Computer Science Course Descriptions

CS 5301 (EE 5301) Advanced Professional and Technical Communication (3 semester hours) CS 5301 utilizes an integrated approach to writing and speaking for the technical professions. The advanced writing components of the course focus on writing professional quality technical documents such as proposals, memos, abstracts, reports, letters, emails, etc. The advanced oral communication components of the course focus on planning, developing, and delivering dynamic, informative and persuasive presentations. Advanced skills in effective teamwork, leadership, listening, multimedia and computer generated visual aids are also emphasized. Graduate students will have a successful communication experience working in a functional team environment using a real time, online learning environment. (3-0) Y

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

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. Corequisite: CS 5303. (3-0) S

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

CS 5335 Programming Projects in C and C++ (3 semester hours) Numerous programming projects in both C and C++. All fundamentals of C, with special emphasis on use of pointers. Use of C++ extensions to create and extend (by inheritance) abstract data types. The use/advantages of virtual functions (dynamic polymorphism). Prerequisites: CS 5303 and CS 5330 or equivalent experience. (3-0) S

CS 5336 Programming Projects in Java (3 semester hours) Overview of the object-oriented philosophy. Implementation of object-oriented designs using the Java programming environment. Emphasis on using the browser to access and extend the Java class library. Prerequisite: CS 5303 or equivalent experience. (3-0) Y

CS 5343 Algorithm Analysis & Data Structures (3 semester hours) Formal specifications and representation of lists, arrays, trees, graphs, multilinked 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) Processes and threads. Concurrency issues including semaphores, monitors and deadlocks. Simple memory management. Virtual memory management. CPU scheduling algorithms. I/O management. File management. Introduction to distributed systems. Prerequisites: CS 5330 and CS 5343 (may be taken concurrently) and a working knowledge of C and Unix. (3-0) S

CS 5349 Automata Theory (3 semester hours) Deterministic and nondeterministic finite automata; regular expressions, regular sets, context-free grammars, pushdown automata, context free languages. Selected topics from Turing Machines and undecidability. Prerequisite: CS 5333. (3-0) S

CS 5354 (CE 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

CS 5375 Principles of UNIX (3 semester hours) Design and history of the UNIX operating system. Detailed study of process and file system data structures. Shell programming in UNIX. Use of process-forking functionality of UNIX to simplify complex problems. Interprocess communication and coordination. Device drivers and streams as interfaces to hardware features. TCP/IP and other UNIX inter-machine communication facilities. Prerequisite: CS 5335. (3-0) S

CS 5390 Computer Networks (3 semester hours) The design and analysis of protocols for computer networking. Topics include: network protocol design and composition via layering, contention resolution in multi-access networks, routing metrics and optimal path searching, traffic management, global network protocols: dealing with heterogeneity and scalability.. Prerequisite: CS 5343. (3-0) S

CS 5V71 Cooperative Education (1-3 semester hours) Placement in a faculty-supervised work environment in industry or government. Sites may be local or out-of-state. The cooperative education program provides exposure to a professional working environment, application of theory to working realities, and an opportunity to test skills and clarify goals. Experience gained may also serve as a work credential after graduation. (May be repeated to a maximum of 9 credit hours.) Departmental approval is required. ([1-3]-0) S

CS 5V81 (SE 5V81) Special Topics in Computer Science (1-9 semester hours) Selected topics in Computer Science. (May be repeated to a maximum of 9 credit hours.) ([1-9]-0) S

CS 6304 (CE 6304, EE 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 in computers: pipelining, instruction level parallelism, memory hierarchies, and input/output. Students will undertake a major computing system analysis and design project. Prerequisites: EE 2310, EE 4320, and C/C++. (3-0) Y

CS 6320 Natural Language Processing (3 semester hours) This course covers state-of-the-art methods for natural language processing. After an introduction to the basics of syntax, semantic, and discourse analysis, the focus shifts to the integration of these modules into natural-language processing systems. In addition to natural language understanding, the course presents advanced material on lexical knowledge acquisition, natural language generation, machine translation, and parallel processing of natural language. Prerequisite: CS 5343. (3-0) Y

