Communication Arts and Sciences—CAS

992 Doctoral Seminar
Fall, Spring, Summer. 3(3-0) A student may earn a maximum of 15 credits in all enrollments for this course. R: Open only to Ph.D. students in Mass Media and Communication or approval of college.

Topics on theoretical and research issues in communication and mass media.

993 Research Internship
Fall, Spring, Summer. 1 credit. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to Ph.D. students in Mass Media.

Participation in faculty research projects.

999 Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to Ph.D. students in Mass Media.

Doctoral dissertation research.

COMPUTER SCIENCE AND ENGINEERING

Department of Computer Science and Engineering

College of Engineering

101 Computing Concepts and Competencies
Fall, Spring, Summer. 3(2-2) SA: CPS 100, CPS 130
Core concepts in computing including information storage, retrieval, management, and representation. Applications from specific disciplines. Applying core concepts to design and implement solutions to various focal problems, using hardware, multimedia software, communication and networks.

131 Technical Computing and Problem Solving
Fall, Spring. 3(1-3) P:M: (MTH 124 or concurrently or MTH 132 or concurrently or LBS 118 or concurrently) or (MTH 152H or concurrently) SA: CPS 131
Use of computing systems for technical problem solving in engineering and science.

231 Introduction to Programming I
Fall, Spring. 4(3-2) P:M: (LBS 118 or concurrently) or MTH 124 or concurrently or MTH 132 or concurrently or MTH 152H or concurrently) RB: (CSE 131) SA: CSE 230
Introduction to object-oriented programming using C++. Design, implementation and testing of programs to solve problems in engineering, mathematics and science. Programming fundamentals, functions, classes, arrays, and pointers.

232 Introduction to Programming II
Fall, Spring. 4(3-2) P:M: (CSE 231) and (LBS 118 or MTH 124 or MTH 132 or MTH 152H) SA: CSE 330
Continuation of object-centered programming using C++. Development of classes and reliable software. Data structures and their encapsulation; stacks, queues, lists, trees, and hash tables. Algorithms operating on data structures. Object-oriented design and programming.

240 Informatics
Fall, Spring, Summer. 3(3-0) P:M: (CSE 103 or CSE 131 or CSE 231) and (MTH 103 or MTH 116 or MTH 124 or MTH 132 or LBS 117) or designated score on Mathematics placement test. R: Approval of department.

Digital representation of objects such as numbers, signals, and 3-D shapes. Algorithms that operate on digital objects. Storage devices and network distribution of digital objects. How information systems support various applications.

260 Discrete Structures in Computer Science
Fall, Spring. 4(4-0) P:M: (MTH 126 or MTH 132 or MTH 153H or LBS 119) SA: CPS 260

290 Independent Study in Computer Science
Fall, Spring. 1 credit. A student may earn a maximum of 3 credits in all enrollments for this course. R: Approval of department; application required. SA: CPS 290
Supervised individual study in an area of computer science.

291 Selected Topics in Computer Science
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Approval of department.

Topics selected to supplement and enrich existing courses and lead to the development of new courses.

320 Computer Organization and Architecture
Fall, Spring. 3(3-0) P:M: (CSE 232 and CSE 260) SA: CPS 320 Not open to students with credit in ECE 331.

Boolean algebra and digital logic. Combinational and sequential circuits. Representations of data and instructions. Architecture and major components of computer systems. Assembly language programming and interfacing to high level languages. Assembler and linker processing.

331 Algorithms and Data Structures
Fall, Spring. 3(3-0) P:M: (CSE 232 and CSE 260) R: Open only to students in the Department of Computer Science or the Computer Engineering or the LBS Computer Science discipline.

Linear data structures, trees, graphs and algorithms which operate on them. Fundamental algorithms for searching, sorting, string matching, graph problems. Design and analysis of algorithms.

