COMPUTER SCIENCE AND SOFTWARE ENGINEERING

Chair: Jamie Kretsch, Department of Computer Science and Software Engineering

UNIX Administrator and Teacher: Joseph Chung

Bachelor of Science with a Major in Computer Science

The Computer Science curriculum provides a solid foundation in the computing sciences, preparing students for employment in industry or for graduate school. Software design and development is emphasized along with foundational computing concepts. The higher-level courses enable students to explore a variety of topics, such as databases, networks, artificial intelligence, scripting languages, game programming, UNIX administration, and computer security.

The Advanced Computing Concentration, which is accredited by the Computing Accreditation Commission of ABET (http://www.abet.org), is recommended especially for students who plan to attend graduate school in computer science or who plan to specialize in scientific computing. The educational objectives of the Advanced Computing Concentration are to enable graduates, within a few years after graduation, to:

- Work as effective team members or team leaders in the development of computer and software systems covering a wide range of business, educational and scientific applications.
- Enter professional careers in positions including computer programmer, software tester, systems analyst, network administrator, software systems designer, database manager, computer systems integrator, software security analyst, and game developer.
- Undertake graduate studies and develop the knowledge and expertise to complete advanced studies or do research in computer science, engineering, and other scientific fields.
- Work in teams, communicating effectively with technical and non-technical team members, clients, and customers, while meeting the social and ethical responsibilities of their profession.
- Explore, synthesize, and implement ideas in their areas of interest and activity.
- Adapt to new technologies and methodologies with the skills required to react to a changing world.

Students interested in Computer Science but looking for a more flexible curriculum may choose to pursue the non-ABET-accredited Applied Computing Concentration. This program requires fewer math and science credits, which allows students to take additional coursework or a minor in other academic areas.

Certificate in Networking Technologies and Applications

This fifteen-credit certificate provides professional training in network technologies. Students in the certificate program will enhance their networking knowledge, gain focused professional expertise toward careers, and increase their employability. The certificate would focus on practical needs of students in the Applied Computer Science track as well as others who are interested in careers that require expertise in practical network technologies and skills.

Bachelor of Science in Software Engineering

The undergraduate Software Engineering curriculum, which is accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org) is designed to give students a broad background in both computer and engineering science with a heavy emphasis on those aspects of software engineering that will enable graduates to efficiently participate in the design, development, and deployment of large software systems. Because of the sequential nature of the courses and the number of requirements for engineering majors, careful planning is necessary to complete the curriculum in four years.

The educational objectives of the BS in Software Engineering program are to prepare software engineering graduates to do the following things within the first few years after graduation from the program:

- Obtain employment in organizations that develop or acquire software and/or enter graduate school;
- Make strong contributions to teams that are responsible for the specification, design, construction, testing, deployment, maintenance, or use of software systems;
- Develop experience in additional areas of professional specialty that, when combined with their BSSE education, will continue the path toward lifelong learning;
- Use their engineering, communications, interpersonal, and business skills to advance their careers in a business, government, or academic environment;
- Critically assess their engineering capabilities and acquire the additional knowledge and skills they need to maintain currency within their evolving work environment;
- Assist their employers’ organizations in achieving their business goals.

Majors

- B.S. in Computer Science Advanced Computing Concentration (catalog.monmouth.edu/undergraduate-catalog/science/computer-science-software-engineering/computer-science-bs-advanced-computing-concentration)
- B.S. in Computer Science Applied Computing Concentration (catalog.monmouth.edu/undergraduate-catalog/science/computer-science-software-engineering/computer-science-bs-applied-computing-concentration)
- B.S. in Software Engineering (catalog.monmouth.edu/undergraduate-catalog/science/computer-science-software-engineering/software-engineering-bs)

Minor

- Computer Science (catalog.monmouth.edu/undergraduate-catalog/science/computer-science-software-engineering/computer-science-minor)
- Information Technology (catalog.monmouth.edu/undergraduate-catalog/science/computer-science-software-engineering/information-technology-minor)
Certificate

- Networking Technologies and Applications (catalog.monmouth.edu/undergraduate-catalog/science/computer-science-software-engineering/networking-technologies-applications-certificate)
- Information Technology (catalog.monmouth.edu/undergraduate-catalog/science/computer-science-software-engineering/information-technology-certificate)

