**COMPUTER SCIENCE**

**CMP SCI 1010 Introduction to Computers and the Internet: 3 semester hours**
Prerequisites: None. Covers basic concepts and components of a PC: survey of popular applications including e-mail, word processors, spreadsheets, overview of the Internet, popular browsers, World Wide Web, search engines, multimedia, web pages, security, and privacy. Credit not granted for both **CMP SCI 1010** and **INFSYS 1800**.

**CMP SCI 1011 Introduction to the Internet and World Wide Web: 3 semester hours**
Intended for any student wishing to utilize the Internet and World Wide Web more effectively. Topics include networking basics, the Internet and World Wide Web, browsers, search engines, Web Services, utilities, tools, online privacy and security. Students will learn to develop a personal web page using skills acquired in the course.

**CMP SCI 1012 Learning to Program Using Virtual Worlds: 3 semester hours**
Introduces modern programming principles without requiring the knowledge of a traditional programming language. Instead, this course utilizes a novel graphical approach that enables the student to create, populate, and manipulate virtual 3-dimensional worlds which resemble video games. The development of these worlds allows students to gain direct experience and skills in using computers to solve problems. Students will create worlds of varying complexity.

**CMP SCI 1250 Introduction to Computing: 3 semester hours**
Prerequisites: **MATH 1030** with B-or better, or **MATH 1100**, or **MATH 1800**. Provides an introduction to the concepts of computation, problem solving, and computer systems. Covers fundamental programming constructs, basic data types, and modularization using a modern high level language. Problem solving skills are developed through a progression of programming projects.

**CMP SCI 2250 Programming and Data Structures: 3 semester hours**
Prerequisite: **CMP SCI 1250**. Continuation of **CMP SCI 1250**. Discusses properties and implementation of abstract data types such as lists, trees, stacks and queues. Introduces procedural and class abstraction, basic program architecture, use of interfaces, modular programming, and file processing.

**CMP SCI 2261 Object-Oriented Programming: 3 semester hours**
Prerequisite: **CMP SCI 2250**. Introduces object-oriented concepts, terminology, and notation (UML) using Java. Covers encapsulation, classes, objects, inheritance, and the use of class libraries. Additional topics may include graphical user interfaces, applets, and related tools and technologies.

**CMP SCI 2700 Computer Organization and Architecture: 3 semester hours**
Prerequisite: **CMP SCI 2250**. Introduces details of computer systems from architectural and organizational points of view. Covers data representation, basic digital logic circuits, memory types and hierarchies, I/O and storage devices, CPU architectures such as RISC, CISC, parallel, and multi-core.

**CMP SCI 2750 System Programming and Tools: 3 semester hours**
Prerequisites: **CMP SCI 2250**. Covers systems programming, scripting, libraries, utilities, and development tools. Additional programming topics include piping, binary files, exception handling, command-line arguments and symbolic debugging. This course also explores tools available in the Unix/Linux environments.
**CMP SCI 3010 Web Programming: 3 semester hours**
Prerequisite: CMP SCI 2250. Provides a survey of current Web technologies including markup languages (such as HTML/XHTML, CSS, XML), client side languages (such as JavaScript), server side languages (such as PERL, PHP), and Web protocols. This course requires client-server computing projects.

**CMP SCI 3130 Design and Analysis of Algorithms: 3 semester hours**
Prerequisites: CMP SCI 2250, MATH 1320, and MATH 3000. This course addresses the design and analysis of fundamental algorithms in computer science. Studies basic sorting algorithms, priority queues, order statistics, search trees, and hash tables. Analysis techniques may involve time and space complexity analysis of both iterative and recursive algorithms, analysis of algorithm correctness, and amortized complexity analysis. Additional topics may include data compression, string manipulation, greedy algorithms, dynamic programming, and graph traversal.

**CMP SCI 3710 Assembly Language Programming: 3 semester hours**
Prerequisite: CMP SCI 2700. Explores machine architecture concepts and principles through a study of assembly language programming. Topics covered include integer and floating point arithmetic, procedures, conditional processing, strings, macros, and interfaces to high level languages. Programming projects using a commercially available assembly language will be required.

**CMP SCI 4010 Advanced Web Development with Java: 3 semester hours**
Prerequisites: CMP SCI 2261 and CMP SCI 3010, or consent of instructor. Covers more advanced Java topics, along with related concepts and technologies for Web development. Topics may include database connectivity, multi threading, security, networking, MVC pattern, testing and source control for Java applications, and server-side topics such as servlets and web servers.

**CMP SCI 4012 Introduction to Enterprise Web Development: 3 semester hours**
Prerequisites: CMP SCI 4010. This course covers design and implementation issues for enterprise web development, and some popular advanced technologies. Topics include MVC and persistence frameworks, such as Spring and Hibernate. Other topics may include Java Web services, EJB, messaging standards such as JMS, and Java EE design patterns. Students will develop enterprise-level web application projects. Credit cannot be earned for both CMP SCI 4012 and CMP SCI 5012.

