

COMMUNICATION

COMMUNITY HEALTH SCIENCE

CMS

**512\*.** *Biostatistics and Epidemiology*  
 Summer. 2(3-0)  
 R: Open only to graduate and graduate-professional students in the Colleges of Osteopathic Medicine, Human Medicine, and Nursing or approval of department.  
 Medical literature to illustrate statistical reasoning and research design. Emphasis on analysis rather than computation. Prospective or retrospective studies. Sensitivity, specificity, and predictive values. Epidemiologic terminology.  
 QA: CMS 512

**513\*.** *Health Law, Health Policy, and Health Care*  
 Fall. 2(02-00)  
 R: Open only to graduate and graduate-professional students in the Colleges of Osteopathic Medicine, Human Medicine, and Nursing or approval of department.  
 Legal processes related to health care systems. Law suits, malpractice, statutory and case law. Insurance and tax considerations. Continuing field experiences and seminars in community medicine.  
 QA: CMS 513

**515\*.** *Issues in Minority Health*  
 Fall, Spring, Summer. 3(03-00)  
 R: Open only to graduate and graduate-professional students in the Colleges of Osteopathic Medicine, Human Medicine, and Nursing or approval of department.  
 Patterns of health and illness in minority populations.

**521\*.** *Evaluation of Health Services*  
 Spring. 3(03-00)  
 R: Approval of department.  
 Experimental and quasi-experimental designs. Cost benefit and efficiency models. Assessment of health services delivery.  
 QA: CMS 521

**522\*.** *Principles of Gerontology for Medical Practice*  
 Spring. 3(03-00)  
 R: Open only to graduate-professional students in the Colleges of Osteopathic and Human Medicine or approval of department.  
 Lectures, readings, tapes, small group seminars, and home visits related to normal aging epidemiology. Major chronic diseases and other issues of geriatric care.  
 QA: CMS 522

**590\*.** *Special Problems in Community Medicine*  
 Fall, Spring, Summer. 1 to 8 credits.  
 R: Approval of department; application required.  
 Each student works under faculty direction on an experimental, theoretical, or applied problem.  
 QA: CMS 590

**600\*.** *Preventive Medicine and Public Health Clerkship*  
 Fall, Spring, Summer. 2 to 12 credits in increments of 2 credits.  
 R: Open only to colleges of Human Medicine and Osteopathic Medicine students with successful completion of two years of medical school; approval of department.  
 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.  
 QA: CMS 600

**605\*.** *Occupational Health Clerkship*  
 Fall, Spring, Summer. 6 to 12 credits in increments of 6 credits.  
 R: Open only to colleges of Human Medicine and Osteopathic Medicine students with successful completion of two years of medical school; approval of department.  
 Industrial setting delivery of medical care to workers. Treatment of industrial accident injuries. Review of safety and preventive medicine programs.  
 QA: CMS 605

**610\*.** *Primary Care Geriatrics Clerkship*  
 Fall, Spring, Summer. 6 to 12 credits in increments of 6 credits.  
 R: Open only to colleges of Human Medicine and Osteopathic Medicine students with successful completion of two years of medical school; approval of department.  
 Clinical and community experiences including taking patient's history, assessment, development and use of management and care plan, and use of community resources for the long-term care of the aged.  
 QA: CMS 610

**618\*.** *Clinical Tropical Medicine*  
 Fall. 2 to 4 credits in increments of 2 credits.  
 R: Approval of department.  
 Selected topics such as African AIDS, malaria, onchocerciasis, tuberculosis, and schistosomiasis. Pathophysiology, treatments, epidemiology, current research, and controversies.  
 QA: CMS 618

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

**621\*.** *Clinical Tropical Medicine Clerkship*  
 Spring. 8 to 16 credits in increments of 8 credits.  
 P: CMS 618. R: Open only to graduate-professional students in the colleges of Osteopathic and Human Medicine in final year.  
 Supervised clinical experiences in a large African teaching hospital and its outpatient clinics; students must spend at least six weeks on site. Small group discussions led by MSU faculty.