Nafi Diallo, Assistant Professor (Graduate Faculty). PhD, New Jersey Institute of Technology. Areas of interest are programming languages, software engineering, machine learning and secure systems, more specifically techniques for building secure and reliable systems.
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Jamie Kretsch, Specialist Professor and Chair. BS, Monmouth University; MS, University of Wisconsin-Madison. Interests are gender diversity in computing and technology and online education.
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Janice Rohn, Specialist Professor.
Information Technology Coordinator. BA, Thomas Edison State University; MS, National Technological University. Areas of interest include Android application development.
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Daniela Rosca, Associate Professor (Graduate Faculty). MS, Polytechnic University of Bucharest; PhD, Old Dominion University. Interests include requirements elicitation, analysis and specification, and methodologies for the development and use of business rules.
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Richard Scherl, Associate Professor (Graduate Faculty). BA, Columbia University; MA, University of Chicago; PhD, University of Illinois. Interests include artificial intelligence (especially knowledge representation, automated reasoning and natural language processing), cognitive science, and databases.
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William M. Tepfenhart, Professor (Graduate Faculty). BS, MS, PhD, University of Texas at Dallas. Interests include artificial intelligence, software architecture, and software design.
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Jiacun Wang, Professor and Graduate Program Director (Graduate Faculty). BS, Jiangsu University of Science and Technology; PhD, Nanjing University of Science and Technology, China. Interests include software architecture, Petri nets, real-time systems, discrete event systems, telecommunications, and networking.
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Cui Yu, Associate Professor (Graduate Faculty). BS, Nanjing University of Aeronautics and Astronautics; PhD, University of Singapore, Singapore. Interests include database management systems, spatial databases, and information storage and retrieval.
cyu@monmouth.edu

CS-102 Introduction to Computing and Problem Solving Credits: 4
Term Offered: All Terms
Course Type(s): TL
Introduces a broad overview of computing topics, designed to provide students with awareness of the computing field’s many aspects. Topics include fundamentals of computer architecture, operating systems, applications, networks and problem-solving. Computing topics are demonstrated and presented using computing applications including word processors, spreadsheets, databases, presentation software, and Web page development software. Introduces social and ethical issues related to computing and explores the local and global impact of computing on individuals, organizations and society. It also gives students their initial exposure to group project work.

CS-175 Introduction to Computer Science I Credits: 4
Term Offered: All Terms
Course Type(s): None
Introduction to the basic concepts of program development in a modern object-oriented language; problem-solving methods and algorithm development; basic data types; language syntax; style and documentation; and coding and testing of programs.

CS-176 Introduction to Computer Science II Credits: 4
Prerequisite: CS-175 passed with a grade of C or higher.
Term Offered: All Terms
Course Type(s): None
Continuation in depth and breadth of problem-solving and algorithm development, using the same modern object-oriented language as in CS-175. More advanced, object-oriented design. Introduction to polymorphism and inheritance. Four hours per week.

CS-199 Independent Study in Computer Science Credits: 1-3
Prerequisite: Prior permission of directing professor and department chair required.
Course Type(s): None
Independent study in a computer science topic not substantially treated in a regular course; for students with superior ability. One-hour consultation per week.

CS-202 Discrete Mathematics and Applications Credits: 4
Prerequisites: CS-175 and MA-109.
Term Offered: All Terms
Course Type(s): None
Covers the basic concepts, methods, structures, and models from discrete mathematics used throughout computer science. Topics addresses include: logic and mathematical reasoning, functions, sets, summations, asymptotic notation, algorithms and complexity, number theory, cryptography, matrix algebra, induction and recursion, counting techniques, combinatorial objects, discrete structures, discrete probability theory, relations, and graph theory and graph algorithms.

