MTH 112

Computer Science.

100. Using Computers
Fall, Spring, Summer. (3-2-2)
R: Freshmen and sophomores only. Not open to students in the College of Engineering and the College of Natural Science. Applications of computing. Computer hardware, software, communication and networks. Impact of computing and computers on the individual and society. Hands-on application exercises. Databases, files, systems, graphics, spreadsheets, wordprocessing.
QA: CPS 190

130. Introduction to Computing
Fall, Spring, Summer. (3-2-2)
Computer aided software engineering for design. Structured, modular BASIC for programming. Selection, loops, arrays, sequential and direct files, character and pixel graphics, and spreadsheets. Applications from business, science and humanities.
QA: CPS 116

131. Introduction to Technical Computing
Fall, Spring. (3-2-2)
P: MTH 103 or MTH 110 or MTH 116; or MTH 120 or MTH 124 or MTH 132 or concurrently.
Computer systems and applications. Design and implementation of programs using FORTRAN. Examples from engineering, mathematics and science.
MTH 109 or MTH 111 QA: CPS 112

132. Algorithms and Computing
Fall, Spring. (4-3-2)
P: MTH 132.
MTH 112 QA: CPS 262

260. Discrete Structures in Computer Science
Fall, Spring. (3-3-0)
P: MTH 133.
MTH 214, CPS 252 QA: CPS 271

290. Independent Study in Computer Science
Fall, Spring. 1 credit to a maximum of 5 credits in all enrollments for this course.
R: Approval of department; application required. Supervised individual study in an area of computer science.
QA: CPS 256

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; application required. Supervised individual study in an area of computer science.
QA: CPS 292

320. Computer Organization and Assembly Language Programming
Fall, Spring. (4-2-2)
P: CPS 246. Not open to students with credit in EE 331.
QP: CPS 252, MTH 214 QA: CPS 311

330. Data Structures and Programming Concepts
Fall, Spring. (4-3-2)
Data types and structures. Algorithms including searching, sorting and hashing. Program correctness, program analysis. Abstract data types including stacks, queues, and trees. Object-oriented programming, introduction to various program libraries.
QP: CPS 311, CPS 252, CPS 321 QA: CPS 333

360. Automata and Formal Language Theory
Fall, Spring. (3-0)
QP: CPS 321, MTH 215 QA: CPS 322

410. Operating Systems
Fall, Spring. (4-3-2)
P: CPS 330; Open only to College of Engineering Computer Science, Computer Engineering, and Electrical Engineering majors.
History and evolution of operating systems. Process and processor management. Primary and auxiliary storage management. Performance evaluation, security, distributed systems. Case studies of modern operating systems.
QP: CPS 353 QA: CPS 413, CPS 881

420. Computer Architecture
Fall, Spring. (4-3-2)
P: CPS 330; EE 331 or CPS 329, CPS 360. R: Open only to College of Engineering Computer Science, Computer Engineering.
Computer Organization, Electrical Engineering, and LBS Computer Science majors.
Digital logic and sequential machine design. Computer organization, control unit and arithmetic logic unit implementation, input/output, memory organization, parallel operations, digital system simulation.
QP: CPS 311, CPS 322 QA: CPS 421

422. Computer Networks
Fall, Spring. (3-3-0)
P: STT 351; CPS 320 or EE 331. R: Open only to College of Engineering Computer Science, Computer Engineering.
Computer network architecture and protocols. Medium access control. Physical, data link, network, transport, and session layers. Local-area and wide-area networks.
QP: STT 351 or STT 441 and CPS 311 QA: CPS 412, CPS 512

440. Artificial Intelligence and Symbolic Programming
Fall, Spring. (4-3-2)
P: CPS 330, CPS 360. R: Open only to College of Engineering Computer Science and Computer Engineering majors.
Machine intelligence. Heuristic programming. Representation and control in LISP and PROLOG. Applications to search, rule-based diagnosis, and parsing.
QP: CPS 322, CPS 333 QA: CPS 441, CPS 442

449. Design of Intelligent Systems
Spring. (4-2-1)
P: CPS 440; CPS 320 or EE 331. R: Open only to College of Engineering Computer Science seniors and graduate students.
Intelligent system applications such as natural language, machine vision, or a diagnostic expert system. Team development, software engineering, project management.
QP: CPS 441 QA: CPS 442

450. Translation of Programming Languages
Spring. (4-3-2)
P: CPS 330, CPS 340, CPS 320 or EE 331. R: Open only to College of Engineering Computer Science and Computer Engineering majors.
QP: CPS 322, CPS 333 QA: CPS 452

