DEPARTMENT OF COMPUTER SCIENCES AND ELECTRICAL ENGINEERING

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Programs

- Computer and Information Security, B.S. (http://catalog.marshall.edu/undergraduate/programs-az/engineering-computer-sciences/computer-sciences-electrical-engineering/computer-information-security-bs/)
- Computer and Information Security, Minor (http://catalog.marshall.edu/undergraduate/programs-az/engineering-computer-sciences/computer-sciences-electrical-engineering/computer-information-security-minor/)
- Computer and Information Technology, B.S. (http://catalog.marshall.edu/undergraduate/programs-az/engineering-computer-sciences/computer-sciences-electrical-engineering/computer-information-technology-bs/)
- Computer Science, Accelerated Graduate Degree (http://catalog.marshall.edu/undergraduate/programs-az/engineering-computer-sciences/computer-sciences-electrical-engineering/computer-science-accelerated-graduate-degree/)
- Computer Science, B.S. (http://catalog.marshall.edu/undergraduate/programs-az/engineering-computer-sciences/computer-sciences-electrical-engineering/computer-science-bs/)
- Computer Science, Minor (http://catalog.marshall.edu/undergraduate/programs-az/engineering-computer-sciences/computer-sciences-electrical-engineering/computer-science-minor/)
- Cybersecurity, Accelerated Graduate Degree (http://catalog.marshall.edu/undergraduate/programs-az/engineering-computer-sciences/computer-sciences-electrical-engineering/cybersecurity-accelerated-graduate-degree/)
- Data Science, Accelerated Graduate Degree (http://catalog.marshall.edu/undergraduate/programs-az/engineering-computer-sciences/computer-sciences-electrical-engineering/data-science-accelerated-graduate-degree/)
- Electrical and Computer Engineering, B.S.E.E. (http://catalog.marshall.edu/undergraduate/programs-az/engineering-computer-sciences/computer-sciences-electrical-engineering/electrical-computer-engineering-bsee/)
- Pre-Computer Science (http://catalog.marshall.edu/undergraduate/programs-az/engineering-computer-sciences/computer-sciences-electrical-engineering/pre-computer-science/)

Courses

- General Education Course

Computer and Information Technology

CIT 150 Spreadsheet and Database Apps **3 Credit hours**
Comprehensive coverage of spreadsheets and databases. Includes techniques to collect, manage, and analyze data; solve problems; and effectively communicate results for scientific research. Includes macro development and introduction to scripting.
Grade Mode: Normal Grading Mode

CIT 163 Intro to Programming: C++ **3 Credit hours**
Concepts of software development and maintenance using C++, including syntax of the language, loops, functions, pointers, decision structures, and file processing. Proper program design using object-oriented programming techniques are emphasized.
Grade Mode: Normal Grading Mode

CIT 260 Instrumentation **3 Credit hours**
The course introduces students to modern data gathering methods, laboratory instrumentation, and programming. Focuses range from transportation development, forensics, to environmental issues.
Grade Mode: Normal Grading Mode

CIT 263 Web Programming I **3 Credit hours**
Students will learn techniques for creating advanced documents and programs for the Web using HTML, DHTML, XML, JavaScript, and PHP scripting. Students will also learn how to install and maintain a Web server.
Grade Mode: Normal Grading Mode

CIT 264 Technology Foundations **3 Credit hours**
This course introduces the student to the common hardware and technology that pervades business and society as a whole. Topics include pc's, networks, software, the internet, cellular phones, etc.
Grade Mode: Normal Grading Mode

CIT 265 C# NET Programming **3 Credit hours**
Covers the essentials for developing robust and secure applications using C#, Windows forms, and the .NET framework. Also covers ADO.NET, writing secure .NET applications and web services.
Pre-req: IST 236 or CIT 236 or CS 120.
Grade Mode: Normal Grading Mode

CIT 266 Applied C++ Programming **3 Credit hours**
Designed to teach students intermediate C++ programming through an applied approach with examples and applications. The course extends topics covered in prerequisite courses. Prior programming knowledge in any language required.
Pre-req: CIT 163 with a minimum grade of D or CS 120 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CIT 280 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

CIT 281 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

CIT 282 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

CIT 283 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

CIT 285 Independent Study **1-4 Credit hours**
Independent study for selected freshmen and sophomores under supervision of faculty; may be repeated only once.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