CS-205 Data Structures and Algorithms Credits: 4
Prerequisites: CS-176, passed with a grade of C or higher and either MA-130 or CS-202, passed with a grade of C or higher.
Term Offered: All Terms
Course Type(s): None
Introduction to the design, implementation, and use of fundamental data structures (list, stacks, queues, trees); extensions of these structures and associated algorithms and informal complexity analysis. Four hours per week.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Term Offered</th>
<th>Course Type(s)</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS-212</td>
<td>Networking Fundamentals I</td>
<td>3</td>
<td>Spring Term</td>
<td>None</td>
<td>Preparates students with knowledge and skills required to successfully install, operate, and troubleshoot a small branch office network. Includes topics on networking fundamentals; connecting to a WAN; basic security and wireless concepts; routing and switching fundamentals; the TCP/IP and OSI models; IP addressing; WAN technologies; operating and configuring IOS devices; configuring RIPv2, static and default routing; implementing NAT and DHCP; and configuring simple networks.</td>
</tr>
<tr>
<td>CS-222</td>
<td>Networking Fundamentals II</td>
<td>3</td>
<td>All Terms</td>
<td>None</td>
<td>Preparates students with knowledge and skills required to successfully install, operate, and troubleshoot a small to medium size enterprise branch network. Covers topics on VLSM and IPv6 addressing; extending switched networks with VLANs; configuring, verifying and troubleshooting VLANs; the VTP, RSTP, OSPF and EIGRP protocols; determining IP routes; managing IP traffic with access lists; NAT and DHCP; establishing point-to-point connections; and establishing Frame Relay connections.</td>
</tr>
<tr>
<td>CS-230</td>
<td>Android Application Development</td>
<td>3</td>
<td>All Terms</td>
<td>None</td>
<td>Introduces students to writing applications for Android mobile devices. It familiarizes students with the development software for creating Android apps, programming logic used in the apps, and Java code that puts the software design and logic into the practice using an Android emulator.</td>
</tr>
<tr>
<td>CS-275</td>
<td>Introduction to an Algorithmic Language</td>
<td>3</td>
<td>All Terms</td>
<td>None</td>
<td>A thorough overview of the syntax of an algorithmic language and stress on the concepts of structured programming. Four hours per week.</td>
</tr>
<tr>
<td>CS-286</td>
<td>Computer Architecture I</td>
<td>3</td>
<td>All Terms</td>
<td>None</td>
<td>Prerequisites: CS-176 or CS-275, passed with a grade of C or higher. Term Offered: All Terms</td>
</tr>
<tr>
<td>CS-288</td>
<td>Cooperative Education: Computer Science</td>
<td>3</td>
<td>All Terms</td>
<td>None</td>
<td>Prerequisites: Junior standing, thirty or more earned credits with at least fifteen taken at Monmouth University and CS-205 passed with a grade of C or higher. Term Offered: All Terms</td>
</tr>
<tr>
<td>CS-298</td>
<td>Special Topics in Computer Science (200 Level)</td>
<td>1-3</td>
<td>Spring Term</td>
<td>None</td>
<td>Preparates: As announced in the course schedule. Term Offered: All Terms</td>
</tr>
<tr>
<td>CS-299</td>
<td>Independent Study in Computer Science</td>
<td>3</td>
<td>Spring Term</td>
<td>None</td>
<td>Prerequisite: Prior permission of directing professor and department chair required. Term Offered: Spring Term</td>
</tr>
<tr>
<td>CS-302</td>
<td>Designing and Implementing Routing in Enterprise Networks</td>
<td>3</td>
<td>All Terms</td>
<td>None</td>
<td>Prerequisites: CS-212 and CS-222, both passed with a grade of C or higher. Term Offered: All Terms</td>
</tr>
<tr>
<td>CS-306</td>
<td>Computer Algorithms II</td>
<td>4</td>
<td>All Terms</td>
<td>WT</td>
<td>Prerequisite: CS-205, passed with a grade of C or higher. Course Type(s): None Continuation in depth and breadth of the design, implementation, and use of data types (list, binary search tree, tree, hash table, graph); intermediate algorithm design; complexity analysis. Four hours per week.</td>
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<tr>
<td>CS-310</td>
<td>Advanced Object-Oriented Programming and Design</td>
<td>4</td>
<td>All Terms</td>
<td>None</td>
<td>Prerequisite: CS-205, passed with a grade of C or higher; and EN-101 and EN-102 or permission of the instructor. Term Offered: Fall Term</td>
</tr>
<tr>
<td>CS-312</td>
<td>Designing and Implementing Switching in Enterprise Networks</td>
<td>3</td>
<td>All Terms</td>
<td>None</td>
<td>Prerequisite: CS-302, passed with a grade of C or higher. Term Offered: All Terms</td>
</tr>
<tr>
<td>CS-315</td>
<td>Theory of Computing</td>
<td>3</td>
<td>All Terms</td>
<td>None</td>
<td>Prerequisite: CS-176 or CS-275, passed with a grade of C or higher and either CS-202 or MA-120 or MA-130, passed with a grade of C or higher. Term Offered: All Terms</td>
</tr>
</tbody>
</table>

