

**590. Special Problems in Community Medicine**  
Fall, Winter, Spring, Summer. 1 to 8 credits. May reenroll for a maximum of 32 credits. Approval of department.  
Each student will work under direction of a faculty member on an experimental, theoretical or applied problem.

**620. Directed Studies in Community Medicine**  
Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 24 credits. Approval of department.  
Individual projects on special problems related to community medicine.

## COMPUTER SCIENCE CPS

### College of Engineering

**110. Introduction to Computer Programming**  
Fall, Winter, Spring, Summer. 3(3-0)  
Students may not receive credit in both CPS 110 and CPS 120.  
FORTRAN programming, number systems and basic computer structure. Applications from various areas including business and social science.

**120. Computer Programming for Engineers and Scientists**  
Fall, Winter, Spring, Summer. 3(3-0)  
MTH 111 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) LBC 112 or concurrently. Interdepartmental with and administered by Lyman Briggs College.  
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.

**255. Computer Models in Science and Engineering**  
Spring. 3(3-0) CPS 110 or CPS 120 or equivalent FORTRAN. Interdepartmental with and administered by the Department of Mechanical Engineering.  
Problem-solving; development of student's ability to formulate computable models based on finite physical elements, examples from statics, dynamics, electrical resistance, and conduction heat transfer.

**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**  
(290.) 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 110, or CPS 120; MTH 108 or 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.

**305. List Processing Languages**  
Winter. 3(3-0) CPS 300 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 110 or CPS 120.  
The mechanics of COBOL, a business data processing language; presented with illustrative problems.

**311. Assembly Language and Machine Organization**  
Fall, Winter. 4(3-1) CPS 300. MTH 113 or concurrently, or approval of department.  
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(3-1) CPS 311. MTH 214 or concurrently or approval of department.  
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(3-1) 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 300, MTH 113.  
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 MTH 334.  
Finite-state machines, stack automata. Turing machines. Effective procedures and computability. Introduction to recursive functions. Symbol manipulation systems.

**341. Computer Aided Manufacturing**  
Spring. 4(3-2) CPS 110 or CPS 120. Interdepartmental with and administered by the Department of Mechanical Engineering.  
Numerical control. Computer-Aided Numerical Control, Direct Numerical Control, and adaptive control applied in present day manufacturing. Use of the APT language to control NC machines.

**411. Information Theory**  
Winter. 3(3-0) CPS 110 or CPS 120; CPS 322 recommended; STT 351 or STT 441.  
Measures of information content and flow. Channel capacity and theoretical limits on information transmission. Applications to coding and computer related studies.

**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.

**421. Combinational Circuits**  
Fall. 3(3-0) CPS 311 and CPS 321 or approval of department.  
Combinational circuits. Minimization, multiple output, NAND-NOR implementation and iterative circuits.

**422. Sequential Circuits**  
Winter. 3(3-0) CPS 322 or approval of department, CPS 421.  
Synchronous and asynchronous machines. Boolean equations, state minimization, races and hazards. Regular expressions, Moore and Mealy models.

**423. Computer Architecture**  
Spring. 3(3-0) CPS 422.  
Computer arithmetic algorithms, memory systems, computer design, input-output system design, digital system simulation.