CS 6321 Discourse Processing (3 semester hours) Introduction to discourse processing from natural language texts. Automatic clustering of utterances into coherent units (segments) with hierarchical structures. State-of-the-art research in textual cohesion, coherence, and discourse understanding. Included topics are anaphoric reference and ellipsis, notion of textual context, and relationship between tense, aspect, and discourse states. Prerequisite: CS 6320 or consent of the instructor (3-0) T

CS 6322 Information Retrieval (3 semester hours) The course covers modern techniques for storing and retrieving unformatted textual data and providing answers to natural language queries. Current research topics and applications of information retrieval in data mining, data warehousing, text mining, digital libraries, hypertext, multimedia data, and query processing are also presented. Prerequisite: CS 5343. (3-0) Y

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 5343 (3-0) Y

CS 6325 Introduction to Bioinformatics (3 semester hours). The course provides a broad overview of the bioinformatics field. Comprehensive introduction to molecular biology and molecular genetics for a program of study in bioinformatics. Discussion of elementary computer algorithms in biology (e.g., sequence alignment and gene finding). Biological databases, data analysis and management. (3-0) T

CS 6333 Algorithms in Computational Biology (3 semester hours). The principles of algorithm design for biological datasets, and analysis of influential problems and techniques. Biological sequence analysis, gene finding, RNA folding, protein folding, sequence alignment, genome assembly, comparative genomics, phylogenetics, clustering algorithms. Prerequisite: CS 6325. (3-0) S

CS 6351 Computer Systems Design (3 semester hours) Design of instruction sets, memory addressing modes, interleaved memory, cache memory design. Instruction pipelines, techniques for removing dependency delays. Computer bus systems and interfaces for various input/output device types. Pipelined and parallel functional units and their associated code generation algorithms. RISC architectures, support of high level languages, data flow machines, functional languages, lazy evaluation and graph reduction machines. Prerequisite: CS 6349. (3-0) T

CS 6352 (CE 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

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

CS 6354 (CE 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

CS 6356 (SE 6356) Software Maintenance, Evolution, and Re-Engineering (3 semester hours) Principles and techniques of software maintenance. Impact of software development process on software justifiability, maintainability, evolvability, and planning of release cycles. Use of very high-level languages and dependencies for forward engineering and reverse engineering. Achievements, pitfalls, and trends in software reuse, reverse engineering, and re-engineering. Prerequisite: CS 5354. (3-0) Y

CS 6357 (SE 6357) Software Quality Assurance and Metrics (3 semester hours) Concepts of the pervasive system attributes: reliability, efficiency, maintainability, reusability, etc. Software complexity and measures. Software process measures, product measures and resource measure. Validation of software measures. Software measures and measurement theory. Measuring, monitoring and controlling reliability. Supporting tools. Prerequisite: CS 5354. (3-0) Y

CS 6359 (SE 6359) Object-Oriented Analysis and Design (3 semester hours) Analysis and practice of modern tools and concepts that can help produce software that is tolerant of change. Consideration of the primary tools of encapsulation and inheritance. Construction of _software-ICs_ which show the parallel with hardware construction. Prerequisites: CS 5354 and either CS 5335 or CS 5336. (3-0) S

CS 6360 (SE 6360) Database Design (3 semester hours) Methods, principles, and concepts that are relevant to the practice of database software design. Database system architecture; conceptual database models; relational and object-oriented databases; database system implementation; query processing and optimization; transaction processing concepts, concurrency, and recovery; security. Prerequisite: CS 5343. (3-0) S