CIT 301 Public Service Experience **1 Credit hour**
At least 30 contact hours in a public service/volunteer experience with a group, organization or agency that offers a service to the general public. Advisor permission required.
Grade Mode: Credit/No Credit Grade Only

CIT 313 Web Programming II **3 Credit hours**
The second semester of a two course sequence on Web programming. This course focuses on server-side programming and databases. Topics covered include PHP, mySQL, web services, and security.
Pre-req: CIT 263 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CIT 332 Software Engineering I **3 Credit hours**
Introduction to the industrial process of software systems development. The course covers project management and planning risk management issues; software quality and configuration issues; and processes, methods, and development tools.
Pre-req: CIT 236 or IST 236 or CS 120.
Grade Mode: Normal Grading Mode

CIT 333 Software Engineering II **3 Credit hours**
Second course in a two course sequence. Covers the system development life cycle: requirement analysis and specifications; design methods; system implementation and integration; testing; and reuse issues. Team project participation.
Pre-req: CIT 332 with a minimum grade of D or IST 332 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CIT 340 Game Development I:2D **3 Credit hours**
Covers computer software industry, history and the role of a creative game development team. Students will participate in the game development process, including art, animation, programming, music, sound and writing.
Pre-req: CIT 236 or IST 236 or CS 120.
Grade Mode: Normal Grading Mode

CIT 352 Network Protocols and Admin **3 Credit hours**
This course provides students with knowledge of network terminology, structures, topologies, protocols, and inter-faces involving Local Area and Wide Area networks.
Pre-req: CIT 163 with a minimum grade of D or IST 163 with a minimum grade of D or CS 110 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CIT 365 Database Management **3 Credit hours**
To understand the logical and physical design of data stored and retrieved from a relational database. Exposure to distributed databases, database administration and structured query language will also be done.
Grade Mode: Normal Grading Mode

CIT 410 Electronic Commerce **3 Credit hours**
This course examines electronic commerce. Group decision making and collaborative applications through the Internet. Develop applications that retrieve and store information in distributed databases.
Pre-req: CIT 365 with a minimum grade of D or IST 365 with a minimum grade of D and CIT 313 with a minimum grade of D.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

CIT 413 iOS Development **3 Credit hours**
Students will learn to develop iOS applications using HTML5/ PhoneGap, Objective-C, and Swift, using Apple and third-party SDKs. Also covers basic concepts for designing intuitive and usable user-interfaces.
Pre-req: CIT 265.
Grade Mode: Normal Grading Mode

CIT 414 Android Development **3 Credit hours**
Students will learn to develop Android applications using Java and the Android SDK. Course covers user interfaces, audio integration, SQLite databases, location services, sensors, and custom graphics.
Pre-req: CIT 265 with a minimum grade of D.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

CIT 416 Advanced Web Programming **3 Credit hours**
Includes topics in XHTML, JavaScript Data Object Model, dynamic application of CSS rules to page elements, browser's support for XML, object-oriented PHP programming, server side graphics generation, web services.
Pre-req: CIT 365 with a minimum grade of D and CIT 313 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CIT 440 Computer Graphics for Gaming **3 Credit hours**
Fundamental concepts dealing with the display of graphic information on semi-interactive storage tube displays. The course includes techniques for hidden line display, hidden line removal, and two- and three-dimensional transformation.
Pre-req: CIT 236 with a minimum grade of D or IST 236 with a minimum grade of D or CS 120 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CIT 441 Game Development II:3D **3 Credit hours**
Covers state of the art techniques for computer game design and development with an emphasis on the 3D graphics and interaction through practical, example driven approaches of game development.
Pre-req: CIT 340 with a minimum grade of D or IST 360 with a minimum grade of D.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

CIT 443 Game Development III: AI **3 Credit hours**
Advanced concepts of game development with a focus on artificial intelligence. AI techniques covered including A* path finding algorithm, rule-based reasoning, reinforcement learning, neural networks, genetic algorithm, knowledge representation.
Pre-req: CIT 441 with a minimum grade of D or IST 439 with a minimum grade of D.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

CIT 446 3D Modeling and Animation **3 Credit hours**
Covers 3D modeling to create environments and character animation. Explores 3D forms within sculpture, architecture, animation and games. Includes development of simplifications, abstractions and hyper-realities for gaming.
Attributes: Digital Humanities, No Textbook Required
Grade Mode: Normal Grading Mode

