COMMUNITY HEALTH SCIENCE

510*. 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

515*. Health Law, Health Policy, and
Health Care
Fall, 3(0-0) 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 suite, 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(0-0) 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(0-0) R: Approval of department.
QA: CMS 521

522*. Principles of Gerontology for
Medical Practice
Spring, 3(0-0) R: Open only to graduate-professional students in the Colleges of Osteopathic 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 the second year of medical school; approval of department.
Clinical and community experiences in personal and community health service, 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.
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

615*. 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, filariasis, and schistosomiasis. Pathophysiology, treatment, 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. F: 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

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.
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, loop, and function calls. Object oriented programming, introduction to various computer libraries.
QA: CPS 115

131. Introduction to Technical Computing
Fall, Spring. 3(2-2) P: MTH 102 or concurrently.
Computing systems and applications. Design and implementation of programs using FORTRAN. Examples from engineering, mathematics and science.
QP: MTH 109 OR MTH 111 QA: CPS 112

230. Algorithms and Computing
Fall, Spring. 4(3-2) P: MTH 112.
QP: MTH 112 QA: CPS 251 CPS 252

240. Discrete Structures in Computer Science
Fall, Spring. 3(3-0)
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 293

330. 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 233 MTH 214 QA: CPS 311

330. Data Structures and Programming Concepts
Fall, Spring. 4(3-2) P: CPS 236, CPS 260. R: Open only to Computer Science, Computer Engineering, Computational Mathematics, Electrical Engineering, and I & S 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 325 CPS 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 Sciences, Computer Engineering, Electrical and Computer Engineering students.
Regular languages and grammars, finite-state automata, transducers and relationships among them. Context-free languages and grammars. Language recognition, parsing, hierarchies of formal languages. Turing computability and undecidability.
QP: CPS 321 MTH 315 QA: CPS 322

410*. Operating Systems
Fall, Spring. 4(3-2).
P: CPS 330; CPS 350 or EE 331. R: Open only to College of Engineering Computer Science, Computer Engineering, and Electrical Engineering majors.
QP: CPS 333 QA: CPS 413 CPS 881

420. Computer Architecture
Fall, Spring. 4(3-3).
P: CPS 330; EE 331 or CPS 320, CPS 360. R: Open only to College of Engineering Computer Science, Computer Engineering, and Electrical Engineering 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

421*. 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 architecture and models. Medium access control. Physical, data link, network, transport, and session layers. Local area and wide area networks.
QP: STT 351 OR STT 411 AND CPS 311 QA: CPS 812

440. Artificial Intelligence and Symbolic Programming
Fall, Spring. 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 325 CPS 333 QA: CPS 441 CPS 442

441*. Design of Intelligent Systems
Spring. 4(3-2).
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, Spring. 3(3-0).
P: CPS 320, CPS 322; CPS 322 or EE 331. R: Open only to College of Engineering Computer Science and Computer Engineering majors.
QP: CPS 322 CPS 333 QA: CPS 452

452*. Organisation of Programming Languages
Fall, 3(3-0).
P: CPS 330, CPS 320; CPS 322 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(3-2).
P: CPS 330, MTH 314. R: Open only to College of Engineering Computer Science majors.
Hardware, fundamental algorithms. Two and three-dimensional imaging geometry and transformations. Curve and surface design and rendering, shading, color, and animation.
QP: CPS 333 MTH 334 QA: CPS 414

474*. Vector and Parallel Programming
Fall, Spring. 3(2-2).
P: CPS 320, MTH 314. R: Open only to College of Engineering Computer Science and Electrical Engineering majors.
QP: CPS 414 MTH 334

479*. Software Tools for Concurrent Systems
Fall, Spring. 4(4-2).
P: CPS 330, CPS 360; CPS 420 or CPS 474. R: Open only to Computing Science and Computer Engineering 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 program analysis, and visualization.
QP: CPS 412 CPS 322 CPS 333

480*. Database Systems
Spring. 4(3-3).
P: CPS 330, CPS 360; CPS 320 or EE 331. R: Open only to College of Engineering Computer Science and Computer Engineering majors.
Storage and access to physical databases including indexing, hashing, and range access. 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 enroll 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 enroll 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 to lead to the development of new courses.
QA: CPS 490

500*. Graduate Seminar
Fall. 0(1-0).
R: Graduate Engineering Computer Science majors.
Current research areas and research problems in computer science.