452. Organization of Programming Language
Fall. (3-3-0)
P: CPS 330, CPS 360, CPS 320 or EE 331. R: Open only to College of Engineering Computer Science majors.
Organization of programming languages including language processors, syntax, data types, sequence control, scope and management. Comparison of language features from the functional, imperative, logical and object-oriented paradigms.
QP: CPS 322, CPS 333 QA: CPS 490

470. Software Engineering
Fall. (4-3-2)
P: CPS 330, CPS 360, CPS 320 or EE 331. R: Open only to College of Engineering Computer Science and Computer Engineering majors.
Software life cycle including specification, design, coding, testing and verification of a software product. Stepwise refinement and rapid prototyping. Software portability, reusability and maintenance. Construction of a large software product.
QP: CPS 329, CPS 333

472. Computer Graphics
Spring. (3-2-2)
P: CPS 330, MTH 314. R: Open only to College of Engineering Computer Science majors.
Graphics hardware. Fundamental algorithms. Two- and three-dimensional imaging geometry and transformations. Curve and surface design, rendering, shading, color, and animation.
QP: CPS 333, MTH 334 QA: CPS 414

474. Vector and Parallel Programming
Fall. (3-2-2)
P: CPS 490, MTH 314. R: Open only to College of Engineering Computer Science and Computer Engineering majors.
QP: CPS 454, MTH 104

479. Software Tools for Concurrent Systems
Fall, Spring. (4-2-1)
P: CPS 330, CPS 360; CPS 622 or CPS 474. R: Open only to College of Engineering Computer Science seniors and graduate students.
Not open to students with credit in CPS 449.
Design, development and application of software tools for parallel and distributed systems. Program development, debugging, performance monitoring, simulation, data and control flow analysis, and visualization.
QP: CPS 412, CPS 322, CPS 353

480. Database Systems
Spring. (4-1-3)
P: CPS 330, CPS 360, CPS 320 or EE 331. R: Open only to College of Engineering Computer Science and Computer Engineering majors.
Storage and access to physical databases including indexing, hashing, and range accesses. Data models, query languages, transaction processing, recovery techniques. Object-oriented and distributed database systems. Database design.
QP: CPS 322, CPS 333 QA: CPS 483

490. Independent Study in Computer Science
Fall, Spring. 1 credit. A student may earn a maximum of 5 credits in all enrollments for this course.
R: Approval of department; application required. Supervised individual study in an area of computer science.
QA: CPS 495
491. Selected Topics in Computer Science
Fall, Spring. 3(3-0). A student may earn a maximum of 6 credits in all enrollments for this course.
P: Open only to College of Engineering Computer Science majors. Approval of department.
Topics selected to supplement and enrich existing courses and lead to the development of new courses.
QA: CPS 890

802. Pattern Recognition and Analysis
Spring. 4(4-0)
P: CPS 330, MTH 314, STT 441. R: Open only to Computer Science or Electrical Engineering majors.
Algorithms for classification and pattern recognition, including decision trees, statistical and syntactic methods, supervised and unsupervised machine learning, cluster analysis and ordination, exploratory data analysis, methodology for design of classifiers.
QP: MTH 334, STT 442, CPS 301 or CPS 304 QA: CPS 806, CPS 806

803. Computer Vision
Fall. 3(3-0)
P: CPS 330, MTH 314, STT 351. R: Open only to Computer Science or Electrical Engineering majors.
Computer Vision courses and lead to the development of new computer vision systems. Image formation and transforms, encoding, enhancement, edge detection, segmentation, 3D extraction, description and recognition. Scene analysis. Applications.
QP: CPS 322, MTH 334, STT 441 QA: CPS 822

807. Computer System Performance and Measurement
Spring of even-numbered years. 3(3-0)
Interdepartmental with Electrical Engineering.
P: CPS 410, STT 441. R: Open only to Computer Science or Electrical Engineering majors.
QP: CPS 413, STT 441 QA: CPS 876

808. Modelling and Discrete Simulation
Fall of even-numbered years. 3(3-0) Interdepartmental with Electrical Engineering.
P: CPS 330, STT 341. R: Open only to Computer Science or Electrical Engineering majors.
Simulation examples and languages. Mathematical models, petri nets, model validation, random variate generation. Analysis of simulation data. Case studies.
QP: CPS 413, STT 441 QA: CPS 876

812. Advanced Operating Systems
Spring. 3(3-0)
P: CPS 410, CPS 420. R: Open only to Computer Science or Electrical Engineering majors.
Parallel and distributed operating systems. Load sharing, scheduling, reliability, recovery, memory management. Distributed file systems, distributed agreement, and object-oriented operating systems.
QP: CPS 881 QA: CPS 890