COMPUTER SCIENCE CPS

**100.** *Using Computers*  
 Fall, Spring, Summer. 3(2-2)  
 R: Freshmen and sophomores only. Not open to students in the College of Engineering and the College of Natural Science.  
 Applications of computation. Computer hardware, software, communication and networks. Impact of computation and computers on the individual and society. Hands-on application exercises. Databases, files, systems, graphics, spreadsheets, wordprocessing.  
 QA: CPS 100

**130.** *Introduction to Computing*  
 Fall, Spring, Summer. 3(2-2)  
 R: Freshmen and sophomores only.  
 Computer Aided Software Engineering for design. Structured, modular BASIC for programming. Selection, loops, arrays, sequential and direct files, character and pixel graphics, and spreadsheets. Applications from business, science and humanities.  
 QA: CPS 115

**131.** *Introduction to Technical Computing*  
 Fall, Spring. 3(2-2)  
 P: MTH 132 or concurrently.  
 Computing systems and applications. Design and implementation of programs using FORTRAN. Examples from engineering, mathematics and science.  
 QP: MTH 109 ORMTH 111 QA: CPS 112

**230.** *Algorithms and Computing*  
 Fall, Spring. 4(3-2)  
 P: MTH 132.  
 Computer systems and problem solving. Software development. Structured design and implementation of algorithms. Procedural and object-oriented programming. Compilation and linking.  
 QP: MTH 112 QA: CPS 251 CPS 252

**260.** *Discrete Structures in Computer Science*  
 Fall, Spring. 3(3-0)  
 P: MTH 133.  
 Propositional and first order logic. Equivalence, inference. Mathematical induction, diagonalization principle. Set operations, relations, functions. Lattices, Boolean algebras. Truth tables and minimization of Boolean expressions. Applications to CPS.  
 QP: MTH 214 CPS 252 QA: CPS 321

**290\*.** *Independent Study in Computer Science*  
 Fall, Spring. 1(-) May reenroll for a maximum of 3 credits.  
 R: Approval of department; application required.  
 Supervised individual study in an area of computer science.  
 QA: CPS 295

**291\*.** *Selected Topics in Computer Science*  
 Fall, Spring. 1 to 4 credits. May reenroll for a maximum of 8 credits.  
 R: Approval of department.  
 Topics selected to supplement and enrich existing courses and lead to the development of new courses.  
 QA: CPS 292

**320.** *Computer Organization and Assembly Language Programming*  
 Fall, Spring. 4(3-2)  
 P: CPS 230. R: Not open to students with credit in EE 331.  
 Machine representation of data and instructions. Machine organization, primary storage, registers, arithmetic logic unit, control unit, operations. Assembly language programming, interface to high level languages. Assemblers and loaders.  
 QP: CPS 252 MTH 214 QA: CPS 311

**330.** *Data Structures and Programming Concepts*  
 Fall, Spring. 4(3-2)  
 P: CPS 230, CPS 260. R: Open only to Computer Science, Computer Engineering, Computational Mathematics, Electrical Engineering, and LBS Computer Science students.  
 Data types and structures. Algorithms including searching, sorting and hashing. Program correctness, program analysis. Abstract data types including stacks, queues, and trees. Object-oriented programming, introduction to various program libraries.  
 QP: CPS 311 CPS 252CPS 321 QA: CPS 333

