COMPUTATIONAL SCIENCES AND INFORMATICS, PHD

Banner Code: SC-PHD-CSI

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Founded in 1992, the program addresses the role of computation in science, mathematics, and engineering, and is designed around the emphases of Computer Modeling and Simulation and of Data Science. Computational science, focused on modeling and simulation, is defined as the systematic development and application of computing systems and computational solution techniques for modeling and simulation of scientific and engineering phenomena. Informatics, focused on data science, is defined as the systematic development and application of computing systems and computational solution techniques for analyzing data obtained through experiments, modeling, database searches, and instrumentation. The resulting interdisciplinary approach leads to an understanding that traditional theory or experimentation alone cannot provide. The close relationship of the PhD to the research and development activities in federal laboratories, scientific institutions, and high-technology firms affords students opportunities for continued or new employment. Scheduled courses and sequences accommodate part-time students, with most courses meeting once a week in the late afternoon or early evening. The research and teaching activities associated with the program reflect the recognized role of computation and data analysis as part of a triad with theory and experiment, leading to a better understanding of nature. The program is designed to be completed in four to five years.

Admissions & Policies

Admissions

University-wide admissions policies can be found in the Graduate Admissions Policies section of this catalog.

To apply for this program, please complete the George Mason University Admissions Application (https://www2.gmu.edu/admissions-aid/apply-now).

Eligibility

Students interested in applying for admission should have a bachelor's degree in computational science, any natural science, mathematics, engineering, or computer science with a minimum GPA of 3.00 in their last 60 credits of study. Applicants to the PhD program should have a mathematics background up to and including differential equations and should also have knowledge of a computer programming language such as C, C++, Fortran, Python, etc.

Application Requirements

The GRE is required, unless the applicant holds a master's degree from a regionally-accredited school in the United States. An acceptable TOEFL score (as determined by the university) is required for international students; for more information visit the Admission of International Students (https://catalog.gmu.edu/admissions/international-students) section of the catalog. The ETS code for Mason is 5827.

Students should submit a completed George Mason University Admissions Application (https://www2.gmu.edu/admissions-aid/apply-now) along with three letters of recommendation, an expanded goals statement, and application fee in addition to the items listed above.

Application deadlines can be found on the Office of Admissions website (https://admissions.gmu.edu/grad/application-deadlines-and-requirements/?academicUnit=SC&_ga=1.13682175.956654242.1443444993). Applications requesting financial support must be received by February 1 for the fall semester. Applications from local applicants may be accepted after these general deadlines.

For additional information, please contact the CSI graduate coordinator.

Policies

For policies governing all graduate degrees, see AP.6 Graduate Policies.

Reduction of Credit

For students entering the doctoral program with a master's degree in a related field from a regionally accredited institution, the required coursework may be reduced up to 24 credits, subject to approval of the graduate coordinator and the college's associate dean. Research-based courses and seminar courses are not eligible for reduction.

Transfer of Credit

Students who have prior graduate coursework that has not been applied to any degree may request to have a maximum of 30 of those graduate credits transferred, with approval of the graduate coordinator, the college's associate dean, and in accord with university policy. Research-based courses and seminar courses are not eligible for transfer.

Requirements

Degree Requirements

Total: 72 credits

Students should refer to the Admissions & Policies tab for specific policies related to this program.

General Core Courses

Code	Title	Credits
Select two courses (6 credits) from the following:		6
CSI 690	Numerical Methods	
CSI 695	Scientific Databases	
CSI 702	High-Performance Computing	
CSI 703	Scientific and Statistical Visualization	
Total Credits		6

Areas of Emphasis Courses

From the list below, students are advised to select six courses that correspond to areas of emphasis in:

- *Computer Modeling and Simulation*- Including applications to the natural sciences
- *Data Science*- Including computational learning, statistics, and data analytics