An intensive study of a particular subject or problem in computer science to be announced prior to registration. May be conducted on either a lecture-discussion or a seminar basis. Three or four hours per week.
CS-316 Implementing Network Security Credits: 3
Prerequisites: CS-212 and CS-222, both passed with a grade of C or higher.
Term Offered: All Terms
Course Type(s): None
Prepares students with knowledge and skills required to secure networks. Includes topics on core security technologies, the installation, troubleshooting and monitoring of network devices to maintain integrity, confidentiality and availability of data and devices, and competency in the technologies that use its security structures. A hands-on career oriented course, with an emphasis on practical experience, to help students develop specialized security skills, along with critical thinking and complex problem solving skills.

CS-320 IP Telephony Design and Implementation Credits: 3
Prerequisites: CS-212 and CS-222.
Term Offered: All Terms
Course Type(s): None
Prepares students with knowledge of how to implement and support data and voice integration solutions at the network-access level. Topics covered include basic IP Telephony operation, router configuration, support, troubleshooting, and integration with an existing PSTN network.

CS-322 Network Troubleshooting Credits: 3
Prerequisite: CS-312, passed with a grade of C or higher.
Term Offered: All Terms
Course Type(s): None
Prepares students with knowledge and skills necessary to plan and perform regular maintenance on complex enterprise routed and switched networks and use technology-based practices to perform network troubleshooting.

CS-324 Computer Architecture II Credits: 3
Prerequisite: CS-286, passed with a grade of C or higher.
Term Offered: All Terms
Course Type(s): None
Boolean algebra, combinational and sequential circuit devices are presented in lectures and laboratory. Computer hardware organization. Memory and CPU design. CPU control with microcode. Four hours per week.

CS-325 Software Engineering Concepts Credits: 3
Prerequisite: CS-205, passed with a grade of C or higher; and EN-101 and EN-102 or permission of the instructor.
Term Offered: Fall Term
Course Type(s): WT
Overview of software engineering concepts, analysis/design techniques, Unified Modeling Language (UML), software documentation, and group development of software.

CS-330 Administrating Unified Communication Manager Credits: 3
Prerequisites: CS-212 and CS-222, passed with a grade of C or higher.
Term Offered: All Terms
Course Type(s): None
Prepares students with knowledge of deploying a Unified Communications Manager to support single site and multi-site deployment models.

CS-335 Programming Language Concepts Credits: 3
Prerequisite: CS-205, passed with a grade of C or higher.
Term Offered: All Terms
Course Type(s): None
Design, evaluation, and implementation of programming languages. Discussion of imperative, applicative, object-oriented and concurrent languages. Four hours per week.

CS-350 Research in Computer Science Credits: 1-4
Prerequisites: Junior standing, CS-306, passed with a grade of C or higher, a minimum of fifteen credits at Monmouth University, and a minimum GPA of 3.25.
Course Type(s): EX5
Original research work, associated with an external constituent and/or organization, planned and carried out with assistance of faculty research advisor. Research conducted by the student will be shared with the external constituency and submitted for outside publication and review. Number of credits arranged with advisor. Limited to Computer Science students with approval of chair, program director, or advisor.

CS-360 Introduction to Game Development Credits: 3
Prerequisite: CS-205 passed with a grade of C or higher.
Term Offered: Fall Term
Course Type(s): None
An introduction to the creation of computer/video games and the different elements of games, including computer graphics, animation, artificial intelligence, algorithms, data structures, networking, software development cycles and human-computer interaction. Also listed as SE-360.

CS-370 Program Development Under Unix Credits: 3
Prerequisite: CS-176 or CS-275, passed with a grade of C or higher.
Term Offered: Fall Term
Course Type(s): None
Introduction to the use of the UNIX operating system and its utilities for incremental and distributed program development, maintenance, and debugging. The course covers the UNIX shell, utilities, and program development tools that are used for large projects involving multiple developers on multiple machines. Three hours per week.

