

**Descriptions — Computer Science  
of  
Courses**

**COMPUTER SCIENCE CPS**

**College of Engineering**

**112. Computing for Engineers and Scientists I**

Fall, Winter, Spring, Summer. 3(2-2)  
MTH 112 or concurrently. Student may not receive credit in both CPS 112 and CPS 120.

Algorithms; data representation, structures, type; decision structures. Design and implementation of algorithms. Applications from engineering, mathematics, and science. Computer arithmetic; microcomputers, mainframes, editors, files.

**113. Computing for Engineers and Scientists II**

Fall, Winter, Spring, Summer. 3(2-2)  
CPS 112, MTH 112. Student may not receive credit in both CPS 113 and CPS 300.

Continuation of CPS 112 with emphasis upon more complex problem solving tasks. Development of self-sufficiency. Use of reference manuals and documentation. Networks, operating systems, software systems.

**115. Introduction to Computing**

Fall, Winter, Spring, Summer. 3(3-0)

Applications of computers in business, education, government and industry. Introduction to computing systems and programming in BASIC.

**120. Computer Programming for Engineers and Scientists**

Fall, Winter, Spring, Summer. 3(3-0)  
MTH 111. Student may not receive credit in both CPS 112 and CPS 120.

FORTRAN programming, number systems and basic computer structure. Applications from engineering, mathematics and physical science.

**124. APL-Computer Programming for Scientists**

Fall, Winter, Spring, 3(3-0) LBS 112 or concurrently. Interdepartmental with and administered by Lyman Briggs School.

APL programming; interactive programming techniques; arithmetic, logical, and extended APL operators; functions, applications to concurrent topics in mathematics; principles of operation of time-shared computers.

**130. Computers in Society**

Fall. 3(3-0)

A non-technical introduction to computers, programming, applications and to the computer revolution. Topics: automation, data banks, privacy, the engineered society.

**214. Computing for Engineers and Scientists III**

Fall, Winter, Spring, Summer. 3(2-2)  
CPS 113; MTH 113.

Continuation of CPS 113. Data and instruction structures from both the high-level and implementation perspectives. Emphasis upon problem solving tasks requiring complex data and instructional structures.

**251. Algorithms and Computing I**

Fall, Winter, Spring. 3(2-3) MTH 112.

Algorithms, numeric and character data, data types, variables, expressions, decision structures, arrays, and procedures. Design and implementation of algorithms in PASCAL.

**252. Algorithms and Computing II**

Winter, Spring, Summer. 3(2-3) CPS 251, MTH 113.

Problem solving methods, numeric computation, string processing, number and character representation, data structures, and programming style. Design and implementation of algorithms in PASCAL.

**292. Selected Topics**

Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits when different topics are taken.

Topics selected will in general supplement and enrich existing courses, and lead to the development of new courses.

**295. Independent Study**

Fall, Winter, Spring, Summer. 1 credit. May reenroll for a maximum of 4 credits in CPS 295 and CPS 495 combined. Approval of department.

Independent undergraduate research in computer science.

**300. Computer Programming**

Fall, Winter, Spring, Summer. 3(3-0)  
CPS 120. Student may not receive credit in both CPS 113 and CPS 300.

Development and implementation of numeric and non-numeric algorithms using FORTRAN. Number systems and representations of data. Concepts of storage, processors and compilers.

**301. FORTRAN Laboratory**

Fall, Winter, Spring, Summer. 1(0-3)  
CPS 252 or concurrently. Students may not receive credit in CPS 301 and in CPS 120.

Programming laboratory using FORTRAN.

**304. PASCAL Programming**

Fall, Summer. 2(1-3) CPS 300, MTH 113. Students with credit in CPS 251 may not receive credit in CPS 304.

Programming style, problem solving methods, linear data structure, trees. Design and implementation of algorithms in PASCAL.

**305. List Processing Languages**

Winter. 3(3-0) CPS 300 or CPS 301.

Development and implementation of computer programs in string and list processing languages. Emphasis upon non-numeric applications. Structure of a simple list processing language. Comparison of list processing languages.

**306. COBOL Programming**

Spring. 3(3-0) CPS 115 or CPS 120 or CPS 251.

The mechanics of COBOL, a business data processing language; presented with illustrative problems.