COMPUTER SCIENCE

- 360. Automata and Formal Language Theory**  
 Fall, Spring. 3(3-0)  
 P: CPS 230, CPS 260. R: Open only to Computer Science, Computer Engineering, Computational Mathematics, Electrical Engineering, and LBS Computer Science students.  
 Regular languages, regular grammars, finite-state automata, transducers and relationships among them. Context-free languages and grammars. Language recognition, parsers. Properties of formal languages. Turing computability and undecidability.  
 QP: CPS 321 MTH 215 QA: CPS 322
- 410\*. Operating Systems**  
 Fall, Spring. 4(3-2)  
 P: CPS 330; CPS 320 or EE 331. R: Open only to College of Engineering Computer Science, Computer Engineering, and Electrical Engineering majors.  
 History and evolution of operating systems. Process and processor management. Primary and auxiliary storage management. Performance evaluation, security, distributed systems. Case studies of modern operating systems.  
 QP: CPS 333 QA: CPS 413 CPS 881
- 420. Computer Architecture**  
 Fall, Spring. 4(3-2)  
 P: CPS 330; EE 331 or CPS 320, CPS 360. R: Open only to Computer Science, Computer Engineering, Electrical Engineering, and LBS Computer Science majors.  
 Digital logic and sequential machine design. Computer organization, control unit and arithmetic logic unit implementation. Input-output, memory organization, parallel operations. Digital system simulation.  
 QP: CPS 311 CPS 322 QA: CPS 424
- 422\*. Computer Networks**  
 Fall, Spring. 3(3-0)  
 P: STT 351; CPS 320 or EE 331. R: Open only to College of Engineering Computer Science, Computer Engineering, and Electrical Engineering majors.  
 Computer network architectures and models. Medium access control. Physical, data link, network, transport, and session layers. Local-area and wide-area networks.  
 QP: STT 351 ORSTT 441 AND CPS 311 QA: CPS 412 CPS 812
- 440\*. Artificial Intelligence and Symbolic Programming**  
 Fall. 4(3-2)  
 P: CPS 330, CPS 360. R: Open only to College of Engineering Computer Science and Computer Engineering majors.  
 Machine intelligence. Heuristic programming. Representation and control in LISP and PROLOG. Applications to search, rule-based diagnosis, and parsing.  
 QP: CPS 322 CPS 333 QA: CPS 441 CPS 442
- 449\*. Design of Intelligent Systems**  
 Spring. 4(2-4)  
 P: CPS 440; CPS 320 or EE 331. R: Open only to College of Engineering Computer Science seniors and graduate students. Not open to students with credit in CPS 479.  
 Intelligent system applications such as natural language, machine vision, or a diagnostic expert system. Team development, software engineering, project management.  
 QP: CPS 441 QA: CPS 442
- 450\*. Translation of Programming Languages**  
 Fall. 4(3-2)  
 P: CPS 330, CPS 360; CPS 320 or EE 331. R: Open only to College of Engineering Computer Science and Computer Engineering majors.  
 Theory and practice of programming language translation. Languages, grammars and parsing. Lexical, syntactic and semantic analysis. Compile-time error handling. Code optimization and code generation.  
 QP: CPS 322 CPS 333 QA: CPS 452
- 452\*. Organization of Programming Languages**  
 Fall. 3(3-0)  
 P: CPS 330, CPS 360; CPS 320 or EE 331. R: Open only to College of Engineering Computer Science majors.  
 Organization of programming languages including language processors, syntax, data types, sequence control, storage management. Comparison of language features from the functional, imperative, logical and object-oriented paradigms.  
 QP: CPS 322 CPS 333 QA: CPS 400
- 470\*. Software Engineering**  
 Fall. 4(3-2)  
 P: CPS 330, CPS 360; CPS 320 or EE 331. R: Open only to College of Engineering Computer Science and Computer Engineering majors.  
 Software life cycle including specification, design, coding, testing, and verification of a software product. Stepwise refinement and rapid prototyping. Software portability, reusability and maintenance. Construction of a large software product.  
 QP: CPS 322 CPS 333
- 472\*. Computer Graphics**  
 Spring. 3(2-2)  
 P: CPS 330, MTH 314. R: Open only to College of Engineering Computer Science majors.  
 Graphics hardware. Fundamental algorithms. Two- and three-dimensional imaging geometry and transformations. Curve and surface design, rendering, shading, color, and animation.  