CS-371 Scripting Languages Credits: 3
Prerequisite: CS-176 or equivalent.
Term Offered: All Terms
Course Type(s): None
An introduction to programming using widely-used, dynamically-typed, interpreted programming languages, which are sometimes called "scripting" languages. Covers general-purpose scripting languages, such as Perl and Python that are used to develop a wide range of applications. Scripting languages, such as PHP, that are used primarily in web development, will not be covered in this course.

CS-375 File Management Credits: 4
Prerequisite: CS-205, passed with a grade of C or higher.
Course Type(s): None
Overview of files, records and files, blocking and buffering, secondary storage devices; sequential file organization, external sort/merge algorithms; random access; relative file organization; tree-structured file organization; search trees, indexed sequential file organization; list-structured file organization; multiple-key file organization. Four hours per week.

CS-388 Cooperative Education: Computer Science Credits: 3
Prerequisites: Junior standing, thirty or more earned credits with at least fifteen taken at Monmouth University and CS-205 passed with a grade of C or higher.
Term Offered: All Terms
Course Type(s): EX2
Provides an opportunity for students who are engaged in a computer science-related experience. Fifteen to twenty hours of work experience per week. This course may be repeated for credit.
CS-398  Special Topics in Computer Science (300 Level)  Credits: 1-3  
Prerequisite: As announced in the course schedule.  
Course Type(s): None  
An intensive study of a particular subject or problem in computer science to be announced prior to registration. May be conducted on either a lecture-discussion or a seminar basis. Three or four hours per week.

CS-414  Computer Networks  Credits: 4  
Prerequisite: CS-286, passed with a grade of C or higher.  
Term Offered: All Terms  
Course Type(s): None  
Provides introduction to computer-networking concepts, technologies, and services, including basic communications theory, analog and digital devices, Public Switched Telephone Network, data networks, LANs, wireless services, data protocols, the Internet, multi-media, and B-ISDN.

CS-418  Compiler Construction  Credits: 3  
Prerequisite: CS-205 passed with a grade of C or higher.  
Term Offered: All Terms  
Course Type(s): None  
The principles and practices of incorporating the theory of finite automata and context-free languages, the maintenance and use of semantic information, and the generation and optimization of code to produce a compiler. Four hours per week.

CS-420  Survey of Artificial Intelligence Concepts and Practices  Credits: 4  
Prerequisite: CS-205, passed with a grade of C or higher.  
Term Offered: All Terms  
Course Type(s): None  
Introduction to fundamental concepts and practices of artificial intelligence, covering problem definition, search techniques, knowledge representation, control knowledge, and symbolic reasoning. Includes at least two of the following advanced topics: planning, understanding, natural language processing, learning, connectionist models, common sense reasoning, and expert systems. Four hours per week.

CS-432  Database Systems  Credits: 4  
Prerequisite: CS-205, passed with a grade of C or higher.  
Term Offered: Fall Term  
Course Type(s): None  
Overview of database system concepts; data modeling; ER and UML diagrams; relational database schema definition; database design; query languages; hands-on experience of SQL and Oracle. Four hours per week.

CS-435  Systems Programming  Credits: 3  
Prerequisites: CS-286 and CS-205, both passed with a grade of C or higher, and Senior standing.  
Term Offered: All Terms  
Course Type(s): None  
Introduction to the implementation of basic system software: text editors, assemblers, loaders, and macro processors, with emphasis on software methodology for creating and maintaining large programs. The language of instruction will be C, which will be briefly introduced. Four hours per week.

CS-438  Operating Systems Analysis  Credits: 4  
Prerequisites: CS-286 and CS-205, both passed with a grade of C or higher.  
Term Offered: All Terms  
Course Type(s): None  
Management of memory, processes, files, and devices. OS design principles and performance measures. Multiprogramming, multiprocessing, concurrency, deadlock, virtual machines. Competitive and cooperating processes. Programs will be written in C. Throughout the course, students will be expected to work in pairs to solve problems and in a larger group for a more substantial project.

