standing.

ENG MGT 5210 Economic Decision Analysis (LEC 3.0)

Comprehensive treatment of engineering economy including effects of taxation and inflation; sensitivity analysis; decisions with risk and uncertainty; decision trees and expected value, normally includes solutions on personal computer and student problem report. Prerequisite: Graduate students without previous course in engineering economy because of partial overlap.

ENG MGT 5212 Intelligent Investing (LEC 3.0)

An overview of the essential elements of intelligent investing. Coverage includes stocks, bonds, exchange traded funds, mutual funds, stock screening, fundamental and technical analysis, valuation, market and industry analysis, macroeconomic indicators, investing strategies, and portfolio construction. Prerequisites: Senior or Graduate Standing.

ENG MGT 5312 Advanced Risk Assessment and Reduction (LEC 3.0)

Safe, secure manufacturing facilities protect the health of employees and the public, preserve the environment, and increase profitability. Methods for systematically identifying hazards and estimating risk improve the safety performance and security of manufacturing facilities. Prerequisite: Senior or Graduate Standing.

ENG MGT 5313 Packaging Management (LEC 3.0)

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.

ENG MGT 5314 Computer Integrated Manufacturing Systems (LEC 2.0 and LAB 1.0)

Study of the design and use of computer-based integrated manufacturing management systems in the allocation and control of plant, equipment, manpower, and materials. Prerequisite: Eng Mgt 3310.

ENG MGT 5315 Interdisciplinary Problems In Manufacturing Automation (LEC 1.0 and LAB 2.0)

Introduction to basic techniques and skills for concurrent engineering, manufacturing strategies, product design, process planning, manufacturing data management and communication are the topics covered. Students experiment the design process through team projects and structured manufacturing laboratory work. (Co-listed with Mech Eng 5644, Chem Eng 4310).

ENG MGT 5316 Safety Engineering Management (LEC 3.0)

This course is an introduction to the principles of safety engineering applied to industrial situations. Job safety analysis, reduction of accident rates, protective equipment, safety rules and regulations, environmental hazards, health hazards, and ergonomic hazards are covered. Prerequisite: Senior or graduate standing.

ENG MGT 5320 Project Management (LEC 3.0)

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. Prerequisite: Graduate Standing.

ENG MGT 5330 Advanced Human Factors (LEC 3.0)

An in-depth review of the foundations of human factors, focusing on the interaction of people with various forms of technology in a variety of environments. Topics include research and evaluation methods, displays (e.g., visual, auditory), attention and information processing, decision making, motor skills, anthropometry, and biomechanics. (Co-listed with PSYCH 5710).

ENG MGT 5410 Industrial System Simulation (LEC 3.0)

Simulation modeling of manufacturing and service operations through the use of computer software for operational analysis and decision making. Prerequisite: Stat 3115 or Stat 3117.

ENG MGT 5411 Engineering Design Optimization (LEC 3.0)

This course is an introduction to the theory and practice of optimal design as an element of the engineering design process. The use of optimization as a tool in the various stages of product realization and management of engineering and manufacturing activities is stressed. The course stresses the application of nonlinear programming methods. Prerequisite: Math 3304 or 3329.

ENG MGT 5412 Operations Management Science (LEC 3.0)

Application of management science with an emphasis on supporting managerial decision-making. Design and operations of systems are modeled and analyzed using quantitative and qualitative techniques implemented using modern technology. Specific approaches include mathematical modeling and optimization, probabilistic/statistical analysis, and simulation. Prerequisites: Graduate standing.

ENG MGT 5413 Introduction To Intelligent Systems (LEC 3.0)

Introduction to the design of intelligent systems. Topics include: definitions of intelligence, rule-based expert systems, uncertainty management, fuzzy logic, fuzzy expert systems, artificial neural networks, genetic algorithms and evolutionary computation, hybrid systems, and data mining. Prerequisite: Graduate or senior standing.

ENG MGT 5414 Introduction To Operations Research (LEC 3.0)

Mathematical methods for modeling and analyzing industrial systems, topics including linear programming, transportation models, and network models. Prerequisite: Stat 3115 or Stat 3117.

ENG MGT 5510 Industrial Marketing Systems Analysis (LEC 3.0)

An analysis of the factors of engineered products, customers, communication, promotion, personal selling, persuasion and management within a dynamic industrial sales environment. Prerequisites: Senior or graduate standing.

ENG MGT 5511 Technical Entrepreneurship (LEC 3.0)

Student teams develop a complete business plan for a company to develop, manufacture and distribute real technical/product service. Lectures & business fundamentals, patents, market/ technical forecasting, legal and tax aspects, venture capital, etc., by instructor and successful technical entrepreneurs. Prerequisite: Senior or graduate standing.