**CMP SCI 4020 Introduction to Android Apps: Android Fundamentals: 3 semester hours**
Prerequisites: CMP SCI 4010, or consent of the instructor. This course covers the fundamental programming principles, software architecture and user experience considerations underlying handheld software applications and their development environments. Involves in-depth, hands-on examples, implemented on the Android Platform, and discussion of security. Credit not granted for both CMP SCI 4020 and CMP SCI 5020.

**CMP SCI 4030 Introduction to Intelligent Web: 3 semester hours**
Prerequisites: CMP SCI 2261, CMP SCI 2750, CMP SCI 3010, and CMP SCI 3130. Covers the application of artificial intelligence and other modern techniques to help construct, navigate, and experience the Web. Topics may include retrieval models, classification, mining, association, topology, and indexing algorithms such as PageRank and HITS. Credit cannot be earned for both CMP SCI 4030 and CMP SCI 5030.
**CMP SCI 4140 Theory Of Computation: 3 semester hours**  
Prerequisite: CMP SCI 3130. Provides an introduction to the theory of computation. Describes basic computational models, such as finite state machines, pushdown automata, Turing machines and grammars. Covers the concept of nondeterministic computation and the relationships between different computational models. Discusses decidability, reducibility, and classification of problems into complexity classes based on their time and space complexity, such as P, NP, and PSPACE.

**CMP SCI 4220 Introduction to iOS Programming and Apps: 3 semester hours**  
Prerequisites: CMP SCI 2261, CMP SCI 2750, and CMP SCI 3010. This course covers Objective-C and uses it for building iOS apps. It also introduces Xcode, Interface Builder, basic architectural patterns for MVC such as action, delegation, and outlets. Additional topics may include online services, mapping, persistence with core data, and single and multiple views.

**CMP SCI 4222 iOS Apps: 3 semester hours**  
Prerequisites: CMP SCI 4220 or consent of the instructor. This course focuses on building more sophisticated apps using Objective-C and the scripting language Swift. May include networking such as web services, Bluetooth and wifi connectivity, graphics and animation in 2-d and 3-d, autolayouts, OpenGL, advanced data sources such as plist and core data, source control and unit testing. May also discuss security topics. Credit not granted for both CMP SCI 4222 and CMP SCI 5222.

**CMP SCI 4250 Programming Languages: 3 semester hours**  
Prerequisite: CMP SCI 2261 and CMP SCI 3010 or Graduate Standing. Studies the principles, approaches, and trade-offs in modern programming languages, including a comparative study of syntax, semantics, and pragmatics. Examines major programming paradigms: object-oriented, imperative, functional and logic.

**CMP SCI 4280 Program Translation: 3 semester hours**  
Prerequisites: CMP SCI 2700, CMP SCI 2750, CMP SCI 3130, and CMP SCI 4250. Focuses on methods, techniques, and mechanisms used to create the abstraction from high level programming to machine level execution. This course also requires an individual, semester long project.

**CMP SCI 4300 Introduction to Artificial Intelligence: 3 semester hours**  
Prerequisites: CMP SCI 2261, CMP SCI 2750 and CMP SCI 3130. Provides an introduction to artificial intelligence. The list of topics may include search, planning, knowledge-based reasoning, probabilistic inference, machine learning, natural language processing, and practical applications.

**CMP SCI 4340 Introduction to Machine Learning: 3 semester hours**  
Prerequisites: CMP SCI 2261, CMP SCI 2750 and CMP SCI 3130. Provides an introduction to machine learning in the context of applications such as data mining, natural language processing, and adaptive computer systems. The course reviews several supervised, unsupervised, and reinforcement machine learning techniques such as naive Bayes networks, clustering, and decision trees. Selected concepts in computational learning theory may also be covered. Credit cannot be granted for both CMP SCI 4340 and CMP SCI 5340.

**CMP SCI 4410 Computer Graphics: 3 semester hours**  
Prerequisites: CMP SCI 2750 and CMP SCI 3130. Covers the theoretical foundation and algorithms for computer graphics. Students learn the basics of graphics programming for modeling, rendering, and animation of 2D and 3D objects. Vector and raster graphics, and different display devices are also discussed. A brief discussion of special graphics hardware, such as GPU, may be presented.
**CMP SCI 4420 Introduction to Digital Image Processing: 3 semester hours**
Prerequisites: CMP SCI 2750 and CMP SCI 3130. Focuses on image analysis and visual perception. Students learn data structures and algorithms for image processing, region and texture analysis, image filtering, edge detection, contour following, and image enhancement in both spatial and frequency domain. Other topics may include color processing, coding for storage, retrieval, transmission, and image restoration. Credit cannot be granted for both CMP SCI 4420 and CMP SCI 5420.

**CMP SCI 4500 Introduction to the Software Profession: 3 semester hours**
Prerequisite: CMP SCI 2261, CMP SCI 2700, CMP SCI 2750, CMP SCI 3010, and CMP SCI 3130. Focuses on software development and on the skills required for success in the software profession. Topics related to software development may include software process, models and views, software architectures, documentation, and testing strategies. Topics related to the profession may include ethics, licensing, copyright, trademarks, and professional conduct. Individual and group projects, research, and presentations may be required in this capstone course.

