602. Fundamentals of Patient Care  
(H M 602.) Fall, Winter, Spring, Summer. 9 to 12 credits. Approval of department. Interdepartmental with and administered by the Department of Family Practice. 
A full-time introduction to clinical medicine with emphasis on data gathering, and formulation and presentation of plans for patients and families in the hospital and out-patient setting.

605. Occupational Health Clerkship  
Fall, Winter, Spring, Summer. 6 to 12 credits. May reenroll for a maximum of 12 credits. Grade P in all courses offered in terms 1 through 6. 
The occupational health program in an industrial setting. Exposure to delivery of medical care to workers, treatment of industrial accident injuries. Review of safety and preventive medicine programs.

607. Ambulatory Care Clerkship  
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 9 credits. 
H M 602. Interdepartmental with the department of Family Practice, Medicine, and Pediatrics and Human Development. Administered by the Department of Family Practice. 
Outpatient experience, lasting an equivalent of 34 half-days and extending over a minimum of 20 weeks. Continuous and comprehensive patient care under supervision of appropriate physicians.

619. Clinical Health Education Clerkship  
Fall, Winter, Spring, Summer. 6 to 12 credits. Successful completion of first two years of medical school. 
Clinical and community experiences including history taking, patient assessment, development and use of management and care plan and use of community resources for the long term care of the aged.

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.

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 6. CRM 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, 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, Summer. 3(3-0) LBS 112 or concurrently. 
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.

#### 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. 3(2-3) 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 concurrently. Students may not receive credit in CPS 301 and in CPS 120. 
Programming laboratory using FORTRAN.

#### 304. PASCAL Programming  
Fall, Winter, Spring. 3(3-0) LBS 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.

#### 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. 

#### 312. Generative Coding and Information Structures  
Winter. 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. 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 multiprogramming.

#### 321. Introduction to Discrete Structures  
Fall, Winter. 3(3-0) CPS 253 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.
410. Selected Topics
Fall, Winter, Spring, Summer. 3-4 credits. May enroll for a maximum of 6 credits in CPS 455 and CPS 490 combined. Approval of department.
A new developing area of computer science selected by the department.

495. Independent Study
Fall, Winter, Spring, Summer. 1 credit. May enroll for a maximum of 8 credits in CPS 495 combined. Approval of department.
Independent undergraduate research in computer science.

801. Independent Study
Fall, Winter, Spring. 1 to 4 credits. May enroll 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 multiperand addition/subtraction; standard, compressed and cellular array multipliers; high-performance division; 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 and 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.

841. Artificial Intelligence I
Winter. 4(4-0) CPS 259, 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 technique. 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 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.
890. **Special Topics**
Fall, Winter, Spring, Summer. 2 to 4 credits. May be repeated for a maximum of 12 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.

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.

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. 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 821. 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.

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**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. **Testing and Grading**
(ED 465.) Fall, Winter, Spring, Summer. 3(3-0) E T 200 or T E 200A or T E 200B or T E 200C. 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, Winter, Spring, Summer. 3(3-0) Approval of department. An overview of standardized tests and sources of information about them. Selection and use of standardized tests. Interpretation of standardized test scores. Local and widescale testing programs.

410. **Instructional Design and Technology**
(E D 410.) Fall, Spring. 2 to 4 credits. May be repeated 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(2-2) 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 from birth through adolescence. Observation and participation in schools is an integral part of the course.

413. **Mental Health of School Children**
(ED 413.) Fall, Winter, Spring, Summer. 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, Winter, Spring, Summer. 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, Winter, Spring, Summer. 3(3-0) CEP 460A or approval of department. The development of curriculum for mentally retarded children and youth emphasizing current practices in pre-school through secondary school programs for educable and trainable mentally retarded.

428C. **Educational Procedures for the Mentally Retarded**
(ED 428C.) Fall, Winter, Spring, Summer. 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**
(E D 428D.) Fall, Winter, Spring, Summer. 3(3-0) Approval of department. Procedures in teaching severely mentally retarded children and youth.

431A. **Educational Media in Instruction**
(ED 431.) Fall, Winter, Spring, Summer. 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, Winter, Spring, Summer. 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 442) Fall, Spring, Summer. 3(3-0) Approval of instructor. History and current status of the paraprofessional movement. Review of the selection, training, and evaluation processes; identification of special problems and the use of support personnel.

450. **Interpersonal Process Recall**
(ED 450.) Fall, Winter, Spring, Summer. 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 460A.) Fall, Winter, Spring, Summer. 3(3-0) Emphasis on nature of handicapping conditions and educational needs and approaches. Includes mental retardation, emotional disturbance, visual, auditory and physical handicaps.