

**630. Alcoholism Clerkship**

Fall, Winter, Spring, Summer. 2 to 12 credits. May reenroll for a maximum of 12 credits. COM students: Satisfactory completion of terms 1 through 8. CHM students: Satisfactory completion of Phase II.

Diagnosis, inpatient and outpatient management of alcoholics.

**COMPUTER SCIENCE      CPS**

**College of Engineering**

**115. Introduction to Computing**

Fall, Winter, Spring, Summer. 3(3-0) Not open to students with credit in CPS 120, LBS 124, CPS 130 or CPS 251.

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 or concurrently. Students may not receive credit in both CPS 110 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 operators of time-shared computers.

**130. Computers in Society**

Fall. 3(2-1)

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

**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 or approval of department; MTH 111.

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 or approval of department.

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) CPS 252, CPS 301 or CPS 300, CPS 304, MTH 214 or LBS 216.

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. Sub-program 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 or LBS 216.

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 or LBS 217.

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.

**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 or E E 430 or approval of department.

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.

**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.

**Descriptions – Computer Science  
of  
Courses**

- 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.
- 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. Special Problems**  
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) EE 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.
- 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.
- 822. Digital Image Processing**  
Winter. 3(3-0) MTH 334, CPS 447 or SYS 311 or approval of instructor.  
Image digitization, sampling, and coding. Discrete picture transforms. Image restoration and enhancement. Image segmentation and description.
- 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.
- 841. Artificial Intelligence and Adaptive Systems I**  
Winter. 4(4-0) CPS 301 or CPS 304, STT 441.  
Foundations of heuristic methods; syntactic means-end analysis; semantic means-end analysis; adaptive systems.
- 842. Artificial Intelligence and Adaptive Systems II**  
Spring. 4(4-0) CPS 841.  
Computer representation of information from natural languages; representation of two and three dimensional environments; theory of design of robots; future trends.
- 863. Structured Multiprogramming Systems**  
Spring. 3(3-0) CPS 313; CPS 322 or concurrently.  
Advanced software techniques for computer operating systems. Term project to design, implement and analyze an operating system using quality structured program construction.
- 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 of even-numbered years. 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 of even-numbered years. 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, subschemas and access methods. Analytic and theoretical treatment.
- 899. Master's Thesis Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
- 906. Advances in Pattern Recognition**  
Fall. 3(3-0) CPS 805, CPS 806.  
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.
- 912. General Automata Theory II**  
Winter of even-numbered years. 3(3-0) CPS 911. Interdepartmental with Electrical Engineering.  
Reliability and redundancy of finite automata. Probabilistic sequential machines. Languages definable by probabilistic and deterministic automata. Axioms for equivalence of regular expressions.
- 913. General Automata Theory III**  
Spring of even-numbered years. 3(3-0) CPS 912. Interdepartmental with Electrical Engineering.  
Degrees of difficulty of computation. Models of parallel computation. Iterative automata.
- 921. Advanced Computer Systems I**  
Fall of odd-numbered years. 3(2-3) CPS 827; graduate course in operating systems. 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 of even-numbered years. 3(2-3) 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.
- 944. Theory of Algorithms**  
Summer. 3(3-0) CPS 832 or CPS 912.  
Formulation of computation concept and algorithm verification. Topics included are finite and infinite acceptors, recursive functions, program verification, decision problems, flowchart schemas, and fixpoint theory of programs.
- 999. Doctoral Dissertation Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.