COMPUTER SCIENCE AND SOFTWARE ENGINEERING

Chair: Daniela Rosca, 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 B.S. in Computer Science, 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 BS in Computer Science 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 B.A. in Computer Science. 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 BA in Computer Science program 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.

Programs

Majors

- B.S. in Computer Science (http://catalog.monmouth.edu/undergraduate-catalog/science/computer-science-software-engineering/computer-science-bs)
- B.A. in Computer Science (http://catalog.monmouth.edu/undergraduate-catalog/science/computer-science-software-engineering/computer-science-ba)
- B.S. in Software Engineering (http://catalog.monmouth.edu/undergraduate-catalog/science/computer-science-software-engineering/software-engineering-bs)

Minor

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

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

Faculty

Eugenio Cesario, Associate Professor. MA, PhD, University of Calabria, Italy. 
ecesario@monmouth.edu

Gil Eckert, Specialist Professor. BS, Stockton University, MS, Kean University.
egckert@monmouth.edu

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. 
jwang@monmouth.edu

Janice Rohn, Specialist Professor. Information Technology Coordinator. BA, Thomas Edison State University; MS National Technological University.
jarohn@monmouth.edu

Daniela Rosca, Associate Professor and Chair (Graduate Faculty). MS, Polytechnic University of Bucharest, PhD, Old Dominion University. Interests include artificial intelligence (especially knowledge representation, automated reasoning and natural language processing), cognitive science, and databases.
drosca@monmouth.edu

Jamie Kretsch, Specialist Professor. BS, Monmouth University; MS, University of Wisconsin-Madison. Interests are gender diversity in computing and technology and online education. 
jkretsch@monmouth.edu

Gil Eckert, Specialist Professor. BS, Stockton University, MS, Kean University. 
egckert@monmouth.edu

Katie Gatto, Specialist Professor. BA, Georgian Court University; MS, MBA, Colorado Technical University. 
kgatto@monmouth.edu

Ling Zheng, Assistant Professor. BS, Southern Medical University, Guangzhou, China; MS, Zhejiang University, Hangzhou, China; PhD, New Jersey Institute of Technology. 
lzheng@monmouth.edu

Courses

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
Prerequisite: CS-102.
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.
Term Offered: All Terms
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.

CS-212  Networking Fundamentals I  Credits: 3
Term Offered: Spring Term
Course Type(s): None
Prepares 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.

CS-222  Networking Fundamentals II  Credits: 3
Prerequisite: CS-212.
Term Offered: All Terms
Course Type(s): None
Prepares 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.

CS-250  Android Application Development  Credits: 3
Prerequisites: CS-175 and CS-176.
Term Offered: Spring Term
Course Type(s): None
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.

CS-275  Introduction to an Algorithmic Language  Credits: 3
Prerequisite: Permission of the instructor.
Term Offered: All Terms
Course Type(s): None
A thorough overview of the syntax of an algorithmic language and stress on the concepts of structured programming. Four hours per week.

CS-286  Computer Architecture I  Credits: 3
Prerequisites: CS-176 or CS-275, passed with a grade of C or higher.
Term Offered: All Terms
Course Type(s): None

CS-288  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 work experience. Fifteen to twenty hours of work experience per week. May be repeated for credit.

CS-289  Internship in Computer Science  Credits: 3
Prerequisites: Sophomore standing, departmental approval, and placement.
Term Offered: Summer Term
Course Type(s): EX1
Supervised practical experience in Computer Science. Repeatable for credit.

CS-298  Special Topics in Computer Science (200 Level)  Credits: 1-3
Prerequisite: As announced in the course schedule.
Term Offered: All Terms
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-299  Independent Study in Computer Science  Credits: 3
Prerequisite: Prior permission of directing professor and department chair required.
Term Offered: Spring Term
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-302  Designing and Implementing Routing in Enterprise Networks  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 necessary to use advanced IP addressing and routing in implementing scalable and secure routers connected to LANs and WANs. Also covers configuration of secure routing solutions to support branch offices and mobile workers.