 QP: CPS 333 MTH 334 QA: CPS 414
- 474\*. Vector and Parallel Programming**  
 Fall. 3(2-2)  
 P: CPS 420, MTH 314. R: Open only to College of Engineering Computer Science and Electrical Engineering majors.  
 Programming of high-performance supercomputers. Hardware, algorithms, numerical accuracy, compilers. Vector, multiple-instruction multiple-data-stream and single-instruction single-data-stream machines.  
 QP: CPS 424 MTH 334
- 479\*. Software Tools for Concurrent Systems**  
 Fall, Spring. 4(2-4)  
 P: CPS 330, CPS 360; CPS 422 or CPS 474. R: Open only to College of Engineering Computer Science seniors and graduate students. Not open to students with credit in CPS 449.  
 Design, development and application of software tools for parallel and distributed systems. Program development, debugging, performance monitoring, simulation, data and control flow analysis, and visualization.  
 QP: CPS 412 CPS 322 CPS 333
- 480\*. Database Systems**  
 Spring. 4(3-2)  
 P: CPS 330, CPS 360; CPS 320 or EE 331. R: Open only to College of Engineering Computer Science and Computer Engineering majors.  
 Storage of and access to physical databases including indexing, hashing, and range accesses. Data models, query languages, transaction processing, recovery techniques. Object-oriented and distributed database systems. Database design.  
 QP: CPS 322 CPS 333 QA: CPS 483
- 490\*. Independent Study in Computer Science**  
 Fall, Spring. 1(-) May reenroll for a maximum of 3 credits.  
 R: Open only to Computer Science majors.  
 Approval of department; application required.  
 Supervised individual study in an area of computer science.  
 QA: CPS 495
- 491\*. Selected Topics in Computer Science**  
 Fall, Spring. 1 to 4 credits. May reenroll for a maximum of 8 credits.  
 R: Open only to College of Engineering Computer Science majors. Approval of department.  
 Topics selected to supplement and enrich existing courses and lead to the development of new courses.  
 QA: CPS 490
- 800\*. Graduate Seminar**  
 Fall. 0(1-0)  
 R: Graduate Engineering Computer Science  
 Current research areas and research problems in computer science.
- 802\*. Pattern Recognition and Analysis**  
 Spring. 4(4-0)  
 P: CPS 330, MTH 314, STT 441. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Algorithms for classifying and understanding data. Statistical and syntactic methods, supervised and unsupervised machine learning. Cluster analysis and ordination. Exploratory data analysis. Methodology for design of classifiers.  
 QP: MTH 334 STT 442 CPS 301 OR CPS 304 QA: CPS 805 CPS 806
- 803\*. Computer Vision**  
 Fall. 3(3-0)  
 P: CPS 330, MTH 314, STT 351. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Visual information processing problems. Human and machine vision systems. Image formation and transforms. Encoding, enhancement, edge detection, segmentation. 2D and 3D object description and recognition. Scene analysis. Applications.  
 QP: CPS 252 MTH 334 STT 441 QA: CPS 822
- 807\*. Computer System Performance and Measurement**  
 Spring of odd-numbered years. 3(3-0)  
 Interdepartmental with the Department(s) of Electrical Engineering.  
 P: CPS 440, STT 441. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Queueing network modelling, general analytic techniques, workload characterization, representing specific subsystems, parameterization. Software and hardware monitors, performance measures. Case studies, software packages.  
 QP: CPS 413 STT 441 QA: CPS 876
- 808\*. Modelling and Discrete Simulation**  
 Fall of even-numbered years. 3(3-0)  
 Interdepartmental with the Department(s) of Electrical Engineering.  
 P: CPS 330, STT 441. R: Graduate Engineering Computer Science, Electrical Engineering  
 Introduction to simulation, simulation examples, simulation languages. Mathematical models, petri nets, model validation, random variate generation, analysis of simulation data. Case studies.  
 QP: CPS 413 STT 441 QA: CPS 876
- 812\*. Advanced Operating Systems**  
 Spring. 3(3-0)  
 P: CPS 410, CPS 420. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Parallel and distributed operating systems. Load sharing, scheduling, reliability, recovery, memory management. Distributed file systems, distributed agreement, and object-oriented operating systems.  
 QP: CPS 881 QA: CPS 890