814. Formal Methods in Software Development
Fall of odd numbered years. 3(3-0)
P: MTH 472. R: Open only to Computer Science or Electrical Engineering majors.
Formal specification techniques, integrating verification with development. Design and the implementation of term projects.
QP: MTH 471 QA: CPS 890

820. Advanced Computer Architecture
Fall, Spring. 3(3-0) Interdepartmental with Electrical Engineering.
P: CPS 410, CPS 420. R: Open only to Computer Science or Electrical Engineering majors.
Course description to follow with emphasis on instruction set architecture, pipelining, vector processors, cache memory, high bandwidth memory design, virtual memory, interrupts and I/O, benchmarking techniques. New developments related to single CPU systems.
QP: CPS 413, CPS 424 QA: CPS 815

822. Parallel Processing Computer Systems
Spring. 3(3-0) Interdepartmental with Electrical Engineering.
P: CPS 390. R: Open only to Computer Science or Electrical Engineering majors.
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.
QP: CPS 815 QA: CPS 821

530. Design and Theory of Algorithms
Fall. 3(3-0)
P: CPS 330, CPS 360. R: Open only to Computer Science or Electrical Engineering majors.
Analysis of algorithms and algorithm design techniques. Efficient algorithms for classical problems. Intractable problems and techniques to handle them.
QP: CPS 322, CPS 333 QA: CPS 834

835. Algorithmic Graph Theory
Fall. 3(3-0)
P: CPS 330, CPS 360, MTH 314. R: Open only to Computer Science or Electrical Engineering majors.
Classical concepts in Graph Theory. Algorithmic aspects of graphs such as finding paths, network flow, spanning trees and matching.
QP: CPS 322, CPS 330, MTH 334 QA: CPS 835

839. Design of Parallel Algorithms
Spring. 3(3-0)
P: CPS 450, CPS 830. R: Open only to Computer Science or Electrical Engineering majors.
Current research topics and issues. Models of parallel computation. Implementation of algorithms on SIMD and MIMD machines. Relationship to VLSI.
QP: CPS 854 QA: CPS 890

841. Artificial Intelligence
Fall. 3(3-0)
P: CPS 410. R: Open only to Computer Science or Electrical Engineering majors.
Types of intelligence, knowledge representation, cognitive models, goal-oriented systems, heuristic search and games, expert systems. Language understanding, robotics and computer vision, theorem proving and deductive systems, and learning.
QP: CPS 441 QA: CPS 841

845. Knowledge-Based Systems (MTC)
Spring. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course.
P: CPS 841. R: Open only to Computer Science or Electrical Engineering majors.
Research literature examining model-based reasoning, design, or diagnosis. Effectiveness and potential for future developments.
QP: CPS 841 QA: CPS 890

846. Laboratory in Knowledge-Based Systems (MTC)
Summer. 3(1-1) A student may earn a maximum of 8 credits in all enrollments for this course.
P: CPS 845. R: Open only to Computer Science or Electrical Engineering majors.
Development of a working model-based reasoning, design, diagnostic system. Design, implementation, and testing.
QA: CPS 850

860. Foundations of Computing
Fall. 3(3-0)
P: CPS 360. R: Open only to Computer Science or Electrical Engineering majors.
QP: CPS 322 QA: CPS 831, CPS 832

882. Computational Complexity
Spring of odd-numbered years. 3(3-0)
P: CPS 390. R: Open only to Computer Science or Electrical Engineering majors.
Theory of computational complexity. Uniform, nonuniform, and probabilistic complexity classes. The polynomial time hierarchy, Structure of complexity classes.
QP: CPS 851 QA: CPS 832, CPS 811

889. Independent Study
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
P: Open only to Computer Science or Electrical Engineering majors. Approval of department.
Independent study of a topic of the student's choosing, in cooperation with a faculty instructor.
QP: CPS 884 QA: CPS 884

890. Selected Topics
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
P: Open only to Computer Science or Electrical Engineering majors.
QP: CPS 889

899. Master's Thesis Research
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 24 credits in all enrollments for this course.
P: Open only to Computer Science majors.
QA: CPS 880

902. Selected Topics in Recognition by Machine
Fall. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course.
P: CPS 862, CPS 893. R: Open only to Computer Science or Electrical Engineering majors.
Advanced topics in pattern recognition and computer vision such as Markov random fields, modelling and recognition of three-dimensional objects, and integration of visual modules.
QP: CPS 865, CPS 896, CPS 822 QA: CPS 906

910. Selected Topics in Computer Networks and Distributed Systems
Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course.
P: CPS 421, CPS 812. R: Open only to Computer Science or Electrical Engineering majors.
Advanced topics and developments in high-bandwidth computer networks, protocol engineering, and distributed computer systems.
QP: CPS 412, CPS 812, CPS 881 QA: CPS 890

