Department of Systems Engineering

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Objectives

Systems engineering is an interdisciplinary field of systems engineering, focusing on the design, modeling, interconnection, and management of large complex systems. In addition to the methods of traditional engineering, systems engineering relies on skills and expertise in areas such as optimization, simulation, economics and finance, risk management, and decision making under uncertainty. These skills come together to address the challenges of designing and managing complex interconnected systems, ranging from an automobile or an airplane to communication systems, financial markets, the power grid, and many more.

The Department of Systems Engineering at UT Dallas focuses research and curriculum in the fundamentals of systems engineering and management, with applications in interdisciplinary areas of interest to industry, such as energy systems, financial engineering systems, software systems, healthcare systems, cyber security systems, control and mechatronic systems, and others. In so doing, the Department of Systems Engineering offers an MS degree in Systems Engineering and Management (MS-SEM), a joint program with the UT Dallas Naveen Jindal School of Management. The program brings together faculty and disciplines from the engineering school and from the management school into a single program that has traditional and executive education formats.

Research

While many diverse areas of research and curriculum are represented by the core faculty and affiliated faculty in the Department of Systems Engineering, we identify with a few basic, core areas of concentration which combine graduate level research and curriculum:

- Control Systems and Mechatronic Systems
- Financial Engineering
- Energy Systems
Other curriculum-centric concentration areas, discussed below for the MS-SEM degree program, are also possible areas of research focus.

In keeping with the established tradition of research at UT Dallas, the Systems Engineering Department through its research efforts and its MS-SEM degree program, encourages students to interact with researchers in other strong programs in the Jonsson School of Engineering and Computer Science and the Naveen Jindal School of Management, including computer science, electrical engineering, mechanical engineering, bioengineering, computer engineering, operations management, finance, marketing, innovation and entrepreneurship, and business management.

**Master of Science in Systems Engineering and Management (MS-SEM)**

*36 hours minimum*

**Admission Requirements**

A student lacking undergraduate prerequisites for graduate courses must complete prerequisites or receive approval from the graduate advisor and the course instructor. A diagnostic examination may be required. Please consult with the University's general admission requirements, discussed in the graduate catalog, whereas specific admission requirements for the MS-SEM follow.

A student entering the MS-SEM program should meet the following guidelines:

- A minimum of a BS in engineering, mathematics, physics, chemistry, economics or finance from an accredited program (specifically, programs that provide adequate fundamental skills in mathematics).
- Must submit GRE and/or GMAT scores, as appropriate.
- Must submit three letters of recommendation from individuals who are able to judge the candidate's probability of success in pursuing a program of study leading to the MS-SEM degree.
- Must also submit an essay outlining the candidate's background, education, and professional goals.

**Degree Requirements**

The MS-SEM program is designed to be flexible to accommodate different student backgrounds, allowing students to pick up areas in which they are deficient, while still guaranteeing core competency in systems engineering and systems management. This program has both a thesis and a non-thesis option. All part-time MS-SEM students will be assigned initially to the non-thesis option. Those wishing to elect the thesis option may do so by obtaining the approval of a faculty thesis supervisor.

The MS-SEM degree requires a total of 36 credit hours consisting of 12 courses in the non-thesis
option or 10 courses plus six hours of thesis credit for the thesis option. All students must have an academic advisor and an approved degree plan. Courses taken without advisor approval will not count toward the 36 semester-hour requirement. Successful completion of the approved course of studies leads to the MS-SEM degree. Please also note that the University's general degree requirements are discussed elsewhere in the graduate catalog.

Non-thesis Option

Completion of a minimum of 36 semester hours of graduate level lecture courses including the required core courses. With advisor approval, these may include some 5000 level courses. Students must earn a grade of B- or better in each of four core courses (see below).

Thesis Option

An alternative to 36 credit hours required for the MS-SEM degree, would be the completion of a minimum of 30 semester hours of graduate level lecture courses, with a grade of B- or better in each of the required core courses (see below), six semester hours of a combination of master's research (SYSM 6V70) and thesis (SYSM 6V90), submitted to the graduate school, and a formal public defense of the thesis.

Students enrolled in the thesis option should meet with individual faculty members to discuss research opportunities and to choose a research advisor during the first or second semester that the student is enrolled. After the second semester of study, course selection should be made in consultation with the research advisor. Part-time students are encouraged to enroll in only one course during their first semester and in no more than two courses during any semester they are also working full-time.

Research and thesis hours cannot be counted in an MS-SEM degree plan unless a thesis is written and successfully defended. A supervising committee, which must be chosen in consultation with the student's thesis advisor prior to enrolling for thesis credit, administers the defense. With advisor approval, the lecture courses may include some 5000 level courses. Full-time students at UT Dallas who receive financial assistance are required to enroll in nine semester credit hours each semester.

Course Requirements

Core Courses: 12 hours

Students are required to take four courses (a total of 12 credit hours) from a set of eight courses in the lists below. Two of the courses must be from the Engineering Core section and two from the Management Core section. The four required courses contribute a total of 12 credit hours toward the MS degree.

