Computer Engineering Course Descriptions

CS 5303 Computer Science I (3 semester hours) Computer science problem solving. The structure and nature of algorithms and their corresponding computer program implementation. Programming in a high-level block-structured language (e.g., PASCAL, Ada, C++, or JAVA). Elementary data structures: arrays, records, linked lists, trees, stacks, and queues. (3-0) S

CE 5325 (EE 5325) Hardware Modeling Using VHDL (3 semester hours) This course introduces students to VHDL beginning with simple examples and describing tools and methodologies. It covers the language, dwelling on fundamental stimulation concepts. Students are also exposed to the subset of VHDL that may be used for synthesis of custom logic. VHDL simulation and synthesis labs and projects are performed using commercial and/or academic VLSI CAD tools. Prerequisite: EE 3320 or equivalent. (3-0) T

CS 5330 Computer Science II (3 semester hours) Basic concepts of computer organization: Numbering systems, two's complement notation, multi-level machine concepts, machine language, assembly programming and optimization, subroutine calls, addressing modes, code generation process, CPU datapath, pipelining, RISC vs. CISC, performance calculation. Co-requisite: CS 5303. (3-0) S

CS 5333 Discrete Structures (3 semester hours) Mathematical foundation of computer science. Logic, sets, relations, graphs and algebraic structures. Combinatorics and metrics for performance evaluation of algorithms. (3-0) S

CS 5343 Algorithm Analysis and Data Structures (3 semester hours) Formal specifications and representation of lists, arrays, trees, graphs, multi-linked structures, strings and recursive pattern structures. Analysis of associated algorithms. Sorting and searching, file structures. Relational data models. Prerequisites: CS 5303, CS 5333. (3-0) S

CS 5348 Operating Systems Concepts (3 semester hours) An introduction to fundamental concepts in operating systems, their design, implementation, and usage. Topics include: process management, main memory management, virtual memory, I/O and device drivers, file systems, secondary storage management, introduction to critical sections and deadlocks. Prerequisites: CS 5330 and CS 5343 (may be taken concurrently) and a working knowledge of C and Unix. (3-0) S

CE 5354 (CS 5354, SE 5354) Software Engineering (3 semester hours) Formal specification and program verification. Software life-cycle models and their stages. System and software requirements engineering; user-interface design. Software architecture, design, and analysis. Software testing, validation, and quality assurance. Corequisite: CS 5343 (CS 5343 can be taken before or at the same time as CS 5354) (3-0) S

CE 5381 Curriculum Practical Training in Computer Engineering (3 semester hours) This course is required of students who need additional training in engineering practice. Credit does not apply to the 33 hour M.S.C.E. requirement. Consent of Graduate Adviser required. (May be repeated to a maximum of 9 hours). (3-0) S

CE 6301 (EE 6301) Advanced Digital Logic (3 semester hours) Modern design techniques for digital logic. Logic synthesis and design methodology. Link between

front-end and back-end design flows. Field programmable gate arrays and reconfigurable digital systems. Introduction to testing, simulation, fault diagnosis and design for testability. Prerequisites: EE 3320 or equivalent and background in VHDL/Verilog. (3-0) T

CE 6302 (EE 6302) Microprocessor Systems (3 semester hours) Design of microprocessor based systems including I/O and interface devices. Microprocessor architectures. Use of emulators and other sophisticated test equipment. Extensive laboratory work. Prerequisite: EE 4304 or equivalent. (2-3) Y

CE 6303 (EE 6303) Testing and Testable Design (3 semester hours) Techniques for detection of failures in digital circuits and systems. Fault modeling and detection. Functional testing and algorithms for automatic test pattern generation (ATPG). Design of easily testable digital systems. Techniques for introducing built-in self test (BIST) capability. Test of various digital modules, like PLA's, memory circuits, datapath, etc. Prerequisites: EE 3320 or equivalent and background in VHDL/Verilog. (3-0) Y

