

Master of Science

Engineering with a Concentration in Modeling and Simulation (MS)

The master's degree in modeling and simulation (M&S) emphasizes a strong, common subject core while providing the student with the flexibility to design a plan of study to meet each individual's study objectives and needs. The purpose of the program's subject core is to provide a common academic foundation for all simulation students. Thus, all students in this program will have grounding in the same methods, principles, and philosophy of simulation. This provides the mechanisms for the simulationist to work across disciplines and domains while maintaining a common frame of reference for communication, technical specialization, and advanced study and research. The Master of Science (MS) in Modeling and Simulation offers two options: Thesis Option and Course Option. The Thesis Option requires six hours of thesis credit and 24 hours of course credit and it is directed primarily at full-time students who are preparing for a career in advanced M&S research and/or academic positions. The Course Option requires 30 hours of course credit and it is focused on developing the practical skills and knowledge needed to solve problems requiring applications of modeling and simulation. The Course Option is further divided into two tracks: Development Track and Application Track. The Development Track is programming intensive and prepares students for advanced simulation development, while the Application Track focuses on the usage of existing advanced simulation tools.

The program's subject core consists of:

1. an overview of modeling and simulation;
2. an in-depth exploration of specific simulation methodological approaches;
3. simulation system modeling principles and techniques;
4. an introduction to computer visualization and visual simulation; and,
5. principles of stochastic analysis.

Most courses are offered in an online format. They are delivered to Old Dominion University's higher education centers and are available synchronously using video conferencing software.

Master of Science Admission Requirements

The Master's Degree in Modeling and Simulation is designed for students having bachelor's degrees in Engineering, Science or Mathematics, although students from other educational backgrounds may apply with appropriate leveling courses. Prerequisites for admission include: mathematics – two courses in differential and integral calculus and one course in calculus-based probability and statistics; and computer science – algorithmic problem solving using a high-level object-oriented programming language such as C++.

A minimum GPA of 2.80 overall and a minimum GPA of 3.0 in the undergraduate major are required. Students with notable deficiencies may be considered for provisional admission and will be required to complete prerequisite course requirements in addition to the graduate degree requirements. Job experience and training may be considered in evaluating prerequisite requirements.

Applicants should plan to submit a completed application form, transcripts from all colleges and universities attended, GRE scores (verbal, quantitative, and analytical writing - required of MS applicants for the thesis option only), a resume and personal statement of objectives, two letters of recommendation from former university instructors or current employer

(recommendation letters are required of MS applicants for the thesis option only), and TOEFL scores if an international applicant.

Potential prerequisite courses for the master's degrees in modeling and simulation include the following:

1. Introductory differential and integral calculus equivalent to MATH 211 (<https://catalog.odu.edu/search/?P=MATH%20211>) (Calculus I) and MATH 212 (<https://catalog.odu.edu/search/?P=MATH%20212>) (Calculus II).
2. Calculus-based probability and statistics; this material is available for graduate credit in PSYC 727 (<https://catalog.odu.edu/search/?P=PSYC%20727>). Undergraduate courses STAT 330 (<https://catalog.odu.edu/search/?P=STAT%20330>) or ENMA 420 (<https://catalog.odu.edu/search/?P=ENMA%20420>) will also meet the prerequisite requirement.
3. Computer science fundamentals including an object-oriented programming language such as C++, algorithmic problem solving, and data structures.

Curriculum Requirements

Master of Science Degree Requirements

The Master of Science program requires 12 hours of course credit in modeling and simulation foundation courses. These foundation courses include:

MSIM 741	Principles of Visualization	3
MSIM 551 or MSIM 751	Analysis for Modeling and Simulation Advanced Analysis for Modeling and Simulation	3
Advanced Modeling Course (See List Below)		3
Advanced Simulation Course (See List Below)		3

Advanced Modeling Course Examples (3 credits)

MSIM 607	Machine Learning I
MSIM 660	System Architecture and Modeling
MSIM 702	Systemic Decision Making
MSIM 730	Simulation Formalisms
MSIM 772	Modeling Global Events
MSIM 774	Transportation Network Flow Models

Other courses with Graduate Program Director's approval.

Advanced Simulation Course Examples (3 credits)

MSIM 711	Finite Element Analysis
MSIM 715	High Performance Computing Simulation and Data Analytics
MSIM 722	Cluster Parallel Computing
MSIM 725	Principles of Combat Modeling and Simulation
MSIM 742	Synthetic Environments
MSIM 776	Simulation Modeling in Transportation Networks

Other courses with Graduate Program Director's approval.

The remaining course credits (12 credits for the thesis option and 18 credits for the course option) are elective course credits. These courses are selected to achieve one or more program objectives or themes and must be approved by the student's advisor and/or graduate program director. Elective courses outside the ECE Department must be approved by the graduate program director. The thesis option concludes with 6 credit hours of thesis credit (MSIM 699 (<https://catalog.odu.edu/search/?P=MSIM%20699>)) and a thesis defense and the course option concludes with a comprehensive exam.

Students must also complete the Responsible Conduct of Research for Engineers training online.

Certain students will need to take pre-requisite leveling courses that will count towards the 12 credit hour elective course requirement. These courses are: MSIM 510 (<https://catalog.odu.edu/search/?P=MSIM%20510>) Model Engineering; MSIM 541 (<https://catalog.odu.edu/search/?>)

P=MSIM%20541) Computer Graphics and Visualization; MSIM 602 (<https://catalog.odu.edu/search/?P=MSIM%20602>) Simulation Fundamentals; and, MSIM 603 (<https://catalog.odu.edu/search/?P=MSIM%20603>) Simulation Design. The Course Option Application Track only requires MSIM 510 (<https://catalog.odu.edu/search/?P=MSIM%20510>) Model Engineering and MSIM 602 (<https://catalog.odu.edu/search/?P=MSIM%20602>) Simulation Fundamentals as leveling courses.

The MS Course Option is also offered online via Canvas which provides online lectures, homework submissions, examinations, discussion boards, wikis, video/audio collaboration sessions, and grading. Students with reliable high-speed internet service can connect and participate in engaging discussions and distributed asynchronous learning with the instructor and other students. All course materials are distributed and collected electronically. Students located in the Hampton Roads region may utilize live courses to fulfill the elective course requirement with approval from the ECE graduate program director.