Engineering Core Courses

SYSM 6301 Systems Engineering, Architecture and Design
**SYSM 6302** Dynamics of Complex Networks and Systems

**SYSM 6303** Quantitative Introduction to Risk and Uncertainty in Business

**SYSM 6305** Optimization Theory and Practice

**Management Core Courses**

**SYSM 6311** Systems Project Management in Engineering and Operations

**SYSM 6312** Systems Financial Management

**SYSM 6318** Marketing Management

**SYSM 6333** Systems Organizational Behavior

**Prescribed Electives: 12 hours**

Students are required to take an additional four courses (a total of 12 credit hours) from the set of eight core courses listed above and/or the set of courses listed below. Two of these courses must be chosen from the two Engineering sections (core and elective), and two from the two Management sections (core and elective). Because a program objective is to maintain a high degree of flexibility, students are encouraged to work with an MS-SEM program advisor to discuss possible (limited) exceptions and substitutions for the prescribed elective courses.

**Engineering Elective Courses**

**SYSM 6304** Risk and Decision Analysis

**SYSM 6306** Engineering Systems: Modeling & Simulation

**SYSM 6307** Linear Systems

**SYSM 6308** Software Maintenance, Evolution & Re-Engineering

**SYSM 6309** Advanced Requirements Engineering

**SYSM 6310** Software Testing, Validation and Verification

**SYSM 6321** Financial Engineering I

**SYSM 7321** Financial Engineering II

**Management Elective Courses**

**SYSM 6313** Systems Negotiation Deals and Dispute Resolution

**SYSM 6314** Manufacturing & Service Systems Planning & Analysis

**SYSM 6315** The Entrepreneurial Experience

**SYSM 6316** Managing Innovation Within the Corporation

**SYSM 6317** Management of High Tech Products
Free Electives: 12 hours

Working with an MS-SEM program advisor, students are required to take four additional and distinct courses either from the remaining SYSM courses listed above or from other courses offered in management or engineering that form a "concentration" or "specialization" in systems-related, possibly industry-specific sectors. The concentration area consists of four courses (12 semester hours) in the degree program; examples include: Mechatronic and Control Systems, Financial Engineering Systems, Energy Systems, Healthcare Systems, Telecom and IT Networks, Information Assurance and Cyber-security, Global Supply Chain Management, Entrepreneurship and Innovation, and Enterprise Systems. Finally, because of the flexible nature of the MS-SEM degree program, students may submit for approval a "personalized" concentration area that focuses on aspects of systems engineering, and may combine elements of other concentration areas on a focused theme.

Systems Engineering and Management (MS-SEM) Courses

Engineering Courses

- **SYSM 6301** Systems Engineering, Architecture and Design
- **SYSM 6302** Dynamics of Complex Networks and Systems
- **SYSM 6303 (OPRE 6301)** Quantitative Introduction to Risk and Uncertainty in Business
- **SYSM 6304 (OPRE 6335)** Risk and Decision Analysis
- **SYSM 6305** Optimization Theory and Practice
- **SYSM 6306 (BMEN 6372, MECH 6314)** Engineering Systems: Modeling & Simulation
- **SYSM 6307 (ENGR 6331, MECH 6300)** Linear Systems
- **SYSM 6308 (CS 6356, SE 6356)** Software Maintenance, Evolution & Re-Engineering
- **SYSM 6309 (SE 6361, CS 6361)** Advanced Requirements Engineering
- **SYSM 6310 (SE 6367, CE 6367, CS 6367)** Software Testing, Validation, and Verification
- **SYSM 6321** Financial Engineering I
- **SYSM 7321** Financial Engineering II
- **SYSM 6V70** Research In Systems Engineering and Management
Management Courses

**SYSM 6311** (OPRE 6362) Systems Project Management in Engineering and Operations
**SYSM 6312** (FIN 6301) Systems Financial Management
**SYSM 6313** (OB 6332) Systems Negotiation and Dispute Resolution
**SYSM 6314** Manufacturing & Service Systems Planning & Analysis
**SYSM 6315** (ENTP 6398) The Entrepreneurial Experience
**SYSM 6316** (ENTP 6388) Managing Innovation within the Corporation
**SYSM 6317** Management of High Tech Products
**SYSM 6318** (MKT 6301) Marketing Management
**SYSM 6319** (MECO 6303) Business Economics
**SYSM 6320** (BPS 6332) Strategic Leadership
**SYSM 6332** (ENTP 6375) Technology and New Product Development
**SYSM 6333** (OB 6301) Systems Organizational Behavior
**SYSM 6V98** Systems Management Internship

Systems Engineering Courses

**SYSE 6321** Systems Integration
**SYSE 6322** Digital Control of Automotive Powertrain Systems
**SYSE 6323** (MECH 6323) Robust Control Systems
**SYSE 6324** (BMEN 6388, ENGR 6336, MECH 6313, SYSE 6324) Nonlinear Control Systems

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