CIT 447 Modeling/Simulation Dev **3 Credit hours**
Course applies fundamentals of game development to educational games or simulations within a virtual world. Explores virtual worlds, basic scripting/modeling techniques and role-playing simulations to teach any concept.
Pre-req: CIT 441 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CIT 448 Mobile Game Development **3 Credit hours**
Students will work in teams to develop games for mobile devices. Emphasis on mobile development tools, techniques, cross platform development, and standard practices, using open-source software.
Pre-req: CIT 340 with a minimum grade of D.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

CIT 466 Database Programming **3 Credit hours**
This course teaches students database programming available to relational database systems. Students will work with fourth generation languages to analyze, design and develop, and execute programs in a database environment.
Pre-req: CIT 365 or IST 365.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

CIT 470 Internship in CIT **3 Credit hours**
Capstone course in CIT. A professionally supervised internship within the student's area of emphasis in the Computer and Information Technology major. Must be pre-approved before registering.
Attributes: Capstone Course
Grade Mode: Normal Grading Mode

CIT 480 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

CIT 481 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

CIT 482 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

CIT 483 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

CIT 485 Independent Study **1-4 Credit hours**
Independent study for selected juniors and seniors under supervision of faculty; may be repeated only once.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

CIT 490 Capstone Project in CIT **3 Credit hours**
Capstone course in CIT. Students will plan, implement, and present a solution to a real-world problem within their emphasis demonstrating their technical and professional skills. Must be pre-approved before registering.
Attributes: Capstone Course
Grade Mode: Normal Grading Mode

Computer Science

CS 105 Expl World with Computing (CT) **3 Credit hours**
Central principles and big ideas of computing: problem-solving, computational and critical thinking, abstraction, creativity, reasoning, data, algorithms, recursion, visualization, and limits of computation. Solve real-world problems with computing.
Pre-req: ACT Math with a score of 17 or SAT Verbal Before March 16 with a score of 400 or SAT MATH SECTION SCORE with a score of 440 or Placement Math After SP17 with a score of 101 or MTH 102 with a minimum grade of C or MTH 102B with a minimum grade of C or MTH 127 with a minimum grade of C or MTH 130 with a minimum grade of C or MTH 132 with a minimum grade of C or MTH 229 with a minimum grade of C or MTH 229H with a minimum grade of C.
Attributes: Critical Thinking, Digital Humanities
Grade Mode: Normal Grading Mode

CS 110 Computer Science I **3 Credit hours**
Pre-req: ACT Math with a score of 24 or SAT Mathematics Before Mar. 16 with a score of 560 or SAT MATH SECTION SCORE with a score of 580 or MTH 127 or MTH 130 and MTH 132 (may be taken concurrently) or MTH 229 (may be taken concurrently) or MTH 229H (may be taken concurrently).
Concurrent PR: MTH 132 or MTH 229 or MTH 229H
Attributes: Digital Humanities
Grade Mode: Normal Grading Mode

CS 110H Computer Science Honors **3 Credit hours**
Object-oriented and algorithmic problem solving principles and techniques; programming with classes in an integrated programming environment; and program debugging.
Pre-req: ACT Math with a score of 24 or SAT Mathematics Before Mar. 16 with a score of 560 or SAT MATH SECTION SCORE with a score of 580 or MTH 127 or MTH 130 and MTH 132 (may be taken concurrently) or MTH 129 (may be taken concurrently) or MTH 129H (may be taken concurrently).
Concurrent PR: MTH 132 or MTH 129 or MTH 129H
Grade Mode: Normal Grading Mode

CS 120 Computer Science II **3 Credit hours**
Object-oriented analysis and design, advanced programming with classes, arrays, strings, sorting, searching, I/O, GUI development, system life cycle and software development methodologies. CR/PR: CS 110
Pre-req: CS 110 with a minimum grade of D or CS 110H with a minimum grade of D.
Attributes: Digital Humanities
Grade Mode: Normal Grading Mode

CS 205 Scientific Computing **3 Credit hours**
An introduction to computer programming, software design, and algorithm analysis and implementation. Abstract concepts illustrated with examples and exercises drawn from the mathematical and physical sciences. Primarily for non-CS majors.
Pre-req: MTH 140 or MTH 229 (may be taken concurrently) or MTH 229H (may be taken concurrently).
Concurrent PR: MTH 229 or MTH 229H
Grade Mode: Normal Grading Mode