Code	Title	Credits
Select six courses (18 credits) from the following: [1]		18
CSI 500	Computational Science Tools	
CSI 501	Introduction to Scientific Programming	
CSI 672	Statistical Inference	
CSI 674	Bayesian Inference and Decision Theory	
CSI 676	Regression Analysis	
CSI 678	Times Series Analysis and Forecasting	
CSI 685	Fundamentals of Materials Science	
CSI 690	Numerical Methods	
CSI 695	Scientific Databases	
CSI 701	Foundations of Computational Science	
CSI 702	High-Performance Computing	
CSI 703	Scientific and Statistical Visualization	
CSI 709	Topics in Computational Sciences and Informatics	
CSI 721	Computational Fluid Dynamics I	
CSI 739	Topics in Bioinformatics	
CSI 740	Numerical Linear Algebra	
CSI 742	The Mathematics of the Finite Element Method	
CSI 744	Linear and Nonlinear Modeling in the Natural Sciences	
CSI 747	Nonlinear Optimization and Applications	
CSI 754	Earth Science Data and Advanced Data Analysis	
CSI 758	Visualization and Modeling of Complex Systems	
CSI 771	Computational Statistics	
CSI 772	Statistical Learning	
CSI 773	Statistical Graphics and Data Exploration	
CSI 777	Principles of Knowledge Mining	
CSI 780	Principles of Modeling and Simulation in Science	
CSI 782	Statistical Mechanics for Modeling and Simulation	
CSI 783	Computational Quantum Mechanics	
CSI 786	Molecular Dynamics Modeling	
CSI 787	Computational Materials Science	
CSI 788	Simulation of Large Scale Systems	
CSI 873	Computational Learning and Discovery	
CSI 876	Measure and Linear Spaces	
CSI 877	Geometric Methods in Statistics	
Total Credits		18

[1]   When choosing courses, avoid courses previously taken to fulfill the 'General Core Courses' requirement and only choose one 500-level course.

Colloquium/Seminar

The department offers weekly colloquia and seminar series to ensure that students are exposed to the latest developments at area research institutions. One credit may be chosen from:

Code	Title	Credits
CSI 898	Research Colloquium in Computational Sciences and Informatics	1
or CSI 991	Seminar in Scientific Computing	
Total Credits		1

Electives

Electives should be chosen to bring the total number of credits to 72. Courses must be approved by the student's advisor and the graduate coordinator. Additionally,

- A maximum of 2 credits of CSI 898 Research Colloquium in Computational Sciences and Informatics and/or CSI 991 Seminar in Scientific Computing may be applied as electives.
- A maximum of two 500-level courses may be applied between both the 'Areas of Emphasis Courses' requirement and the 'Electives' requirement.
- CSI 796 Directed Reading and Research and CSI 996 Doctoral Reading and Research are the only allowable research-based courses that can be used as electives.
- The following courses may not be used as electives: CSI 798 Research Project, CSI 799 Master's Thesis, CSI 998 Doctoral Dissertation Proposal, and CSI 999 Doctoral Dissertation.
- Students may pursue interdisciplinary research that supplements the 'Areas of Emphasis Courses' and 'Electives' requirements with each other and also with bioinformatics, climate dynamics, computational chemistry, computational social science, geoinformation sciences, and several other autonomous PhD program areas within the College of Science.

Doctoral Research

No more than 24 combined credits from CSI 998 Doctoral Dissertation Proposal and CSI 999 Doctoral Dissertation may be applied toward satisfying doctoral degree requirements, with a minimum of 6 credits of CSI 999 Doctoral Dissertation.

Students become eligible to register for CSI 998 Doctoral Dissertation Proposal upon having an approved dissertation committee. Upon advancement to candidacy, students will be eligible to register for CSI 999 Doctoral Dissertation.

Code	Title	Credits
Select 24 credits from the following:		24
CSI 998	Doctoral Dissertation Proposal	
CSI 999	Doctoral Dissertation	
Total Credits		24

Candidacy Examination

The student must successfully complete separate written, computational, and oral candidacy examinations prepared and administered by the student's dissertation committee.

Dissertation Proposal and Advancement to Candidacy

Students advance to doctoral candidacy by fulfilling the following requirements:

- The student must successfully complete all coursework and candidacy examinations as stated above.
- The student prepares a dissertation proposal describing in detail the planned dissertation research. The proposal must be approved by the dissertation committee.
- Following successful completion of the research proposal and candidacy exams, the committee will recommend the student for advancement to doctoral candidacy to the graduate coordinator and the college's associate dean.

Dissertation Research and Defense

After advancing to candidacy, the student will work on a doctoral dissertation while enrolled in CSI 999 Doctoral Dissertation. The dissertation is a written piece of original contribution that demonstrates a doctoral candidate's mastery of the subject matter. A student is expected to produce new and original research worthy of publication in peer-reviewed journals. After the dissertation is completed, the committee will review the dissertation and examine the student in a public oral dissertation defense.