with theoretical models and predictions. More recently a third area has gained importance, namely, computational physics, which involves the use of computers in modeling and analyzing complex systems. This major is available to those students interested in studying physics with an emphasis on the use of computers. It provides students with highly sought-after computer and problem solving skills in a growing area of interdisciplinary study.

The requirements for the computational physics major are as follows:

Prerequisites (16):

PHYS 151, 152	General Physics I, II	8
MATH 181	Calculus I	4
MATH 182	Calculus II	4

Co-requisites (12):

MATH 241	Differential Equations	4
MATH 225	Multivariate Calculus	4
MATH 261	Linear Algebra	4

Required (35) which must include:

PHYS 251	Mechanics I	4
PHYS 212	Modern Physics	2
PHYS 275/276	Experimental Physics Lab	2
PHYS 353	Electricity and Magnetism I	4
PHYS 355	Thermal Physics	4
PHYS 471, 472	Physics Project Lab	2
PHYS 482	Senior Capstone: Physics Seminar	1
CSCI 211	Programming I	4
CSCI 218	Programming II	4
CSCI 236	Data Structures and Algorithms	4
MATH 331	Numerical Analysis	4

Additional recommended supporting courses include:

PHYS 258	Analog Electronics	4
PHYS 259	Digital Electronics	4
CSCI 226	Computer Architecture	4
CSCI 245	Software Engineering	4

COURSE DESCRIPTIONS:

See Mathematics, Physics and Computer Science sections.

Computer Science (major and minor)

Department of Mathematics and Computer Science: Kristin A. Camenga, chair. Keith A. Horn, Associate Dean

Faculty: Wei Hu

Web site: www.houghton.edu/academics/programs/math-computer-science

Phone: 585.567.9280

The computer science major emphasizes the theoretical foundations and application techniques for solving problems in today's technological environment. It is a necessary preparation for those who plan to create the technology of tomorrow whether in the pursuit of graduate study or in information management leadership positions in business, industry, or government. The major provides the flexibility to be tailored to the student's particular career interests. The Senior Project provides an opportunity to gain valuable pre-graduation experience while working with current computer theories and applications. It is this flexibility and the broad exposure to computer concepts, together with a liberal arts education, that has been appreciated by and will continue to appeal to employers of computer professionals.

Major: 52 hours (44 in major, 8 in pre/co-requisites)

Pre/co-requisites:

MATH 181	Calculus I	4
MATH 182	Calculus II *Or*	
MATH 183	Science Honors Calculus	4

Computer Science Major: 44 hours

Major courses:

CSCI 211	Programming I	4
CSCI 218	Programming II	4
CSCI 236	Data Structures and Algorithms	4
CSCI 226	Computer Architecture	4
CSCI 336	Programming III	4
CSCI 340	Data Bases	4
CSCI 420	Networking	4
CSCI 480	Senior Capstone: Senior Seminar	4
Three elective CSCI courses		12
	Total hours:	44

Minor in Computer Science: 16 hours

Required courses:

CSCI 211	Programming I	4
CSCI 218	Programming II	4
CSCI 226	Computer Architecture	4
CSCI 236	Data Structures and Algorithms	4
	Total hours:	16

COURSE DESCRIPTIONS

CSCI 115 **Perspectives on Computing** (4, OD)
An overview of how computers process, transmit, and store information. Designed for the non-major and includes many applications and issues found in contemporary culture. For example, privacy issues related to databases maintained by insurance companies or protection of intellectual property in light of increasingly popular file sharing applications. There are no prerequisites. This does not count toward a major or minor in computer science.

CSCI 211 **Programming I** (4, F)
This course covers the fundamentals of object-oriented programming utilizing the Java programming language. This first programming course provides students with basic Java programming concepts, data types, operators, flow control statements, objects, classes, methods, arrays, strings, applications, applets, and graphics user interfaces. 2nd Science.

CSCI/MATH 214 **Discrete Mathematics** (2, F11, F13)
Topics include: sets, functions, relations (incl. Partial order), methods of propositional logic, introduction to predicate logic, counting, recurrence relations, asymptotic analysis, proof (incl. Induction), introduction to probability, and graphs.

CSCI 218 **Programming II** (4, S)
This course extends the concepts learned in Programming I. It covers some advanced features of Java including advanced graphical user interfaces, exceptions, threads, graphics, multimedia, input/output, and networking. Prerequisite: CSCI 211.

CSCI 226 **Computer Architecture** (4, S12, S14)
Structure and internal organization of digital computers. Machine language and assembly language, representation of numbers, CPU organization, subroutines and linkage. Prerequisite: CSCI 211 or equivalent proficiency.

CSCI 236 **Data Structures and Algorithms** (4, F)
This course covers the fundamental data structures of computer science and accompanying algorithms. Linked Lists, Stacks, Queues, Binary Trees, Priority Queues, Heaps and other ADTs will be included. Classical sorting and searching algorithms will be learned and implemented. Prerequisite: CSCI 218.

CSCI 245 **Software Engineering** (4, OD)
This course covers both a theoretical and a practical foundation in software engineering. In the theoretical part, it covers principles and methods of software engineering, including requirements, specification, design, implementation, testing, validation, operation, and maintenance. In the practical part, it covers the development of software products from an industry perspective, including generation of appropriate documents. Prerequisite CSCI 218.

CSCI 326 **Operating Systems** (4, OD)
A study of computer architecture at the register level. Management of the processor, memory, peripheral devices, and information. Interrelationships of architecture and operating systems. Performance evaluation. Exposure to system manager responsibilities in UNIX and Windows. Prerequisite: CSCI 226 and CSCI 236 or permission.