COMPUTER SCIENCE

**814\*.** **Formal Methods in Software Development**  
 Fall of odd-numbered years. 3(3-0)  
 P: MTH 472. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Formal specification languages, integrating verification with development. Design and the implementation of term project.  
 QP: MTH 471 QA: CPS 890

**820\*.** **Advanced Computer Architecture**  
 Fall, Spring. 3(3-00)  
 Interdepartmental with the Department(s) of Electrical Engineering.  
 P: CPS 410, CPS 420. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Instruction set architecture. Pipelining, vector processors, cache memory, high bandwidth memory design, virtual memory, input and output. Benchmarking techniques. New developments related to single CPU systems.  
 QP: CPS 413 CPS 424 QA: CPS 815

**822\*.** **Parallel Processing Computer Systems**  
 Spring. 3(3-0) Interdepartmental with the Department(s) of Electrical Engineering.  
 P: CPS 820. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Massively parallel SIMD processors, multiprocessor architectures, interconnection networks, synchronization and communication. Memory and address space management, process management and scheduling. Parallel compilers, languages, performance evaluation.  
 QP: CPS 815 QA: CPS 921

**830\*.** **Design and Theory of Algorithms**  
 Fall, Spring. 3(3-0)  
 P: CPS 330, CPS 360. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Analysis of algorithms. Algorithm design techniques. Efficient algorithms for classical problems. Intractable problems and techniques to handle them.  
 QP: CPS 322 CPS 333 QA: CPS 834

**835\*.** **Algorithmic Graph Theory**  
 Fall. 3(3-0)  
 P: CPS 330, CPS 360, MTH 314. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Classical concepts in Graph Theory. Algorithmic aspects of graphs such as finding paths, network flow, spanning trees and matching.  
 QP: CPS 322 CPS 333 MTH 334 QA: CPS 835

**838\*.** **Design of Parallel Algorithms**  
 Spring. 3(3-0)  
 P: CPS 420, CPS 830. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Current research topics and issues. Models of parallel computation. Implementation of algorithms on SIMD and MIMD machines. Relationship to VLSI.  
 QP: CPS 834 QA: CPS 890

**841\*.** **Artificial Intelligence**  
 Fall. 3(3-0)  
 P: CPS 440. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Types of intelligence, knowledge representation, cognitive models. Goal-based systems, heuristic search and games, expert systems. Language understanding, robotics and computer vision, theorem proving and deductive systems, and learning.  
 QP: CPS 441 QA: CPS 841

**845\*.** **Knowledge-Based Systems (MTC)**  
 Spring. 2(2-0) May reenroll for a maximum of 6 credits.  
 P: CPS 841. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Research literature examining model-based reasoning, design, or diagnosis. Effectiveness and potential for future developments.  
 QP: CPS 841 QA: CPS 890

**845A\*.** **Knowledge-Based Systems: Model-Based Reasoning**  
 . 2(2-0)  
 P: CPS 841. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Current research literature examining model based reasoning and simulation, their effectiveness and potential for future developments.  
 QP: CPS 841 QA: CPS 890

**845B\*.** **Knowledge-Based Systems: Design**  
 . 2(2-0)  
 P: CPS 841. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Current research literature on knowledge-based system approaches to design, their effectiveness and possible improvements.  
 QP: CPS 841 QA: CPS 890

**845C\*.** **Knowledge-Based Systems: Diagnosis**  
 . 2(2-0)  
 P: CPS 841. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Current research literature on knowledge-based systems approaches to diagnosis, their effectiveness and possible improvements.  
 QP: CPS 841 QA: CPS 890

**846\*.** **Laboratory in Knowledge-Based Systems(MTC)**  
 Summer. 2(1-1) May reenroll for a maximum of 6 credits.  
 P: CPS 845. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Development of a working model-based reasoning, design, diagnostic system. Design, implementation, and testing.  
 QA: CPS 890