**311. Assembly Language and Machine Organization**

Fall, Winter. 4(3-2) MTH 214 and one of the following pairs: CPS 252, CPS 301 or CPS 300, CPS 304, or CPS 113, CPS 304.

Machine structure, registers and operations. Programming in assembly language. Discrimination of assembler, loader and execution tasks. Comparison with interpretive processing. Introduction to program and data structures. Subprogram linkage.

**312. Generative Coding and Information Structures**

Winter, Spring. 4(3-2) CPS 311.

Macro facilities, conditional assembly, interaction with monitor, assembly language I/O. Use of buffer, stack, queue, deque, tree and list data structures. Interpreters, recursive routines.

**313. Introduction to System Programming**

Fall, Spring, Summer. 4(3-2) CPS 312.

Loaders and operating systems. Study of existing batch and time-sharing systems. Design and implementation of part of an operating system. Segments, overlays, multi-processing and multi-programming.

**321. Introduction to Discrete Structures**

Fall, Winter. 3(3-0) CPS 252 or CPS 300, MTH 214.

Set operations, relations, functions and mappings. Boolean algebra, Boolean matrices, truth tables, minimization. Propositional and predicate calculus, well formed formulas, precedence relations, quantifiers. Applications to computer science.

**322. Introduction to Theory of Computing**

Winter, Spring. 3(3-0) CPS 321, MTH 215.

Finite-state machines, stack automata. Turing machines. Effective procedures and computability. Introduction to recursive functions. Symbol manipulation systems.

**340. Computer Aided Manufacturing**

(341.) Spring. 4(3-2) CPS 115 or CPS 120 or CPS 251 or LBS 124. Interdepartmental with and administered by the Department of Metallurgy, Mechanics, and Materials Science.

APT and COMPACT numerical control languages. Group technology and computer-aided process planning. Introduction to manufacturing robotics.

Approved through Winter 1986.

**412. Computer Communications**

Winter. 3(3-0) CPS 300 or CPS 301; STT 351 or STT 441.

Computer networks; analysis by queueing theory; network design algorithms, routing and flow.

**414. Interactive Computer Graphics**

Summer. 3(3-0) CPS 312, matrix algebra.

Design of interactive graphics systems including display devices, processors, data structures, interrupt processing and graphical techniques. Two and three dimensional transformations, perspectives, hidden surface removal, shading. Graphics languages.

**416. Digital Design**

Fall, Spring, Summer. 3(3-0) CPS 311, CPS 322.

Combinational logic with MSI, LSI (medium-scale and large-scale integrated circuits) and microprocessors. Synchronous and asynchronous machines. Processor and control logic design.

**417. Digital Design Laboratory**

Fall, Winter, Summer. 2(1-3) CPS 416 or concurrently.

Designing, constructing and testing computer related circuits using discrete logic, MSI, LSI and microprocessors.

**423. Computer Architecture**

Fall, Winter, Spring. 3(3-0) CPS 416.

Computer arithmetic algorithms, memory systems, computer design, input-output system design, digital system simulation.