CS 210 Data Structures and Algorithms **3 Credit hours**
Design and implementation of data structures including stacks, queues, lists, trees, heaps, balanced trees, and graphs. Other topics include hasing, threading, data parsing, program testing, correctness, efficiency, and exceptions.
Pre-req: CS 120 with a minimum grade of D and MTH 220 (may be taken concurrently) with a minimum grade of D.
Concurrent PR: MTH 220
Grade Mode: Normal Grading Mode

CS 215 Adv Data Struct and Algorithms **3 Credit hours**
Advanced techniques for designing and analyzing algorithms, including asymptotic analysis; data structures; divide-and-conquer algorithms and recurrences; greedy algorithms; dynamic programming; graph algorithms; randomized algorithms; and NP-complete problems.
Pre-req: CS 210 with a minimum grade of D and (MTH 229 with a minimum grade of D or MTH 229H with a minimum grade of D) and MTH 220 (may be taken concurrently) with a minimum grade of D.
Concurrent PR: MTH 220
Grade Mode: Normal Grading Mode

CS 280 Special Topics **1-4 Credit hours**
EMERGING TOPICS IN COMPUTER SCIENCE.
Grade Mode: Normal Grading Mode

CS 281 Special Topics **1-4 Credit hours**
EMERGING TOPICS IN COMPUTER SCIENCE.
Grade Mode: Normal Grading Mode

CS 282 Special Topics **1-4 Credit hours**
EMERGING TOPICS IN COMPUTER SCIENCE.
Grade Mode: Normal Grading Mode

CS 283 Special Topics **1-4 Credit hours**
EMERGING TOPICS IN COMPUTER SCIENCE.
Grade Mode: Normal Grading Mode

CS 300 Programming Languages **3 Credit hours**
Pre-req: CS 210 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CS 305 Software Engineering **3 Credit hours**
This course provides a broad introduction to software engineering theories, methods, and tools. Requires substantial writing.
Topics include requirements engineering, analysis and design, implementation, versioning, and testing.
Pre-req: MTH 220 and CS 210 and ENG 354 (may be taken concurrently).
Concurrent PR: ENG 354
Grade Mode: Normal Grading Mode

CS 310 Software Engineering II **3 Credit hours**
Pre-req: CS 305 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CS 315 Software Quality Assurance **3 Credit hours**
Testing techniques and validation of system requirements. Design reviews and code inspections; unit, integration, system, regression, load, stress, user acceptance, and regression testing; statistical testing; test strategies and project metrics.
Pre-req: CS 310 and MTH 345.
Grade Mode: Normal Grading Mode

CS 320 Internetworking **3 Credit hours**
Principles and issues in interconnecting multiple physical networks into a coordinated system, operation of internet protocols in the interconnected environment, and design of applications to operate in this environment.
Pre-req: CS 210 and (MTH 229 or MTH 229H).
Grade Mode: Normal Grading Mode

CS 330 Operating Systems **3 Credit hours**
Modern operating systems design and implementation: multi-tasking and time sharing, concurency and synchronization, interprocess communication, resource scheduling, memory management, deadlocks, I/O, file systems, and security.
Pre-req: CS 210.
Grade Mode: Normal Grading Mode

CS 351 Computer Sciences Co-Op **0 Credit hours**
A supervised experience in which the student works for a company to gain practical experience in a students major.
Pre-req: ENGR 217 with a minimum grade of D.
Grade Mode: Credit/No Credit Grade Only

CS 360 Automata and Formal Languages **3 Credit hours**
Basic theoretical concepts are introduced, including finite state automata, regular expressions, context-free grammars, pushdown automata, Turing machines, recursively enumerable languages, the halting problem, and the Church-Turing thesis.
Pre-req: MTH 220 and CS 210.
Grade Mode: Normal Grading Mode

CS 370 Computer Graphics **3 Credit hours**
Mathematical theory and practical tools and techniques for generating realistic pictures using computers. This is a project-centered course and involves extensive programming using the open GL standard.
Pre-req: CS 210 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CS 402 Computer Architecture **3 Credit hours**
Design and analyze structure of major hardware components of computers including: ALU, instruction sets, memory hierarchy, parallelism through multicore and many core, storage systems and interfaces.
Pre-req: CS 300 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CS 404 High Performance Computing **3 Credit hours**
Software design and development targeting high performance computing architectures. Multi-core and many-core systems: I/O, file systems, performance metrics. Programming models include MPI, OpenMP, MapReduce, CUDA, OpenCL.
Pre-req: CS 402.
Grade Mode: Normal Grading Mode