CS-306  Computer Algorithms II  Credits: 4
Prerequisite: CS-205 passed with a grade of C or higher.
Term Offered: All Terms
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.

CS-310  Advanced Object-Oriented Programming and Design  Credits: 4
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
Object-oriented programming and design, using a language different from that used in CS-176. Use of classes, inheritance, polymorphism, and libraries. Topics will include flexible system design for such requirements as globalization.
CS-312 Designing and Implementing Switching in Enterprise Networks Credits: 3
Prerequisite: CS-302 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, configure, and verify the implementation of complex enterprise switching solutions using Enterprise Architecture. Also covers secure integration of VLANs, WLANs, and voice and video into campus networks.

CS-315 Theory of Computing Credits: 3
Prerequisites: 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
Course Type(s): None
An introduction to phrase structure languages and their relation to automata, computability, and program verification.

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: Fall Term
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: Fall Term
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-337 Enterprise Mobile Apps Design and Development Credits: 3
Prerequisite: CS-205 passed with a grade of C or higher.
Term Offered: Fall Term
Course Type(s): None
Prepares students with knowledge of deploying and integrating these apps with corporate data sources, sensor devices and cloud computing services. Also listed as SE-337.

CS-338 Mobile App Development Credits: 3
Prerequisite: CS-205 passed with a grade of C or higher.
Term Offered: Fall Term
Course Type(s): None
Presents methodologies to build enterprise mobile apps on iPad tablets and iPhone smartphones using iOS. The course will cover technologies to use in the design and development of apps on mobile devices and integration of these apps with corporate data sources, sensor devices and cloud computing services. Also listed as SE-338.

CS-339 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.
Term Offered: Fall Term
Course Type(s): EX1
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-378 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): EX1
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-389 Internship in Computer Science Credits: 3
Prerequisites: Junior standing, departmental approval, and placement.
Term Offered: Summer Term
Course Type(s): EX1
Supervised practical experience in Computer Science. Repeatable for credit.

CS-398 Special Topics in Computer Science (300 Level) Credits: 1-3
Prerequisite: As announced in the course schedule.
Term Offered: All Terms
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.
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: Fall Term
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-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. May be repeated for credit.

CS-489  Internship in Computer Science  Credits: 1-3
Prerequisites: Junior standing, departmental approval, and placement.
Term Offered: All Terms
Course Type(s): EX1
Supervised practical experience in Computer Science. Repeatable 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.

CS-498  Special Topics in Computer Science (400 Level)  Credits: 1-3
Prerequisite: As announced in the course schedule.
Term Offered: All Terms
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-499  Independent Study in Computer Science  Credits: 1-4
Prerequisite: Prior permission of directing professor and department chair required.
Term Offered: All Terms
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.

IT-100  Information Technology  Credits: 3
Term Offered: All Terms
Course Type(s): TL
Introduction to computer-based information management concepts that provide 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.

IT-102  Information Technology for Scientists  Credits: 3
Term Offered: All Terms
Course Type(s): TL
Introduction to computer-based information management that provides an integrated approach to personal computer software in a Windows environment, which includes word processing, spreadsheet, mathematics, database, presentation graphics, Internet and electronic communication applications. Emphasizes scientific applications, technical report preparation and presentation. Hands-on experience with a microcomputer on a networked system is provided.

IT-103  Applied Information Technology  Credits: 3
Term Offered: Fall Term
Course Type(s): TL
Applies the principles and tools of information technology toward a deeper understanding of their impact on scientific, social and ethical issues via a central theme for the semester such as (but not limited to) climate change, big data, health-care cost analysis and others. This course will use software such as spreadsheets, databases, modeling, simulation, data analysis, software, electronic-communication applications; information retrieval from the internet and on-line library resources; social media, intranet and extranet systems to help students emerge with thematic materials in a way that deepens their understanding of associated topics.