- 447. Digital Filtering**  
Spring. 3(3-0) CPS 300 or CPS 301, MTH 310.  
Background. Sampling theorems. Discrete linear systems. The digital filter. Digital filter design. Discrete Fourier transforms. Applications and generalizations.  
Approved through Winter 1986.
- 451. Design of Language Processors I**  
Fall. 3(3-0) CPS 313 or concurrently, CPS 322.  
Relation between languages and automata. Properties of grammars. Lexical analysis and symbol-table management. Syntactic analysis using top-down parsing, precedence, LR(k) and LL(k). Preliminary design of a compiler.
- 452. Design of Language Processors II**  
Winter. 3(3-0) CPS 451.  
Continuation of CPS 451. Semantics and generation of intermediate code. Pragmatics of code optimization, register allocation and machine code generation. Macro facilities, compiler generators and interpreters. Implementation of designed compiler.
- 453. Design of Language Processors III**  
Spring. 3(3-0) CPS 452.  
Continuation of CPS 452. Readings from the current literature. Completion of compiler project.
- 471. Algorithms and Data Structures**  
Fall. 4(4-0) MTH 215, one programming course in a high level language. Not open to students with credit in CPS 311.  
Algorithms, data structures, control structures, data types, analysis of algorithms, lists, trees, graphs, sets, sorting and searching.
- 472. Machine Organization and System Programming**  
Winter. 4(4-0) CPS 322, CPS 471.  
Machine organization, addressing formats, assembly language, assemblers, compilers, linkers, loaders, interrupt and I/O programming, paging and segmentation.
- 484. Database Management Systems**  
Fall, Spring. 4(3-3) CPS 312, CPS 321.  
File systems, access methods. Data models, design and manipulation languages. Design methods and implementation.
- 490. Selected Topics**  
Fall, Winter, Spring, Summer. 3(3-0)  
May reenroll for a maximum of 9 credits if a different topic is taken. Approval of department.  
A new developing area of computer science selected by the department.
- 495. Independent Study**  
Fall, Winter, Spring, Summer. 1 credit. May reenroll for a maximum of 4 credits in CPS 295 and CPS 495 combined. Approval of department.  
Independent undergraduate research in computer science.
- 801. Independent Study**  
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 8 credits. Approval of department.
- 805. Clustering and Scaling Algorithms**  
Fall. 3(3-0) CPS 301 or CPS 304, STT 441 or approval of department.  
Algorithms that organize large amounts of data. Includes metric clustering, hierarchical clustering and multi-dimensional scaling.
- 806. Fundamentals of Pattern Recognition**  
Spring. 4(4-0) CPS 301 or CPS 304, MTH 334, STT 442.  
Decision-theoretic and nonstatistical approaches; discriminant functions; parameter and density estimation; feature extraction; supervised and unsupervised learning; sample size effects; error estimation; design of pattern recognition systems; computational considerations.
- 809. Computer Arithmetic Algorithm Design**  
Fall. 4(4-0) E E 431 or CPS 423. Interdepartmental with and administered by Electrical Engineering.  
Number systems; fast two-operand and multioperand addition/subtraction; standard, recoded and cellular array multipliers; high-performance dividers; floating-point arithmetic; error control; pipelining.
- 812. Computer Networks**  
Spring. 3(3-0) CPS 412. Interdepartmental with Electrical Engineering.  
Network architecture model, routing and congestion control, satellite and radio networks, local computer networks, virtual terminal and file transfer protocols, network security, transport and session protocols, distributed processing.
- 813. Logic Design Methodologies**  
Spring. 3(3-0) CPS 423 or E E 431. Interdepartmental with and administered by Electrical Engineering.  
Modeling and simulation of logic circuits; hardware description languages; design methodologies for logic arrays and bit-slice processors; fault tolerance, testability, computer aided design of logic circuits; automated routing algorithms.
- 815. Architecture of Computational Systems**  
Winter. 3(3-0) CPS 423. Interdepartmental with Electrical Engineering.  
Overview of computer system organization; theoretical constructs of computer systems; processors; control units; memory; interconnection networks.
- 818. Introduction to Robotics**  
Spring. 3(3-0) E E 415 or M E 458 or approval of department. Interdepartmental with and administered by Electrical Engineering.  
Robot configuration and geometry. Robot drive systems, kinematics, controller design, sensors, sensor-based robots. Economic, political and social implications. Industrial application.
- 822. Computer Vision**  
Winter. 4(4-0) MTH 334, CPS 252, STT 441.  
Imaging geometry, sampling, coding. Picture transformations, enhancement. Edge detection, segmentation. Object and scene description and recognition applications.
- 827. Switching Theory**  
Spring. 3(3-0) CPS 826.  
Asynchronous and speed independent circuits; static and dynamic hazards; use of race conditions.
- 831. Theory of Formal Languages I**  
Fall. 3(3-0) CPS 322 or approval of department.  
Definition of formal languages; acceptors and grammars; regular, linear and context free languages; closure properties.
- 832. Theory of Formal Languages II**  
Winter. 3(3-0) CPS 831.  
Context sensitive languages; derivation restricted grammars; semantics of formal languages.
- 835. Analysis of Graph Algorithms**  
Fall. 3(3-0) MTH 334, CPS 322.  
Basic concepts in graphs, fundamental graph algorithms: shortest paths, minimum spanning trees, network flow, connectivities, matching, their limitations and complexities, other graph algorithms, NP-complete graph problems.
- 841. Artificial Intelligence I**  
Winter. 4(4-0) CPS 252, STT 441.  
Foundations of heuristic methods; syntactic means-end analysis; semantic means-end analysis; adaptive systems.
- 842. Artificial Intelligence II**  
Spring. 3(3-0) CPS 312, CPS 841.  
Computer representation of information from natural languages; representation of two and three dimensional environments; theory of design of robots; future trends.
- 876. Performance Measurement Techniques**  
Fall. 3(3-0) CPS 313, CPS 322, STT 441.  
Performance evaluations on computer systems, evaluation of the central processor. Systems analysis, simulation, programmed measurement, and instrumental measurement techniques. Case studies.
- 881. Operating Systems Theory I**  
Winter. 3(3-0) CPS 313, STT 441.  
Control of concurrent processes. Deterministic and probabilistic models of processor scheduling. Introduction to auxiliary and buffer storage models.
- 882. Operating Systems Theory II**  
Spring. 3(3-0) CPS 881.  
Auxiliary and buffer storage models. Storage allocation in paging systems. Multiprogrammed memory management.
- 884. Large Data Base Theory**  
Summer. 3(3-0) CPS 313, CPS 452, or approval of department.  
Data base management constituent parts; data definition, data manipulation, data retrieval and report generation. Hierarchical, network and relational data base models. Schemas, sub-schemas and access methods. Analytic and theoretical treatment.
- 890. Special Topics**  
Fall, Winter, Spring, Summer. 2 to 4 credits. May reenroll for a maximum of 10 credits. Approval of department.  
Special topics in computer science of current interest and importance.
- 899. Master's Thesis Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