CS 6361 (SE 6361) Requirements Engineering (3 semester hours) System and software requirements engineering. Identification, elicitation, modeling, analysis, specification, management, and evolution of functional and non-functional requirements. Strengths and weaknesses of different techniques, tools, and object-oriented methodologies. Interactions and trade-offs among hardware, software, and organization. System and sub-system integration with software and organization as components of complex, composite systems. Transition from requirements to design. Critical issues in requirements engineering. Prerequisite: CS 5354. (3-0) S

CS 6362 (SE 6362) Software Architecture and Design (3 semester hours) Concepts and methodologies for the development, evolution, and reuse of software architecture and design, with an emphasis on object-orientation. Identification, analysis, and synthesis of system data, process, communication, and control components. Decomposition, assignment, and composition of functionality to design elements and connectors. Use of non-functional requirements for analyzing trade-offs and selecting among design alternatives. Transition from requirements to software architecture, design, and to implementation. State of the practice and art. Prerequisite: CS 5354. (3-0) S

CS 6363 Design and Analysis of Computer Algorithms (3 semester hours) The study of efficient algorithms for various computational problems. Algorithm design techniques. Sorting, manipulation of data structures, graphs, matrix multiplication, and pattern matching. Complexity of algorithms, lower bounds, NP completeness. Prerequisite: CS 5343 (3-0) S

CS 6364 Artificial Intelligence (3 semester hours) Design of machines that exhibit intelligence. Particular topics include: representation of knowledge, vision, natural language processing, search, logic and deduction, expert systems, planning, language comprehension, machine learning. Prerequisite: CS 5343. (3-0) Y

CS 6365 Data and Text Mining for Computational Biology (3 semester hours). The course introduces data and text mining as practiced currently in the bioinformatics field. Major topics include: sequence alignment for determining similarity between proteins and genes; properties of similarities and distances; genomic, proteomic, and text databases in the real world; finding patterns (motifs) in genes and proteins; differentiating between valid patterns and noise; classification; clustering and its application to phylogenetic trees; and selected topics from text mining. Prerequisite: CS 6325. (3-0) Y

CS 6366 Computer Graphics (3 semester hours) Device and logical coordinate systems. Geometric transformations in two and three dimensions. Algorithms for basic 2-D drawing primitives, such as Bresenham's algorithm for lines and circles, Bezier and B-Spline functions for curves, and line and polygon clipping algorithms. Perspectives in 3-D, and hidden-line and hidden-face elimination, such as Painter's and Z-Buffer algorithms. Fractals and the Mandelbrot set. Prerequisites: CS 5330, CS 5343, and linear algebra. (3-0) Y

CS 6367 (CE 6367, SE 6367) Software Testing, Validation, and Verification (3 semester hours) Requirement based testing including equivalent partition, predicate analysis, boundary value analysis, and state diagrams. Test assessment and test case generation through a variety of techniques: (i) control flow analysis, (ii) data flow analysis, and (iii) mutation testing (strong, weak, and selective). Analysis and use of testing tools for control flow, data flow, and mutation for both unit and system testing. Software reliability. Derivation of verification conditions and formal proof of program.s correctness for programs with arrays. Prerequisite: CS 5354. (3-0) Y

CS 6368 Telecommunication Network Management (3 semester hours) In-depth study of network management issues and standards in telecommunication networks. OSI management protocols including CMIP, CMISE, SNMP, and MIB. ITU's TMN (Telecommunication Management Network) standards, TMN functional architecture and information architecture. NMF (Network Management Forum) and service management, service modeling and network management API. Issues of telecommunication network management in distributed processing environment. Prerequisite: One of CS 5390, CS 6390, CS 6385 or equivalent. (3-0) Y

CS 6369 Complexity of Combinatorial Algorithms (3 semester hours) Topics include bounded reducibility and completeness, approximation algorithms and heuristics for NP-hard problems, randomized algorithms, additional complexity classes. Prerequisite: CS 6363. (3-0) T