CE 6304 (EE 6304, CS 6304) Computer Architecture (3 semester hours) Trends in processor, memory, I/O and system design. Techniques for quantitative analysis and evaluation of computer systems to understand and compare alternative design choices in system design. Components in high performance processors and computers: pipelining, instruction level parallelism, memory hierarchies, and input/output. Students will undertake a major computing system analysis and design project. Prerequisites: EE 4304 and C/C++. (3-0) Y

CE 6305 (EE 6305) Computer Arithmetic (3 semester hours) Carry look ahead systems and carry save adders. Multipliers, multi-bit recoding schemes, array multipliers, redundant binary schemes, residue numbers, slash numbers. High-speed division and square root circuits. Multi-precision algorithms. The IEEE floating point standard, rounding processes, guard bits, error accumulation in arithmetic processes. Cordic algorithms. Prerequisites: EE 3320 and C/C++. (3-0) Y

CE 6306 (EE 6306) Application Specific Integrated Circuits Design (3 semester hours) This course discusses the design of application specific integrated circuits (ASIC). Specific topics include: VLSI system design specification, ASIC circuit structures, synthesis, and implementation of an ASIC digital signal processing (DSP) chip. Prerequisite: EE 3320. (3-0) Y

CE 6307 (EE 6307) Fault-Tolerant Digital Systems (3 semester hours) Concepts in hardware and software fault tolerance. Topics include fault models, coding in computer systems, fault diagnosis and fault-tolerant routing, clock synchronization, system reconfiguration, etc. Survey of practical fault-tolerant systems. Prerequisites: EE 6301, EE 3341 or equivalent. (3-0) R

CE 6308 (EE 6308, CS 6396) Real-Time Systems (3 semester hours) Introduction to real-time applications and concepts. Real-time operating systems and resource management. Specification and design methods for real-time systems. System performance analysis and optimization techniques. Project to specify, analyze, design, implement and test small real-time system. Prerequisite: CS 5348. (3-0) R

CE 6324 (CS 6324) Information Security (3 semester hours) A comprehensive study of security vulnerabilities in information systems and the basic techniques for developing secure applications and practicing safe computing. Topics include common attacking techniques such as buffer overflow, Trojan, virus, etc. UNIX, Windows and Java

security. Conventional encryption. Hashing functions and data integrity. Public-key encryption (RSA, Elliptic-Curve). Digital signature. Watermarking for multimedia. Security standards and applications. Building secure software and systems. Management and analysis of security. Legal and ethical issues in computer security. Prerequisite: CS 5348 and CS 5390 (3-0) Y

CE 6325 (EE 6325) VLSI Design (3 semester hours) Introduction to MOS transistors. Analysis of the CMOS inverter. Combinational and sequential design techniques in VLSI; issues in static, transmission gate and dynamic logic design. Design and layout of complex gates, latches and flip-flops, arithmetic circuits, memory structures. Low power digital design. The method of logical effort. CMOS technology, and rationale behind various design rules. Use of CAD tools to design, layout, check, extract and simulate a small project. Prerequisite: EE 3320 or equivalent. (3-0) Y

CE 6345 (EE 6345) Engineering of Packet-Switched Networks (3 semester hours) Detailed coverage, from the point of view of engineering design, of the physical, data-link, network and transport layers of IP (Internet Protocol) networks. This course is a Masters-level introduction to packet networks. Prior knowledge of digital communication systems is strongly recommended. (3-0) Y

CE 6352 (CS 6352) Performance of Computer Systems and Networks (3 semester hours) Overview of case studies. Quick review of principles of probability theory. Queuing models and physical origin of random variables used in queuing models. Various important cases of the M/M/m/N queuing system. Little's law. The M/G/1 queuing system. Simulation of queuing systems. Product form solutions of open and closed queuing networks. Convolution algorithms and Mean Value Analysis for closed queuing networks. Discrete time queuing systems. Prerequisite: a first course on probability theory. (3-0) S