CSCI 328 **Foundations of Computing** (4, OD)
This course covers the introduction to the classical and contemporary theory of computation including regular, context-free, and computable (recursive) languages with finite state machines, pushdown automata, and Turing machines. It also covers the historical reasons and the need that gave rise to many different programming languages and discusses the features of the most successful and more influential of them. The similarities and the differences among procedural, functional, object-oriented logic as well as parallel programming languages will also be covered.

CSCI 331 **Web Programming** (4, OD)
This course covers the new programming models that are used to support Web applications. It covers software design, interface design, the development side of Web applications. It helps the students learn how to build software that accepts information from users across the Web and returns data to the user and understand how to interact with database engines to store and retrieve information. Specific topics that are included are HTML, XML, JSP (Java Server Page) and Java servlets. Prerequisite: CSCI 218.

CSCI 336 **Programming III** (4, F11, F13)
This course covers J2EE (Java Enterprise Edition). The topics will include how to develop n-tier applications, design various application architectures based on the J2EE platform, and enterprise technologies - JDBC, RMI, JNDI, EJB, JMS, and JINI. Prerequisite: CSCI 236.

CSCI 340 **Databases** (4, F12)
Introduction to relational databases. Fundamentals of database and query design. Database management topics include security, integrity, and concurrency techniques. Use of relational database software (including SQL) for application projects. Topics include decision-based and object-based databases. Exposure to database manager responsibilities. Prerequisite: CSCI 218 or permission.

CSCI 344 **Enterprise Application Integration** (4, OD)
EAI overview, types of legacy systems, EAI and e-business, data-level EAI, application interface-level EAI, method-level EAI, user interface-level EAI, middleware models, RPCs, messaging (Microsoft MSMQ and IBM MQ Series), distributed objects, Java middleware, WML basics. Prerequisite: CSCI 336 and CSCI 331.

CSCI 393 **Summer Collaborative Research in Computer Science** (1-4, Summer)
Students work individually or in small teams reviewing literature, solving challenging problems in biology using machine learning and data mining algorithms and techniques from computer science, and describing their work in written form. The course focuses on interdisciplinary research which covers mathematics, statistics, computer science, and computational biology. May be repeated for credit. Prerequisite: Permission from instructor.

CSCI 420 **Networking** (4, S13)
An introduction to the basics of data communication and networking. Topics include the OSI model, physical processes used for digital transmission, standardization, local area networks, the network protocols, and network applications. Exposure to network manager responsibilities in UNIX and Windows NT. Prerequisite: CSCI 326 or permission.

CSCI 428 **IT Architectures** (4, OD)
The course focuses on the principles and priorities of enterprise systems design, emphasizing the new requirements brought by e-commerce and distributed integrated systems. It also discusses middleware technology alternatives, resiliency, performance and scalability, security, systems management, information access and accuracy. Prerequisites: CSCI 336 and CSCI 331.

CSCI 480 **Senior Capstone: Computer Science Seminar** (4, S)
For seniors, except by permission. Required of all computer science majors.

CSCI 490 **Senior Project** (4, OD)
The senior project allows seniors to participate in a scholarly endeavor with faculty and other students or in a formally controlled internship. This project will include at least the following three components: (1) A review

of one or more scholarly papers from primary literature of computer science; (2) The writing of a significant scientific paper or substantial document to give the student experience in writing for a scientific audience; (3) An oral presentation to students and/or faculty.

CSCI 391, -2; 491, -2 **Independent Study** (1, 2, 3 or 4)

CSCI 295, -6; 395, -6; 495 **Special Topics in Computer Science** (1, 2, 3 or 4 OD)
Previous topics include: wireless Java; Java message service; wavelets: neural networks; C#; and NET.

CSCI 496 **Honors in Computer Science** (4)

Earth Science (concentration in General Science)

Department of Physics and Earth Science: Mark E. Yuly, chair. Keith A. Horn, Associate Dean

Faculty: Donell Brandon Hoffman, Christopher M. Wells, Mark E. Yuly
Web site: www.houghton.edu/academics/programs/physics
Phone: 585.567.9280

General Information
Courses support current environmental and space interests and lead to the concentration required for a general science major. General science majors are required to take Physical Geology (ESCI 101) and another four-hour Earth Science course or General Astronomy (PHYS 102); an Earth Science concentration in General Science is fulfilled by adding eight more hours, including independent study.

COURSE DESCRIPTIONS

ESCI 101 **Physical Geology** (4, F11)
Study of materials, structure, and dynamics of the Earth's crust. Identification of rocks and minerals; topographic map studies. Three lecture, three laboratory hours each week. Lab Science or 2nd Science.

ESCI 212 **Environmental Earth Science** (4, OD)
Relationship between humans and Earth systems in the atmosphere, hydrosphere, lithosphere. Environmental problem solving. The laboratory will focus on applications of GIS and GPS to environmental and earth science problems. Three lecture, three laboratory hours each week. Lab Science or 2nd Science.

ESCI 224 **Atmospheric Science** (4, OD)
Comparative study of planetary atmospheres. Phenomena of Earth's atmosphere and aerospace, weather, meteorology, and climatology. Three lecture, three laboratory hours each week.

ESCI 230 **Hydrology** (4, OD)
A study of the properties and circulation of water on the surface of the land, underground and in the atmosphere. Topics to be covered include fluid mechanics, groundwater, wastewater, and environmental concerns. An engineering perspective will be used. Three lecture, three laboratory hours each week.

ESCI 291, 292, 391, 392, 491, 492 **Independent Study** (1, 2, 3 or 4)

ESCI 295, 395, 495 **Special Topics in Earth Science** (1, 2, 3 or 4)

ESCI 480 **Senior Capstone: General Science Seminar** (1, S)
Written thesis and oral presentation on a topic selected for interdisciplinary breadth describing current scientific research in the area of the student's concentration, based on a thorough review of scientific literature.