Twin Cities Campus

Scientific Computation Minor

Chemical Engineering & Materials Science

College of Science and Engineering

Link to a list of faculty for this program.

- **Students will no longer be accepted into this program after Spring 2018. Program requirements below are for current students only.**

Contact Information:
Scientific Computation Program, University of Minnesota, 151 Amundson Hall, 421 Washington Ave SE, Minneapolis, MN 55455 (612-625-6345; fax: 612-626-7246)
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Website: http://www.scicomp.umn.edu

- Program Type: Graduate minor related to major
- Requirements for this program are current for Spring 2022
- Length of program in credits (Masters): 6
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.

Along with the program-specific requirements listed below, please read the General Information section of the catalog website for requirements that apply to all major fields.

The graduate degree program in scientific computation encompasses course work and research on the fundamental principles necessary to use intensive computation to support research in the physical, biological, and social sciences and engineering. There is a special emphasis on research issues, state-of-the-art methods, and the application of these methods to outstanding problems in science, engineering, and other fields that use scientific computation, numerical analysis and algorithm development, symbolic and logic analysis, high-performance computing tools, supercomputing and heterogeneous networks, and visualization.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

The minor requires the approval of the Scientific Computation director of graduate studies.

Courses used for the minor must be taken on the A/F grading scale. Credits may not be from courses in the student's major field.

Core Coursework

All students take 6 credits from the following list. Other courses with a significant computation component, with approval of the Scientific Computation director of graduate studies, may be chosen to fulfill the core course requirement.

AEM 8251 - Finite-Volume Methods in Computational Fluid Dynamics (3.0 cr)
CEGE 8022 - Numerical Methods for Free and Moving Boundary Problems (3.0 cr)
CEGE 8361 *{Inactive}*(3.0 cr)
CEGE 8401 - Fundamentals of Finite Element Method (3.0 cr)
CEGE 8402 - Nonlinear Finite Element Analysis (3.0 cr)
CEGE 8561 - Analysis and Modeling of Aquatic Environments I (3.0 cr)
CEGE 8562 - Analysis and Modeling of Aquatic Environments II (3.0 cr)
CEGE 8572 - Computational Environmental Fluid Dynamics (4.0 cr)
CHEM 8021 - Computational Chemistry (4.0 cr)
CHEM 8541 - Dynamics (4.0 cr)