CS 405 Computing for Bioinformatics **3 Credit hours**
Study of computational algorithms and programming techniques for various bioinformatics tasks including parsing DNA files, sequence alignments, tree construction, clustering, species identification, principal component analysis, correlations, and gene expression arrays.
Pre-req: CS 215.
Grade Mode: Normal Grading Mode

CS 410 Database Engineering **3 Credit hours**
Study of data models, data description languages, query languages including relational algebra and SQL, logical and physical database design, transactions, backup and recovery. Design and implementation of a database application.
Pre-req: CS 210 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CS 412 Embedded Systems **3 Credit hours**
The design of systems containing embedded computers. Micro-controller technology, assembly language and C programming, input/output interfacing, data acquisition hardware, interrupts, and timing. Real-time operating systems and application programming. Application examples.
Pre-req: CS 402 with a minimum grade of D or EE 340 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CS 415 Data Mining **3 Credit hours**
Covers (1) the process of knowledge discovery, (2) algorithms (association rules, classification, and clustering), and (3) real-world applications. Focuses on efficient data mining algorithms and scaling up data mining methods.
Pre-req: CS 215 and CS 410.
Grade Mode: Normal Grading Mode

CS 425 Computational Intelligence **3 Credit hours**
Genetic algorithms, evolutionary strategies, and genetic programming. Methods of knowledge representation using rough sets, type-1 fuzzy sets, and type-2 fuzzy sets. Neural network architectures and their learning algorithms.
Pre-req: CS 300.
Grade Mode: Normal Grading Mode

CS 430 Cyber Security **3 Credit hours**
Concepts and issues in physical and cyber security; technological vulnerabilities found in operating systems, database servers, web servers, internet, and local area networks; developing defensive and offensive security measures.
Pre-req: CS 320 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CS 435 Cyber Risk **3 Credit hours**
Advanced course on the functions and purposes of the latest development in cyber security techniques and tools used to create, secure, protect and remediate cyber-infrastructures from various cyber threats.
Pre-req: CS 430 with a minimum grade of D or CS 340 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CS 440 Digital Image Processing **3 Credit hours**
Mathematical techniques, algorithms, and software tools for image sampling, quantization, coding and compression, enhancement, reconstruction, and analysis.
Pre-req: CS 210 and MTH 329.
Grade Mode: Normal Grading Mode

CS 452 Natural Language Processing **3 Credit hours**
Fundamental algorithms and computational models for core tasks in natural language processing: word and sentence tokenization, parsing, information and meaning extraction, spelling correction, text summarization, question answering, and sentiment analysis.
Pre-req: (CS 215 and MTH 220).
Grade Mode: Normal Grading Mode

CS 455 Systems Engineering **3 Credit hours**
Tools and techniques for optimizing the design and construction of software-intensive systems by considering system issues and making engineering tradeoffs in conflicting criteria and interacting decision parameters.
Pre-req: CS 330 and CS 340 and CS 350.
Grade Mode: Normal Grading Mode

CS 475 Internship **3-12 Credit hours**
An in-depth and hands-on involvement in a real-world project under direct professional supervision. The project may be on-campus or off-campus. Requires prior apporval of the internship director, who is a member of the computer science faculty.
Pre-req: CS 300 with a minimum grade of D or CS 215 with a minimum grade of D.
Grade Mode: Credit/No Credit Grade Only

CS 480 Special Topics **1-4 Credit hours**
EMERGING TOPICS IN COMPUTER SCIENCE.
Grade Mode: Normal Grading Mode

CS 481 Special Topics **1-4 Credit hours**
EMERGING TOPICS IN COMPUTER SCIENCE.
Grade Mode: Normal Grading Mode

CS 482 Special Topics **1-4 Credit hours**
EMERGING TOPICS IN COMPUTER SCIENCE.
Grade Mode: Normal Grading Mode

CS 483 Special Topics **1-4 Credit hours**
EMERGING TOPICS IN COMPUTER SCIENCE.
Grade Mode: Normal Grading Mode

CS 485 Independent Study **1-4 Credit hours**
EMERGING TOPICS IN COMPUTER SCIENCE.
Grade Mode: Normal Grading Mode

CS 486 Independent Study **1-4 Credit hours**
EMERGING TOPICS IN COMPUTER SCIENCE.
Grade Mode: Normal Grading Mode