ENG MGT 5512 Legal Environment (LEC 3.0)

Study of the effect of the legal environment on the decisions which the engineering manager must make. The course investigates the social forces that produced this environment and the responsibilities incumbent upon the engineer. Prerequisites: Senior or graduate standing.

ENG MGT 5513 Energy and Sustainability Management Engineering (LEC 3.0)

This course explores strategic processes and partnership required for the management of sustainable energy infrastructures and innovation in energy systems. Topics relate to renewable energy, energy efficiencies, energy conversion, energy technology, and economic efficiency of energy sources. Prerequisite: Senior or Graduate Standing.

ENG MGT 5514 Patent Law (LEC 3.0)

A presentation of the relationship between patent law and technology for students involved with developing and protecting new technology or pursuing a career in patent law. Course includes an intense study of patentability and preparation and prosecution of patent applications. Prerequisite: Senior or graduate standing. (Co-listed with Chem Eng 4300).

ENG MGT 5515 Integrated Product And Process Design (LEC 3.0)

Emphasize design policies of concurrent engineering and teamwork, and documenting of design process knowledge. Integration of product realization activities covering important aspects of a product life cycle such as "customer" needs analysis, concept generation, concept selection, product modeling, process development, and end of product life options. Prerequisites: Junior or above standing. (Co-listed with MECH ENG 5757).

ENG MGT 5516 Integrated Product Development (LAB 2.0 and LEC 1.0)

Students in design teams will simulate the industrial concurrent engineering development process. Areas covered will be design, manufacturing, assembly, process quality, cost, supply chain management, and product support. Students will produce a final engineering product at the end of the project. Prerequisite: Eng Mgt 5515 or Mech Eng 5757 or Mech Eng 3653 or Mech Eng 5708. (Co-listed with Mech Eng 5758).

ENG MGT 5610 Advanced Facilities Planning & Design (LAB 1.0 and LEC 2.0)

An integrated approach to the planning and design of facilities; examination of advanced techniques and tools for facility location, space allocation, facility layout materials handling system design, work place design; e.g. mathematical programming and simulation modeling. Prerequisites: Graduate standing.

ENG MGT 5613 Value Analysis (LEC 3.0)

An organized effort at analyzing the function of goods or services for the purpose of achieving the basic functions at the lowest overall cost, consistent with achieving the essential characteristics. Covers the basic philosophy, function analysis, FAST diagramming, creativity techniques, evaluation of alternatives, criteria analysis, and value stream mapping. Prerequisite: Senior or graduate standing.

ENG MGT 5614 Supply Chain Management Systems (LEC 3.0)

This course focuses on the development of logistics management skills related to global supply chains. Particular attention will be given to supply chain systems management as part of the firm's strategic positioning, cultural interactions and transportation sourcing decisions. Prerequisite: Stat 3115 or Stat 3117.

ENG MGT 5615 Production Planning And Scheduling (LEC 3.0)

Introduction to basic techniques of scheduling, manufacturing planning and control, just-in-time systems, capacity management, master production scheduling, single machine processing, constructive Algorithms for flow-shops, scheduling heuristics, intelligent scheduling systems are the topics covered. Prerequisite: Eng Mgt 3310.

ENG MGT 5710 Six Sigma (LEC 3.0)

This course is an introduction to the principles of implementing the Six Sigma philosophy and methodology. Topics include tools and methods including process flow diagrams, cause and effect diagrams, failure mode and effects analysis, gage R&R, capability studies, design of experiments and strategy for organizing six sigma techniques in industry. Prerequisite: Graduate standing.

ENG MGT 5711 Total Quality Management (LEC 3.0)

Examination of various quality assurance concepts and their integration into a comprehensive quality management system: statistical techniques, FMEA's, design reviews, reliability, vendor qualification, quality audits, customer relations, information systems, organizational relationships, motivation. Prerequisite: Senior or graduate standing.

ENG MGT 5712 Introduction To Quality Engineering (LEC 3.0)

This course is an introduction to the theory and practice of quality engineering with particular emphasis on the work of Genichi Taguchi. The application of the quality loss function, signal to noise ratio and orthogonal arrays is considered in-depth for generic technology development; system, product and tolerance design; and manufacturing process design. The emphasis of the course is off-line quality control. Other contributions in the field are also considered. Prerequisite: Eng Mgt 5711.

ENG MGT 5713 Management And Methods In Reliability (LEC 3.0)

Study of basic concepts in reliability as they apply to the efficient operation of industrial systems. Prerequisite: Stat 3115, 3117, or 5643.

ENG MGT 5714 Statistical Process Control (LEC 3.0)

The theoretical basis of statistical process control procedures is studied. Quantitative aspects of SPC implementation are introduced in context along with a review of Deming's principles of quality improvement and a brief introduction to sampling inspection. Prerequisite: Stat 3115, or Stat 3117.