**846A\*.** **Laboratory in Knowledge-Based Systems: Model-Based Reasoning**  
 . 2(1-1)  
 P: CPS 845A. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Development of a working model-based reasoning system based on tools such as the FM tool system definition. Design, implementation, and testing.  
 QA: CPS 890

**846B\*.** **Laboratory in Knowledge-Based Systems: Design**  
 . 2(1-1)  
 P: CPS 845B. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Development of a working design system based on tools such as the DSPL tool system definition. Design, implementation, and testing.  
 QA: CPS 890

**846C\*.** **Laboratory in Knowledge-Based Systems: Diagnosis**  
 . 2(1-1)  
 P: CPS 845C. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Development of a working diagnostic system based on tools such as the CSRL tool system definition. Design, implementation, and testing.  
 QA: CPS 890

**860\*.** **Foundations of Computing**  
 Fall. 3(3-0)  
 P: CPS 360. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Models of computation: partial recursive functions, Turing machines, alternative models of computing. Basic theory and limitations of computability. Undecidability. Resource-bounded computational complexity, non-determinism, NP-completeness.  
 QP: CPS 322 QA: CPS 831 CPS 832

**862\*.** **Computational Complexity**  
 Spring of even-numbered years. 3(3-0)  
 P: CPS 860. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Theory of computational complexity. Uniform, nonuniform and probabilistic complexity classes. The polynomial time hierarchy. Structure of complexity classes.  
 QP: CPS 831 QA: CPS 832 CPS 911

**880\*.** **Advanced Database Systems**  
 Fall. 3(3-0)  
 P: CPS 480. R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Distributed and object-oriented databases and knowledgebase systems. Design theory, query optimization, and transaction processing.  
 QP: CPS 484 QA: CPS 884

**890\*.** **Special Problems**  
 Fall, Spring, Summer. 1 to 3 credits.  
 May reenroll for a maximum of 6 credits.  
 R: Open only to graduate students in Computer Science or Electrical Engineering. Approval of department.  
 Independent study of some topic, system, or language not covered in a regular course.  
 QA: CPS 801

**891\*.** **Selected Topics**  
 Fall, Spring. 1 to 3 credits. May reenroll for a maximum of 9 credits.  
 R: Open only to graduate students in Computer Science and Electrical Engineering.  
 Selected topics in computer science of current interest and importance but not covered in a regular course.  
 QA: CPS 890

**898\*.** **Master's Project**  
 Fall, Spring, Summer. 2 to 4 credits in increments of 2 credits. May reenroll for a maximum of 12 credits.  
 R: Open only to graduate students in Computer Science.  
 Master's Degree Plan B individual student project: original research, system design and development, system conversion or installation, research replication, or survey and reporting on some topic area.  
 QA: CPS 801

**899\*.** **Master's Thesis Research**  
 Fall, Spring, Summer. 1 to 8 credits. May reenroll for a maximum of 24 credits.  
 R: Open only to graduate students in Computer Science. Approval of department.  
 QA: CPS 899

**902\*.** **Selected Topics in Recognition by Machine**  
 Fall. 3(3-0) May reenroll for a maximum of 9 credits.  
 P: CPS 802, CPS 803. R: Graduate Engineering Computer Science, Electrical Engineering  
 Advanced topics in pattern recognition and computer vision such as Markov random fields, modeling and recognition of three dimensional objects, and integration of visual modules.  
 QP: CPS 805 CPS 806 CPS 822 QA: CPS 906

COMPUTER SCIENCE

COUNSELING, EDUCATIONAL PSYCHOLOGY AND S CEP

**910\*** **Selected Topics in Computer Networks and Distributed Systems**  
 Spring. 3(3-0) May reenroll for a maximum of 9 credits.  
 P: CPS 421, CPS 812. R: Graduate Engineering Computer Science, Electrical Engineering  
 Advanced topics and recent developments in high-bandwidth computer networks, protocol engineering, and distributed computer systems. Topics will vary from one semester to another. The course may be repeated for credit.  
 QP: CPS 412 CPS 812CPS 881 QA: CPS 890

