590. Special Problems in Community Medicine
Fall, Winter, Spring, Summer. 1 to 5 credits. May reenroll for a maximum of 52 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 4 credits. May reenroll for a maximum of 32 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. 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. 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.

134. APL-Computer Programming for Scientists
Fall, Winter, Spring. 3(3-0) LBC 112 or concurrently. Interdepartmental with and administered by Luman Briggs College. APL programming; interactive programming techniques; arithmetic, logical, and extended APL operators; functions, applications to concurrent topics in mathematics, principles of operations 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 computer 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
(295) 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. 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, processes 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 110 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. 3(3-0) CPS 311, MTH 241 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. 3(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 Computers
Fall, Winter. 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. 3(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(3-2) CPS 422. Computer arithmetic; algorithms, memory systems, computer design, input-output system design, digital system simulation.

447. Digital Filtering

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

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 analyzing 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 6 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 ef-
ects; 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 multi-
output-to-combinational circuits.

826. Theory of Digital Machines
Winter. 3(3-0) CPS 425.
Sequencing machines; machine specification in
terms of states and transitions; decomposition;
state minimization and assignment.

827. Switching Theory
Spring. 3(3-0) CPS 425.
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 381.
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 mean-
end analysis; semantic means-end analysis; adaptive systems.

842. Artificial Intelligence and
Adaptive Systems II
Spring of even-numbered years. 4(4-0)
CPS 484.
Computer representation of information from
natural languages; representation of two and
three dimensional environments; theory of de-
sign of robots; future trends.

851. 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 op-
erating systems. Term project to design, im-
plement and analyze an operating system using
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 an-
alysis, simulation, programmed measurement,
and instrumental measurement techniques.
Case studies.

884. Large Data Base Theory
Summer. 3(3-0) CPS 415, CPS 452, or
approval of department.
Data base management constituent parts; data
definition, data manipulation, data retrieval and
report generation. Hierarchical, network and rel-
tional 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 506.
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-
derpartment 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.

929. Research
Fall, Winter, Spring, Summer. Variable
credit. Approval of department.

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 341 or CPS
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) CPS, 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) J C 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. Organisational Theory in
Criminal Justice
Fall, Winter. 4(4-0) J C 110, J C 233.
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 crim-
inal justice process.

335. Police Process
Fall, Winter, Spring. 4(4-0) J C 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.

913. General Automata Theory Ill
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 342 or CPS 642.
Formulization of computation concept and algo-
rithm verification. Topics include finite and
infinite acceptors, recursive functions, pro-
gram verification, decision problems, flowchart
schemas, and finite state 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 341 or CPS
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) CPS, 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) J C 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. Organisational Theory in
Criminal Justice
Fall, Winter. 4(4-0) J C 110, J C 233.
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 crim-
inal justice process.

335. Police Process
Fall, Winter, Spring. 4(4-0) J C 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.