CS 6370 (SE 6370) Information Systems Engineering (3 semester hours) Study of characteristics, analysis and synthesis of information systems in industrial, business, and governmental organizations. Building conventional information systems through requirements modeling and analysis, design, and implementation. Approaches and issues in engineering and re-engineering intelligent, cooperative, and distributed information systems. Prerequisite: CS 6360. (3-0) Y

CS 6371 Advanced Programming Languages (3 semester hours) Functional Programming, Lambda Calculus, Logic Programming, Abstract Syntax, Denotational Semantics of Imperative Languages, Fixpoints semantics, Verification of Programs, Partial Evaluation, Interpretation and Automatic Compilation, Axiomatic Semantics, Applications of semantics to software engineering. Prerequisite: CS 5343, CS 5349 (3-0) S

CS 6372 Computational Systems Biology (3 semester hours). The course will provide a system-level understanding of biological systems by analyzing biological data using computational techniques. The major topics include: computational inference of biological networks (regulatory, protein interactions, and metabolic) and the effects of biological networks in cellular processes, development, and disease. Prerequisite: CS 6325. (3-0) T

CS 6373 Intelligent Systems (3 semester hours) Logical formalizations of knowledge for the purpose of implementing intelligent systems that can reason in a way that mimics human reasoning. Topics include: syntax and semantics of common logic, description logic, modal epistemic logic; reasoning about uncertainties, beliefs, defaults and counterfactuals; reasoning within contexts; implementations of knowledge base and textual inference reasoning systems; and applications. Prerequisite: CS 5343.(3-0) Y

CS 6374 Computational Logic (3 semester hours) Methods and algorithms for the solution of logic problems. Topics include problem formulation in first order logic and extensions, theorem proving algorithms, polynomially solvable cases, logic programming, and applications. Prerequisites: CS 5343, and knowledge of _C._ (3-0) Y

CS 6375 Machine Learning (3 semester hours) Algorithms for training perceptions and multi-layer neural nets: back propagation, Boltzmann machines, self- organizing nets. The ID3 and the Nearest Neighbor algorithms. Formal models for analyzing learnability: exact identification in the limit and probably approximately correct (PAC) identification. Computational limitations of learning machines. Prerequisite: CS 5343. (3-0) Y

CS 6376 Parallel Processing (3 semester hours) Topics include parallel machine models, parallel algorithms for sorting, searching and matrix operations. Parallel graph algorithms. Selected topics in parallel processing. Prerequisite: CS 6363. (3-0) T

CS 6377 Introduction to Cryptography (3 semester hours). This course covers the basic aspects of modern cryptography, including block ciphers, pseudorandom functions, symmetric encryption, Hash functions, message authentication, number-theoretic primitives, public-key encryption, digital signatures and zero knowledge proofs. Prerequisites: CS5333 and CS5343. (3-0) T

CS 6378 (CE 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 or equivalent; knowledge of C and UNIX. (3-0) S

CS 6379 Biological Database Systems and Data Mining (3 semester Hours) Relational data models and database management systems; theories and techniques of constructing relational databases to store biological data, including sequences, structures, genetic linkages and maps, and signal pathways. Introduction to a relational database query language (SQL) with emphasis on answering biologically important questions. Summary of current biological databases. Data integration from various sources and security. Novel data mining methods in bioinformatics with an emphasis on protein structure prediction, homology search, genomic sequence analysis, gene finding and gene mapping. Future directions for biological database development. Prerequisites: BIOL 5373, BIOL 5381, and CS 5343 or consent of the instructor (3-0) T

CS 6380 (CE 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

CS 6381 Combinatorics and Graph Algorithms (3 semester hours) Fundamentals of combinatorics and graph theory. Combinatorial optimization, optimization algorithms for graphs (max flow, shortest routes, Euler tour, Hamiltonian tour). Prerequisites: CS 5343, CS 6363. (3-0) T

CS 6382 Theory of Computation (3 semester hours) Formal models of computation. Recursive function theory. Undecidability and incompleteness. Selected topics in theory of computation. Prerequisite: Consent of Instructor. (3-0) Y

