590. Special Problems in Community Medicine
Fall, Winter, Spring, Summer. 1 to 8 credits. May enroll 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.

600. Preventive Medicine and Public Health Clerkship
Fall, Winter, Spring, Summer. 2 to 12 credits. Successful completion of first two years of medical school.
Clinical and community experiences in personal and community health services, environmental health, and other health and medical programs which meet health needs of various population groups.

605. Occupational Health Clerkship
Fall, Winter, Spring, Summer. 6 to 12 credits. May enroll for a maximum of 12 credits. Grade F in all courses offered in terms 1 through 8.
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.

610. Geriatric Clerkship
Fall, Winter, Spring, Summer. 2 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.

619. Clinical Health Education Clerkship
Fall, Winter, Spring, Summer. 6 to 12 credits. May enroll for a maximum of 12 credits.
Grade F in all courses offered in terms 1 through 8.
Clinical experiences for developing and applying skills in patient and family health education. Identification of behavioral components of health care. Assessment of educational needs of patient and family.

620. Directed Studies in Community Medicine
Fall, Winter, Spring, Summer. 1 to 6 credits. May enroll 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 enroll for a maximum of 12 credits.
Grade F in all courses offered in terms 1 through 8. CHM students: Satisfactory completion of Phase II.
Diagnosis, inpatient and outpatient management of alcoholics.

112. Computing for Engineers and Scientists I
Fall, Winter, Spring, Summer. 3(2-2) MTH 112.
Successful completion of first two years of medical school. Successful completion of first two years of medical school.
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) MTH 112.
Successful completion of first two years of medical school. Successful completion of first two years of medical school.
Student may not receive credit in both CPS 112 and CPS 360.

115. Introduction to Computing
Fall, Winter, Spring. 3(3-0)
Applications of computers in business, education, government and industry. Introduction to computing systems and programming in BASIC.

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 current topics in mathematics; principles of operation of time-shared computers.

214. Computing for Engineers and Scientists III
Fall, Winter, Spring. 3(2-2) CPS 113; MTH 112.
Continuation of CPS 113 with emphasis upon more complex problem solving tasks requiring complex data and instructional structures.

251. Algorithms and Computing I
Fall, Winter, Spring. 3(3-3) 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(3-2) 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 4 credits. May enroll for a maximum of 8 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 enroll for a maximum of 4 credits in CPS 295 and CPS 495 combined. Approval of department.
Independent undergraduate research in computer science.

302. Computer Programming
Fall, Winter, Spring, Summer. 3(3-0) CPS 120.
Student may not receive credit in both CPS 112 and CPS 360.
Development and implementation of numeric and non-numeric algorithms using FORTRAN. Number systems and representations of data. Concepts of storage, processors and compilers.

303. FORTRAN Laboratory
Fall, Winter, Spring, Summer. 1(0-3) CPS 292 or concurrently. Students may not receive credit in CPS 112 and CPS 360.
Programming laboratory using FORTRAN.

304. PASCAL Programming
Fall, Winter, Spring, Summer. 2(1-3)
Interdepartmental with and administered by Lyman Briggs School.
PASCAL programming; interactive programming techniques; arithmetic, logical, and extended APL operators; functions, applications to current topics in mathematics; principles of operation of time-shared computers.

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 programs.

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.

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. 4(3-3) 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-programming and multi-programming.

321. Introduction to Discrete Structures
Fall, Winter. 3(3-0) CPS 292 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. Application to computer science.
322. Introduction to Theory of Computing
Winter, Spring. 3(3-0) CPS 321, MTH 215.

412. Computer Communications
Winter. 3(3-0) CPS 300 or CPS 301; STT 312 or STT 411.
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.
Combination 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.

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.

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 315, one programming 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. 2 to 4 credits. May be repeated for a maximum of 6 credits when different topics are taken. Approval of department.
A new developing area of computer science selected by the department.

495. Independent Study
Fall, Winter, Spring, Summer. 1 to 4 credits. May be repeated for a maximum of 8 credits. Approval of department.
Independent undergraduate research in computer science.

801. Independent Study
Fall, Winter, Spring, Summer. 1 to 4 credits. May be repeated 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. Include metric clustering, hierarchical clustering and multi-dimensional scaling.

806. Fundamentals of Pattern Recognition
Spring. 4(4-0) CPS 301 or CPS 364, 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.

890. 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 multiple-operand addition/subtraction; standard, reended and cellular array multipliers; high-performance dividers; floating point arithmetic; error control; pipelining.

812. Computer Networks
Spring. 3(3-0) CPS 412 and 415.
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.
COUNSELING, EDUCATIONAL PSYCHOLOGY AND SPECIAL EDUCATION  

CEP 428B. Curriculum for the Mentally Impaired  
(ED 428B.) Winter. 3(3-0) CEP 460 or approval of department.  
Development of curriculum for mentally impaired children and youth emphasizing current practices in pre-school through secondary school programs for the moderately and mildly mentally impaired.

CEP 428C. Educational Procedures for the Mentally Impaired  
(ED 428C.) Winter. 3(3-0) CEP 460 or approval of department.  
Methods of instruction for mentally impaired children and youth including the assessment of individual abilities, the development of instructional objectives, and the teaching of nonacademic and academic skills.

CEP 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.

CEP 431D. Educational Media in Instruction  
(ED 431D.) Fall. Winter, Spring. 3(3-0) Juniors.  

CEP 434. Computers in the Classroom  
Fall, Winter, Spring. 3(3-0) Juniors.  
A course to teach computer literacy and programming in public schools. Computer aid in the classroom. Applying instructional design principles to the selection, evaluation, and development of computer courseware.

CEP 442. Use of Paraprofessionals in Counseling  
(ED 442.) Spring. 3(3-0) Odd-numbered years.  
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.

CEP 446A. Teaching Science with Microcomputers  
Winter. 3(3-0) CEP 434. Interdepartmental with and administered by the Department of Teacher Education.  
Survey and critique of software available for science instruction; students adapt generic and create original microcomputer routines and/or teaching strategies for use in science teaching.