**CMP SCI 4520 Introduction to Object-Oriented Analysis And Design: 3 semester hours**
Prerequisite: CMP SCI 2261, CMP SCI 3010, CMP SCI 3130. Covers object-oriented development, illustrated with a visual modeling language and following an agile process. Discusses elements of analysis, requirements, design, implementation, and deployment such as use cases, static and dynamic diagrams, patterns, and frameworks. This course includes a semester long project starting with requirements and culminating with deployment. Credit not granted for both CMP SCI 4520 and CMP SCI 5520.

**CMP SCI 4610 Database Management Systems: 3 semester hours**
Prerequisites: CMP SCI 2750 and MATH 3000. Focuses on database theory and applications, with emphasis on the relational model. Topics include database design, modeling, file systems, indexing, integrity constraints, relational algebra, normalization, transaction processing, and concurrency control. Students are exposed to emerging DBMS technologies and applications. Several programming projects will be required, using a popular SQL server.

**CMP SCI 4700 Computer Forensics: 3 semester hours**
Prerequisites: CMP SCI 2700, CMP SCI 2750, and CMP SCI 3010. This course explores topics and methodologies for examining digital evidence, along with some principles of the investigative process. Includes memory, file system, operating system, network, and mobile device forensics. Addresses both theory and hands-on aspects for conducting digital forensic examinations.

**CMP SCI 4710 Mobile and Ubiquitous Computing: 3 semester hours**
Prerequisites: CMP SCI 2261. This course provides an introduction to the rapidly developing field of ubiquitous computing while at the same time exploring more focused topics in the three main categories of this field, namely systems, experience, and sensors. Explores setting up the infrastructure, privacy issues, evaluation of field applications, internationalization, user interfaces, and geolocation analysis.

**CMP SCI 4730 Computer Networks and Communications: 3 semester hours**
Prerequisites: CMP SCI 2750 and MATH 1320. This course provides a broad overview of computer networks and communications. Covers the fundamental principles and protocols across the whole layering structure of the Internet protocol stack. A top-down approach covers multiple topics including network application layer, transport layer, network layer, link layer, and physical layer protocols. May also include a range of related technologies such as WWW, HTTP, FTP, DNS, SMTP, TCP, UDP, ICMP, IPv4, IPv6, OSPF, RIP, BGP, IEEE 802.11 (WiFi), cellular networks, LANs, Ethernet, CSMA/CD, CDMA, multimedia networking, network management, and security in Internet.
**CMP SCI 4750 Introduction to Cloud Computing: 3 semester hours**
Prerequisites: CMP SCI 2750. This course provides an introduction to development and deployment of applications in the cloud space. Touches on different aspects of cloud computing such as IaaS, PaaS, and SaaS. Includes significant discussion on legal and security aspects of clouds in the marketplace. May also include public, private, and hybrid clouds, and Internet of Things. Credit not granted for both CMP SCI 4750 and CMP SCI 5750.

**CMP SCI 4760 Operating Systems: 3 semester hours**
Prerequisites: CMP SCI 2700, CMP SCI 2750, and CMP SCI 3130. Covers the structure of a generic operating system, considering in detail the algorithms for interprocess communication, process scheduling, resource management, memory management, file systems, and device management. Presents examples from contemporary operating systems. This course also requires practical projects implemented within a modern operating system or simulator environment.

**CMP SCI 4780 Computer and Network Security: 3 semester hours**
Prerequisite: CMP SCI 2750. This course provides a broad overview of computer and network security technologies and concerns from multiple perspectives, such as cryptography, Public Key Infrastructures (PKI), hashes and message digests, computer viruses and malware, email security, TCP/IP security, IPSec, Secure Socket Layer (SSL), Transport Layer Security (TLS), Virtual Private Networks (VPN), Firewall, AAA (Authentication, Authorization, Accounting), wireless and mobile systems security, secure identifications (IDs), cloud security, privacy and integrity, network attacks, system monitoring, and Intrusion Detection System (IDS). Management and human factors related to security will also be discussed.

**CMP SCI 4782 Information Security: 3 semester hours**
Prerequisites: CMP SCI 4730 or CMP SCI 4780 or consent of instructor. This course covers topics related to maintaining security in an organizational infrastructure, including risk analysis of the environment, access level and control including multi-factor authentication, and detection capabilities to ensure adequate security monitoring. Additional topics may include network level protections, firewalls, intrusion detection/prevention systems, securing web and mobile applications, securing cloud implementations, and overall architectural considerations for system security. Credit not granted for both CMP SCI 4782 and CMP SCI 5782.

**CMP SCI 4880 Individual Studies: 1-3 semester hours**
Prerequisites: Consent of the instructor. This course allows a student to pursue individual studies under the supervision of a faculty member. It may include development of a software project. The course may be repeated for credit.

**CMP SCI 4890 Topics in Computer Science: 3 semester hours**
Prerequisites: Consent of the Instructor. Covers a special topic in computer science to be determined by recent developments in the field and the interests of the instructor. Course may be repeated for credit.

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Last update: July 10, 2015