IT-150  Information Technology for Business  Credits: 3
Term Offered: All Terms
Course Type(s): TL
Introduction to computer-based information business management that provides an integrated approach to personal computer software in a Windows environment. This includes fundamental technology literacy; operating systems, word processing, spreadsheet, database, presentation graphics, and electronic communication applications; computer and network security; troubleshooting; information retrieval from the Internet and on-line library resources; intranet and extranet systems; and the ethical, societal, legal, and economic implications of computer technology. Hands-on experience with a microcomputer on a networked system is provided.
IT-200  Advanced Information Technology  Credits: 3
Prerequisite: 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 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.

IT-250  Internet and Network Technology  Credits: 3
Prerequisite: IT-200 or CS-175 or permission of the department.
Term Offered: All Terms
Course Type(s): None
Introduction to integrated application software used for authoring and publishing Web sites in a Windows environment. Applications include markup programming and Internet scripting languages used to create Web pages. Network technologies and the fundamental concepts involved in creating a network and in facilitating network operation will also be introduced. Concepts include: protocols, networking media, and architectures. Hands-on experience with a microcomputer on a networked system is provided.

IT-298  Special Topics in Information Technology (200 Level)  Credits: 3
Prerequisites: IT-100 and as announced in the course schedule.
Term Offered: Fall Term
Course Type(s): None
Topics of current interest in Information Technology.

IT-300  Windows Applications: Program Design and Implementation  Credits: 3
Prerequisite: IT-250 or permission of the department.
Term Offered: All Terms
Course Type(s): None
Program development life cycle, core programming concepts, and software design and methodologies used to create Windows applications with Visual Basic. Practical problems 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 designing 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.

IT-398  Special Topics in Information Technology (300 Level)  Credits: 3
Prerequisites: IT-100 and as announced in the course schedule.
Term Offered: Fall Term
Course Type(s): None
Topics of current interest in Information Technology.

IT-399  Independent Study in Information Technology  Credits: 3
Term Offered: All Terms
Course Type(s): None
Reading and research on a selected topic under the direction of a faculty member.