355 Object-oriented Software Design
Fall, Spring. 3(3-0) P:M: (CSE 232 and CSE 260) R: Open only to students in Computer Science or Computer Engineering or the LBS Computer Science field of concentration or the LBS Computer Science discipline major or the LBS Computer Science disciplinary minor. SA: CSE 355

410 Operating Systems
Fall, Spring. 3(3-0) P:M: (CSE 232 and CSE 260) and (CSE 320 or ECE 331) R: Open only to students in the Department of Computer Science and Engineering or the Computer Engineering major or the LBS Computer Science field of concentration or the LBS Computer Science coordinate major or the Computer Science disciplinary minor. SA: CPS 410


420 Computer Architecture
Fall, Spring. 3(3-0) P:M: (CSE 232 and CSE 260) and (CSE 320 or ECE 331) R: Open only to students in the Department of Computer Science and Engineering or the Computer Engineering major or the LBS Computer Science field of concentration or the LBS Computer Science coordinate major or the Computer Science disciplinary minor. SA: CPS 420


422 Computer Networks
Fall, Spring. 3(3-0) P:M: (STT 351 or ECE 280) and (CSE 320 or ECE 331) R: Open only to students in the Department of Computer Science or the Computer Engineering or the LBS Computer Science major or the LBS Computer Science coordinate major or the Computer Science disciplinary minor. SA: CPS 422


435 Software Engineering
Fall, Spring. 3(3-0) P:M: (CSE 320 and CSE 331 and CSE 335) R: Open only to students in the Department of Computer Science or the Computer Engineering or the LBS Computer Science major or the LBS Computer Science coordinate major or the Computer Science disciplinary minor. SA: CSE 470

Software lifecycle including specification, design, coding, testing, and verification of a software product. Stepwise refinement and traceability. Software maintenance and documentation.
440 Introduction to Artificial Intelligence  
Fall: 3(3-0) P: (CSE 331 or CSE 335) R: Open only to students in the Department of Computer Science and Engineering or the Computer Engineering major or the LBS Computer Science field of concentration or the LBS Computer Science coordinate major or the Computer Science disciplinary minor. SA: CPS 440


444 Information Technology Project Management  
Spring: 3(3-0) Interdepartmental with Information Technology Management; Telecommunication. Administered by The Eli Broad College of Business. P: (ITM 311) R: Open only to seniors in the Specialization in Information Technology.

Practical training and experiences in design, testing, and launch of new information technologies and systems.

450 Translation of Programming Languages  
Spring: 3(3-0) P: (CSE 331 or CSE 335) and (CSE 320 or ECE 331) R: Open only to students in the Department of Computer Science and Engineering or the Computer Engineering major or LBS Computer Science field of concentration or the LBS Computer Science coordinate major or the Computer Science disciplinary minor. SA: CPS 450


452 Organization of Programming Languages  
Fall: 3(3-0) P: (CSE 331 or CSE 335) and (CSE 320 or ECE 331) R: Open only to students in the Department of Computer Science and Engineering or the Computer Engineering major or the LBS Computer Science coordinate major or the LBS Computer Science field of concentration or the Computer Science disciplinary minor. SA: CPS 452

Organization of programming languages. Type systems. Alternative to execution models. Comparison of language features: functional, imperative, logical and object-oriented.

460 Computability and Formal Language Theory  
Fall: Spring, 3(3-0) P: (CSE 331) R: Open only to students in the Department of Computer Science and Engineering or Computer Engineering major or LBS Computer Science coordinate major or the LBS Computer Science field of concentration or the Computer Science disciplinary minor. SA: CSE 360

Formal models of computation such as finite state automata, pushdown automata and Turing machines. Formal definitions of languages, problems, and language classes including recursive, recursively enumerable, regular, and context free languages. The relationships among various models of computation, language classes, and problems. Church’s thesis and the limits of computability. Proofs of program properties including correctness.

471 Media Processing and Multimedia Computing  
Fall: 3(3-0) P: (CSE 320) and (CSE 331 or CSE 335) R: Open only to students in the Department of Computer Science and Engineering or the Computer Engineering major or the LBS Computer Science field of concentration or the LBS Computer Science coordinate major or the Computer Science disciplinary minor.


