

ENGINEERING MANAGEMENT

Sandra Furterer, Chairperson, Department of Engineering Management, Systems, & Technology

Dr. Philip Appiah-Kubi, Graduate Program Director, Department of Engineering Management, Systems, and Technology

Master of Science in Engineering Management (ENM)

The program includes a minimum of 30 semester hours consisting of the following:

The program of study in Engineering Management is designed to prepare engineers to be effective leaders and managers. Courses in this program provide students with the educational foundation necessary to plan, design, optimize and direct complex programs, processes, and systems – and manage the teams that make them work.

Required Courses	12 credit hours
ENM 500 Probability & Statistics for Engineers	3
ENM 530 Engineering Economy	3
ENM 582 Engineering Organizational Development	3
Choose one of the following project-based courses ¹	
ENM 505 Management of Engineering Systems	3
or ENM 564 Lean Six Sigma for Engineers	
or ENM 590 Case Studies in Engineering Management	
or MSC 599 Thesis	
Engineering Management & Management Science Elective Courses	12 credit hours
Twelve (12) credit hours of ENM and/or MSC courses not used to satisfy the requirements above.	
General Elective Courses	6 credit hours
Six (6) credit hours of graduate-level electives as approved by the advisor or program director.	

¹ Students interested in completing a thesis must have advisor approval and complete six (6) credit hours of MSC 599 - Thesis by choosing three (3) credit hours of MSC 599 as the 'project-based course' and an additional three (3) credits of MSC 599 as an elective course.

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 five graduate-level certificates are also available. Students seeking any of these graduate certificates must apply to and be accepted for admission into a University of Dayton graduate

degree program. All Graduate School policies pertaining to admission apply.

Certificate in Foundations of Engineering Management (FEM)

The foundations of Engineering Management Certificate is comprised of three courses – Engineering Economy, Engineering Organizational Development, and Lean Production Systems. These courses serve as the foundation for financial decision making, managing technical personnel and projects, and problem solving and continuous improvement in production systems.

The certificate is comprised of the following three courses:

ENM 530	Engineering Economy	3
ENM 540	Lean Production Systems	3
ENM 582	Engineering Organizational Development	3

Certificate in Modeling & Simulation (MSN)

The Modeling & Simulation certificate is comprised of three courses which will prepare students to formulate and solve mathematical and simulation models in decision making environments.

MSC 521	Introduction to Operations Research	3
MSC 572	System Simulation	3
or ENM 576	Simulation Modeling for Engineering Managers	
Choose 1 modeling elective from the following:		3
ENM 565	Reliability Engineering I	
MSC 523	Nonlinear Optimization	
MSC 541	Productn Engineerng	
MSC 542	Inventory Theory & Application	
MSC 544	Forecasting & Time Series Analysis	
MSC 555	System Dynamics I	
MSC 571	Data Analytics for Systems Engineers	
MSC 595	Current Problems	
Total Hours		9

Certificate in Six Sigma and Operational Excellence (SOE)

Six Sigma is a data-driven approach and methodology for process improvement, and Operational Excellence embraces principles and tools to create an maintain substantial organizational improvements. This graduate level certificate emphasizes essential concepts, practices, and methods for quality improvement, lean management, and effective teamwork. In depth course work in the areas of quality assurance and design & analysis of experiments provide students a rigorous, analytical basis for implementing Lean Six Sigma and Organizational Excellence in practice.

The certificate is comprised of the following three courses:

ENM 564	Lean Six Sigma for Engineers ¹	3
ENM 560	Quality Assurance ¹	3
ENM 561	Design & Analysis of Experiments ¹	3

¹ ENM 500 - Probability & Statistics for Engineers (or equivalent) is a prerequisite for the courses in the Six Sigma and Operational Excellence certificate.

Certificate in Systems Engineering Management (SEM)

Systems engineering is an interdisciplinary approach to design and manage the life cycle of complex systems. The management of such systems must ensure the integration of all aspects of the system which requires knowledge of project management and the ability to make decisions under uncertainty. In addition, managers require a structured approach for defining customer needs and project functionality, documenting requirements, and then proceeding with design synthesis and system validation while considering the system as a whole.

The certificate is comprised of the following three courses:

ENM 505	Management of Engineering Systems	3
ENM 534	Decision Analysis	3
ENM 539	Project Management	3

Certificate in Systems Architecture and Analytics (SAA)

The Systems Architecture & Analytics certificate is comprised of three courses which serve as the foundation for the design, development, and analysis of complex programs, processes or products.

MSC 550	Requirements Engineering and Analysis	3
MSC 551	Systems Architecture and Model-Based Systems Engineering	3
MSC 571	Data Analytics for Systems Engineers	3
Total Hours		9

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

This is an introductory course which provides the engineer with insight into the areas of law that will impact an engineer's professional practice. Special emphasis is given to the study of intellectual property including patents, trademarks and copyrights. The course covers points to be considered in entering into contracts, legal options for setting up a business, and the engineer's legal exposure in the design of products, and legal responsibilities as an engineering employee or employer. Students will have the opportunity to participate in a mock trial through interaction with the law school and local judges.

ENM 525. Global Supply Chain Management. 3 Hours

This course educates students on the fundamental roles played by supply chain management in the global economy. Students will understand the management of local and global supply chain functions and their impact on industries, customers, and suppliers. Students will learn to optimize supply chain resources to reduce costs and improve revenue. Students will learn to utilize data and contemporary tools to make informed decisions in a global supply chain environment.

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 540. Lean Production Systems. 3 Hours

This course includes the principles and current practices using Lean Manufacturing to integrate humans, machines, and materials in producing a marketable product. The use of lean methods to design, develop, and implement the production system are covered. Topics include just-in-time, kaizen, 5s, inventory and production control, and assembly line balancing. The Toyota Production System (TPS) framework will be used as the basis for problem solving and continuous improvement applications for production systems. Graduate standing.

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 management, quality control, and quality assurance. This course provides an overview of quality management philosophies and implementation strategies. Statistical methods for process control and variety of quality assurance tools are introduced. 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. Required background: descriptive statistics, confidence intervals, and hypothesis testing.

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 576. Simulation Modeling for Engineering Managers. 3 Hours

This course is intended to enhance the student's ability to effectively manage simulation projects and use the results to inform and support organizational problem solving and decision making. Students will learn concepts and methods that underlie each major phase of a simulation project while also learning how to build valid models of basic systems. Simulation software will be used to provide students with hands on experience in designing, building, analyzing and interpreting the results of basic computer simulation experiments and in communicating those results with stakeholders. Prerequisites: ENM 500.

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.

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.