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CHEM 8551 - Quantum Mechanics I (4.0 cr)
CHEM 8552 - Quantum Mechanics II (2.0 cr)
CHEM 8561 - Thermodynamics, Statistical Mechanics, and Reaction Dynamics I (4.0 cr)
CHEM 8562 - Thermodynamics, Statistical Mechanics, and Reaction Dynamics II (4.0 cr)
CSCI 5302 - Analysis of Numerical Algorithms (3.0 cr)
CSCI 5304 - Computational Aspects of Matrix Theory (3.0 cr)
CSCI 5403 *{Inactive}*(3.0 cr)
CSCI 5421 - Advanced Algorithms and Data Structures (3.0 cr)
CSCI 5451 - Introduction to Parallel Computing: Architectures, Algorithms, and Programming (3.0 cr)
CSCI 5461 - Functional Genomics, Systems Biology, and Bioinformatics (3.0 cr)
CSCI 5481 - Computational Techniques for Genomics (3.0 cr)
CSCI 5561 - Computer Vision (3.0 cr)
CSCI 5607 - Fundamentals of Computer Graphics 1 (3.0 cr)
CSCI 5608 - Fundamentals of Computer Graphics II (3.0 cr)
CSCI 5609 - Visualization (3.0 cr)
CSCI 5707 - Principles of Database Systems (3.0 cr)
CSCI 5801 - Software Engineering I (3.0 cr)
CSCI 5802 - Software Engineering II (3.0 cr)
CSCI 8314 - Sparse Matrix Computations (3.0 cr)
CSCI 8725 - Databases for Bioinformatics (3.0 cr)
EE 5239 - Introduction to Nonlinear Optimization (3.0 cr)
EE 5531 - Probability and Stochastic Processes (3.0 cr)
EE 5561 - Image Processing and Applications: From linear filters to artificial intelligence (3.0 cr)
EE 8231 - Optimization Theory (3.0 cr)
EPSY 8221 *{Inactive}*(3.0 cr)
EPSY 8222 - Advanced Measurement: Theory and Application (3.0 cr)
ESCI 5201 - Time-Series Analysis of Geological Phenomena (3.0 cr)
HINF 5430 - Foundations of Health Informatics I (3.0 cr)
HINF 5431 - Foundations of Health Informatics II (3.0 cr)
HINF 8434 *{Inactive}*(3.0 cr)
IE 5531 - Engineering Optimization I (4.0 cr)
LING 5801 - Introduction to Computational Linguistics (3.0 cr)
MATH 5467 - Introduction to the Mathematics of Image and Data Analysis (4.0 cr)
MATH 5485 - Introduction to Numerical Methods I (4.0 cr)
MATH 5486 - Introduction To Numerical Methods II (4.0 cr)
MATH 5535 - Dynamical Systems and Chaos (4.0 cr)
MATH 5587 - Elementary Partial Differential Equations I (4.0 cr)
MATH 5588 - Elementary Partial Differential Equations II (4.0 cr)
MATH 5651 - Basic Theory of Probability and Statistics (4.0 cr)
MATH 5705 - Enumerative Combinatorics (4.0 cr)
MATH 5707 - Graph Theory and Non-enumerative Combinatorics (4.0 cr)
MATH 8441 - Numerical Analysis and Scientific Computing (3.0 cr)
MATH 8442 - Numerical Analysis and Scientific Computing (3.0 cr)
MATH 8445 - Numerical Analysis of Differential Equations (3.0 cr)
MATH 8450 - Topics in Numerical Analysis (1.0 - 3.0 cr)
MATH 8571 - Theory of Evolutionary Equations (3.0 cr)
ME 5228 - Introduction to Finite Element Modeling, Analysis, and Design (4.0 cr)
ME 5351 - Computational Heat Transfer (4.0 cr)
ME 8228 - Finite Elements in Multidisciplinary Flow/Thermal/Stress and Manufacturing Applications (4.0 cr)
ME 8229 - Finite Element Methods for Computational Mechanics: Transient/Dynamic Problems (4.0 cr)
ME 8345 - Computational Heat Transfer and Fluid Flow (3.0 cr)
NSC 5202 - Theoretical Neuroscience: Systems and Information Processing (3.0 cr)
PHYS 5041 - Mathematical Methods for Physics (4.0 cr)
PHYS 5042 *{Inactive}*(4.0 cr)
PSY 5036W - Computational Vision [WI] (3.0 cr)
PSY 5038W - Introduction to Neural Networks [WI] (3.0 cr)
PSY 5960 - Topics in Psychology (1.0 - 4.0 cr)
SCIC 8001 - Parallel High-Performance Computing (3.0 cr)
SCIC 8011 - Scientific Visualization (3.0 cr)
SCIC 8021 - Advanced Numerical Methods (3.0 cr)
SCIC 8031 - Modeling, Optimization, and Statistics (3.0 cr)
SCIC 8041 - Computational Aspects of Finite Element Methods (3.0 cr)
SCIC 8095 - Problems in Scientific Computation (1.0 - 3.0 cr)
SCIC 8190 - Supercomputer Research Seminar (1.0 cr)
SCIC 8253 - Computational Nanomechanics (3.0 cr)
SCIC 8551 - Multiscale Methods for Bridging Length and Time Scales (3.0 cr)

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SCIC 8594 - Scientific Computation Directed Research (1.0 - 4.0 cr)
STAT 8701 - Computational Statistical Methods (3.0 cr)
STAT 8711 *{Inactive}*(3.0 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans.
Students may not complete the program with more than one sub-plan.

Masters

Master's students complete the 6-credit core curriculum.

Doctoral

Doctoral students complete the core curriculum plus 6 additional credits, in consultation with the Scientific Computation director of graduate studies. Courses can be chosen from the list of core coursework, or from fields that support computational science.

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