CS 487 Independent Study **1-4 Credit hours**
EMERGING TOPICS IN COMPUTER SCIENCE.
Grade Mode: Normal Grading Mode

CS 488 Independent Study **1-4 Credit hours**
EMERGING TOPICS IN COMPUTER SCIENCE
Grade Mode: Normal Grading Mode

CS 490 Senior Project **3 Credit hours**
Application of technical and professional skills in solving a real-world problem in a team environment. Discuss professional code of conduct, societal issues, and transition from student to industry professional.
Pre-req: CS 310 with a minimum grade of D and CS 410 with a minimum grade of D.
Attributes: Capstone Course
Grade Mode: Normal Grading Mode

Computer & Info Security

CYBR 210 Comp and Info Sec Principle **3 Credit hours**
Introduction to the various technical and administrative aspects of Computer and Information Security. Understanding key issues associated with protecting information assets, determining the protection needed and response to security incidents.
Pre-req: CS 105 or CS 110 or CS 110H.
Grade Mode: Normal Grading Mode

CYBR 240 Information Security Policies **3 Credit hours**
Introduction to information security policies, sociological and psychological issues in policy implementation in general. Discuss the lifecycle of policy creation, enactment in different domains of security and policy structure.
Pre-req: CS 105 with a minimum grade of D or CS 110 with a minimum grade of D or CS 110H with a minimum grade of D.
Grade Mode: Normal Grading Mode

CYBR 310 Introduction to Cryptography **3 Credit hours**
This course covers the basic aspects of modern crytography, including block ciphers, pseudorandom functions, symmetric encryption, Hash functions, message authentication, number theoretic primitives, public-key encryption, digital signatures and zero knowledge proofs.
Pre-req: CS 210 and (STA 225 or STA 345).
Grade Mode: Normal Grading Mode

CYBR 330 Cyber Security **3 Credit hours**
Concepts and issues in physical and cyber security; technical vulnerabilities found in operating systems, database servers, Web servers, Internet, and local area networks; developing defensive and offensive security measures.
Pre-req: CS 320 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CYBR 350 Cyber System Administration **3 Credit hours**
Introduction of System Administration and related topics, including trouble-shooting system and network problems, hardware and software configuration and installation, basic scripting, and security aspects of Internet hosts.
Pre-req: CS 320 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CYBR 360 Cyber Infrastructure Security **3 Credit hours**
Comprehensive analysis on the utilization and augmentation of cyber security technologies to harden cyber infrastructure and its interconnected cyber-physical systems against various attacks.
Pre-req: CS 320 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CYBR 400 Computer Security Design **3 Credit hours**
Foundation technical and analytical skills to implement comprehensive computer security that encompass designing secure systems, information security, protecting information assets, managing computer security, risk mitigation strategies, and incident response.
Pre-req: CYBR 350.
Grade Mode: Normal Grading Mode

CYBR 435 Cyber Risk **3 Credit hours**
Advanced course on the functions and purposes of the latest development in cyber security techniques and tools used to create, secure, protect and remediate cyber-infrastructures from various cyber threats.
Pre-req: CYBR 330 with a minimum grade of D or CS 330 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CYBR 442 Cyber Operations **3 Credit hours**
Study of various concepts and aspects in choosing, deploying, supporting, troubleshooting and securing various local and distributed components of a cyber operation with consideration of the human factor.
Pre-req: CYBR 350 and CYBR 360.
Grade Mode: Normal Grading Mode

CYBR 475 Internship **3 Credit hours**
An in-depth and hands-on involvement in a real-world project under direct professional supervision. The project my be on-campus or off-campus.
Grade Mode: Normal Grading Mode

CYBR 480 Special Topics **1-4 Credit hours**
Study of an advanced topic not normally covered in other courses.
Grade Mode: Normal Grading Mode

CYBR 481 Special Topics **1-4 Credit hours**
Study of an advanced topic not normally covered in other courses.
Grade Mode: Normal Grading Mode

CYBR 482 Special Topics **1-4 Credit hours**
Study of an advanced topic not normally covered in other courses.
Grade Mode: Normal Grading Mode

CYBR 483 Special Topics **1-4 Credit hours**
Study of an advanced topic not normally covered in other courses.
Grade Mode: Normal Grading Mode

