COMPUTER SCIENCE (CS)

CS-501A   Computer Programming Essentials   Credits: 3
Term Offered: All Terms
Course Type(s): TPS
An introduction in computer programming for newly admitted graduate students. Students will learn basic concepts in modern computer programming. Students will complete all the programming exercises and assignments in the modern objected-oriented language.

CS-501B   Program Development   Credits: 3
Prerequisite(s): CS-501A passed with a grade of B- or higher
Term Offered: All Terms
Course Type(s): None
Continuation at the coverage of the same modern object-oriented language introduced in CS-501A. More advanced object-oriented design, including inheritance and polymorphism.

CS-502   Theoretical Foundations of Computer Science   Credits: 3
Term Offered: All Terms
Course Type(s): None
Concepts, methods, models, and associated computer exercises for important topics in discrete mathematics and probability. Includes: 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, graph theory, moments, random variables, and graph algorithms. Limited to Computer Science majors.

CS-503   Data Structures and Algorithms   Credits: 3
Prerequisite(s): CS-501B passed with a grade of B- or higher
Term Offered: All Terms
Course Type(s): None
Design and implementation of fundamental data structures and algorithms, including: linked lists, hashing, sorting, trees, stacks, queues, sets and bags, and recursion. Application to problem solving and object-oriented design of moderate-sized programs.

CS-505   Operating Systems Concepts   Credits: 3
Prerequisite(s): CS-503 passed with a grade of B- or higher
Term Offered: All Terms
Course Type(s): None
The basic concepts of operating systems from the point of view of an advanced user: the interaction of the kernel, the command interpreter, and user processes. Focus is on process and resource management, concurrency control, and inter-process communication. Examples and projects are based mainly on Unix. The course also includes an introduction to computer architecture from an operating-systems perspective (processors, devices, interrupts, clocks, etc.).

CS-509   Advanced Object-Oriented Programming and Design   Credits: 3
Prerequisite(s): CS-501B passed with a grade of B- or higher
Term Offered: Spring Term
Course Type(s): None
Object-oriented programming and design, using a language different from that used in CS 501B. Used in classes, inheritance, polymorphism, and libraries.

CS-512   Algorithm Design   Credits: 3
Prerequisite(s): CS-502 and CS-503 both passed with a grade of B- or higher
Term Offered: Spring Term
Course Type(s): CISEL
Design and analysis of algorithms; dependence of algorithm efficiency on data structure choice; correctness of algorithm implementation and basic design techniques and their applications to programming with fundamental data structures.

CS-514   Networks   Credits: 3
Prerequisite(s): CS-501A
Term Offered: All Terms
Course Type(s): CISEL
An introductory-level course on the hierarchy of networking software and hardware. Particular emphasis on Medium Access Control, Network layer, Transport layer, and Session layer. Several MAC-layer protocols, TCP/IP. Also listed as MIS-514. Prerequisite: CS-501A

CS-517   Database Design and Management   Credits: 3
Prerequisite(s): CS-503 passed with a grade of B or higher
Term Offered: All Terms
Course Type(s): CISEL
Introduction to database systems, data modeling, design theory and methodologies, query languages and query processing. Coverage of relational database model and design, normalization process, SQL, hands-on database design and application development. Also listed as MIS-517.

CS-518   Fundamentals of Computer Security and Cryptography   Credits: 3
Prerequisite(s): CS-514 or MIS-514 passed with a grade of B- or higher
Term Offered: Fall Term
Course Type(s): CISEL
An introduction to computer security and its related issues, including cryptography. It covers threats assessment, security policies, basic cryptography, security mechanisms, and assurance. Also includes several case studies on enhancing the security level of specific systems by integrating different security mechanisms and techniques. Both theoretical and practical issues are addressed in the course. Students who successfully complete this course will be capable of assessing the threats, enhancing the security, and evaluating the assurance level of specific computer systems.

CS-520   Introduction to Intelligent Systems   Credits: 3
Prerequisite(s): CS-502 and CS-503 both passed with a grade of B- or higher
Term Offered: All Terms
Course Type(s): CISEL
Introduction to methods and algorithms used to incorporate intelligence into computer programs. Topics include search techniques, representation and reasoning, and machine learning. Applications of these methods are stressed. Also covers implementation of some of the fundamental algorithms.

CS-521   Artificial Intelligence   Credits: 3
Prerequisite(s): CS-503 and CS-520 both passed with a grade of B- or higher
Term Offered: Spring Term
Course Type(s): None
Basic and advanced methods in symbolic and quantitative artificial intelligence through Lisp programming techniques. Current issues concerning rule-based vs. statistical methods via applications.

CS-522   Knowledge Fusion   **Credits: 3**
Prerequisite(s): CS-517 or CS-520 passed with a grade of B- or higher.
Course Type(s): CISEL
Coverage of the fundamental techniques for integrating information from heterogeneous sources to obtain actionable knowledge. The sources of information include databases, files, and Web pages. Covered techniques include both those based upon logic and also approaches based on probabilistic reasoning.