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 lecture 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.
Corequisite: IT-300.
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.
Term Offered: All Terms
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
Term Offered: Summer Term
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.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Term Offered</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE-299</td>
<td>Independent Study in Software Engineering</td>
<td>3</td>
<td>All Terms</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Independent Study of a particular subject or problem in software</td>
<td></td>
<td></td>
<td>engineering under the guidance of a software engineering faculty member.</td>
</tr>
<tr>
<td>SE-306</td>
<td>Formal Methods in Software Engineering</td>
<td>3</td>
<td>Fall Term</td>
<td>Prerequisite: MA-120 or MA-130.</td>
</tr>
<tr>
<td></td>
<td>Covers a variety of formal methods and applies them to software-</td>
<td></td>
<td></td>
<td>specification development. Assumes a firm grounding in mathematical</td>
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<td></td>
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<td></td>
<td></td>
<td>logic, knowledge of proof techniques, and skill in the translation of</td>
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<td></td>
<td></td>
<td>problems expressed in English into predicate logic.</td>
</tr>
<tr>
<td>SE-312</td>
<td>Software Verification, Validation, and Maintenance</td>
<td>3</td>
<td>Fall Term</td>
<td>Prerequisites: SE-104 and CS-176 or CS-275.</td>
</tr>
<tr>
<td></td>
<td>Covers inspections of requirements, design and code, as well as</td>
<td></td>
<td></td>
<td>testing, the handling of change requests, software evolution, code</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>comprehension, and change management.</td>
</tr>
<tr>
<td>SE-337</td>
<td>Enterprise Mobile Apps Design and Development</td>
<td>3</td>
<td>Fall Term</td>
<td>Prerequisite: CS-205 passed with a grade of C or higher.</td>
</tr>
<tr>
<td></td>
<td>Presents methodologies to build enterprise mobile apps on iPad</td>
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<td>Term Offered: Fall Term</td>
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<td>Course Type(s): None</td>
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<tr>
<td></td>
<td>and iPhone smartphones using iOS. The course will cover</td>
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<td>Integration of these apps with corporate data sources, sensor devices,</td>
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<td></td>
<td>components, microprocessor system architecture, and assembly and C/C</td>
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<td>++ language programming of input/output device drivers. Also listed as CS-337.</td>
</tr>
<tr>
<td>SE-351</td>
<td>Microprocessor Laboratory</td>
<td>3</td>
<td>Fall Term</td>
<td>Prerequisite: MA-120 or MA-130.</td>
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<td></td>
<td>Provides practice in developing software that drives the</td>
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<td>Term Offered: Fall Term</td>
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<td>Course Type(s): None</td>
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<tr>
<td></td>
<td>interfaces between a microprocessor and the outside world.</td>
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<td>Introduces the student to microprocessor-based, hardware-interface</td>
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<td></td>
<td>design.</td>
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<td>Provides include: logic circuit analysis and synthesis, digital hardware</td>
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<td>components, microprocessor system architecture, and assembly and C/C++</td>
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<td>language programming of input/output device drivers.</td>
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<tr>
<td>SE-352</td>
<td>Embedded and Real-Time Software</td>
<td>3</td>
<td>Spring Term</td>
<td>Prerequisite: SE-351.</td>
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<tr>
<td></td>
<td>Familiarizes students with the fundamental issues related to</td>
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<td>Term Offered: Spring Term</td>
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<td>Course Type(s): None</td>
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<tr>
<td></td>
<td>Embedded and real-time software systems and gives them an</td>
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<td></td>
<td>Introduction to the creation of computer/video games and the different</td>
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<td></td>
<td></td>
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<td></td>
<td>elements of games, including computer graphics, animation,</td>
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<td></td>
<td></td>
<td></td>
<td>artificial intelligence, algorithms, data structures, networking, software</td>
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<td></td>
<td></td>
<td></td>
<td>development cycles and human-computer interaction. Also listed as CS-360.</td>
</tr>
<tr>
<td>SE-353</td>
<td>Comparative Languages</td>
<td>3</td>
<td>Fall Term</td>
<td>Prerequisites: CS-176 or CS-275.</td>
</tr>
<tr>
<td></td>
<td>Begins with a history of the development of programming</td>
<td></td>
<td></td>
<td>Term Offered: Fall Term</td>
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<td>Course Type(s): None</td>
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<tr>
<td></td>
<td>language that provides the background necessary to understand</td>
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<td></td>
<td>Introduction to the use of the UNIX operating system and its</td>
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<td>utilities for incremental and distributed program development,</td>
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<td>maintenance, and debugging. The course covers the UNIX shell,</td>
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<td>utilities, and program development tools that are used for large</td>
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<td></td>
<td>projects involving multiple developers on multiple machines. Three hours per</td>
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<td></td>
<td></td>
<td>week. Also listed as CS-370.</td>
</tr>
<tr>
<td>SE-356</td>
<td>Internet Technologies for Software Engineers</td>
<td>3</td>
<td>Spring Term</td>
<td>Prerequisites: CS-102 and CS-176 or CS-275.</td>
</tr>
<tr>
<td></td>
<td>Provides an intensive look at the leading-edge technologies</td>
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<td>Term Offered: Spring Term</td>
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<td>Course Type(s): None</td>
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<td></td>
<td>that are used to build Internet applications, what they do, and</td>
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<td>A practical introduction to the principles, methods, and tools required to</td>
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<td>create high-quality software applications for the distributed, client-server</td>
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<td>context of the Web. Emphasis is on architectural designs, and language</td>
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<td>and data access methods that are common in Web-based systems.</td>
</tr>
<tr>
<td>SE-357</td>
<td>Engineering Web-based Systems</td>
<td>3</td>
<td>Spring Term</td>
<td>Prerequisites: SE-205 and SE-207.</td>
</tr>
<tr>
<td></td>
<td>Engineering Web-based Systems</td>
<td></td>
<td></td>
<td>Term Offered: Spring Term</td>
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<td>Course Type(s): None</td>
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<td></td>
<td>A practical introduction to the principles, methods, and tools</td>
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<td>Introduction to the creation of computer/video games and the different</td>
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<td>artificial intelligence, algorithms, data structures, networking, software</td>
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<td></td>
<td></td>
<td></td>
<td>development cycles and human-computer interaction. Also listed as CS-360.</td>
</tr>
<tr>
<td>SE-360</td>
<td>Introduction to Game Development</td>
<td>3</td>
<td>Fall Term</td>
<td>Prerequisites: CS-205 passed with a grade of C or higher.</td>
</tr>
<tr>
<td></td>
<td>An introduction to the creation of computer/video games and the</td>
<td></td>
<td></td>
<td>Term Offered: Fall Term</td>
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<td>Course Type(s): None</td>
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<td>Introduction to the use of the UNIX operating system and its</td>
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<td></td>
<td>projects involving multiple developers on multiple machines. Three hours per</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>week. Also listed as CS-370.</td>
</tr>
<tr>
<td>SE-370</td>
<td>Program Development Under Unix</td>
<td>3</td>
<td>Spring Term</td>
<td>Prerequisites: CS-176 or CS-275.</td>
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<tr>
<td></td>
<td>Program Development Under Unix</td>
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<td>Term Offered: Spring Term</td>
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<td>Course Type(s): None</td>
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<tr>
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<td>Introduction to the use of the UNIX operating system and its</td>
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<td>projects involving multiple developers on multiple machines. Three hours per</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>week. Also listed as CS-370.</td>
</tr>
<tr>
<td>SE-398</td>
<td>Special Topics in Software Engineering</td>
<td>3</td>
<td>All Terms</td>
<td>As announced in the course schedule.</td>
</tr>
<tr>
<td></td>
<td>A 300-level intensive study of a particular subject or problem</td>
<td></td>
<td></td>
<td>Term Offered: All Terms</td>
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<td></td>
<td>Course Type(s): None</td>
</tr>
<tr>
<td></td>
<td>Engineering to be announced prior to registration. May be</td>
<td></td>
<td></td>
<td>Either a lecture-discussion or a seminar basis. Three or four hours per week.</td>
</tr>
</tbody>
</table>