CYBR 484 Special Topics **1-4 Credit hours**
Study of an advanced topic not normally covered in other courses.
Grade Mode: Normal Grading Mode

CYBR 485 Special Topics **1-4 Credit hours**
Study of an advanced topic not normally covered in other courses.
Grade Mode: Normal Grading Mode

CYBR 486 Independent Study **1-4 Credit hours**
Independent study for selected juniors and seniors under supervision of faculty; may be repeated only once.
Grade Mode: Normal Grading Mode

CYBR 487 Independent Study **1-4 Credit hours**
Independent study for selected juniors and seniors under supervision of faculty; may be repeated only once.
Grade Mode: Normal Grading Mode

CYBR 488 Independent Study **1-4 Credit hours**
Independent study for selected juniors and seniors under supervision of faculty; may be repeated only once.
Grade Mode: Normal Grading Mode

CYBR 489 Independent Study **1-4 Credit hours**
Independent study for selected juniors and seniors under supervision of faculty; may be repeated only once.
Grade Mode: Normal Grading Mode

CYBR 490 Senior Project **3 Credit hours**
Application of technical and profesional skills in solving a real-world problem in a team environment. Discuss professional code of conduct, societal issues, and transition from student to industry professional.
Pre-req: CYBR 330.
Attributes: Capstone Course
Grade Mode: Normal Grading Mode

Electrical Engineering

EE 202 Circuits II **3 Credit hours**
The transient response of first and second order systems. Balanced three-phase systems. Mutual inductance, transformers, resonance, and two-port networks.
Pre-req: ENGR 201 with a minimum grade of D and MTH 230 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 204 Intro to Digital Systems **3 Credit hours**
Number systems, digital components and systems, Boolen switching algebra; the analysis and design of combinational and sequential circuits; introduction to computer architecture.
Pre-req: MTH 220 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 210 Programming Lab **3 Credit hours**
This course introduces students to the fundamental principles of programming for solving engineering programs. It familiarizes students with the process of translating real-life engineering problems to computation problems.
Pre-req: CS 110.
Grade Mode: Normal Grading Mode

EE 211 Intro to Computer Engineering **3 Credit hours**
Provide a study of Data Structure, operating systems' concepts, HW designed methods and relationship between hardware and software.
Pre-req: EE 210 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 310 Electromagnetic Fields **3 Credit hours**
This course provdies in depth coverage of all aspects electromagnetics, with a focus on field and wave generation and propagation. The course will focus on more practical aspects of E-M theory.
Pre-req: EE 202 with a minimum grade of D and MTH 335 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 320 Analysis of Signals & Systems **3 Credit hours**
This class introduces students to concepts of probability and random variables necessary for study of signals and systems involving uncertainty; applications to elementary problems in detection, signal processing and communication.
Pre-req: MTH 335.
Grade Mode: Normal Grading Mode

EE 330 Random Signals and Systems **3 Credit hours**
This course will introduce the students to the fundamental concepts of probabiliity theory applied to engineering problems, including elementary set operations, sample spaces and probability laws, conditional probability and independence.
Pre-req: EE 320 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 340 Computer Architecture & Design **4 Credit hours**
This course is a study of the factors influencing the design of hardware and software elements of computer systems. Topics include: instruction set design; cache and virtual memory organizations.
Pre-req: EE 211 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 350 Elect Properties of Materials **3 Credit hours**
Introduction to basic physical properties of solid materials; some solid state physics employed, but major emphasis is on engineering applications based on semiconducting, magnetic, dielectric and superconducting phenomena.
Pre-req: EE 202 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 360 Control Systems **3 Credit hours**
Application of state variable and frequency domain techniques to modeling, analysis and synthesis of single input, single output linear control systems.
Pre-req: EE 202 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 370 Electric Machinery **3 Credit hours**
Fundamentals of energy-handling electric circuits, analysis of power electric circuits, elements of linear and rotating electric machinery, induction, and DC machinery.
Pre-req: EE 310 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 375 Communcation Systems I **3 Credit hours**
Introduction to the fundamental concepts of computer communication networks. Topics include the OSI reference model, the physical data link, network, and transport layers, TCP/IP, LANs, ALOHA, routing and flow controls.
Pre-req: EE 310 with a minimum grade of D and EE 320 (may be taken concurrently) with a minimum grade of D.
Concurrent PR: EE 320
Grade Mode: Normal Grading Mode

