


School of Arts and Sciences



SCIENTIFIC COMPUTING

www.scicomp.pitt.edu

Modern science and engineering have become increasingly reliant upon computation as an aid to development, design, and research. It has become clear that solving large-scale scientific and engineering problems usually requires knowledge that straddles several disciplines. In particular, such projects almost always are critically dependent upon some aspects of the mathematical and computational sciences. This includes, among others, knowledge of mathematical modeling, state-of-the-art numerical analysis, symbolic and logic analysis, software development tools for high-performance computer architectures, and, especially, parallel and vector computer, graphical analysis, visualization, and networking.

There is a growing call for more people trained in this increasingly important, interdisciplinary field. In 1998, Pitt responded to this need by establishing the BS in scientific computing degree to be operated jointly by the Department of Mathematics and the Department of Computer Science.

Requirements for a BS in Scientific Computing

The major consists of at least 52 credits of courses in mathematics and computer science and, in addition, requires a minor of at least 12 credits in a related area of the physical or biological sciences, economics, or an approved area of engineering. Note: Students in this major are exempt from taking two second-level general education courses in A&S.

Basic Courses (6 cr. total)

Choose one of the following courses:

MATH 0400 Discrete Mathematical Structures

This course covers the basic concepts of set theory, logic, combinatorics, Boolean algebra, and graph theory with an orientation towards applications.

CS 0441 Discrete Structures for Computer Science

The purpose of this course is to understand and use discrete structures that are backbones of computer science. In particular, this class is meant to introduce logic, proofs, sets, relations, functions, counting, and probability with an emphasis on applications in computer science.

Choose one of the following courses:

MATH 1110 Industrial Mechanics

This course is concerned with the approximate numerical solution of problems that arise in an industrial environment.

CS 1538 Introduction to Simulation

This course introduces students to the concepts, definitions, and techniques applicable to the simulation of systems. Both continuous and discrete modeling are covered, with emphasis on the latter. The objective of the class is to familiarize the student with several modern discrete simulation languages and their use in modeling.

Basic Mathematics (15–16 cr. total)

MATH 0220 Analytic Geometry and Calculus 1

The focus of this course, the first in a three-course sequence, is the derivative and integral of functions of one variable and their applications.

MATH 0230 Analytic Geometry and Calculus 2

This is the second course in the calculus sequence. It focuses on the calculus of transcendental functions, techniques of integration, series of numbers and functions, polar coordinates, and conic sections.

MATH 0240 Analytic Geometry and Calculus 3

This course, the last in the sequence, focuses on vectors and surfaces in space and the calculus of functions of several variables including partial derivatives and multiple integrals, Stokes' theorem, and first order differential equations.

Choose one of the following courses:

MATH 0250 Matrix Theory and Differential Equations

The topics of this course are matrix algebra, vector spaces, linear transformations, linear differential equations with constant coefficients, and systems of first order linear differential equations.

MATH 0280 Introduction to Matrices and Linear Algebra

The principal topics that this course will cover include vectors, matrices, determinants, linear transformations, eigenvalues and eigenvectors, and selected applications.

MATH 1180 Linear Algebra 1

This course stresses the theoretical and rigorous development of linear algebra.

MATH 1185 Honors Linear Algebra

This course is an introduction to computational and theoretical aspects of linear algebra.

Basic Computer Science (13 cr. total)

CS 0401 Introduction to Computer Science

The purpose of this course is to introduce the student to some fundamental topics in computer science and to improve programming skills through an introduction to the programming language C++.

CS 0445 Introduction to Information Structures

This course emphasizes the study of the basic data structures of computer science and their implementations using the C++ language.

CS 0447 Computer Organization and Assembly Language Programming

The purpose of this course is to study the components of computing systems common to most computer architectures.

CS 1501 Data Structures and Algorithms

This course introduces all problem-solving methods of computer science involved in the manipulation of data.

Advanced Undergraduate Computational Mathematics (9 cr. total)

MATH 1070 Numerical Mathematics: Analysis

This course is an introduction to numerical analysis at the advanced undergraduate level.

MATH 1080 Numerical Linear Algebra

This course is the continuation of MATH 1070. It is an introduction to numerical linear algebra that addresses numerical methods for solving linear algebraic systems and matrix Eigen problems and applications to partial differential equations.