CS-525   Simulation   **Credits: 3**
Prerequisite(s): CS-502, CS-503, and CS-514 all passed with a grade of B- or higher
Term Offered: Spring Term
Course Type(s): None
Formal models of discrete event systems, computer simulation of models, and analysis of simulation results. Discrete event simulation is applied to studying the performance of computer and communication systems. Object-oriented design and programming in C++.

CS-529   Web Services and .NET   **Credits: 3**
Prerequisite(s): CS-503 passed with a grade of B- or higher
Term Offered: Spring Term
Course Type(s): CISEL
Introduction to Web services. Theoretical and practical coverage of client-server architecture, communication protocols, and messaging, including XML and SOAP transactions. .NET Framework architecture is used for the applications. We contrast with other platforms, e.g., Java-based Web services. Students implement Web services and simple clients on PCs or mobile devices.

CS-532   Compiler Design   **Credits: 3**
Prerequisite(s): CS-512 passed with a grade of B- or higher
Term Offered: Spring Term
Course Type(s): CISEL
The major techniques used in compiler writing, lexical analysis, syntax analysis, storage management, error detection and recovery, and code generation. Tools for compiler writing (LEX, YACC, etc.).

CS-533   Database System Implementation   **Credits: 3**
Prerequisite(s): CS-502 and CS-503 both passed with a grade of B- or higher
Term Offered: Fall Term
Course Type(s): CISEL
DBMS architecture, data storage and indexing, query processing and optimization, transaction management and recovery, and some issues related to advanced database applications.

CS-535   Telecommunications   **Credits: 3**
Prerequisite(s): CS-502, CS-505, and CS-514 all passed with a grade of B- or higher
Term Offered: Fall Term
Course Type(s): None
In-depth coverage of the lower layers of the network hierarchy: Physical layer, Data Link layer, Network layer, and Transport layer.

CS-536   File Management and Query Strategies   **Credits: 3**
Prerequisite(s): CS-503 passed with a grade of B or higher
Term Offered: Summer Term
Course Type(s): None
Addresses data storage and organization, file management principles, and query processing and applications. Students will gain hands-on experience in file processing and application development.

CS-550   Computer System Architecture   **Credits: 3**
Prerequisite(s): CS-502 and CS-503 both passed with a grade of B- or higher
Term Offered: Spring Term
Course Type(s): None
Computer system interconnection structures, central processing unit, control unit, microprogrammed control, memory organization, cache and virtual memory, computer arithmetic, RISC processors, introduction to parallel processing, and case studies.

CS-588   Computer Science Practice and Experiences   **Credits: 1**
Prerequisite(s): 18 credits in Computer Science or Software Engineering
Term Offered: All Terms
Course Type(s): None
Provides opportunity for Computer Science graduate students to obtain related experience in employment at a local company or institution with Monmouth University sponsorship. Available to Computer Science graduate students who have completed at least eighteen credit hours of graduate courses (500 level), with a minimum GPA of 3.00. Does not satisfy elective requirements. Students may take the course a maximum of two times. This is a pass/fail course. Departmental approval is required to take this course.

CS-598   Special Topics in Computer Science   **Credits: 3**
Term Offered: All Terms
Course Type(s): CISEL
Subject matter varies with the interest of the students and of the professor teaching the course. The exact nature of the topic covered in any given semester is indicated in the student's transcript.

CS-599   Independent Study in Computer Science   **Credits: 3**
Term Offered: All Terms
Course Type(s): None
Independent study in a topic not substantially treated in a regular graduate course, for students with superior ability; weekly consultation. Prior permission of directing professor and the graduate program director is required to take this course. This course can only be taken once for credit. Completion of all foundation and core courses and a minimum G.P.A. of 3.50 is required to take this course.

CS-611   Secure Web Services Design   **Credits: 3**
Prerequisite(s): CS-501B passed with a grade of B- or higher
Term Offered: Spring Term
Course Type(s): CISEL
Web applications present a complex set of security issues for architects, designers, and developers. The most secure and hack-resilient Web applications are those that have been built from the ground up with security in mind. This course focuses on principles of secure Web applications design. Topics include threats and counter measures, security in Web service frameworks, session control, access control, and data protection. Also listed as SE-611.

CS-612   Ethical Hacking   **Credits: 3**
Prerequisite(s): CS-518
Course Type(s): CISEL
Introduce penetration testing methodologies and ethical hacking tools. Discuss the importance of protecting corporate and government data from cyber-attacks. Learn advanced computer security resources that address new vulnerabilities and innovative methods to protect networks.

CS-613   Digital Forensics   **Credits: 3**
Prerequisite(s): CS-518
Term Offered: Spring Term
Course Type(s): CISEL
Introduce digital forensic fundamentals. Focus on discovering, authenticating, and analyzing digital evidence.

CS-618   Data Mining   **Credits: 3**
Prerequisite(s): CS--517 and CS-520 both passed with a grade of B- or higher
Term Offered: Spring Term
Course Type(s): CISEL
An introduction to the fundamental concepts, algorithms, and techniques of data mining. Topics include: data preprocessing, classification algorithms and techniques, anomaly detection, and the design of data warehousing and OLAP systems.

