Computer Science (CS)

305. Data Structures. Emphasis of this course is on the organization of information, the implementation of common data structures such as lists, stacks, queues, trees, and graphs, and techniques of data abstraction, including encapsulation and inheritance. This course also explores recursion, the close relationship between data structures and algorithms and the analysis of algorithm complexity ('O' notion). Hands-on programming is a central component of this course. Mini-labs and programming assignments are administered. Assignments will focus on the design, implementation, testing and evaluation of various data structures.

310. Analysis of Algorithms. This course introduces basic elements of the design and analysis of computer algorithms. Topics include asymptotic notations and analysis, parallel sorting networks, divide and conquer, greedy methods and matroids, dynamic programming, basic graph algorithms, NP-completeness, approximation algorithms, and network flows analysis. For each topic, beside in-depth coverage, one or more representative problems and their algorithms shall be discussed. In addition to the design and analysis of algorithms, students are expected to gain substantial discrete mathematics problem solving skills essential for computer engineers. Prerequisite: CIS 305.

320. Digital Logic. Basic building blocks and design methods to construct synchronous digital systems. Alternative representations for digital systems; Bipolar TTL vs. MOS implantation technologies; Standard logic (SSI, MSI) vs. programmable logic (PLD, FPGA); Finite state machine design. Usage of Xilinx HDL design software for implantation of various logic circuits.

340. Computer Architecture. Basic hardware/software components, assembly language, and functional architecture design of computers; syntax and semantics of a typical microprocessor assembly language instruction sets, construction and execution of an assembly program; the design and I/O modules, memory, control unit and arithmetic unit. Prerequisite: CIS 320.

367. Software Engineering. This course will offer a wide perspective on software development, including requirements analysis, technical design, estimating, programming style, testing and quality, and management issues. Pre-requisite: Consent of instructor.

370. Programming Language Design. This course explores the design of high-level languages; criteria for language selection; specification techniques for syntax and semantics; trends in high-level language design and introduction to programming in LISP. Prerequisite: BCIS 2331 or COSC 1320.

380. Automata Theory. A study of the basic types of abstract languages and their acceptors; the Chomsky hierarchy; solvability and recursive function theory; application of theoretical results to practical problems. Prerequisite: MATH 331.

390. Ethics in Technology. This course examines ethical issues and moral problems that are faced by engineers, computer scientists and information technology professionals. CIS 390 covers issues such as moral/ethical relevance, professional responsibilities, privacy, intellectual property, risks and liabilities. Students review case studies of ethical conflicts in work environment and resolve theoretical situations through application of ethical codes.

410. Operating Systems. The principles and concepts that govern the design of modern computer operating systems are studied. Managing computing resources such as the memory, the processor and the Input/Output devices are covered – algorithms for CPU scheduling, memory and general resource allocation; process coordination and management; case studies of several operating systems. Operating systems also manage the authentication, accounting and authorization aspects in a multi-user system. Issues and limitations imposed on a computing environment by the choice of different operating systems are also explored. Prerequisite: CIS 305.

417. Information Theory. This course presents concepts of data information theory, bandwidth computation, error coding and recovery, data security and cryptography. Prerequisite: Calculus II and MATH 453.

420. **Computer Networks**. Several computer networking concepts are covered including the OSI reference model for networking protocols, TCP/IP implantation, internetworking technologies such as frame relay, FDDI, X-25, ISDN services, the Internet, and the World Wide Web. The use of internetworking software applications, routing/switching hardware and algorithms, security, intranets and intranet servers and browsers, networks and network servers, LANs/WANs. The course will also include case studies of existing networks and network architectures. Prerequisite: CIS 305.

425. **Distributed Computing.** Concepts of heterogeneous multi-computer systems, distributed operating systems are covered. Communication in a client/server model using RPC, Message oriented communications, remote object invocation, and stream oriented communication for multimedia environments, distributed processes and software agents. Other distributed system concepts such as clock synchronization, data consistency and replication, fault tolerance, security and distributed component and file systems are also covered. Prerequisite: CIS 410 and 420.

435. **Mobile and Wireless Networks.** This course will cover a broad selection of topics in mobile data communications such as various wireless networking technologies (Bluetooth, 802.11, 802.16, satellite communication), mobile IP and ad hoc routing algorithms, mobile TCP, mobile data management, location dependency/awareness, mobile applications/services, security issues and user interface issues. Prerequisite: CIS 420.

440. Web Applications Engineering. This course examines various paradigms in client/server technologies for development of dynamic websites such as ebay or Hotmail. Various aspects of dynamic websites such as cgi, database backend with web services using the XML related technologies, servlets, Javabeans will also be explored. This course has a significant programming component. Prerequisite: COSC 1320 or BCIS 2331.

445. **Telecommunication Systems.** Course presents basic concepts in telecommunications, emphasizing topics such as SONET, Cell and Frame Relay, ATM and multimedia switching. Recent concepts such as VPN over MPLS are introduced. Operation and Maintenance (OAM) of large computer networks are also discussed. Prerequisite: CIS 420.

447. **Modeling and Simulation.** A study of modeling and computer stimulation of discrete and continuous systems – those characterized by stochastic discrete events and those characterized by differential equations. Will include the study and use of simulation languages. Prerequisite: CIS 420, MATH 453, and Calculus II.

