Department of Systems Engineering

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, cybersecurity 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 Erik 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 semester credit hours minimum

Department Faculty

Professors: Mathukumalli Vidyasagar, Steve Yurkovich

Assistant Professor: Robert D. Gregg

UT Dallas Affiliated Faculty: Farokh B. Bastani, Alain Bensoussan, Robert D. Gregg, Duncan L. MacFarlane, Suresh P. Sethi, Rajiv Shah, Mark W. Spong, Lakshman Tamil, W. Eric Wong

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 semester credit hours consisting of 12 courses in the
non-thesis option or 10 courses plus six semester credit 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 credit 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 credit 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 Course Requirements).

**Thesis Option**

An alternative to 36 semester credit hours required for the MS-SEM degree, would be the completion of a minimum of 30 semester credit hours of graduate level lecture courses, with a grade of B- or better in each of the required core courses (see Course Requirements), six semester credit 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 semester credit 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 semester credit hours**

Students are required to take four courses (a total of 12 semester credit hours) from a set of eight courses from 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 semester 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 semester credit hours**

Students are required to take an additional four courses (a total of 12 semester 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 and Simulation  
**SYSM 6307** Linear Systems  
**SYSM 6308** Software Maintenance, Evolution, and Re-Engineering  
**SYSM 6309** Advanced Requirements Engineering  
**SYSM 6310** Software Testing, Validation and Verification  
**SYSM 6321** Financial Engineering I  
**SYSM 6325** Requirements Development and Integration for Complex Systems

**Management Elective Courses**

**SYSM 6313** Systems Negotiation Deals and Dispute Resolution  
**SYSM 6315** The Entrepreneurial Experience  
**SYSM 6316** Managing Innovation Within the Corporation
Free Electives: 12 semester credit 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 credit hours) in the degree program; examples include: Control and Mechatronic Systems, Cybersecurity and Information Assurance, Energy and Infrastructure Systems, Enterprise and Data Management Systems, Entrepreneurship and Innovation Management, Global Supply Chain Management, Healthcare and Biomedical Systems, Optimization and Operations Research, Telecom, IT and Multimedia Networks, and Transportation 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 and Simulation
- **SYSM 6307** (EECS 6331, MECH 6300) Linear Systems
- **SYSM 6308** (CS 6356, SE 6356) Software Maintenance, Evolution, and Re-Engineering
- **SYSM 6309** (SE 6361, CS 6361) Advanced Requirements Engineering
Certificate Program

The volume and sophistication of cybersecurity threats point to a critical demand for research and education in the general area of cybersecurity, which is highly interdisciplinary by nature. Elements
form computer science, systems engineering, and information technology management form the basis for systems-related technologies to secure typical vulnerabilities. In addressing this growing critical demand, the Certificate in Cybersecurity Systems (CCSS) offered at UT Dallas provides a joint program between the Erik Jonsson School of Engineering and Computer Science (engineering and computer science) and Jindall School of Management (internal audit and information technology management), with a natural home in the Department of Systems Engineering (SYSE).

Graduate Certificate in Cybersecurity Systems

12 semester credit hours

Department Faculty

Professors: Yvo G. Desmedt, Latifur Khan, Bhavani Thuraisingham

Associate Professors: Kevin Hamlen, Murat Kantarcioglu

Assistant Professors: Alvaro Cárdenas, Zhiqiang Lin

Senior Lecturer: Ebru Cankaya

Overview

The CCSS requires 12 semester credit hours, and may be combined with other courses and/or certificates toward an MS degree, such as Computer Science, Information Technology and Management, or Systems Engineering and Management, provided that the student has gained admission into that particular program.

To earn the certificate, students in the program must take four courses with an overall GPA of 3.0.

Required Course (3 semester credit hours)

MIS 6311 Cybersecurity Fundamentals

Track #1: Computer Science (CS) Emphasis (9 semester credit hours)

Students can choose three courses from the following:

CS 6324 Information Security
CS 6349 Network Security
CS 6348 Data and Applications Security

Or a course from a list of existing cybersecurity systems in Computer Science courses (offered periodically, and must be approved)
Track #2: Internal Audit, Information Management (IA/IM) Emphasis (9 semester credit hours)

Students must take **MIS 6330** and **ACCT 6336**, and choose between **ACCT 6380** or **MIS 6363**:

- **MIS 6330** Information Technology Security
- **ACCT 6336** Information Technology Audit and Risk Management
- **ACCT 6380** Internal Audit or **MIS 6363** Cloud Computing

Track #3: Systems Engineering and Management Emphasis (9 semester credit hours)

Students must take **SYSM 6301**, and choose between **CS 6324** or **MIS 6330**:

- **SYSM 6301** Systems Engineering, Architecture and Design
- **CS 6324** Information Security or **MIS 6330** Information Technology Security

Students can choose at least one course from each of the CS and IA/IM tracks from the following:

- **CS 6348** Data and Applications Security (CS track)
- **CS 6349** Network Security (CS track)
- **MIS 6363** Cloud Computing (CS track)
- **ACCT 6336** Information Technology Audit and Risk Management (IA/IM track)
- **ACCT 6380** Internal Audit (IA/IM track)

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