COMPUTATIONAL SCIENCES AND INFORMATICS, PHD

Banner Code: SC-PHD-CSI

Academic Programs Administrator

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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 (https://catalog.gmu.edu/admissions/graduate-policies/) section of this catalog. International students and students having earned international degrees should also refer to Admission of International Students (https://catalog.gmu.edu/admissions/international-students/) for additional requirements.

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 from an institution of higher education accredited by a Mason-recognized U.S. institutional accrediting agency or international equivalent.

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

To apply for this program, prospective students should submit the George Mason University Admissions Application (https://www2.gmu.edu/admissions-aid/apply-now/) and its required supplemental documentation, two letters of recommendation, a goals statement, and GRE scores unless the applicant holds a master's degree from an institution of higher education accredited by a Mason-recognized U.S. institutional accrediting agency or international equivalent.

For additional information, please contact the CSI graduate coordinator.

Policies

For policies governing all graduate programs, see AP.6 Graduate Policies (https://catalog.gmu.edu/policies/academic/graduate-policies/).

Transferring Previous Graduate Credit into this Program

Previously earned and relevant graduate credits may be eligible for transfer into this program; details can be found in the Credit by Exam or Transfer (https://catalog.gmu.edu/policies/academic/graduate-policies/) section of this catalog. Please note that this program does not accept the transfer of previous research credits, including master's thesis credits.

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

Select 18 credits from the courses listed below. The selected courses may include 'General Core Courses' not applied toward those requirements.

Code	Title	Credits
Select six courses (18 credits) from the following:		18
CSI 500	Computational Science Tools [1]	

or CSI 501	Computational Science Programming
CSI 672	Statistical Inference
CSI 674	Bayesian Artificial Intelligence
CSI 678	Times Series Analysis and Forecasting
CSI 685	Fundamentals of Materials Science
CSI 709	Topics in Computational Sciences and Informatics
CSI 721	Computational Fluid Dynamics I
CSI 740	Numerical Linear Algebra
CSI 742	The Mathematics of the Finite Element Method
CSI 745	Robust Optimization for Decision Making
CSI 747	Nonlinear Optimization and Applications
CSI 758	Visualization and Modeling of Complex Systems
CSI 772	Data-Driven Modeling and 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 873	Computational Learning and Discovery
Total Credits	**18**

[1] Only one 500-level course may be applied toward the 18 credit requirement.

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 899	Colloquium in Computational and Data Sciences	
Total Credits		**1**

Electives

Electives should be chosen to bring the total number of coursework credits to 48. 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 899 Colloquium in Computational and Data Sciences 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 may be used as electives.
- The following courses may not be used as electives: CSI 798 Practicum Project, CSI 799 Master's Thesis, CSI 998 Doctoral Dissertation Proposal, and CSI 999 Doctoral Dissertation.
- Suggested elective courses include:
  - Any course in the 'Areas of Emphasis' not applied toward those requisites.
  - Other CSI courses such as: CSI 739 Topics in Bioinformatics, CSI 779 Topics in Computational Statistics, CSI 789 Topics in Computational Physics, and CSI 986 Advanced Topics in Large-Scale Physical Simulation.
  - Other interdisciplinary graduate courses across Mason's offerings. These courses should be chosen with the student's research supervisor for guidance on enhancing the student's ability to perform doctoral research within the emphases. Endorsement of the Computational and Data Sciences Department for applying these courses toward the 'Electives' requirement is required.

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.