

# MANAGEMENT SCIENCE

- Master of Science in Management Science (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 management science is an interdisciplinary program administered by the School of Engineering, with the cooperative support of the College of Arts and Sciences, the School of Business Administration and the School of Education and Health Sciences. Applications are invited from college graduates in all fields of study - business, education, engineering, liberal arts, physical sciences and social sciences. The applicant whose preparation does not include at least three semesters of analytic geometry and calculus will be expected to complete appropriate prerequisite courses prior to admission to the program.

The management scientist is the manager or staff specialist who is trained in the quantitative methodologies of operations research, systems analysis and the decision sciences. Graduates must be proficient in problem solving and decision-making, system modeling and optimization and the application of probability and statistical theory to management problems. Graduates must also be familiar with a variety of other topics, such as quality control, inventory planning and control, reliability and maintainability and system simulation.

The objective of this program is to develop quantitative management skills and capabilities appropriate to each student's needs and objectives. The program emphasizes the practical application of management science techniques in our modern society.

## Master of Science in Management Science (MSC)

The program of study must include a minimum of 36 semester hours consisting of the following:

ENM 500	Probability & Statistics for Engineers	3
MSC 521	Introduction to Operations Research	3
MSC 535	Applied Operations Research/Management Science	3
MSC 572	System Simulation	3

### Group I - Probabilistic Modeling Electives

Select at least two of the following: 6

ENM 505	Management of Engineering Systems	
ENM 560	Quality Assurance	
ENM 561	Design & Analysis of Experiments	
ENM 563	Advanced Engineering Design	
ENM 565	Reliability Engineering I	
MSC 544	Forecasting & Time Series Analysis	

### Group II - Deterministic Modeling Electives

Select at least two of the following: 6

ENM 515	Human Factors Engineering	
ENM 530	Engineering Economy	
ENM 539	Project Management	

ENM 541	Production Engineering	
ENM 565	Reliability Engineering I	
ENM 582	Engineering Organizational Development	
MSC 523	Nonlinear Optimization	
MSC 555	System Dynamics I	
MSC 595	Current Problems	
MSC 599	Thesis	

Twelve semester hours in a cognate field-or additional in-depth MSC 12 courses- appropriate to the student's objectives, as approved by the advisor. Approved fields of study for the cognate field include applied mathematics, artificial intelligence, business administration, computer science, educational administration, engineering, and manufacturing. Two of these courses may be replaced by a 6-semester hour Master's thesis.

Students admitted conditionally will first take the ENM 503 course and then the ENM 500 course the following term. Grades of "B" or better must be earned in each course so the student can be removed from conditional standing. The ENM 503 course will replace one of the program's free electives.

Total Hours 36

When applying for the MSC degree, please note that the M.S. in Engineering Science program does not require the three letters of recommendation or GRE results required by other University of Dayton departments and programs, though these can be helpful in making admission decisions.

## Certificates

Programs of study leading to two graduate-level certificates are also available. These certificates are based on a complete knowledge of calculus. Students seeking either 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 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.

**MSC 599. Thesis. 1-6 Hours**  
Thesis in Management Science.

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

### **MSC 521. Introduction to Operations Research. 3 Hours**

This course covers methods, principles and fundamentals of deterministic and stochastic operations research. Emphasis is on the formulation and solution of mathematical models in decision making environments, the search for optimal solutions to these decisions, and the explicit treatment of uncertainty through the use of probabilistic modeling and statistical analysis. Models include linear and non linear programs, inventory and production models, decision analysis, forecasting, and queuing. Corequisite(s): ENM 500.

### **MSC 523. Nonlinear Optimization. 3 Hours**

This course concentrates on methods and engineering/management science applications of nonlinear optimization. Both single- and multi-variable methods as well as unconstrained and constrained problems are addressed. The course blends theoretical results such as the Kuhn-Tucker conditions and numerical search techniques such as conjugate directions with applications.

### **MSC 535. Applied Operations Research/Management Science. 3 Hours**

This is a capstone course focused on the art rather than the 'science' of problem solving in management science and operations research. Emphasis is placed on the techniques of problem solving and model building, examination of unique problem cases, and a course project requiring modeling, data collection, and analysis. Prerequisite(s): Completion of the management science core courses or equivalent.

### **MSC 544. Forecasting & Time Series Analysis. 3 Hours**

Concentration on statistical techniques for modeling and predicting discrete time-series phenomena, with emphasis on understanding and applying forecasting tools in analysis and management settings. Both classical smoothing methods and the Box-Jenkins methodology for model identification, estimation, and prediction are presented. Prerequisite(s): MSC 500 or equivalent.

### **MSC 555. System Dynamics I. 3 Hours**

Introduction to the methodology for modeling the dynamics of complex engineering, business, and socioeconomic systems. These models are used to study the effect of organizational policies and design in higher-order, multiple-loop, nonlinear feedback systems.

### **MSC 572. System Simulation. 3 Hours**

This course is an introduction to stochastic discrete event simulation of complex systems and human performance. Topics covered include model creation, 2D and 3D animation, the process of generating random numbers and random variables, the analysis of input data, the computer modeling of real systems, validation and variation, and the analysis of simulation output. Emphasis is on modeling real-world systems using modern software. Prerequisite(s): ENM 500 or equivalent.

### **MSC 595. Current Problems. 1-3 Hours**

Topics of current interest in specialized areas of Management Science.