Choose one of the following classes:

MATH 1100 Linear Programming

Topics covered include linear programming problems, the simplex method, quality, revised simplex method, and the transportation problem.

MATH 1270 Ordinary Differential Equations

This course covers methods of solving ordinary differential equations that are frequently encountered in applications.

MATH 1470 Partial Differential Equations and Applications

The objectives of the course are to provide students with the techniques necessary for the formulation and solution of problems involving PDEs and to prepare for further study in PDEs.

Advanced Undergraduate Computer Science (9 cr. total)

CS 1566 Introduction to Computer Graphics

The basic concepts, tools, and techniques of computer graphics are described, and the fundamental transformations of scaling, translation, rotation, windowing, and clipping are presented.

CS 1659 Introduction to High-Performance Computing Systems

This course is an introduction to the architecture of and software techniques for parallel and high-performance computing systems.

Choose one of the following courses:

CS 1510 Design and Analysis of Algorithms

This course will cover methods and strategies that are useful for the design of nonnumeric algorithms.

CS 1520 Programming Languages

Several programming languages will be selected and studied from a programming point of view.

CS 1530 Software Engineering

The purpose of this course is to provide a general survey of software engineering. Particular emphasis is on a group project in which a group of four to five students implements a system from its specification.

CS 1541 Introduction to Computer Architecture

This course is an examination of computer architecture and hardware system organization.

CS 1555 Database Management Systems

The objective of this course is to provide an in-depth knowledge of database system design. Thus, the emphasis is on how to model one's own data and how to use available database management systems effectively.

Applications Area Requirement (12 cr. total)

You are required to pick an application area, to be approved by the Program Committee, consisting of a coherent sequence of courses in the physical or biological sciences, economics, or an area of engineering.

For more information about the scientific computing program, contact:

University of Pittsburgh
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For more information about other majors, contact:

University of Pittsburgh
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Special Programs and Opportunities

University Honors College (UHC)

UHC offers many resources for talented, active students—unique courses, special degrees, opportunities to perform independent research or teach, supplemental advising, and a social and academic community of similarly motivated students. UHC courses offer a more in-depth treatment of the material covered in a nonhonors course. Students work more problems, write more, read more, and discuss topics in greater depth. Although UHC does not have a formal membership and does invite all students to participate in honors courses, there are certain qualifications that must be met to be eligible to take UHC courses. Entering freshmen will be automatically reviewed for participation. A minimum quality point average (QPA) of 3.25 is required for a current Pitt student.

Internships

Having an internship can be one of the most enlightening and productive aspects of your undergraduate education. It not only gives you a closer look at working in a particular field, but can help you gain a competitive edge, make contacts in the marketplace, and earn credits towards your degree. Pittsburgh is an exciting place for internship opportunities: internationally known as a renowned center for health care and ground-breaking medical research; home to many corporate headquarters, including H.J. Heinz, Fisher Scientific, PPG Industries, Westinghouse Electric, and Mellon Bank; and a city with a wealth of cultural and entertainment activities, including three professional sports teams and the Carnegie system of museums. Internships are not limited to Pittsburgh, however. Every year, students complete internships in cities such as Philadelphia, Washington, D.C., New York City, and their own hometowns. Some students even complete an internship as part of their study abroad experience.

Study Abroad

Studying abroad is an exciting way to add an international perspective to your undergraduate education and strengthen your credentials as a graduate. Since only a small percentage of American students study abroad, this experience distinguishes you as a candidate on the job market. While earning credits toward your degree, you also broaden your personal experience and gain an appreciation of other cultures. Scholarships are available, and financial aid is applicable.

Through AustraLearn, students may study at Macquarie University, which has a proud history of high-quality research, outstanding academic achievement, and with youth on its side, has established itself as one of Australia's most dynamic and

progressive universities. Macquarie is a leader in unusual courses and is one of the very few universities in the country to offer nontraditional degrees such as Bachelor of Creative Arts and Bachelor of Medical Science. Students may also study at Queensland University of Technology through AustraLearn. Queensland University of Technology (QUT) is one of Australia's leading universities, with nearly 40,000 students including over 5,000 international students from more than 85 countries. This spread of cultures reflects QUT's international outlook. QUT is committed to developing a culture of excellence in research and teaching, producing confident professionals.