CS-445  Computer Graphics  Credits: 3  
Prerequisite: CS-205, passed with a grade of C or higher.  
Term Offered: All Terms  
Course Type(s): None  
Drawing lines and curves, area filling, fractals, three dimensional viewing, clipping, ray-tracing, shading, hidden line and surface removal. Four hours per week.

CS-461  Simulation and Modeling  Credits: 3  
Prerequisite: CS-205, passed with a grade of C or higher.  
Term Offered: All Terms  
Course Type(s): None  
An introduction to the use of discrete event simulation and other modeling methods and tools to predict the performance of computer systems and communications networks.

CS-471  System Administration  Credits: 3  
Prerequisite: CS-370 or CS-371, passed with a grade of C or higher.  
Term Offered: Spring Term  
Course Type(s): None  
Fundamental topics in system administration, focused primarily on UNIX administration with added coverage of Microsoft Windows NT descendant systems. The course is a hands-on introduction to installing and maintaining modern, multi-user, production UNIX-like operating systems and the essential services that are hosted on these systems.

CS-488  Cooperative Education: Computer Science  Credits: 3  
Prerequisites: Junior standing, thirty or more earned credits with at least fifteen taken at Monmouth University and CS-204 passed with a grade of C or higher.  
Term Offered: All Terms  
Course Type(s): EX2  
Provides an opportunity for students who are engaged in a computer science-related experience. Fifteen to twenty hours of work experience per week. May be repeated for credit.

CS-490  Senior Project  Credits: 4  
Prerequisites: CS-325 and CS-432, both passed with a grade of C or higher.  
Term Offered: Spring Term  
Course Type(s): RD  
Affords the student an opportunity to integrate topics and techniques from previous coursework in a capstone project. The project will combine investigation into computer science literature and actual implementation, either in an area of current research or an application area of interest to industry. Implementation might involve collaboration with other students. The project will be presented formally, both orally and in written form. This course satisfies the reasoned oral discourse requirement for computer science students.
An intensive study of a particular subject or problem in computer science to be announced prior to registration. May be conducted on either a lecture-discussion or a seminar basis. Three or four hours per week.

Prerequisite: Prior permission of directing professor and department chair required.

Term Offered: All Terms

Course Type(s): None

An intensive study in a computer science topic not substantially treated in a regular course; for students with superior ability. One-hour consultation per week.

Prerequisites: IT-100 and as announced in the course schedule.

Term Offered: All Terms

Course Type(s): None

A more in-depth understanding of programming in Visual Basic, including an introduction to Object Oriented Programming (OOP). Real-world projects are used to illustrate application-building techniques used in a variety of applications, including Windows desktop application and applications targeted for the Internet and intranets. Topics include creating customized user interfaces, building dialog boxes, adding drag-and-drop functionality to applications, and creating customized database management and reporting applications. Hands-on experience with a microcomputer on a networked system is provided.

Prerequisites: IT-100 or IT-102, or CS-102 or IT-150.

Term Offered: All Terms

Course Type(s): None

Advanced concepts and techniques in computer-based information management are provided through an integrated approach to personal computer hardware and software in a Windows environment. These include: hardware and software considerations; societal and ethical considerations; the program development life cycle; creating tables; merging documents and desktop publishing in word processing; creating templates, workbooks with multiple worksheets, and creating a data map in electronic spreadsheets; creating custom reports and an application system using macros in database management; and using embedded visuals in presentation graphics applications. Hands-on experience with a microcomputer on a networked system is provided.

Prerequisite: IT-200 or CS-175 or permission of the department.

Term Offered: All Terms

Course Type(s): None

Introduction to computer-based information management that provides an integrated approach to personal computer software in a Windows environment. These include: word processing, spreadsheet, database, presentation graphics, and electronic communication applications; information retrieval from the Internet and online library resources; fundamental computer literacy; and the ethical and societal implications of computer technology. Hands-on experience with a microcomputer on a networked system is provided. Not open to students who have completed CS-102 or IT-102 or IT-150.

Prerequisite: As announced in the course schedule.

Term Offered: All Terms

Course Type(s): None
IT-405  Advanced Internet Technology  Credits: 3
Prerequisites: IT-250 and IT-300.
Term Offered: All Terms
Course Type(s): None
The most current tools and technologies used in professional Web site development are introduced through the case study and experiential approach. Topics include the application of advance scripting languages and software applications for interactive controls, cascading style sheets, dynamic page layout, special effects, document formatting and transformation.