EE 380 Microprocessor Design **3 Credit hours**
Hardware and software for real-time microprocessor-based digital systems. Basic concepts of on-chip components related to digital system functionality. Introduction to 32-bit machines with treatment of 16- and 8- bit machines.
Pre-req: EE 204 with a minimum grade of D and EE 340 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 401 Communication Systems II **3 Credit hours**
This course will cover topics in the field of RF/microwave engineering, such as transmission lines, waveguides, impedance matching, microwave resonators, RF filters, RF amplifiers and an introduction to antenna design.
Pre-req: EE 375 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 410 Electrical Engineering Design **3 Credit hours**
Application of design process and project engineering as practiced in industry; team approach to the design process; development of a project proposal; proposed project implemented in EE 420.
Grade Mode: Normal Grading Mode

EE 411 Intro to Digital IC Design **3 Credit hours**
This course covers the analysis and design of digital integrated circuits using CMOS technology. The course emphasizes design of circuit layout, and HSPICE and IRSIM for simulations, lab included.
Pre-req: ENGR 204.
Grade Mode: Normal Grading Mode

EE 412 Computer Engineering Design **3 Credit hours**
Introduction to the design process and project engineering as practiced in industry; student teams apply the design process by developing a project from proposal; proposed project implemented in EE 420.
Grade Mode: Normal Grading Mode

EE 415 Intro VHDL Design & HW Systems **3 Credit hours**
This course provides fundamental of hardware design methodologies and modeling. It covers the essentials of HDL, embedded C and hardware-embedded systems using VHDL language, Lab included.
Pre-req: EE 380 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 419 Intr Digital Signal Processing **3 Credit hours**
This course covers the transformation, manipulation of signals. It introduces the concepts of discrete-time, discrete frequency domains, representations and analyses of systems, and filter designs, lab is included.
Pre-req: EE 350.
Grade Mode: Normal Grading Mode

EE 420 Capstone Design **3 Credit hours**
Application of the design process and project engineering as practiced in industry; team approach to the design process; completion of project based on proposal from EE 410 or EE 412.
Pre-req: EE 410 with a minimum grade of D or EE 412 with a minimum grade of D.
Attributes: Capstone Course, No Textbook Required
Grade Mode: Normal Grading Mode

EE 425 Electric Power Systems **3 Credit hours**
The course emphasizes power engineering area that includes power generation, transmission, and distribution.
Pre-req: EE 370 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 440 Digital Control Systems **3 Credit hours**
Feedback systems in which a digital computer is used to implement the control law; Z-transform and time domain methods serve as a basis for control systems design.
Pre-req: EE 360.
Grade Mode: Normal Grading Mode

EE 445 Radio Freq & Microwave Engr **3 Credit hours**
Fundamental Radio Frequency (RF) and microwave circuit analysis; return loss, insertion loss; transmission lines, lumped elements, impedence matching; theory, analysis and design of basic RF and microwave passive circuits.
Pre-req: EE 320.
Grade Mode: Normal Grading Mode

EE 447 Real-Time Digital Processing **3 Credit hours**
This course provides an introduction to the principles of real-time digital signal processing and hands-on development of real-time signal processing algorithms.
Pre-req: EE 320.
Grade Mode: Normal Grading Mode

EE 448 Power Electronics **3 Credit hours**
Principles of power electronics. Including understanding of power semiconductor devices, passive components, basic switching circuits, AC/DC, DC/DC, DC/AC converters and their applications.
Pre-req: (ENGR 202 with a minimum grade of D or EE 202 with a minimum grade of D) and EE 310 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 480 Special Topics **1-4 Credit hours**
Special Topics
Grade Mode: Normal Grading Mode

EE 481 Special Topics **1-4 Credit hours**
Special Topics
Grade Mode: Normal Grading Mode

EE 482 Special Topics **1-4 Credit hours**
Special Topics
Grade Mode: Normal Grading Mode

EE 483 Special Topics **1-4 Credit hours**
Special Topics
Grade Mode: Normal Grading Mode

EE 485 Independent Study **1-4 Credit hours**
Independent Study
Grade Mode: Normal Grading Mode

EE 486 Independent Study **1-4 Credit hours**
Independent Study
Grade Mode: Normal Grading Mode

EE 487 Independent Study **1-4 Credit hours**
Independent Study
Grade Mode: Normal Grading Mode

EE 488 Independent Study **1-4 Credit hours**
Independent Study
Grade Mode: Normal Grading Mode