914. Selected Topics in Formal Methods in Software Development
Fall. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course.
P: CPS 814. R: Open only to Computer Science majors.
QP: CPS 814

920. Selected Topics in High Performance Computer Systems
Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course.
P: CPS 822. R: Open only to Computer Science or Electrical Engineering majors.
Design of high performance computer systems. Seminar format.
QP: CPS 821, EE 813 QA: CPS 822
COUNSELING, EDUCATIONAL PSYCHOLOGY AND SPECIAL EDUCATION

Department of Counseling, Educational Psychology and Special Education
College of Education

240. Diverse Learners in Multicultural Perspective
Fall, Spring, Summer. 3(3-0) Interdepartmental with Teacher Education.
R: Not open to students with credit in TE 250.
Communicative, linguistic, physical, sensory, behavioral, affective, and cognitive differences in learning in multicultural classrooms. Factors that mediate access to knowledge.
QA: CEP 480

428B. Elementary Curriculum and Instruction for the Mentally Impaired
Fall, Spring, Summer. 3(3-0) R: Open only to juniors, seniors, or graduate students in the College of Education. Uses of technology in teaching and learning. Major emphasis on developing plans for implementing and evaluating uses of technology in the classroom setting.
QA: CEP 434, CEP 836

460C. Psychoeducational Characteristics of the Mildly Impaired
Fall, Spring. 3(3-0) R: Open only to majors in Special Education.
Exposure to and understanding of the main theoretical approaches to working with the Mildly Impaired.
QA: CEP 450, CEP 460C, CEP 465K

QA: CEP 442B, CEP 442C, CEP 460C, CEP 465K R: Concurrently, or CEP 465B or CEP 468C, CEP 846K: R: Open only to majors in Special Education.
Cognitive, affective, and social characteristics. Instructional practices that affect school learning and personal adjustment.
Temporary approval effective from Fall Semester 1992 through Spring Semester 1994.
QA: CEP 440 QA: CEP 460C

460F. Academic Assessment of the Mildly Impaired
Fall, Spring. 3(3-0) R: Open only to majors in Special Education.
Screening and placement procedures. Terminology and interpretation of tests used for the assessment of mildly impaired students. Interpersonal and professional issues of the mildly impaired.
Temporary approval effective from Fall Semester 1992 through Spring Semester 1994.
QA: CEP 440, TE 310, TE 312, TE 315. C: CEP 460L, CEP 468L R: Open only to majors in Special Education.
Education practices and remedial strategies for teaching academic skills to mildly impaired students.
Temporary approval effective from Fall Semester 1992 through Spring Semester 1994.
QA: CEP 440, TE 310, TE 312, TE 315 QA: CEP 460L

460M. Academic Instruction of the Mildly Impaired
Fall, Spring. 3(3-0) R: Open only to majors in Special Education.
Exposure to and understanding of the main theoretical approaches to working with the Emotionally Impaired.
Cognitive, affective, and social characteristics. Instructional practices that affect school learning and personal adjustment.
Temporary approval effective from Fall Semester 1992 through Spring Semester 1994.
QA: CEP 440, TE 310, TE 312, TE 315 QA: CEP 460L

460L. Practicum: Special Education Core
Fall, Spring. 4(0-2) R: Open only to majors in Special Education.
Supervised practicum in an educational program for mildly impaired students. Emphasis on the educational needs of mildly impaired students.
Temporary approval effective from Fall Semester 1992 through Spring Semester 1994.
QA: CEP 440, TE 310, TE 312, TE 315 QA: CEP 460L

466B. Elementary Curriculum and Instruction for the Emotionally Impaired
Fall, Spring. 3(3-0) R: Open only to majors in Special Education.
Exposure to and understanding of the main theoretical approaches to working with the Emotionally Impaired.
Cognitive, affective, and social characteristics. Instructional practices that affect school learning and personal adjustment.
Temporary approval effective from Fall Semester 1992 through Spring Semester 1994.
QA: CEP 440 QA: CEP 465B

466C. Secondary Curriculum and Instruction for the Emotionally Impaired
Fall, Spring. 2(2-0) R: Open only to majors in Special Education.
Exposure to and understanding of the main theoretical approaches to working with the Emotionally Impaired.
Cognitive, affective, and social characteristics. Instructional practices that affect school learning and personal adjustment.
Temporary approval effective from Fall Semester 1992 through Spring Semester 1994.
QA: CEP 440 QA: CEP 465C

466K. Practicum: Emotionally Impaired Children and Youth
Fall, Spring. 3(3-0) R: Open only to majors in Special Education.
Supervised practicum in an educational program for emotionally impaired students.
Temporary approval effective from Fall Semester 1992 through Spring Semester 1994.
QA: CEP 440 QA: CEP 465K