**914\*** **Selected Topics in Formal Methods in Software Development**  
 Fall of even-numbered years. 3(3-0)  
 May reenroll for a maximum of 9 credits.  
 P: CPS 814. R: Graduate Engineering Computer Science  
 Survey approaches to incorporating formal methods in software development. Current projects using formal methods in software engineering. Object-oriented analysis and development techniques.

**920\*** **Selected Topics in High Performance Computer Systems**  
 Spring. 3(3-0) May reenroll for a maximum of 9 credits.  
 Interdepartmental with the Department(s) of Electrical Engineering.  
 P: CPS 822. R: Graduate Engineering Computer Science, Electrical Engineering  
 Advanced topics in the design of high performance computer systems. Discussed in seminar format; content varies each time offered.  
 QA: CPS 922

**941\*** **Selected Topics in Artificial Intelligence**  
 Fall. 3(3-0) May reenroll for a maximum of 9 credits.  
 P: CPS 841. R: Graduate Engineering Computer Science, Electrical Engineering  
 Topic chosen from an area such as second generation expert systems, human factors, natural language processing, speech understanding, neural networks, genetic algorithms and opportunistic planning.  
 QA: CPS 842

**960\*** **Selected Topics in Algorithms and Complexity**  
 Fall. 3(3-0) May reenroll for a maximum of 9 credits.  
 P: CPS 860, CPS 830 R: Graduate Engineering Computer Science Approval of Department  
 Advanced topics and current research in the general theory of algorithms and computational complexity.  
 QP: CPS 831 QA: CPS 911

**980\*** **Selected Optics in Database Systems**  
 Spring. 3(3-0) May reenroll for a maximum of 9 credits.  
 P: CPS 880 R: Graduate Engineering Computer Science, Electrical Engineering  
 Advanced topics and recent developments in areas such as distributed and parallel database systems, object oriented database systems, knowledgebase and expert database systems.  
 QA: CPS 890

**999\*** **Doctoral Dissertation Research**  
 Fall, Spring, Summer. 1 to 12 credits.  
 May reenroll for a maximum of 0 credits.  
 R: Graduate Engineering Computer Science Approval of Department  
 Doctoral dissertation research  
 QA: CPS 999

**240\*** **Diverse Learners in Multicultural Perspective**  
 Fall, Spring, Summer. 3(2-2)  
 Interdepartmental with the Department(s) of Teacher Education.  
 R: Not open to students with credit in TE

**250.**  
 Communicative, linguistic, physical, sensory, behavioral, affective, and cognitive differences in learning in multicultural classrooms. Factors that mediate access to knowledge.  
 QP: NONE QA: CEP 460

**260\*** **Dynamics of Personal Adjustment**  
 Fall, Spring. 3(3-0)  
 Psychological theories of human adjustment. Implications for effective learning, self-development, and adaptation.  
 QP: NONE QA: NONE

**261\*** **Substance Abuse**  
 Summer. 3(3-0)  
 Effects of mood-altering chemicals. Treatment approaches and resources. Special emphasis on adolescent users.  
 QP: NONE QA: NONE

**341\*** **American Sign Language and the Deaf Community**  
 Fall, Spring, Summer. 2(2-0)  
 Orientation to deaf culture. Essential signing for those expecting to have intermittent contact with deaf adults.  
 QP: NONE QA: NONE

**416\*** **Teaching and Learning With Technology**  
 Fall, Spring, Summer. 3(3-0-)  
 R: Junior and above none none none  
 Uses of computers and related technologies in the teaching/learning setting. Emphasis on the uses of computers as productivity tools for teachers and students.  
 QP: NONE QA: CEP434 CEP836