472 Computer Graphics  
Spring: 3(3-0) P: (MTH 314) and (CSE 331 or CSE 335) R: Open only to juniors or seniors or graduate students in the Department of Computer Science and Engineering or to juniors or seniors in the Computer Engineering major or the LBS Computer Science field of concentration or the LBS Computer Science coordinate major. SA: CPS 472


475 Introduction to Computational Linguistics  
Fall: 3(3-0) Interdepartmental with Linguistics. Administered by Department of Linguistics and Germanic, Slavic, Asian and African Languages. P: (CSE 232 and LIN 401)

Computer science of linguistic theories and their application in natural language processing systems. Stochastic and categorical automata for morphological analysis. Rule systems for grammars. Parsing algorithms for syntactic and semantic analysis, with implications for cognitive models of human sentence processing. Probabilistic models of linguistic events.

480 Database Systems  
Spring: 3(3-0) P: (CSE 331) and (CSE 320 or ECE 331) R: Open only to students in the Department of Computer Science and Engineering or the Computer Engineering major or the LBS Computer Science field of concentration or the LBS Computer Science coordinate major or the Computer Science disciplinary minor. SA: CPS 480

Storage of and access to physical databases including indexing, hashing, and range accesses. Relational data models, database design principles, query languages, query optimization, transaction processing and recovery techniques. Object-oriented and distributed databases.

484 Information Retrieval  
Fall: 3(3-0) P: (CSE 331) RB: (STT 351) R: Open only to students in Computer Science or Computer Engineering or Lyman Briggs Computer Science major.

808 Modelling and Discrete Simulation
Spring of even years. 3(3-0) Interdepartmental with Electrical and Computer Engineering. R: Open only to majors in Computer Science and Engineering or approval of department. SA: CPS 808
Simulation examples and languages. Mathematical models, petri nets, model validation, random variate generation. Analysis of simulation data. Case studies.

809 Algorithms and Hardware Implementation
Fall. 3(3-0) Interdepartmental with Electrical and Computer Engineering. Administered by Department of Electrical and Computer Engineering. SA: EE 809
Arithmetic, signal processing, and image processing algorithms. Array structures: systolic architecture, data flow structure, neural network architecture. Performance analysis.

812 Advanced Operating Systems
Spring. 3(3-0) RB: (CSE 410 and CSE 420) R: Open only to Computer Science and Electrical Engineering majors. SA: CPS 812
Parallel and distributed operating systems. Load sharing, scheduling, reliability, recovery, memory management. Distributed file systems, distributed agreement, and object-oriented operating systems.

813 Advanced VLSI Design
Spring. 3(3-0) Interdepartmental with Electrical and Computer Engineering. Administered by Department of Electrical and Computer Engineering. P:M: (ECE 410) SA: EE 813

814 Formal Methods in Software Development
Fall of odd years. 3(3-0) RB: (MTH 472) R: Open only to majors in the Department of Computer Science and Engineering or approval of department. SA: CPS 814
Formal specification languages, integrating verification with development. Design and the implementation of term project.

820 Advanced Computer Architecture
Fall, Spring. 3(3-0) Interdepartmental with Electrical and Computer Engineering. RB: (CSE 410 and CSE 420) R: Open only to Computer Science or Electrical Engineering majors. SA: CPS 820
Instruction set architecture. Pipelining, vector processors, cache memory, high bandwidth memory design, virtual memory, input and output. Benchmarking techniques. New developments related to single CPU systems.

822 Parallel Processing Computer Systems
Spring. 3(3-0) Interdepartmental with Electrical and Computer Engineering. RB: (CSE 820) R: Open only to Computer Science or Electrical Engineering majors. SA: CPS 822
Massively parallel SIMD processors, multiprocessor architectures, interconnection networks, synchronization and communication. Memory and address space management, process management and scheduling. Parallel compilers, languages, performance evaluation.

824 Advanced Computer Networks and Communications
Fall. 3(3-0) RB: (CSE 422) R: Open only to graduate students in the Department of Computer Science. SA: CPS 824
Advanced topics in computer networking technologies, including high-speed wide area networks and local area networks, wireless and mobile computing networks, optical networks, and multimedia networking.