## Descriptions — Computer Science

### of Courses

**906. Advances in Pattern Recognition**  
Fall. 3(3-0) CPS 805, CPS 806, CPS 822.  
Current research topics in pattern recognition, exploratory data analysis, syntactic pattern recognition and digital image processing; practical applications of pattern recognition methodology.

**911. General Automata Theory I**  
Fall of odd-numbered years. 3(3-0) CPS 423 or SYS 827 or approval of department. Interdepartmental with Electrical Engineering. Characterization of machines and programs as automata; mathematical decomposition of finite automata.

**921. Advanced Computer Systems I**  
Fall. 3(3-0) Two graduate level courses in computer system design (hardware or software). Interdepartmental with Electrical Engineering. Models of single and multiple processors, their computational power, and measures of performance. Interconnection networks, data driven machines, and pipelines.

**922. Advanced Computer Systems II**  
Winter. 3(3-0) CPS 921. Interdepartmental with Electrical Engineering. Design and characterization of parallel algorithms. Matching of algorithms with appropriate hardware configurations. Programming languages which support parallel computation.

**999. Doctoral Dissertation Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

## COUNSELING, EDUCATIONAL PSYCHOLOGY AND SPECIAL EDUCATION CEP

(Name change effective September 1, 1981. Formerly departments of Counseling and Educational Psychology, and Elementary and Special Education.)

### College of Education

**400. Classroom Testing and Grading**  
(ED 465.) Winter, Summer. 3(3-0) T E 200 or T E 200A or T E 200B or T E 200C or approval of department.  
Construction, use, and evaluation of teacher-made classroom tests, objective and essay, in elementary schools, secondary schools, and colleges. Statistical analysis of test scores and item responses. Grading problems.

**401. Standardized Tests and Testing Programs**  
(ED 464.) Fall, Spring, Summer. 3(3-0) Approval of department.  
An overview of standardized tests and sources of information about them. Selection and uses of standardized tests. Interpretation of standardized test scores. Local and widescale testing programs.

**410. Instructional Design and Technology**  
(ED 410.) Winter, Spring, Summer. 2 to 4 credits. May reenroll for a maximum of 6 credits. T E 200 or T E 200A or T E 200B or T E 200C.  
Students design plans for implementing instruction via systems approach and application of learning principles.

**411. School Learning I**  
(ED 411.) Fall, Winter, Spring, Summer. 3(3-0) T E 200 or T E 200A or T E 200B or T E 200C.  
Verbal learning, concept formation, problem solving and transfer with implications for teaching in schools.