CS-620   Applied Machine Learning   **Credits: 3**
Prerequisite(s): CS-503
Term Offered: All Terms
Course Type(s): CISEL
This course introduces basic and advanced machine learning techniques via various applications in finance, healthcare, image recognition and other fields. Topics include classification and regression supervised learning algorithms, unsupervised learning algorithms, and algorithm performance evaluation and validation.

CS-625   Internet Crawler   **Credits: 3**
Prerequisite(s): CS-529 passed with a grade of B- or higher
Term Offered: Spring Term
Course Type(s): CISEL
In-depth coverage of the crawler component of modern search engines. Examination of the architecture of crawlers; algorithms for visitation, retrieval and processing of Web pages, and link analysis (e.g., PageRank computation). Coverage of ethical and legal issues of customized Web robots. Students build automatic Internet crawlers.

CS-628   Security of E-Systems and Networks   **Credits: 3**
Prerequisite(s): CS-518 passed with a grade of B- or higher
Term Offered: Spring Term
Course Type(s): CISEL
The fundamental techniques in security of e-based Systems and Computer Networks. E-based systems are ubiquitous in the modern world with applications spanning e-commerce, e-government, e-services, Virtual Private Networks (VPNs), health care, and government organizations. Deals with the fundamental concepts and tools of security of e-based systems and computer networks and its range of applications. The topics to be covered include: authentication of users, system integrity, confidentiality of communication, availability of business service, non-repudiation of transactions, public key cryptosystems, authentication and digital signature, e-security tools such as Public Key Infrastructure (PKI) systems, biometric-based security systems, trust management systems in communication networks, intrusion detection systems, protecting against malware, and computer network security risk management. Intended for graduate students in computer science, software engineering, and electrical engineering who have some background in computer networks and fundamentals of computer security.

CS-635   Wireless Network Systems and Security   **Credits: 3**
Prerequisite(s): CS-514 passed with a grade of B- or higher
Term Offered: Spring Term
Course Type(s): CISEL
Fundamental techniques in the design, operation, performance evaluation, and security of wireless network systems. Among the topics covered are first, second, third, and fourth generation wireless systems, cellular wireless networks, medium access techniques, physical layer, protocols (AMPS, IS-95, IS-136, GSM, GPRS, EDGE, WCDMA, cdma2000, etc.), fixed wireless systems, personal area networks (PANs) including Bluetooth and Home RF systems, wireless local area network(WLAN) technologies, architectures, protocols, and standards, and advanced topics. Security of WLANs, wireless sensor networks (WSNs), cellular systems, and Bluetooth and Home RF networks will be dealt with as well. Intended for graduate students in computer science, software engineering, and electrical engineering who have some background in computer networks.

CS-655   Cloud Computing - Concepts, Technology and Architecture
                                                                  Credits: 3
Prerequisite(s): CS-503
Term Offered: Summer Term
Course Type(s): CISEL
This course will introduce students to proven and mature cloud computing technologies and practices into a series of well-defined concepts, models, and technology mechanisms and architectures. Case studies will be presented to applying the concepts to practical applications. Also listed as SE-655.

CS-661   Computer Science Advanced Project   **Credits: 3**
Term Offered: All Terms
Course Type(s): CISEL
A challenging project, such as the development of a large, complex program, done under the supervision of a faculty member.

CS-691   Computer Science Thesis I   **Credits: 3**
Term Offered: All Terms
Course Type(s): None
Independent investigation of special topics reflecting the research interests of the sponsoring professor. Provides students with an opportunity to do extended relevant research in collaboration with, or under the supervision of, a faculty member. Sequential registration of one or more credits is required until successful completion. (Minimum of six credits must be accumulated.) Completion of all foundation and core courses and departmental approval is required to take this course.

CS-692   Computer Science Thesis II   **Credits: 3**
Prerequisite(s): CS-691
Term Offered: All Terms
Course Type(s): None
Independent investigation of special topics reflecting the research interests of the sponsoring professor. Provides students with an opportunity to do extended relevant research in collaboration with, or under the supervision of, a faculty member. Sequential registration of one or more credits is required until successful completion. (Minimum of six credits must be accumulated.)

CS-698   Advanced Special Topics   **Credits: 3**
Prerequisite(s): CS-503 passed with a grade of B- or higher or as
announced in the course schedule
Course Type(s): CISEL
The advanced subject matter varies with the interest of the students
and of the professor. The full syllabus for a specific offering will be filed
with the STE and Graduate School Deans when it is scheduled. The exact
nature of the topic covered in any given semester is indicated in the
student's transcript.

CS-699   Independent Study in Computer Science   **Credits: 3**
Term Offered: All Terms
Course Type(s): CISEL
Independent study of a subject not substantially treated in a regular
graduate course. Designed for students with superior abilities who, with
guidance and direction from the supervising faculty member, can master
a new subject. (Limited to students who have not yet taken CS-699.) A
minimum G.P.A. of 3.50, completion of all foundation and core courses
and departmental approval are required to take the course.