825 Computer and Network Security
Spring. 3(3-0) RB: (CSE 410 and CSE 422) Threat assessments, secure software, intrusions and intrusion detection.

830 Design and Theory of Algorithms
Fall, Spring. 3(3-0) RB: (CSE 232 and CSE 460) R: Open only to majors in the Department of Computer Science and Engineering or approval of department. SA: CPS 830
Analysis of algorithms. Algorithm design techniques. Efficient algorithms for classical problems. Intractable problems and techniques to handle them.

833 Algorithmic Graph Theory
Fall. 3(3-0) RB: (CSE 232 and CSE 460 and MTH 314) R: Open only to majors in the Department of Computer Science and Engineering or approval of department SA: CPS 833
Classical concepts in Graph Theory. Algorithmic aspects of graphs such as finding paths, network flow, spanning trees and matching.

838 Design of Parallel Algorithms
Spring. 3(3-0) RB: (CSE 420 and CSE 830) R: Open only to majors in the Department of Computer Science and Engineering or approval of department. SA: CPS 838
Current research topics and issues. Models of parallel computation. Implementation of algorithms on SIMD and MIMD machines. Relationship to VLSI.

841 Artificial Intelligence
Fall. 3(3-0) RB: (CSE 440) R: Open only to Computer Science or Electrical Engineering majors. SA: CPS 841
Types of intelligence, knowledge representation, cognitive models, Goal-based systems, heuristic search and games, expert systems. Language understanding, robotics and computer vision, theorem proving and deductive systems, and learning.

847 Machine Learning
Spring. 3(3-0) P:M: (CSE 841) RB: Algortihms, programming in C or equivalent, probability and statistics, artificial intelligence. R: Open only to students in the Department of Computer Science and Engineering or approval of department.
Computational study of learning and data mining. Strengths and limitations of various learning paradigms, including supervised learning, learning from scalar reward, unsupervised learning, and learning with domain knowledge.

848 Evolutionary Computation
Fall of even years. 3(3-0) RB: (CSE 841 and CSE 440) R: Open only to students in the Department of Computer Science and Engineering or approval of department.
Investigation of evolutionary computation from a historical, theoretical and application viewpoint. Readings from the present literature, experiments with provided software on the application of evolutionary computation principles.

860 Foundations of Computing
Spring of even years. 3(3-0) RB: (CSE 460) R: Open only to majors in the Department of Computer Science and Engineering or approval of department. SA: CPS 860
Models of computation: partial recursive functions, Turing machines, alternative models of computing.

867 Nature and Practice of Cognitive Science
Spring. 3(3-0) Interdepartmental with Zoology. Psychology. Linguistics. Philosophy. Administered by Department of Zoology. RB: Undergraduate course work in behavioral biology, cognitive psychology, philosophy, linguistics, or artificial intelligence. Survey of how different disciplines explore the cognitive processes underlying intelligent behavior.

870 Advanced Software Engineering
Spring. 3(3-0) RB: (CSE 470) Undergraduate software engineering course R: Open only to students in the Department of Computer Science and Engineering. Methods and techniques supporting later lifecycle activities, including software testing and maintenance, reuse, and reverse engineering. Domain-specific software engineering methods. Human-computer interfaces, distributed systems, and visualization techniques.

875 Advanced Computational Linguistics

880 Advanced Database Systems
Fall. 3(3-0) RB: (CSE 480) R: Open only to majors in the Department of Computer Science and Engineering or approval of department. SA: CPS 880
Distributed and object-oriented databases and knowledgebase systems. Design theory, query optimization, and transaction processing.

881 Data Mining
Fall. 3(3-0) RB: Programming skills in C, C++, Java and Matlab. Basic knowledge in calculus, probability and statistics. Techniques and algorithms for knowledge discovery in databases, from data preprocessing and transformation to model validation and post-processing. Core concepts include association analysis, sequential pattern discovery, anomaly detection, predictive modeling, and cluster analysis. Application of data mining to various application domains.