CE 6353 (CS 6353) Compiler Construction (3 semester hours) Lexical analyzers, context-free grammars. Top-down and bottom-up parsing; shift reduce and LR parsing. Operator-precedence, recursive-descent, predictive, and LL parsing. LR(k), LL(k) and precedence grammars will be covered. Prerequisites: CS 5343 and CS 5349. (3-0) Y

CE 6354 (CS 6354, SE 6354) Advanced Software Engineering (3 semester hours) This course covers advanced theoretical concepts in software engineering and provides an extensive hands-on experience in dealing with various issues of software development. It involves a semester-long group software development project spanning software project planning and management, analysis of requirements, construction of software architecture and design, implementation, and quality assessment. The course will introduce formal specification, component-based software engineering, and software maintenance and evolution. Prerequisite: CS 5354 (or equivalent) and knowledge of Java (3-0) S

CE 6367 (CS 6367, SE 6367) Software Testing, Validation, Verification (3 semester hours) Methods for evaluating software for correctness, performance and reliability including code inspections, program proofs and testing methodologies. Formal and informal proofs of correctness. Code walkthroughs, code inspections and their role in software verification. Unit and system testing techniques, testing tools and limitations of testing. Statistical testing, reliability models and performance measurement techniques. Prerequisite: CE 5354. (3-0) Y

CE 6370 (EE 6370) Design and Analysis of Reconfigurable Systems (3 semester

hours) Introduction to reconfigurable computing, programmable logic: FPGAS, CPLDs, CAD issues with FPGA based design, reconfigurable systems: emulation, custom computing, and embedded application based computing, static and dynamic hardware, evolutionary design, software environments for reconfigurable systems. Prerequisite: EE 3320 or equivalent. (3-0) Y

CE 6375 (EE 6375) Design Automation of VLSI Systems (3 semester hours) This course deals with various topics related to the development of CAD tools for VLSI systems design. Algorithms, data structures, heuristics and design methodologies behind CAD tools. Design and analysis of algorithms for layout, circuit partitioning, placement, routing, chip floor planning, design rule checking (DRC). Introduction to CAD algorithms for RTL and behavior level synthesis, module generators, and silicon compilation. Prerequisite: CS 5343; Co-requisite: CE 6325. (3-0) Y

CE 6378 (CS 6378) Advanced Operating Systems (3 semester hours) Concurrent processing, inter-process communication, process synchronization, deadlocks, introduction to queuing theory and operational analysis, topics in distributed systems and algorithms, checkpointing, recovery, multiprocessor operating systems. Prerequisites: CS 5348, knowledge of C and Unix. (3-0) S

CE 6380 (CS 6380) Distributed Computing (3 semester hours) Topics include distributed algorithms, election algorithms, synchronizers, mutual exclusion, resource allocation, deadlocks, Byzantine agreement and clock synchronization, knowledge and common knowledge, reliability in distributed networks, proving distributed programs correct. Prerequisite: CS 5348. (3-0) S

CE 6390 (CS 6390) Advanced Computer Networks (3 semester hours) The design and analysis of computer networks. Topics include network architectures, the OSI reference model, theoretical basis for data-communications, network protocols, local area networks, ISDN. Prerequisites: CS 5341, CS 5390. (3-0) S

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CE 6392 (CS 6392) Mobile Computing Systems (3 semester hours) Topics include coping with mobility of computing systems, data management, reliability issues, packet transmission, mobile IP, end-to-end reliable communication, channel and other resource allocation, slot assignment, routing protocols, and issues in mobile wireless networks (without base stations). Prerequisite: CS 6378 or CS 6390. (3-0) Y

CE 6397 (CS 6397) Synthesis and Optimization of High-Performance Systems (3 semester hours) A comprehensive study of the high-level synthesis and optimization algorithms for designing high performance systems with multiple CPUs or functional units for critical applications such as Multimedia, Signal processing, Telecommunications, Networks, and Graphics applications, etc. Topics including algorithms for architecture-level synthesis, scheduling, resource binding, real-time systems, parallel processor array design and mapping, code generations for DSP processors, embedded systems and hardware/software codesigns. Prerequisite: CS 5348. (3-0) Y