IT-450  Information Systems Project Management  Credits: 3
Prerequisite: IT-250 or permission of the department.
Term Offered: All Terms
Course Type(s): EX5
The tools and skills of the systems analyst needed in information systems project management are introduced through the case study and experiential approach. Project management software will be used within an integrated-software environment-systems framework; students will complete two information technology projects in Web and database design for external clients.

IT-498  Special Topics in Information Technology (400 Level)  Credits: 3
Prerequisites: IT-100 and as announced in the course schedule.
Course Type(s): None
Topics of current interest in Information Technology.

SE-104  Introduction to Software Engineering  Credits: 3
Term Offered: Spring Term
Course Type(s): None
Introduction to the methods and tools for software development. Topics include the personal software process, requirements engineering, software design, testing methods, project management, and other management techniques.

SE-199  Independent Study in Software Engineering  Credits: 3
Course Type(s): None
Independent Study of a particular subject or problem in software engineering under the guidance of a software engineering faculty member.

SE-205  Requirements Engineering and Specifications  Credits: 3
Prerequisites: SE-104 and CS-175.
Term Offered: Fall Term
Course Type(s): None
Elicitation, analysis, specification, validation, and management of user requirements; conflict resolution; process, notations, methods and tools, requirements standards, operational concepts documents (OCD) and system requirements specifications (SRS).

SE-207  Software Design and Architecture  Credits: 3
Prerequisites: SE-104 and CS-176 or CS-275; and EN-101 and EN-102 or permission of the instructor.
Term Offered: Spring Term
Course Type(s): WT
Design process notations, methods, paradigms, and tools. System architecture tradeoff analysis; component and subcomponent specification. Generic (domain) design; architectural styles, frameworks, and patterns. Test and integration plan documents. Architecture standards; design tools.

SE-299  Independent Study in Software Engineering  Credits: 3
Term Offered: All Terms
Course Type(s): None
Independent Study of a particular subject or problem in software engineering under the guidance of a software engineering faculty member.

SE-306  Formal Methods in Software Engineering  Credits: 3
Prerequisite: MA-120 or MA-130.
Term Offered: Fall Term
Course Type(s): None
Covers a variety of formal methods and applies them to software specification development. Assumes a firm grounding in mathematical logic, knowledge of proof techniques, and skill in the translation of problems expressed in English into predicate logic.

SE-312  Software Verification, Validation, and Maintenance  Credits: 3
Prerequisites: SE-104 and CS-175 or CS-275.
Term Offered: Fall Term
Course Type(s): None
Covers inspections of requirements, design and code, as well as testing, the handling of change requests, software evolution, code comprehension, and change management.

SE-351  Microprocessor Laboratory  Credits: 3
Prerequisite: MA-120 or MA-130.
Term Offered: Fall Term
Course Type(s): None
Introduces the student to microprocessor-based, hardware-interface design. Provides practice in developing software that drives the interfaces between a microprocessor and the outside world. Topics include: logic circuit analysis and synthesis, digital hardware components, microprocessor system architecture, and assembly and C/C++ language programming of input/output device drivers.

SE-352  Embedded and Real-Time Software  Credits: 3
Prerequisite: SE-351.
Term Offered: Spring Term
Course Type(s): None
Familiarizes students with the fundamental issues related to embedded and real-time software systems and gives them an opportunity to become familiar with a commercially available system for developing and testing embedded and real-time software. Topics include: definition of embedded systems, process concurrency, interprocess communications, synchronization, and process scheduling.

SE-353  Comparative Languages  Credits: 3
Prerequisite: CS-176 or CS-275.
Term Offered: All Terms
Course Type(s): None
Begins with a history of the development of programming languages that provides the background necessary to understand programming-language design and evaluation. This is followed by an introduction to the basic programming language constructs and then critically comparing their implementation in some of the most common languages. Included is a discussion of the advantages and disadvantages of modern programming languages for a variety of applications. Some of the languages discussed are LISP, C, Small Talk, C++, Java, Ada, PL/1, and Prolog.
SE-356  Internet Technologies for Software Engineers  Credits: 3
Prerequisites: CS-102 and CS-176 or CS-275.
Term Offered: All Terms
Course Type(s): None
Provides an intensive look at the leading-edge technologies that are used to build Internet applications, what they do, and how they do it. Topics covered will include: hyper-text markup language, cascading style sheets, scripting languages, active server pages, Pert/CGI, and the extensible markup language.