CS 6384 Computer Vision (3 semester hours) Algorithms for extracting information from digital pictures. Particular topics include: analysis of motion in time varying image sequences, recovering depth from a pair of stereo images, image separation, recovering shape from textured images and shadows, object matching techniques, model based recognition, the Hough transform. Prerequisite: CS 5343. (3-0) Y

CS 6385 (TE 6385) Algorithmic Aspects of Telecommunication Networks (3 semester hours) This is an advanced course on topics related to the design, analysis, and development of telecommunications systems and networks. The focus is on the efficient algorithmic solutions for key problems in modern telecommunications networks, in centralized and distributed models. Topics include: main concepts in the design of distributed algorithms in synchronous and asynchronous models, analysis techniques for distributed algorithms, centralized and distributed solutions for handling design and optimization problems concerning network topology, architecture, routing, survivability, reliability, congestion, dimensioning and traffic management in modern telecommunication networks. Prerequisites: CS 5343, CS 5348, and TE 3341 or equivalents. (3-0) Y

CS 6386 Telecommunication Software Design (3 semester hours) Programming with sockets and remote procedure calls, real time programming concepts and strategies. Operating system design for real time systems. Encryption, file compression, and implementation of firewalls. An in-depth study of TCP/IP implementation. Introduction to discrete event simulation of networks. Prerequisites: CS 5390. (3-0) Y

CS 6387 (SE 6387) Computer-Aided Software Engineering (3 semester hours) Tools for development, maintenance, evolution and reuse of software. Development, selection, use, and management of such tools. Traditional and emerging methodologies, including structured systems methodologies and knowledge-

based approaches to software development. Opening and closing CASEs: benefits, pitfalls, and critical issues. Prerequisite: CS 5354. (3-0) Y

CS 6388 (SE 6388) Software Project Planning and Management (3 semester hours) Techniques and disciplines for successful management of software projects. Planning, scheduling, tracking, cost and size estimation, risk management, configuration management and version control. Identification, definition, management, and optimization of software engineering processes. Benefits and pitfalls of both conventional and emerging technologies. Prerequisite: CS 5354. (3-0) Y

CS 6389 (SE 6389) Formal Methods and Programming Methodology (3 semester hours) Formal techniques for building highly reliable systems. Use of abstractions for concisely and precisely defining system behavior. Formal logic and proof techniques for verifying the correctness of programs. Hierarchies of abstractions, state transition models, Petri Nets, communicating processes. Operational and definitional specification languages. Applications to reliability-critical, safety-critical, and mission-critical systems, ranging from commercial computer communication systems to strategic command control systems. Prerequisite: CS 5354. (3-0) Y

CS 6390 (CE 6390) Advanced Computer Networks (3 semester hours) Survey of recent advancements in high-speed network technologies. Application of quantitative approach to the study of broadband integrated networks including admission control, access control, and quality of service guarantee. Prerequisite: CS 5390. (3-0) S

CS 6391 Optical Networks (3 semester hours) Enabling technologies for optical networks. Wavelength-division multiplexing. Broadcast-and-select optical networks. Wavelength-routed optical networks. Virtual topology design. Routing and wavelength assignment. Network control and management. Protection and restoration. Wavelength conversion. Traffic grooming. Photonic packet switching. Optical burst switching. Survey of recent advances in optical networking. Prerequisite: CS 5390 AND one of CS 6352, CS 6385, CS 6390 (3-0) Y

CS 6392 (CE 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

CS 6393 Advanced Algorithms in Biology (3 semester hours). Recent advanced topics in algorithms in biology will be discussed. Topics will be chosen from: sorting and transformational operations on strings and permutations, structural analysis of proteins, pooling design and nonadaptive group testing, approximation algorithms, and complexity issues. Prerequisites: CS6363 and CS 6325. (3-0) Y