CE 6398 (CS 6398/EE 6398) DSP Architectures (3 semester hours) Typical DSP algorithms, representation of DSP algorithms, data-graph, FIR filters, convolutions, Fast Fourier Transform, Discrete Cosine Transform, low power design, VLSI implementation of DSP algorithms, implementation of DSP algorithms on DSP processors, DSP applications including wireless communication and multimedia. Prerequisite: CS 5343. (3-0) Y

CE 6399 (CS 6399) Parallel Architectures and Systems (3 semester hours) A comprehensive study of the fundamentals of parallel systems and architecture. Topics including parallel programming environment, fine-grain parallelism such as VLIW and superscalar, parallel computing paradigm of shared-memory, distributed-memory, data-parallel and data-flow models, cache coherence, compiling techniques to improve parallelism, scheduling theory, loop transformations, loop parallelizations and run-time systems. Prerequisite: CS 5348. (3-0) Y

CE 7302 Hardware/Software Co-design (3 semester hours) Fundamental concepts in the design of complex digital systems consisting of hardware and software components. Topics include system description and modeling, efficient systems partitioning, hardware/software synthesis, compilation and behavioral optimization, embedded computing systems, telecommunications systems using general-purpose and special-purpose digital signal processors, and rapid prototyping and emulation using field programmable gate arrays. Prerequisites: CE 6301, CE 6302, and CE 6304. (3-0) Y

CE 7303 Hardware Verification (3 semester hours) This course deals with advanced issues related to the formal verification of complex digital systems. Topics include Binary Decision Diagrams (BDDs) and their application to representation and verification of digital systems, use of abstraction and rigorous analysis methods to solve complicated design problems, etc. Prerequisites: CE 6301, CE 6303, and CE 6325. (3-0) Y

CE 7304 (EE 7304) Advanced Computer Architecture (3 semester hours) Advanced research topics in, multi-processor, network and reconfigurable architectures. Focuses on current research in the area of computer system architecture to prepare students for a career in computer architecture research. Course will use articles from current technical literature to discuss relevant topics, such as digital signal processors and VLIW processors. Prerequisites: EE 6304, CS 5348, and EE 3341 and knowledge of C/C++. (3-0) R

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CE 7325 (EE 7325) Advanced VLSI Design (3 semester hours) Advanced topics in VLSI design covering topics beyond the first course (EE/CE 6325). Topics include: use of high-level design, synthesis, and simulation tools, design for testability, clock distribution and routing problems, synchronous circuits, low-power design techniques, study of various VLSI-based computations, systolic arrays, etc. Discussions on current research topics in VLSI design. Prerequisite: CE 6325 or equivalent. (3-0) R

CE 7328 (EE 7328) Physical Design of High-Speed VLSI Circuits (3 semester hours) Techniques for the physical design of high- speed VLSI circuits. Topics related to interconnection circuit modeling, performance-driven routing, buffer and wire sizing, placement and floor planning, technology mapping and performance evaluation issues encountered in high-speed VLSI circuit designs. Discussion of the state-of-the-art practical industrial design examples. A project related to the development of a prototype CAD tool. Prerequisite: CE 6325 and knowledge of programming in C. (3-0) Y

CE 7V80 Special Topics in Computer Engineering (1-6 semester hours) For letter grade credit only. (May be repeated to a maximum of 9 hours.) ([1-6]-0) S

CE 8V40 Individual Instruction in Computer Engineering (1-6 semester hours) (May be repeated for credit.) For pass/fail credit only. ([1-6]-0) R

CE 8V70 Research In Computer Engineering (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) R

CE 8V98 Thesis (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) S
CE 8V99 Dissertation (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) S