MODELING AND SIMULATION Courses

MSIM 111. Information Literacy and Research for Modeling and Simulation Engineers. 2 Credits.

Lecture 2 hours; 2 credits. Prerequisite: ENGN 110. An introduction to methods and standards for locating and using information in the discipline of modeling and simulation engineering. Topics include: assessing information requirements; searching for, locating and evaluating information sources related to modeling and simulation; tools for managing, sharing, and presenting information; and ethical issues in the use of information. Students will complete exercises and research on topics involving information of interest to modeling and simulation engineers.

MSIM 201. Introduction to Modeling and Simulation. 3 Credits.

Lecture 3 hours, 3 credits. Pre- or Corequisites: CS 150 and MATH 211. This is the first course for Modeling and Simulation Engineering (M&SE) students. M&SE discipline is surveyed at an overview level of detail. Topics include basic definitions, M&S paradigms and methodologies, applications, design processes, and human factors. Information literacy and research methods are addressed. Papers and oral presentations are required and allow the student to investigate different aspects of the discipline. The course provides a general conceptual framework for further M&SE studies.

MSIM 205. Discrete Event Simulation. 3 Credits.

Lecture 3 hours; 3 credits. Prerequisite: MSIM 201. Corequisites: STAT 330 and MSIM 281. An introduction to the fundamentals of modeling and simulating discrete-state, event-driven systems. Topics include basic simulation concepts and terms, queuing theory models for discrete event systems, structure of discrete event simulations, problem formulation and specification, input data representation, output data analysis, verification and validation, and the design of simulation experiments.

MSIM 281. Discrete Event Simulation Laboratory. 1 Credit.

Laboratory 2 hours; 1 credit. Corequisite: MSIM 205. A laboratory course designed to provide a hands-on introduction to the development and application of discrete event simulation. Topics include an introduction to one or more discrete event simulation tools, common modeling constructs, data gathering and input data modeling, design of simulation experiments, output data analysis, and verification and validation. The design and implementation of a series of increasingly complex simulations of various discrete event systems are conducted. The laboratory is designed to accompany MSIM 205. Student written reports are required.

MSIM 310. Systems Modeling. 3 Credits.

Lecture, 3 hours; 3 credits. Prerequisites: MSIM 205 and CS 330; Pre- or Corequisite: MSIM 320. Students learn the skills necessary to develop models of systems in preparation for simulation. They are introduced to different modeling perspectives and how they affect the ability to simulate and to observe system behavior. Numerous modeling techniques and formalisms are introduced supporting both discrete and continuous systems. Modeling is also discussed as a language to communicate with subject matter experts to capture a system's behavior prior to simulation development.

MSIM 320. Continuous Simulation. 3 Credits.

Lecture, 3 hours; 3 credits. Pre- or corequisite: PHYS 232N or 227N (honors version). Corequisites: MSIM 382. Prerequisites: MATH 307 (or MATH 280) and MSIM 201. An introduction to the fundamentals of modeling and simulating continuous-state, time-driven systems. Topics include differential equation representation of systems, formulation of state variable equations, numerical integration, and techniques for numerical solution of differential equations including the Taylor algorithm and the methods of Runge-Kutta. Application domains considered include physical and biological systems.

MSIM 331. Simulation Software Design. 3 Credits.

Lecture, 3 hours; 3 credits. Prerequisites: MSIM 205, CS 330 and CS 381; Corequisite: MSIM 383. Introduction to data structures, algorithms, and programming methodologies in support of computer simulation. Topics include lists, queues, sets, trees, searching, sorting, reusable code, and order of complexity. Simulation structures developed include event lists, time management, and queuing models. Software models are implemented and tested.

MSIM 351. Analysis for Modeling and Simulation. 3 Credits.

Lecture, 3 hours; 3 credits. Prerequisites: MSIM 205 and STAT 330. An introduction to analysis techniques appropriate to the conduct of modeling and simulation studies. Topics include input modeling, random number generation, measures of effectiveness, output analysis, variance reduction techniques, and experimental design. In addition, techniques for verification, validation, and accreditation are introduced. Course concepts are applied to real systems and data.
MSIM 367. Cooperative Education. 1-3 Credits.

1-3 credits. Prerequisite: approval by department and Career Management. Student participation for credit based on the academic relevance of work experience, criteria, and evaluative procedures as formally determined by the department and Career Management prior to the semester in which the work is to take place. (Qualifies as a CAP experience).

MSIM 368. Internship. 1-3 Credits.

1-3 credits. Prerequisite: approval by department and Career Management. Academic requirements will be established by the department and will vary with the amount of credit desired. Allows students to gain short duration career-related experience. (Qualifies as a CAP experience).