CS 6394 Digital Telephony (3 semester hours) Introduction and overview emphasizing the advantages of digital voice networks. Voice digitization. Digital transmission, multiplexing, and switching. Rearrangeable switching networks. Digital modulation for radio systems. Network operation issues: synchronization, control; integration of voice and data, packet switching and traffic analysis. (3-0) Y

CS 6395 Speech Recognition, Synthesis, and Understanding (3 semester hours). Basic speech processing techniques: isolated word recognition using dynamic time warping, acoustic modeling using hidden Markov models, statistical language modeling, search algorithms in large vocabulary continuous speech recognition, components in text-to-speech systems, architecture and components in spoken dialog systems. Prerequisites: CS5343. (3-0) T

CS 6396 (CE 6308, EE 6308) 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, task assignment and scheduling, real-time communication, case studies of real-time operating systems. Prerequisite: CS 5348 or equivalent. (3-0) Y

CS 6397 (CE 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 5343 (3-0) T

CS 6398 (CE 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. Prerequisites: CS 5343. (3-0) T

CS 6399 (CE 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) T

CS 6V81 (SE 6v81) Special Topics in Computer Science (1-9 semester hours) Topics vary from semester to semester. May be repeated for credit as topics vary. ([1-9]-0) S

CS 7301 (SE 7301) Recent Advances in Computing (3 semester hours) Advanced topics and publications will be selected from the theory, design, and implementation issues in computing. May be repeated for credit as topics vary. Prerequisite: Consent of the instructor. (3-0) Y

CS 8V02 (SE 8V02) Topics in Computer Science (1-6 semester hours) (May be repeated to a maximum of 9 hours.) ([1-6]-0) S

CS 8V07 (SE 8V07) Research (1-9 semester hours) Open to students with advanced standing subject to approval of the graduate adviser. ([1-9]-0) S

CS 8V98 (SE 8V98) Thesis (3-9 semester hours) (May be repeated for credit.) ([3-9]-0) S

CS 8V99 (SE 8V99) Dissertation (3-9 semester hours) (May be repeated for credit.) ([3-9]-0) S

Software Engineering Course Descriptions

SE 5354 (CE 5354, CS 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 SE 5354) (3-0) S

SE 5V81 (CS 5V81) Special Topics in Computer Science (1-9 semester hours) Selected topics in Computer Science. (May be repeated to a maximum of 9 credit hours.) ([1-9]-0) S

SE 6354 (CE 6354, CS 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: CE/CS/SE 5354 (or equivalent) and knowledge of Java (3-0) S

SE 6356 (CS 6356) Software Maintenance, Evolution, and Re-Engineering (3 semester hours) Principles and techniques of software maintenance. Impact of software development process on software justifiability, maintainability, evolvability, and planning of release cycles. Use of very high-level languages and dependencies for forward engineering and reverse engineering. Achievements, pitfalls, and trends in software reuse, reverse engineering, and re-engineering. Prerequisite: CS/SE 5354. (3-0) Y

SE 6357 (CS 6357) Software Quality Assurance and Metrics (3 semester hours) Concepts of the pervasive system attributes: reliability, efficiency, maintainability, reusability, etc. Software complexity and measures. Software process measures, product measures and resource measure. Validation of software measures. Software measures and measurement theory. Measuring, monitoring and controlling reliability. Supporting tools. Prerequisite: CS/SE 5354. (3-0) Y

SE 6359 (CS 6359) Object-Oriented Analysis and Design (3 semester hours) Analysis and practice of modern tools and concepts that can help produce software that is tolerant of change. Consideration of the primary tools of encapsulation and inheritance. Construction of _software-ICs_ which show the parallel with hardware construction. Prerequisites: CS/SE 5354 and either CS/SE 5335 or CS/SE 5336. (3-0) S

SE 6360 (CS 6360) Database Design (3 semester hours) Methods, principles, and concepts that are relevant to the practice of database software design. Database system architecture; conceptual database

models; relational and object-oriented databases; database system implementation; query processing and optimization; transaction processing concepts, concurrency, and recovery; security. Prerequisite: CS/SE 5343. (3-0) S