SE-357  Engineering Web-based Systems  Credits: 3
Prerequisites: SE-205 and SE-207.
Term Offered: Spring Term
Course Type(s): None
A practical introduction to the principles, methods, and tools required to create high-quality software applications for the distributed, client-server context of the Web. Emphasis is on architectural designs, and language and data access methods that are common in Web-based systems.

SE-360  Introduction to Game Development  Credits: 3
Prerequisite: CS-205 passed with a grade of C or higher.
Term Offered: Fall Term
Course Type(s): None
An introduction to the creation of computer/video games and the different elements of games, including computer graphics, animation, artificial intelligence, algorithms, data structures, networking, software development cycles and human-computer interaction. Also listed as CS-360.

SE-370  Program Development Under Unix  Credits: 3
Prerequisites: CS-176 or CS-275 passed with a grade of C or higher.
Term Offered: All Terms
Course Type(s): None
Introduction to the use of the UNIX operating system and its utilities for incremental and distributed program development, maintenance, and debugging. The course covers the UNIX shell, utilities, and program development tools that are used for large projects involving multiple developers on multiple machines. Three hours per week. Also listed as CS-370.

SE-398  Special Topics in Software Engineering  Credits: 3
Prerequisite: As announced in the course schedule.
Term Offered: All Terms
Course Type(s): None
A 300-level intensive study of a particular subject or problem in software engineering to be announced prior to registration. May be conducted on either a lecture-discussion or a seminar basis. Three or four hours per week.

SE-402  Human Computer Interaction  Credits: 3
Prerequisite: Completion of forty-eight credits of coursework.
Term Offered: All Terms
Course Type(s): IM
Covers basic human psychology, computer technology, and the interface between them. The key topics of HCI are examined, grounded in the context of usability and the design lifecycle.

SE-403  Software Process Improvement  Credits: 3
Prerequisite: CS-205.
Term Offered: Spring Term
Course Type(s): None
Students will be introduced to the various aspects related to software processes. It will focus on the definition and modeling of a software process, as well as on methods for process assessment and improvement. The concepts will be illustrated through process-improvement case studies, followed by hands-on experience with the improvement of the personal software-development process.

SE-418  Software Project Management  Credits: 3
Prerequisites: CS-176 or CS-275, and EN-101 and EN-102 or permission of the instructor.
Term Offered: Spring Term
Course Type(s): WT
Project management and its application to software-development projects. Emphasis will be on planning, organizing, monitoring, and controlling. Students will learn how to develop work breakdown structures, estimate task durations, assign resources, specify network precedence, and determine a project's critical path. Methods for scheduling in the face of resource constraints will be included, as well as function point counting, algorithmic models for estimating total project cost, and software tools for project planning and monitoring.

SE-485A  Software Practicum  Credits: 3
Prerequisites: CS-205, SE-205, SE-207, and SE-312.
Corequisite: SE-402.
Term Offered: Fall Term
Course Type(s): EX5, RD
Team work on substantial software projects submitted by corporate sponsors. Interim progress reports required, with a final formal defense and presentation to corporate staff, faculty, and other students in the course. At the end of SE-485A, students must submit their software engineering portfolio for review by the Software Engineering faculty.

SE-485B  Software Practicum  Credits: 3
Prerequisite: SE-485A.
Term Offered: Spring Term
Course Type(s): EX5, RD
Team work on substantial software projects submitted by corporate sponsors. Interim progress reports required, with a final formal defense and presentation to corporate staff, faculty, and other students in the course. At the end of SE-485B, students must submit their software engineering portfolio for review by the Software Engineering faculty.

SE-498  Special Topics in Software Engineering  Credits: 3
Prerequisite: As announced in the course schedule.
Term Offered: Fall Term
Course Type(s): None
A 400-level intensive study of a particular subject or problem in software engineering to be announced prior to registration. May be conducted on either a lecture-discussion or a seminar basis. Three or four hours per week.