

ENGINEERING MANAGEMENT

- Master of Science in Engineering Management (p. 1)
- Certificate, Six Sigma (p. 1)
- Certificate, Systems Engineering (p. 1)

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The program of study leading to the Master of Science in Engineering Management is designed to prepare engineers and aspiring engineers for leadership roles in engineering activities in industry, government, business and the military. Graduates should be able to model, analyze and make the difficult decisions required of engineering leaders, after learning course methodologies in statistics, operations research and simulation, and practicing these methodologies by using data and current analytical tools to solve real-world problems.

Master of Science in Engineering Management (ENM)

The program includes a minimum of 36 semester hours consisting of the following:

Core Courses

ENM 500	Probability & Statistics for Engineers	3
ENM 505	Management of Engineering Systems	3
MSC 521	Introduction to Operations Research	3
ENM 530	Engineering Economy	3
MSC 572	System Simulation	3
or MSC 555	System Dynamics I	
ENM 582	Engineering Organizational Development	3
ENM 590	Case Studies in Engineering Management	3

Group I Management-focused ENM Electives

Select one of the following:		3
ENM 515	Human Factors Engineering	
ENM 517	Legal Aspects of Engineering	
ENM 539	Project Management	
ENM 583	Leadership and Engagement for Engineering Diversity	
ENM 585	Engineering Organizational Systems	
ENM 587	Leading in Technical Environments	

Group II Application-focused ENM Electives

Select two of the following:		6
ENM 534	Decision Analysis	
ENM 541	Production Engineering	
ENM 560	Quality Assurance	
ENM 561	Design & Analysis of Experiments	
ENM 563	Advanced Engineering Design	
ENM 564	Lean Six Sigma for Engineers	
ENM 565	Reliability Engineering I	
MSC 555	System Dynamics I ¹	
or MSC 572	System Simulation	

Electives

Indicate two of the following courses or choose from ENM Group I or Group II Electives or from other fields of engineering. 6

ENM 503	Engineering Analysis - Methods & Models	
ENM 566	Reliability Engineering II	
ENM 595	Spcl Prj in Engr Mgmt	
Total Hours		36

¹ Whichever is not taken as core.

The supporting classes and electives within the engineering program of study allows concentrations in areas such as six sigma quality, manufacturing, artificial intelligence, reliability engineering, operations research, and systems engineering, and simulation.

Certificates

Programs of study leading to two graduate-level certificates are also available.

Certificate in Six Sigma (SXS)

The Certificate in Six Sigma is designed to offer practicing engineers and other technically-educated professionals the opportunity to master Six Sigma concepts by studying their theoretical roots and conceptual foundations through coursework at the graduate level. Upon successful completion, students are expected to be able to demonstrate an in-depth understanding of the statistical concepts underlying the methods & tools of Six Sigma, correctly apply those methods & tools, correctly analyze and interpret the results, and pursue further research or coursework in the area.

The certificate program is comprised of the following four courses:

ENM 500	Probability & Statistics for Engineers	3
ENM 560	Quality Assurance	3
ENM 561	Design & Analysis of Experiments	3
ENM 564	Lean Six Sigma for Engineers	3
Total Hours		12

Certificate in Systems Engineering (SYE)

Systems engineering is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, and then proceeding with design synthesis and system validation while considering the system as a whole.

The certificate program is comprised of the following four courses:

ENM 505	Management of Engineering Systems	3
ENM 530	Engineering Economy	3
ENM 539	Project Management	3
ENM 582	Engineering Organizational Development	3
Total Hours		12

Courses

ENM 500. Probability & Statistics for Engineers. 3 Hours

This is an introductory course in the concepts and applications of probability and statistics. Emphasis is on applications and examples that an engineer or analyst would encounter in practice. Probability is presented as the fundamental tool for modeling uncertainty as well as the logical connection between a population of data and its samples. Descriptive statistics are introduced to describe and characterize data. Inferential statistics provide the means of generalizing to a population from a sample, thus enabling solutions and conclusions that otherwise would not be obtained. Modern software provides the leverage to tackle problems of realistic size and complexity. The concepts and methods covered have direct application to forecasting, queuing, inventory, production, scheduling, equipment replacement, reliability, availability, quality control, experimental design, robust engineering, six sigma, and more. Prerequisite(s): An undergraduate course sequence in calculus.

ENM 503. Engineering Analysis - Methods & Models. 3 Hours

Mathematical methods and models used in the study and solution of decision problems found in engineering and operations research/management science. The methods and models presented build on the student's mathematical foundation and are motivated by their use in solving real-world problems. This is not a concept-theory course but rather a course designed to enhance the modeling and analysis skills of the student. Prerequisite(s): An undergraduate course sequence in calculus.

ENM 505. Management of Engineering Systems. 3 Hours

This course addresses systems engineering concepts and processes, explaining activities and tools for developing system solutions to meet customer needs. Using the Systems Engineering Body of Knowledge as a foundation, topics such as systems thinking, requirements analysis, testing, and life-cycle sustainment are discussed along with technical management topics such as configuration and interface management, risk management and decision analysis, and systems engineering. The interdisciplinary and cross-functional nature of systems engineering is also emphasized.

ENM 515. Human Factors Engineering. 3 Hours

Treatment of theory, data, and methods that can be applied to improve the interface between humans and the systems and products that they use. Human capabilities and limitations are studied to support the design of systems and products for safe and efficient use by the human operator.

ENM 517. Legal Aspects of Engineering. 3 Hours

An introductory course to provide the engineer with some insight into the areas of law that will impact an engineer's professional practice. Special emphasis is given to the area of Contract Law due to the important and pervasive interaction that it has with engineering design and project work. Systems of law, legal reasoning, and the court systems are introduced. Product liability and business relationships are discussed. Courtroom experience is achieved through interaction with the UD Law School and local judges with participation in mock trials.