SE 6361 (CS 6361) Requirements Engineering (3 semester hours) System and software requirements engineering. Identification, elicitation, modeling, analysis, specification, management, and evolution of functional and non-functional requirements. Strengths and weaknesses of different techniques, tools, and object-oriented methodologies. Interactions and trade-offs among hardware, software, and organization. System and sub-system integration with software and organization as components of complex, composite systems. Transition from requirements to design. Critical issues in requirements engineering. Prerequisite: CS/SE 5354. (3-0) S

SE 6362 (CS 6362) Software Architecture and Design (3 semester hours) Concepts and methodologies for the development, evolution, and reuse of software architecture and design, with an emphasis on object-orientation. Identification, analysis, and synthesis of system data, process, communication, and control components. Decomposition, assignment, and composition of functionality to design elements and connectors. Use of non-functional requirements for analyzing trade-offs and selecting among design alternatives. Transition from requirements to software architecture, design, and to implementation. State of the practice and art. Prerequisite: CS/SE 5354. (3-0) S

SE 6367 (CE 6367, CS 6367) Software Testing, Validation, and 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/CS/SE 5354. (3-0) Y

SE 6370 (CS 6370) Information Systems Engineering (3 semester hours) Study of characteristics, analysis and synthesis of information systems in industrial, business, and governmental organizations. Building conventional information systems through requirements modeling and analysis, design, and implementation. Approaches and issues in engineering and re-engineering intelligent, cooperative, and distributed information systems. Prerequisite: CS/SE 6360. (3-0) Y

SE 6387 (CS 6387) Computer-Aided Software Engineering (3 semester hours) Tools for development, maintenance, evolution and reuse of software. Development, selection, use, and management of such tools. Traditional and emerging methodologies, including structured systems methodologies and knowledge-based approaches to software development. Opening and closing CASEs: benefits, pitfalls, and critical issues. Prerequisite: CS/SE 5354. (3-0) Y

SE 6388 (CS 6388) Software Project Planning and Management (3 semester hours) Techniques and disciplines for successful management of software projects. Planning, scheduling, tracking, cost and size estimation, risk management, configuration management and version control. Identification, definition, management, and optimization of software engineering processes. Benefits and pitfalls of both conventional and emerging technologies. Prerequisite: CS/SE 5354. (3-0) Y

SE 6389 (CS 6389) Formal Methods and Programming Methodology (3 semester hours) Formal techniques for building highly reliable systems. Use of abstractions for concisely and precisely defining system behavior. Formal logic and proof techniques for verifying the correctness of programs. Hierarchies of abstractions, state transition models, Petri Nets, communicating processes. Operational and definitional specification languages. Applications to reliability-critical, safety-critical, and mission-critical systems, ranging from commercial computer communication systems to strategic command control systems. Prerequisite: CS/SE 5354. (3-0) Y

SE 6V81 (CS 6v81) Special Topics in Computer Science (1-9 semester hours) Topics vary from semester to semester. May be repeated for credit as topics vary. ([1-9]-0) S

SE 7301 (CS 7301) Recent Advances in Computing (3 semester hours) Advanced topics and publications will be selected from the theory, design, and implementation issues in computing. May be repeated for credit as topics vary. Prerequisite: Consent of the instructor. (3-0) Y

SE 8V02 (CS 8V02) Topics in Computer Science (1-6 semester hours) (May be repeated to a maximum of 9 hours.) ([1-6]-0) S

SE 8V07 (CS 8V07) Research (1-9 semester hours) Open to students with advanced standing subject to approval of the graduate adviser. ([1-9]-0) S

SE 8V98 (CS 8V98) Thesis (3-9 semester hours) (May be repeated for credit.) ([3-9]-0) S

SE 8V99 (CS 8V99) Dissertation (3-9 semester hours) (May be repeated for credit.) ([3-9]-0) S