**Course Type(s):** None

**Term Offered:** Spring Term

**Prerequisite:** SE-351.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Prerequisites</th>
<th>Term Offered</th>
<th>Course Type(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE-399</td>
<td>Independent Study in Software Engineering</td>
<td>1-3</td>
<td></td>
<td>All Terms</td>
<td>None</td>
</tr>
<tr>
<td>SE-402</td>
<td>Human Computer Interaction</td>
<td>3</td>
<td>Completion of forty-eight credits of coursework.</td>
<td>All Terms</td>
<td>IM</td>
</tr>
<tr>
<td>SE-403</td>
<td>Software Process Improvement</td>
<td>3</td>
<td>Prerequisite: CS-205.</td>
<td>Spring Term</td>
<td>None</td>
</tr>
<tr>
<td>SE-418</td>
<td>Software Project Management</td>
<td>3</td>
<td>Prerequisites: CS-176 or CS-275, and EN-101 and EN-102 or permission of the instructor.</td>
<td>Spring Term</td>
<td>WT</td>
</tr>
<tr>
<td>SE-485A</td>
<td>Software Practicum</td>
<td>3</td>
<td>Prerequisites: CS-205, SE-205, SE-207, and SE-312.</td>
<td>Fall Term</td>
<td>E5, RD</td>
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<tr>
<td>SE-485B</td>
<td>Software Practicum</td>
<td>3</td>
<td>Prerequisite: SE-485A.</td>
<td>Spring Term</td>
<td>E5, RD</td>
</tr>
<tr>
<td>SE-498</td>
<td>Special Topics in Software Engineering</td>
<td>3</td>
<td>As announced in the course schedule.</td>
<td>Fall Term</td>
<td>None</td>
</tr>
<tr>
<td>SE-499</td>
<td>Independent Study in Software Engineering</td>
<td>1-3</td>
<td>Prerequisite: None.</td>
<td>Spring Term</td>
<td>None</td>
</tr>
</tbody>
</table>

Independent Study of a particular subject or problem in software engineering under the guidance of a software engineering faculty member.