**412. Human Growth and Development**  
(ED 412.) Fall, Winter, Spring, Summer. 4(2-4) T E 200 or T E 200A or T E 200B or T E 200C.  
Patterns in human growth and mental and emotional development of children 3 through 12 and adolescents 12 through 18; observation and participation in schools is an integral part of the course.

**413. Mental Health of School Children**  
(ED 413.) Fall, Winter. 3(3-0) T E 200 or T E 200A or T E 200B or T E 200C.  
Social and emotional adjustments of children. Emphasis on balancing factors favoring prevention and resolution of behavior difficulties and evaluation of school programs on basis of their contribution to mental health.

**428A. Psycho-Educational Characteristics of the Mentally Retarded**  
(ED 428A.) Fall. 3(3-0) CEP 460A or approval of department.  
Cognitive, affective and social characteristics of the mentally retarded. Implications for school learning and life adjustment. Differentiation of mental retardation from related conditions.

**428B. Curriculum for the Mentally Retarded**  
(ED 428B.) Fall. 3(3-0) CEP 460A or approval of department.  
The development of curriculum for mentally retarded children and youth emphasizing current practice in pre-school through secondary school programs for educable and trainable mentally retarded.

**428C. Educational Procedures for the Mentally Retarded**  
(ED 428C.) Fall. 3(3-0) CEP 460A or approval of department.  
Methods of instruction for mentally retarded children and youth, including the development of objectives, assessment of individual abilities, the development of learning skills, and the teaching of non-academic and academic skills.

**428D. Education of the Severely Retarded**  
(ED 428D.) Fall, Winter, Spring. 3(3-0) CEP 460A.  
Procedures in teaching severely mentally retarded children and youth.

**431A. Educational Media in Instruction**  
(ED 431, ED 431A.) Fall, Winter, Spring. 3(3-0) Juniors.  
Educational media for preservice and inservice teachers, and media specialists. Selection and utilization of flat pictures, slides, filmstrips, motion picture films, sound, models, radio, and television. Equipment operation acquired through self instructional laboratory. Field trips required.

**431B. Basic Educational Graphics**  
(ED 431B.) Fall. 3(3-0) CEP 431A or approval of department.  
A course for teachers and prospective teachers in the local production of visual instructional materials.

**434. Computers in the Classroom**  
Fall, Winter, Spring, Summer. 3(3-0) Juniors.  
How to teach computer literacy and programming in public schools. Computer aided instruction in the classroom. Applying instructional design principles to the selection, evaluation, modification, and development of computer courseware.

**442. Use of Paraprofessionals in Counseling**  
(ED 477.) Spring of odd-numbered years. 3(3-0)  
History and current status of the paraprofessional movement. Review of the selection, training, and evaluation processes; identification of issues and problems in the use of support personnel.

**450. Interpersonal Process Recall**  
(ED 414.) Fall, Winter, Spring. 3(3-2) Approval of instructor.  
Interpersonal communication focusing on one's own interpersonal style through self study of video-recorded interviews.

**460A. Education of Exceptional Children**  
(ED 424A.) Fall, Winter, Spring, Summer. 3(3-0)  
Emphasis on the nature of handicapping conditions and educational needs and approaches. Includes mental retardation; emotional disturbance; visual, auditory and physical handicaps.

**460B. Educational Provisions for the Physically Handicapped**  
(ED 427A.) Fall. 3(3-0) CEP 460A, T E 470.  
Facilities, programs, trends, methods, materials and terminology in education of the physically handicapped. Field trips to special classes and hospital school programs.

**461. Core Seminar in Special Education**  
(ED 489.) Fall, Winter, Spring. 2(2-0) T E 101, CEP 460A, admission to special education, core students only.  
Consideration of affective interactions with children, parents, other professionals, and self. Attention to sharing field experiences, examining belief-behavior consistency, teaching in the affective domain, and the parent-teacher partnership.

**463A. The Exceptional Child in the Regular Classroom**  
Spring. 2(2-0) T E 201B.  
Exceptional learners characteristics, and instructional strategies/curricular adaptations appropriate to such learners. Legislation mandating educational programs and affecting school practices will be reviewed.

**465A. Educational Provisions for Deaf Children and Youth**  
(ED 425A.) Winter. 3(3-0) CEP 460A, T E 470, ASC 454.  
Adaptation of educational methods, materials and curriculum to the needs of individuals with severe and profound hearing impairment.