885 Artificial Neural Networks
Fall. 3(3-0) Interdepartmental with Electrical and Computer Engineering. Administered by Department of Electrical and Computer Engineering. SA: CPS 885
914 Formal Methods in Software Development
Fall. 3(3-0) P.M: (CSE 814) RB: Undergraduate courses in software engineering and in logic. R: Open only to students in the Department of Computer Science and Engineering. SA: CPS 914
Current research in selected areas of software engineering such as: approaches for the incorporation of formal methods in software development; current projects using formal methods in software engineering; object-oriented analysis and development techniques; and approaches for the incorporation of user-interface analysis and design in software development.

920 Selected Topics in High Performance Computer Systems
Spring of odd years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. P.M: (CSE 822) R: Open only to Computer Science and Engineering majors or approval of Department. SA: CPS 920
Design of high performance computer systems. Seminar format.

921 Advanced Topics in Digital Circuits and Systems
Fall, Spring. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course. Interdepartmental with Electrical and Computer Engineering. Administered by Department of Electrical and Computer Engineering, SA: EE 921
Topics vary each semester.

921A Testable and Fault-tolerant Digital Systems
Fall of odd years. Spring of odd years. 3(3-0) Interdepartmental with Electrical and Computer Engineering. Administered by Department of Electrical and Computer Engineering. R.B: (ECE 809 and ECE 813) SA: EE 921A

921B Embedded Architectures
Fall of odd years. Spring of odd years. 3(3-0) Interdepartmental with Electrical and Computer Engineering. Administered by Department of Electrical and Computer Engineering. R.B: (ECE 809 and ECE 813) SA: EE 921B
Embedded computers and architectures for real-time computation and/or robust control. ASICs, Bit-slice architectures. Systolic arrays. Neural networks. Genetic algorithms. Implementation technologies and design issues.

921C Electronic Systems Packaging
Fall of odd years. Spring of odd years. 3(3-0) Interdepartmental with Electrical and Computer Engineering. Administered by Department of Electrical and Computer Engineering. R.B: A basic background in electronics and electromagnetics. VLSI packaging technology, thermal management, electrical design, switching noise, multi-chip packaging, materials, device assembly, RF device packaging, and electrical testing.

941 Selected Topics in Artificial Intelligence
Fall. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. R.B: (CSE 841) R: Open only to Computer Science or Electrical Engineering majors. SA: CPS 941
Topic such as second generation expert systems, human factors, natural language processing, speech understanding, neural networks, genetic algorithms and opportunistic planning.

960 Selected Topics in Algorithms and Complexity
Spring of odd years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. R.B: (CSE 830 and CSE 860) R: Open only to graduate students in the Department of Computer Science and Engineering. Approval of department. SA: CPS 960
Current research in the general theory of algorithms and computational complexity.

980 Selected Topics in Database Systems
Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. R.B: (CSE 880) R: Open only to Computer Science or Electrical Engineering majors. SA: CPS 980
Recent developments in areas such as distributed and parallel database systems, object oriented database systems, knowledgebase and expert database systems.

999 Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 9 credits in all enrollments for this course. R: Open only to Computer Science majors. Approval of department. SA: CPS 999
Doctoral dissertation research.

CONSTRUCTION MANAGEMENT PROGRAM

School of Planning, Design and Construction
College of Agriculture and Natural Resources

101 Principles of Building Construction Management
Fall, Summer. 2(2-0) R: Not open to seniors. SA: BCM 101
Historical developments, current issues and trends in commercial and residential construction industries.

124 Residential Construction Materials and Methods
Spring. Summer. 3(3-0) RB: (CMP 101) SA: BCM 124
Properties of construction materials and their application in residential construction.

210 Commercial Construction Methods
Fall. 3(3-0) P.M: (CMP 101 or concurrently and CMP 124) SA: BCM 210 C: CMP 211 concurrently.
Commercial construction: principles, materials, assemblies, and commercial blueprints.

211 Building Codes
Fall. 3(3-0) P.M: (CMP 101 or concurrently and CMP 124) SA: BCM 211 C: CMP 210 concurrently.
Construction codes: structural, mechanical, electrical, and plumbing. Building safety and accessibility.