**428B\*** **Elementary Curriculum and Instruction for the Mentally Impaired**  
 Fall, Spring. 2(2-0)  
 P: CEP 460 C: CEP 460C, CEP 467K R:  
 Juniors & Seniors Education Special Education  
 Curriculum and instruction for elementary school-aged mentally impaired students.  
 QP: CEP 460 QA: CEP 428B

**428C\*** **Secondary Curriculum and Instruction for the Mentally Impaired**  
 Fall, Spring. 2(2-0)  
 P: CEP 460 C: CEP 467K, CEP 460C R:  
 Juniors and Seniors Education Special Education  
 Curriculum and instruction for secondary school-aged mentally impaired students.  
 QP: CEP 460 QA: CEP 428C

**441A\*** **American Sign Language I**  
 Fall, Spring, Summer. 3(3-0)  
 P: CEP 341. R: Not open to freshmen and sophomores.  
 Production, conversation, and grammatical analysis of American Sign Language.  
 QA: CEP465D CEP465E

**441B\*** **American Sign Language II**  
 Fall, Spring, Summer. 3(3-0)  
 P: CEP 441A.  
 More advanced lexical and syntactic structures of American Sign Language. Sentence types, verb inflections, aspect marking, and story telling. Translations between American sign language and English.  
 QP: CEP 465D QA: CEP465E CEP465F CEP465G

**442A\*** **American Sign Language III**  
 Fall, Spring, Summer. 4(3-2)  
 P: CEP 441B.  
 Use of space for multiple-person discourse. Formal register. Colloquial and idiomatic language. Applications to teaching in American Sign Language.  
 QP: CEP465F CEP465G

**442B\*** **American Sign Language IV**  
 Fall, Spring, Summer. 4(3-2)  
 P: CEP 442A.  
 Use of space for creative interpretation of literature, science, mathematics, socio-historical concepts. Formal register. Colloquial and idiomatic language.

**443A\*** **Tactile Communication Systems I**  
 Fall. 3(1-4)  
 Reading and writing standard English Braille notations and familiarity with textbook formats. History and development of Braille. Perkins Braillewriter and slate and stylus.  
 QA: CEP 472A

**443B\*** **Tactile Communication Systems II**  
 Spring. 3(1-4)  
 P: CEP 443A  
 Reading and writing Grade III Braille. Braille shorthand and music, foreign language, mathematics and scientific notations in combination with abacus usage. Textbook formats.  
 QA: CEP 472C

**444\*** **Education of Students with Severe and Multiple Disabilities**  
 Spring. 3(3-0)  
 Definition of severe and multiple disability. Special education services for students with severe and multiple disabilities.  
 QA: CEP 428D CEP 460B

**460\*** **Communication Skill Training for the Helping Professional**  
 Fall, Spring, Summer. 3(3-0)  
 R: Juniors or above none none none  
 Interpersonal communication focusing on dynamics of listening process, one's own interpersonal style, and barriers to communication. Emphasis on self-study. Interpersonal process recall.  
 QA: CEP 450

**460C\*** **Psychoeducational Characteristics of the Mildly Impaired**  
 Fall, Spring. 2(2-0)  
 P: CEP 460 C: CEP 466B or CEP 466C and CEP 466K; or CEP 428B or CEP 428C and CEP 467 <  
 R: Juniors and Seniors Education Special Education  
 Cognitive, affective, and social characteristics of the mildly impaired. Instructional practices that affect school learning and personal adjustment.  
 QP: CEP 460 QA: CEP 460C

**460I\*** **Academic Assessment of the Mildly Impaired**  
 Fall, Spring. 2(2-0)  
 P: CEP 460, TE 310, TE 312, TE 315 C:  
 CEP 460J, CEP 460K R: Juniors and Seniors Education Special Education  
 Screening and placement procedures; terminology and interpretation of tests used for the assessment of intelligence, aptitude, achievement, personality, and interests of the mildly impaired.  
 QP: CEP 460 TE 310TE 312TE 315 QA: CEP 460I