450. **Network Management.** This course enables a student to understand how to support, plan and manage a local or wide area network. Monitoring and configuring of network elements using SNMP and RMON will be studied. The use of COBRA, CLI and web based management tools will also be covered. Prerequisite: CIS 420.

460. **System Programming and Compiler Design.** Study of programming language translation: functions and general organization of compiler design and interpreters; theoretical and implementation aspects of lexical scanners; parsing of context free languages; code generation and optimization; error recovery. Prerequisite: CIS 305, 370 and 380.

470. **Data Mining.** This course focuses on association rules, descriptive and predictive models, classification, statistics, nearest neighbor, clustering and decision trees. Related topics such as data warehousing, data preparation, web mining and temporal mining will also be covered. Prerequisite: MIS 366.

475. **Computer Graphics.** A study of the principles of interactive computer graphics; systems organization and device technologies for raster and vector displays; 2-D and 3-D viewing, clipping, segmentation and interaction handling; 3-D geometrical transformations, projections and hierarchical data structures for graphics modeling. Prerequisite: CIS 305.

485. **Capstone in CS.** (4 SCH) This course will develop a significant software application consisting of group meetings, written reports, oral presentations and code with documentation. Students will learn to 1) apply fundamental software engineering techniques to produce a high quality application, 2) use several advanced software systems development and test tools, 3) work as part of a team to design and develop a large multi-step project in which each person has control of only part of the system, and 4) present work in a professional manner. Prerequisite: Permission of instructor.

489. Individual Study. Individual instruction. May be repeated when topics vary.

497. Special Topics. Organized class. May be repeated when topics vary. Special courses designed to cover areas of specific interest.

Electrical Engineering (EE)

210. Introduction to Electrical Engineering. Current, voltage, power and energy, Kirchhoff's current and voltage laws, resistance, capacitance, inductance, series and parallel combinations of circuit elements will be introduced. Superposition, mesh current and node voltage analysis, complex numbers, signals, communications, modulation, binary number systems, Boolean algebra, and logic elements will be emphasized. Co-requisite: Calculus I and calculus based Physics I.

220. Introduction to Circuits. Circuit elements, voltage and current dividers, and Thevenin and Norton theorems will be reviewed. Inverters, sum and difference amplifies, capacitors and inductors, transient response, RC, RL and TCL circuits, AC steady-state analysis, sinusoids and phasors will be emphasized. Prerequisite: EE210 and calculus based Physics I.

317. Information Theory. Information theory is derived from mathematical concepts of probability and statistics as well as concepts such as entropy from thermodynamics. Information theory quantifies the concept of "information" in noisy signals. It is concerned with information entropy, communication systems, data transmissions and rate distortion theory, cryptography, data compression, error correction, and related topics. Prerequisite: MATH 453 or MATH 457.

310. Algorithm Analysis. This course introduces basic elements of the design and analysis of computer algorithms. Topics include asymptotic notations and analysis, parallel sorting networks, divide and conquer, greedy methods and matroids, dynamic programming, basic graph algorithms, NP-completeness, approximation algorithms, and network flows analysis. For each topic, besides in-depth coverage, one or more representative problems and their algorithms shall be discussed. In addition to the design and analysis of algorithms, students are expected to gain substantial discrete mathematics problem solving skills essential for computer engineers.

321. Digital Logic. This course provides a detailed knowledge of Boolean algebra and its application in digital design. It provides an in-depth coverage of combinational logic circuit analysis, minimization and design techniques. It also covers the basic concepts of sequential circuits including the use of state diagrams and state tables to represent the behavior of sequential circuits.

325. Signals and Systems I. This is one of the fundamental courses of Electrical Engineering, providing theoretical concepts and mathematical tools used for the design and analysis of continuous linear systems, as well as analog signals. Topics covered in this course include linear convolution, impulse response, Fourier series, Fourier transforms and Laplace transform.

326. Signals and Systems I Lab. This course provides practical concepts and software tools for the design and the analysis of both analog signals and continuous-time linear systems. It is based on exercises via computer simulation using MATLAB. The main aim is to get

understanding of frequency and time domain analysis of basic signals and linear time-invariant systems employing linear convolution, impulse response, Fourier transforms and Laplace transform.

332. C++ Programming. (4 SCH) This course introduces students to C++ programming language, a dominant language in the industry today. Students will be taught the fundamentals of programming. These concepts are applicable to programming in any language. Topics covered include basic principles of programming using C++, algorithmic and procedural problem solving, program design and development, basic data types, control structures, functions, arrays, pointers, and introduction to classes for programmer-defined data types. Prerequisite: EE210.

335. Electronics. This course covers the basic topics of Electronics and Electronics Circuit Design: Operational Amplifiers, Diodes, Bipolar Junction Transistors and Field-Effect Transistors. Special attention will be given to practical applications of Field-Effect Transistors including an Introduction to VLSI Design.

470. Digital Design Using VHDL. This course instructs the students in the use of VHDL ((Very High Speed Integrated Circuit Hardware Description Language) for describing the behavior of digital systems. VHDL is a standardized design language used in the computer/ semiconductor industry. This course will teach students the use of the VHDL language for representation of digital signals, use of IEEE standard logic packages/libraries, design description, design of arithmetic, combinational, and synchronous sequential circuits.