**447. Digital Filtering**  
Spring. 3(3-0) CPS 300, 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.

**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 de-  
partment.  
Independent undergraduate research in compu-  
ter 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 300, STT 441 or ap-  
proval of department.  
Algorithms that organize large amounts of data.  
Includes metric clustering, hierarchical cluster-  
ing and multi-dimensional scaling.
- 806. Fundamentals of Pattern  
Recognition**  
Spring. 4(4-0) CPS 300, MTH 334, STT  
442.  
Decision-theoretic and nonstatistical ap-  
proaches; discriminant functions; parameter and  
density estimation; feature extraction; super-  
vised and unsupervised learning; sample size  
effects; error estimation; design of pattern rec-  
ognition systems; computational considerations.
- 825. Theory of Combinational  
Circuits**  
Fall. 3(3-0) CPS 423 or approval of de-  
partment.  
Switching algebra and related group and lattice  
theory; decomposition; the synthesis of  
multiple-output switching functions using  
multi-level combinational circuits.
- 826. Theory of Digital Machines**  
Winter. 3(3-0) CPS 825.  
Sequential machines; machine specification in  
terms of states and transitions; decomposition;  
state minimization and assignment.
- 827. Switching Theory**  
Spring. 3(3-0) CPS 826.  
Asynchronous and speed independent circuits;  
static and dynamic hazards; use of race condi-  
tions.
- 831. Theory of Formal Languages I**  
Fall. 3(3-0) CPS 322 or approval of de-  
partment.  
Definition of formal languages; acceptors and  
grammars; regular, linear and context free lan-  
guages; closure properties.
- 832. Theory of Formal Languages II**  
Winter. 3(3-0) CPS 831.  
Context sensitive languages; derivation re-  
stricted grammars; semantics of formal lan-  
guages.
- 841. Artificial Intelligence and  
Adaptive Systems I**  
Winter of odd-numbered years. 4(4-0)  
CPS 300, STT 441.  
Foundations of heuristic methods; syntactic  
means-end analysis; semantic means-end  
analysis; adaptive systems.
- 842. Artificial Intelligence and  
Adaptive Systems II**  
Spring of odd-numbered years. 4(4-0)  
CPS 841.  
Computer representation of information from  
natural languages; representation of two and  
three dimensional environments; theory of de-  
sign of robots; future trends.
- 861. Structured Programming**  
Fall. 3(3-0) CPS 322; CPS 313 or con-  
currently.  
Block structured languages, control structures  
and mathematical foundations of structured pro-  
gramming; program development by stepwise  
refinement; proving program correctness; exten-  
sive readings from the current literature.
- 862. Advanced Data Structures**  
Winter. 3(3-0) CPS 313; CPS 322 or  
concurrently.  
Structured data types; recursive and structured  
data structures and semantics; hierarchical pro-  
gram structures; models for programming lan-  
guages; extensive readings from the current lit-  
erature.
- 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, im-  
plement 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.
- 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 re-  
lational data base models. Schemas, subschemas  
and access methods. Analytic and theoretical  
treatment.
- 899. Research**  
Fall, Winter, Spring, Summer. Variable  
credit. Approval of department.
- 906. Advances in Pattern Recognition**  
Fall. 3(3-0) CPS 805, CPS 806.  
Theoretical foundations of pattern recognition;  
classical and contemporary research themes in-  
cluding structural approaches, sequential  
methods, and evaluation of alternative strategies.
- 911. General Automata Theory I**  
Fall of odd-numbered years. 3(3-0) CPS  
423 or SYS 827 or approval of department. In-  
terdepartmental 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 au-  
tomata. Axioms for equivalence of regular ex-  
pressions.
- 913. General Automata Theory III**  
Spring of even-numbered years. 3(3-0)  
CPS 912. Interdepartmental with Electrical En-  
gineering.  
Degrees of difficulty of computation. Models of  
parallel computation. Iterative automata.
- 944. Theory of Algorithms**  
Summer. 3(3-0) CPS 832 or CPS 912.  
Formulation of computation concept and al-  
gorithm verification. Topics included are finite  
and infinite acceptors, recursive functions, pro-  
gram verification, decision problems, flowchart  
schemas, and fixpoint theory of programs.
- 999. Research**  
Fall, Winter, Spring, Summer. Variable  
credit. Approval of department.

## CRIMINAL JUSTICE C J

### College of Social Science

- 110. Introduction to Criminal Justice**  
Fall, Winter, Spring. 3(3-0)  
Survey of agencies that compose the system;  
primarily the police, courts and corrections. Also,  
the processes of these components and their rela-  
tionships, as well as related agencies involved  
are examined.
- 235. Criminology**  
Winter, Spring. 4(4-0) SOC 241 or C J  
110 or approval of school. Interdepartmental  
and jointly administered with the Department  
of Sociology.  
Crime analysed from sociological perspective:  
meaning of "crime," crime statistics, and mea-  
surement, theories of crime causation, crime  
typologies, e.g., professional organized, violent,  
sex, white-collar crimes, juvenile delinquency.
- 315. Criminal Investigation**  
(395.) Winter, Spring. 4(4-0) C J 375.  
Theory of investigation, crime scene conduct,  
collection and preservation of physical evidence  
and methods used in scientific interpretation of  
evidence.
- 318. Community Relations in  
Criminal Justice**  
Fall, Winter, Spring. 4(4-0) C J 235.  
Interdisciplinary survey of community relations  
in police and other criminal justice processes;  
theory and case studies. Emphasizes problem  
solving, conflict management, and community  
action in the prevention of civic disorder.
- 330. Organizational Theory in  
Criminal Justice**  
Fall, Winter. 4(4-0) C J 110, C J 235.  
A historic and a comparative overview of the  
principles of organization used by criminal jus-  
tice agencies. Current theories and research on  
organization, with focus on the needs of the crimi-  
nal justice process.
- 335. Police Process**  
Fall, Winter, Spring. 4(4-0) C J 235.  
Functional role of law enforcement within the  
criminal justice system. Law enforcement or-  
ganizations and the function of operational units.  
Role of law enforcement in a democracy; service,  
crime deterrence, discretion, enforcement  
policies and evaluation of effectiveness.