520*. Pattern Recognition and Analysis
Spring. 4(3-0).
P: CPS 330, MTH 314, STT 441. R: Open only to graduate students in Computer Science and Electrical Engineering.
QP: MTH 343 STT 421 OR CPS 301 OR CPS 304 QA: CPS 805 CPS 896

603*. 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.
QP: CPS 233 MTH 345 STT 441 QA: CPS 822

607*. Computer System Performance and Measurement
Spring of odd-numbered years. 3(3-0).
Interdepartmental with the Department(s) of Electrical Engineering.
P: STT 441; STT 818. QA: Open only to graduate students in Computer Science and Electrical Engineering.
QP: CPS 413 STT 441 QA: CPS 876

608*. Modelling and Discrete Simulation
Fall of even-numbered years. 3(3-0).
Interdepartmental with the Department(s) of 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

612*. 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 and recovery. Memory management and dynamic data structures. Distributed file systems, distributed computing systems, ad hoc networks.
QP: CPS 881 QA: CPS 880

Courses with an asterisk (*) have not been approved by the University Committee on Curriculum.

E-35
814*. Formal Methods in Software Development Fall, 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(3-0) 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 compilation, language, 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. Intracible 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 and Computer Graph Theory. Algorithmic aspects of graphs such as finding paths, network flow, spanning trees and matching. 
QP: CPS 325 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 460. R: Open only to graduate students in Computer Science and Electrical Engineering. Types of intelligence, knowledge representation, cognitive models, rule-based systems, heuristics, search and games, expert systems, language understanding, robotics and computer vision, theorem proving and deductive systems, and learning. 
QP: CPS 441 QA: CPS 841

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 reasoning and simulation, their effectiveness and potential for future developments. 
QP: CPS 841 QA: CPS 890

845B*. Knowledge-Based Systems: Diagnosis 2(2-0) P: CPS 841. R: Open only to graduate students in Computer Science and Electrical Engineering. Development of a working model-based reasoning system. 
QP: CPS 841 QA: CPS 890

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

846B*. Laboratory in Knowledge-Based Systems: Diagnosis 2(1-1) P: CPS 845B. 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. 
QP: CPS 845 QA: CPS 890

QP: CPS 822 QA: CPS 831 CPS 832

862*. Computational Complexity Spring, 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 821 QA: CPS 835 CPS 841

880*. Advanced Database Systems Fall, Spring. 3(3-0) P: CPS 480. R: Open only to graduate students in Computer Science and Electrical Engineering. Distributed and object-oriented databases and knowledge-based systems. Design, theory, query optimization, and transaction processing. 
QP: CPS 484 QA: CPS 894

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 and Electrical Engineering. Independent study of some topic, system, or language not covered in a regular course. 
QP: CPS 891

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. 
QP: CPS 890

899*. 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. 
QP: CPS 801

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

902*. Selected Topics in Recognition by Machine Fall, Spring. 3(3-0) May reenroll for a maximum of 9 credits. P: CPS 902. CPS 503. 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 905 CPS 906 CPS 822 QA: CPS 906
COUNSELING, EDUCATIONAL PSYCHOLOGY AND SOCIAL WORK

260*. Diverse Learners in Multicultural Perspective.
Fall, Spring, Summer. 3(2-0)
Intermediate department with the Department(s) of Teacher Education.
R: Not open to students with credit in TE 250.
Remarks: Linguistic, physical, sensory, behavioral, affective, and cognitive differences in learning in multiculturally classrooms. Factors that mediate success in these classrooms. 
Q: NONE Q: CEP 460

441B*. American Sign Language II.
Fall, Spring, Summer. 3(2-0)
P: CEP 441A.
Q: CEP 465D Q: CEP 465E Q: CEP 465F Q: CEP 465G.

442A*. American Sign Language III.
Fall, Spring, Summer. 4(3-2)
P: CEP 441B.
Q: CEP 465P Q: CEP 465Q.

442B*. American Sign Language IV.
Fall, Spring, Summer. 4(3-2)
P: CEP 441C.

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

443B*. Tactile Communication Systems II.
Spring. 3(1-4)
P: CEP 443A.
Q: CEP 472C

444*. Education of Students with Severe and Multiple Disabilities.
Spring. 3(3-0)
Remarks: Definition of severe and multiple disability. Special education services for students with severe and multiple disabilities.
Q: CEP 485D Q: CEP 490B

Fall, Spring, Summer. 3(3-0)
P: CEP 441A.
Remarks: Interpersonal communication, focusing on dynamics of listening process, one's own interpersonal style, and barriers to communication. Emphasis on self-study. Interpersonal process recall.
Q: CEP 450

446C*. Psychosocial Characteristics of the Mildly Impaired.
Fall, Spring, Summer. 3(2-0)
P: CEP 460 C: CEP 465B or CEP 465C and CEP 466A; or CEP 423B or CEP 425G and CEP 467D.
Remarks: Personal independence, focusing on dynamics of listening process, one's own interpersonal style, and barriers to communication. Emphasis on self-study. Interpersonal process recall.
Q: CEP 460 Q: CEP 465C

447B*. Academic Assessment of the Mildly Impaired.
Fall, Spring, Summer. 3(2-0)
P: CEP 460.
Remarks: Psychological, neuropsychological, educational, and social characteristics of the mildly impaired. Instructional skills that affect school learning and personal adjustment.
Q: CEP 460 Q: CEP 465C.