Scientific Computing

Requirements

Interdisciplinary

The Scientific Computing Concentration is an interdisciplinary program in the application of computers to scientific inquiry. A longer title for the program might be "Computing within a Scientific Context."

The concentration focuses on four major areas: (1) computer program development, including the construction and implementation of data structures and algorithms; (2) mathematical modeling of natural phenomena (including cognitive processes) using quantitative or symbolic computer techniques; (3) analysis and visualization of complex data sets, functions and other relationships using the computer; and (4) computer hardware issues, including the integration of computers with other laboratory apparatus for data acquisition. The overall aim is to prepare the student to use computers in a variety of ways for scientific exploration and discovery.

CURRICULUM AND REQUIREMENTS

The concentration in scientific computing requires a total of 3 units of Kenyon coursework. SCMP 118 Introduction to Computer Science (.5 unit) serves as a foundation course for the program, introducing students to programming and other essential ideas of computer science.

Contributory courses have been identified in biology, chemistry, economics, environmental studies, mathematics, political science and physics (see list below). In these courses, computational methods form an essential means for attacking problems of various kinds.

Students in the concentration also will take at least .5 units of "intermediate" scientific computing courses. These courses have computational methods as their main focus and develop these methods extensively.

In addition to regular courses that are identified as "contributory" or "intermediate," particular special-topics courses or independent studies in various departments may qualify in one of these two categories. Students who wish to credit such a course toward the concentration in scientific computing should contact the program director at the earliest possible date.

The capstone course of the program is SCMP 401 Advanced Scientific Computing (.5 unit), a project-oriented, seminar-style course for advanced students.

Required Courses

MATH 118/SCMP 118 Introduction to Programming or PHYS 270 Computational Physics
SCMP 401 Advanced Scientific Computing

Contributory Courses

BIOL 109Y Introduction to Experimental Biology
BIOL 328 Global Ecology and Biogeography
CHEM 126 Introductory Chemistry Laboratory II
CHEM 336 Quantum Chemistry
CHEM 341 Instrumental Analysis
CHEM 370 Advanced Lab: Computational Chemistry
CHEM 374 Advanced Lab: Spectroscopy
ECON 205 Introduction to Econometrics
ECON 337 Portfolio Allocation and Asset Pricing
ECON 375 Advanced Econometrics Seminar
ENVS 261 Geographic Information Science
MATH 106 Elements of Statistics
MATH 116 Statistics in Sports
MATH 206 Data Analysis
MATH 216 Nonparametric Statistics
PHYS 140, 141 Classical Physics
PHYS 146 Introduction to Experimental Physics II
PHYS 240, 241 Fields and Spacetime
PHYS 345 Astronomy and Particle Physics
PHYS 380 Introduction to Electronics
PHYS 381, 382 Projects in Electronics 1, 2
PHYS 385, 386, 387 Advanced Experimental Physics 1, 2, 3
PSCI 280 Political Analysis

Intermediate Courses

MATH 218 Data Structures and Program Design
MATH 228 Mathematical Biology
MATH 328 An Introduction to Coding Theory and Cryptography
MATH 347 Mathematical Models
MATH 416 Linear Regression Models
PHYS 218 Dynamical Systems and Scientific Computing
PHYS 219 Complex Systems and Scientific Computing
SCMP 493 or 494 Individual Study in Scientific Computing

Scientific Computing

Courses

SCMP 118 INTRODUCTION TO PROGRAMMING

Credit: 0.5 QR

This course presents an introduction to computer programming intended both for those who plan to take further courses in which a strong background in computation is desirable and for those who are interested in learning basic programming principles. The course will expose the student to a variety of applications where an algorithmic approach is natural and will include both numerical and non-numerical computation. The principles of program structure and style will be emphasized. Offered every semester. SCMP 118 is crosslisted with mathematics for diversification purposes.

SCMP 401 SCIENTIFIC COMPUTING SEMINAR

Credit: 0.5 QR

This capstone course is intended to provide an in-depth experience in computational approaches to science. Students will work on individual computational projects in various scientific disciplines. This year the course will focus on applications of parallel computing using Kenyon's Beowulf-class computing cluster and other resources at the Ohio Supercomputer Center. Prerequisite: SCMP 118 or PHYS 270, completion of at least .5 unit of an "intermediate" course and at least .5 unit of a contributory course, junior or senior standing, and permission of the instructor and the program director.

SCMP 493 INDIVIDUAL STUDY

Credit: 0.25-0.5

Students conduct independent research projects under the supervision of one of the faculty members in the scientific computing program. Prerequisite: permission of instructor and program director.

ADDITIONAL COURSES THAT MEET THE REQUIREMENTS FOR THIS CONCENTRATION:

CHEM 336: Quantum Chemistry
CHEM 370: Advanced Lab: Computational Chemistry
ECON 375: Advanced Econometrics
MATH 206: Data Analysis
MATH 328: An Introduction to Coding Theory and Cryptography
MATH 347: Mathematical Models
PHYS 140: Classical Physics

PHYS 141: First Year Seminar in Physics
PHYS 218: Dynamical Systems in Scientific Computing
PHYS 219: Complex Systems in Scientific Computing
PHYS 240: Fields and Spacetime
PHYS 241: Fields and Spacetime Laboratory
PHYS 493: Individual Study