MSIM 369. Practicum. 1-3 Credits.

1-3 credits. Prerequisite: approval by the department and Career Management. Academic requirements will be established by the department and will vary with the amount of credit desired. Allows students to gain short duration career-related experience. (Qualifies as a CAP experience).

MSIM 382. Continuous Simulation Laboratory. 1 Credit.

Laboratory, 2 hours; 1 credit. Corequisite: MSIM 320. A laboratory course designed to provide a hands-on introduction to the development and application of continuous simulation. Topics include an introduction to one or more continuous simulation tools, modeling of various physics-based systems, and numerical solution of differential equations. The design and implementation of a series of increasingly complex simulations of various continuous systems are conducted. Written communication skills are stressed; weekly writing assignments are required. The laboratory is designed to accompany MSIM 320. Student written reports are required.

MSIM 383. Simulation Software Design Laboratory. 1 Credit.

Laboratory, 2 hours; 1 credit. Corequisite: MSIM 331. A laboratory course designed to provide a hands-on introduction to the development of simulation software. Topics include data structures, algorithms, and simulation executives. The students will conclude with the development of a basic simulation executive capable of managing discrete event simulations. Written communication skills are stressed; weekly writing assignments are required. The laboratory is designed to accompany MSIM 331. Student written reports are required.

MSIM 395. Topics in Modeling and Simulation Engineering. 1-3 Credits.

1-3 hours lecture; 1-3 credits. Prerequisite: permission of the instructor. Special topics of interest with emphasis placed on the recent developments in modeling and simulation engineering.

MSIM 396. Topics in Modeling and Simulation Engineering. 1-3 Credits.

1-3 hours lecture; 1-3 credits. Prerequisite: permission of the instructor. Special topics of interest with emphasis placed on the recent developments in modeling and simulation engineering.

MSIM 406/506. Introduction to Distributed Simulation. 3 Credits.

Lecture, 3 hours. 3 credits. Prerequisite: MSIM 331. An introduction to distributed simulation. Topics include motivation for using distributed simulation, distributed simulation architectures, time management issues, and distributed simulation approaches. Current standards for distributed simulation are presented.

MSIM 408. Introduction to Game Development. 3 Credits.

Lecture, 3 hours; 3 credits. Prerequisite: CS 361 or MSIM 331. An introductory course focused on game development theory and modern practices with emphasis on educational game development. Topics covered include game architecture, computer graphics theory, user interaction, audio, high level shading language, animation, physics, and artificial intelligence. Students will develop games related to science, technology, engineering, and mathematics (STEM) education. The developed games can run on a variety of computer, mobile, and gaming platforms.

MSIM 441. Computer Graphics and Visualization. 3 Credits.

Lecture, 3 hours; 3 credits. Prerequisites: CS 250. An introduction to graphical systems and methods. Topics include surfaces, solids, and realism techniques such as visible surface, lighting, shadows, and surface detail. Applications to modeling and simulation including 2-D and 3-D solid models, data visualization, and animation.

MSIM 487W. Capstone Design I. 4 Credits.

4 credits; 2 lecture, 4 laboratory. Prerequisites: A grade of C or better in ENGL 211C or 221C or 231C; MSIM 310, 331, and 351. Part of the senior capstone design experience for modeling and simulation engineering majors. Lectures focus on providing professional orientation and exploration of the M&S design process. Written communication, oral
communication and information literary skills are stressed. Individual and group design projects focus on the conduct of a complete M&S project. Industry-sponsored projects are an option. Individual and team reports and oral presentations are required. (This is a writing intensive course.).

**MSIM 488. Capstone Design II. 3 Credits.**

Lecture, 1 hour; laboratory 3 hours. 3 credits. Prerequisite: MSIM 441 and MSIM 487W. Part two of the senior capstone design experience for modeling and simulation engineering majors. Lectures focus on providing professional orientation and exploration of the M&S design process. Written communication, oral communication and information literacy skills are stressed. Individual and group design projects focus on the conduct of a complete M&S project. Industry-sponsored projects are an option. Individual and team reports and oral presentations are required.

**MSIM 495/595. Topics in Modeling and Simulation. 3 Credits.**

1-3 hours lecture; 1-3 credits. Prerequisite: permission of the instructor. Special topics of interest with emphasis placed on recent developments in modeling and simulation engineering.

**MSIM 496. Topics in Modeling and Simulation Engineering. 1-3 Credits.**

1-3 hours lecture; 1-3 credits. Prerequisite: permission of the instructor. Special topics of interest with emphasis placed on the recent developments in modeling and simulation engineering.