ENM 530. Engineering Economy. 3 Hours

This is an introductory course in the concept of time value of money and financial management for engineering managers. The course includes learning curves, cost estimating, managerial accounting, balance sheet and income statement, financial ratios, investment alternatives, depreciation, inflation, capital budgeting and other related topics.

ENM 534. Decision Analysis. 3 Hours

Introduction to decision analysis with applications. Topics explored include structuring decisions under uncertainty, influence diagrams, decision trees, risk analysis, sensitivity analysis, value of information, utility theory, and practical decision making. Prerequisite(s): ENM 500 or equivalent.

ENM 539. Project Management. 3 Hours

This course addresses the concepts, techniques and procedures used to manage engineering programs and projects using an integrated approach for planning, execution, and control. It includes an introduction to the systems approach to project management; project screening and selection; multiple-criteria methods for evaluation; work breakdown structures (WBS) and organization; configuration selection, management and control; project scheduling; project budgets; and resource management. A key goal is to provide the student with sufficient knowledge and tools to confidently manage a project or contribute effectively as a project team member.

ENM 541. Production Engineering. 3 Hours

Study of the integration of man, machine, and material in producing a marketable product. The use of engineering techniques to design, develop, and implement the production system are covered. Topics include break-even analysis, learning curve theory, forecasting, resource balancing, inventory and production control, facility layout and location, job sequencing and scheduling, and assembly line balancing. Modern production techniques such as just-in-time (JIT), MRP systems flexible manufacturing, and computer-integrated manufacturing are discussed. Prerequisite(s): MSC 521 or permission of instructor.

ENM 560. Quality Assurance. 3 Hours

Introduction to the fundamental concepts and methods of modern approaches to quality assurance, with emphasis on statistical methods for process control, process capability analysis, and sampling inspection. The course introduces relevant methods of experimental design and current issues in quality improvement. Prerequisite(s): ENM 500 or equivalent.

ENM 561. Design & Analysis of Experiments. 3 Hours

This course introduces advanced topics in experimental design and analysis, including full and fractional factorial designs, response surface analysis, multiple and partial regression, and correlation. Prerequisite(s): ENM 500 or equivalent.

ENM 563. Advanced Engineering Design. 3 Hours

This graduate-level course seeks to develop in students the ability to integrate dynamic mechanisms (i.e., heat transfer, fluid dynamics, electrical responses, etc.) into system modeling and analyses with uncertainty supporting the verification and validation of systems. Additionally, statistically-based analysis, design, and optimization will be addressed through open-ended problems with explicit considerations of system-level impacts, engineering tradeoffs, and system integration. A course project is required that must demonstrate application of the statistically-based design process. Prerequisite(s): ENM 561 or equivalent; Instructor permission.

ENM 564. Lean Six Sigma for Engineers. 3 Hours

This course will provide a broad exposure to topics in quality improvement that encompass the body of knowledge for Six Sigma Black Belts in both manufacturing and service industries, including hospitals, banks and retailers. Essential concepts, practices, methods and tools for quality improvement, lean management, and effective teamwork are examined, along with the Six Sigma DMAIC problem solving approach. Students will be equipped to help organizations achieve operational excellence by applying what is learned within an improvement project case study. Prerequisite(s): ENM 500 or equivalent.

ENM 565. Reliability Engineering I. 3 Hours

An introduction to reliability engineering concepts and methodology. The reliability, maintainability, and availability of components and multi-component systems are analyzed. Topics include exponential, Weibull, lognormal and normal failure laws, static reliability, hazard rate functions, state dependent failure rate models, redundancy, censoring, empirical models, curve fitting to failure data, and reliability growth testing. Prerequisite(s): ENM 500 or equivalent.

ENM 582. Engineering Organizational Development. 3 Hours

This course addresses individual, group behavior, and organizational design examined within the structure of technical operations, including the systems engineering environment. The objectives are to provide the participants with an understanding of behavioral science and design principles, their effect on organizational performance, and how one applies this science in the management of technical personnel and projects, especially in the systems engineering environment.

ENM 583. Leadership and Engagement for Engineering Diversity. 3 Hours

This course will provide students with an awareness of the barriers, biases and challenges to diversity in engineering, provide strategies that can be used to improve satisfaction in the engineering workplace and in academia; and provide principles and practices that can enhance the students' leadership skills for the engineering workplace. Prerequisite(s): ((ENG 100 or 100B or 114 or 198) or ASI 120)) and ((REL 103 and HST 103 and PHL 103) or ASI 120)) and Junior Status.

ENM 585. Engineering Organizational Systems. 3 Hours

Introduction to organizational theory and practice with emphasis on the design of organizational structures for the effective integration of production, research and development, and engineering activities. Special topics include high performing systems, the technical ad-hoc committee, matrix organization, and project management and other current issues.

ENM 587. Leading in Technical Environments. 3 Hours

Understanding and utilizing the keys to leading in technical organizations represents a distinct advantage to individuals and the institutions they serve. Students will be exposed to the underpinning of leadership in engineering environments including tenets, theories, debates, strategies, and innovative techniques. Opportunities to interact with technical leaders from government and industry will be provided. Practical application skills will be developed.

ENM 590. Case Studies in Engineering Management. 3 Hours

This capstone course emphasizes the completion of an engineering management project or study under the direction of a faculty advisor. A well-written report is required. Prerequisite(s): Completion of the engineering management core courses or equivalent.

ENM 595. Special Problems in Engineering Management. 1-3 Hours

This course covers special assignments in engineering management as arranged and approved by the advisor and the program director.