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 object-oriented language.

CS-501B  Program Development  Credits: 3
Prerequisite: 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: 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: 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: CS-501B, passed with a grade of B- or higher.
Term Offered: Fall 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-511  Technical Communication  Credits: 3
Prerequisite: Open only to those students accepted in the MS program in Computer Science.
Course Type(s): CISEL
Preparation, analysis, synthesis, and presentation of system documentation, technical papers, and data flow diagrams; literature search.

CS-512  Algorithm Design  Credits: 3
Prerequisites: 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
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.

CS-517  Database Design and Management  Credits: 3
Prerequisite: 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: 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
Prerequisites: CS-502 and CS-503, both passed with a grade of B- or higher.
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
Prerequisites: CS-503 and CS-520, both passed with a grade of B- or higher.
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
Prerequisites: CS-517 and CS-520, both passed with a grade of B- or higher.
Term Offered: All Terms
Course Type(s): None
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-523 Networked Information Systems Credits: 3
Prerequisites: CS-505 and CS-517, both passed with a grade of B- or higher.
Course Type(s): None
Basic principles, techniques, and tools for building networked information systems with a significant database component. Current protocols, languages, and data formats.

CS-525 Simulation Credits: 3
Prerequisites: 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-526 Performance Evaluation Credits: 3
Prerequisites: CS-501B, CS-502, and CS-514, all passed with a grade of B- or higher.
Term Offered: All Terms
Course Type(s): None
The role of performance evaluation in the product lifecycle. Introduction to Markov chains and elementary queuing theory; complementary roles of analytic and simulation methods and applications to performance evaluation of computer and communication systems.

CS-528 Database and Transactions Security Credits: 3
Prerequisites: CS-517 and CS-518, both passed with a grade of B- or higher.
Term Offered: All Terms
Course Type(s): None
An overview of the methodologies to protect data. It covers both traditional and emerging security mechanisms and services, as well as the common threats and vulnerabilities of database and transaction processing systems. The topics include: discretionary and mandatory access controls in database systems, secure database design, data integrity, secure transaction processing, inference controls, and auditing. Also covers security models for relational and object-oriented databases, and security of databases in a distributed environment. Both theoretical and practical issues will be addressed in the course.

CS-529 Web Services and .NET Credits: 3
Prerequisite: CS-503 passed with a grade of B- or higher.
Term Offered: All Terms
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-530 Knowledge-Based Systems Credits: 3
Prerequisites: CS-502 and CS-509, both passed with a grade of B- or higher.
Course Type(s): CISEL
Fundamental techniques in building knowledge-based systems using logic programming technology; applications of knowledge-based systems; Prolog programming techniques; using advanced Prolog programming environments.

CS-531 Intelligent Interfaces Credits: 3
Prerequisites: CS-503 and CS-520, both passed with a grade of B- or higher.
Course Type(s): CISEL
Computer-human interfaces that use speech understanding and image processing (such as handwriting).

CS-532 Compiler Design Credits: 3
Prerequisite: CS-512, passed with a grade of B- or higher.
Term Offered: All Terms
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
Prerequisites: 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
Prerequisites: 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: CS-503 passed with a grade of B or higher.
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-537  Client-Server Interfaces  Credits: 3
Prerequisites: CS-505, CS-509, and CS-514, all passed with a grade of B- or higher.
Course Type(s): CISEL
Design of client-server systems. This is a project-dominated course. Students from the AI stream will design and implement a distributed client-server system for some AI application, while students from the COMPUTER NETWORKS stream will be more involved in Transport layer issues. Coverage of the higher layers of the network hierarchy: Transport layer, Session layer, and Application layer. Programming with TCP and UDP.

CS-540  Model Building and Algorithms  Credits: 3
Prerequisites: CS-502, CS-503, and CS-514, all passed with a grade of B- or higher.
Term Offered: All Terms
Course Type(s): None
Solving real-world problems requires skills in model-building, model-selection and the application of appropriate algorithms. The applicable field of knowledge is basically Operations Research (OR). We discuss optimization (linear/integer programming, branch and bound, game theory), network and queuing models, and algorithms that may be applied in the solution of many practical problems arising, for example, in business, government, and private settings.

CS-545  Graphics  Credits: 3
Prerequisite: CS-509 passed with a grade of B- or higher.
Course Type(s): CISEL
Drawing with a graphics kernel, 2D and 3D transformations, view transformation, area filling, line and polygon clipping, hidden surface algorithms, curves and surfaces, Gouraud and Phong shading, pattern and texture mapping, fractals, and rendering using a ray-tracer.

CS-550  Computer System Architecture  Credits: 3
Prerequisites: CS-502 and CS-503, both passed with a grade of B- or higher.
Term Offered: All Terms
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-551  Parallel Processing  Credits: 3
Prerequisite: CS-550, passed with a grade of B- or higher.
Term Offered: All Terms
Course Type(s): None
Parallel computer paradigms, parallel processing application, conditions of parallelism, scalable computer platforms, parallelism issues, performance metrics and benchmarking, speedup performance laws for parallel systems, parallel memory organization, interconnection networks, multiprocessing and multiprocessors, multicomputers, massively parallel systems, mapping applications to parallel systems, and case studies.

CS-560  Master's Seminar  Credits: 3
Prerequisite: Completion of twenty-one credits toward the MS degree, including four core courses, or permission of the instructor.
Course Type(s): CISEL
Emphasis on preparation, analysis, synthesis, and presentation of software system documentation, project progress reports, and technical papers based on literature research.

CS-588  Computer Science Practice and Experiences  Credits: 1
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.

CS-598  Special Topics in Computer Science  Credits: 3
Prerequisites: CS-502 and CS-503, both passed with a grade of B- or higher.
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-618  Data Mining  Credits: 3
Prerequisites: 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-625  Internet Crawler  Credits: 3
Prerequisite: CS-529, passed with a grade of B- or higher.
Term Offered: All Terms
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-627  Quantitative Systems Engineering  Credits: 3
Prerequisite: CS-526, passed with a grade of B- or higher.
Term Offered: All Terms
Course Type(s): None
Development of methods and techniques for analyzing the performance of complex systems. Application to the performance engineering of computer/communications systems, including distributed computing/information systems and integrated telecommunications.
CS-628 Security of E-Systems and Networks  Credits: 3  
Prerequisite: CS-518, passed with a grade of B- or higher.  
Term Offered: All Terms  
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: CS-514, passed with a grade of B- or higher.  
Term Offered: All Terms  
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-661 Computer Science Advanced Project  Credits: 3  
Prerequisites: Completion of all foundation and core courses and departmental approval.  
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  
Prerequisites: Completion of all foundation and core courses and departmental approval.  
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-692 Computer Science Thesis II  Credits: 3  
Prerequisite: 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: CS-503, passed with a grade of B or higher or as announced in the course schedule.  
Term Offered: All Terms  
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  
Prerequisites: A minimum GPA of 3.50; completion of all foundation and core courses and departmental approval.  
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.)