

- 805. Water Treatment Principles**
Winter. 3(3-0) C E 483.
Chemical and physical principles of water treatment.
- 806. Sewage Collection and Treatment**
Spring. 3(3-0) C E 483.
Chemical, physical and biological principles of sewage collection and treatment.
- 899. Research**
(EGR 899.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.
- 905. Biological Principles of Sanitary Engineering I**
Fall. 3(2-3) C E 483.
Fundamental physical, chemical, and biological principles relating to the field of sanitary engineering.
- 906. Biological Principles of Sanitary Engineering II**
Winter. 3(2-3) 905.
Fundamental physical, chemical, and biological principles relating to the field of sanitary engineering.
- 999. Research**
(EGR 999.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

COMMUNICATION COM

College of Communication Arts

- 100. Human Communication I**
Fall, Winter, Spring, Summer. 3(3-0)
Process and functions of communication. Principles underlying communication behavior. Practice in analyzing communication situations and in speaking and writing.
- 101. Human Communication II**
(S T 101.) Fall, Winter, Spring, Summer. 3(3-0) 100.
Continuation of 100, with greater emphasis on speaking and writing, and on analyzing increasingly complex communication situations.
- 199. Methods of Inquiry**
Fall, Spring. 3(3-0) Majors and minors only. 101.
Major theoretic orientations toward communication. Primary tools of scholarly inquiry.
- 205. Persuasion**
(305., S T 305.) Fall, Winter, Spring. 4(4-0) 101.
Process of influencing human behavior through persuasive communication. Experience in creating persuasive messages and in evaluating the acceptability of persuasive attempts.
- 210. Leadership**
(116., S T 116.) Winter. 4(4-0) 100.
Principles and practice in the utilization of communication for effective leadership.
- 299. Individual Projects**
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits. 199, approval of project proposal by department.
Independent research, experience in communication laboratories, or tutorial work in communication skills.

- 300. Effects of Communication**
Fall, Winter, Summer. 4(4-0) 100.
Examination of the dimensions of communication effects.
- 315. Organizational Communication**
(311., S T 311.) Spring. 4(4-0) 101.
Principles and practice in the management of communication systems, with emphases on conflict resolution, information exchange, innovativeness, and information management.
- 350. Signs and Sign-Behavior**
Fall, Winter, Summer. 4(4-0) 100.
Theories of man's symbolic behaviors. Semiotics and general semantics.
- 351. Message Analysis I**
(440.) Winter. 4(4-0) 350.
Methods of describing messages and message codes, with emphasis on the concept of information.
- 352. Message Analysis II**
(320.) Spring. 4(4-0) 351.
Continuation of 351, with emphasis on non-verbal codes: gesture, expression, time and space, light.
- 360. Critical Perspectives on Communication**
Winter. 4(4-0) 100.
Interdependence of communication and other societal factors, emphasizing criteria for ethical and social appropriateness.
- 399. Seminar**
(400.) Winter, Spring. 4(4-0) Majors only. 360.
Contemporary issues in communication.
- 405. Research in Communication Strategies and Styles**
(S T 405.) Fall, Spring, Summer. 5(5-0) Seniors. 300.
Research literature in communication strategies and styles.
- 413. Seminar in Communication Education**
(S T 413.) Fall, Winter, Spring, Summer. 4(4-0) ED 327U.
Philosophies of curricular and co-curricular programs in communication education. Internship experience in those programs.
- 420. Message Design**
Winter. 4(4-0) 101.
Principles and practice in message-media construction and selection.
- 499. Special Projects**
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits. Approval of project proposal by department.
Independent research, group research, student-directed group projects.
- 805. Communication Research**
Fall. 5(4-2) Majors.
Communication research strategy and methodology. Scientific process, bases for derivation and verification of hypotheses, and basic methods of designing research in communication.
- 806. Communication Research**
Winter. 5(4-0) 805.
Continuation of 805.
- 820. Communication Theory and Process**
Fall, Winter, Summer. 3(3-0)
Theoretic models of communication, with emphasis on the applications of communication theory to various professional communication areas.

- 821. Mass Communication Theory and Research**
(921.) Spring. 4(3-0)
Current theories and research in mass communication.
- 822. Interpersonal Communication**
(920.) Winter. 4(3-0)
Current theories and research in interpersonal communication, with emphasis on persuasion.
- 828. Cross-cultural Communication**
(428.) Winter, Spring. 4(4-0)
Role of communication in the economic, social and political development of less developed countries. Problems in communicating across cultural boundaries.
- 850. Seminar in Research Utilization**
(950.) Spring, Summer. 4(3-0) May re-enroll for a maximum of 8 credits. Approval of department.
Applications of communication research to professional practice in such areas as teaching, change agencies, information system management, etc.
- 870. Communication and Change: The Diffusion of Ideas and Information**
(470.) Fall, Spring. 4(4-0)
Research traditions underlying the diffusion of ideas and information, and acceptance of innovation and change. Strategic principles for introduction of change through the use of communication.
- 890. Special Problems**
Fall, Winter, Spring, Summer. 1 to 6 credits. Approval of department.
Special problems as arranged with instructor.
- 899. Research**
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
- 905. Communication Research Design**
Spring. 4(4-0) 806.
Methods of data collection and analysis in communication research. Designing exploratory studies of the communication process. Interviewer training and bias. Content analysis of the mass media. Writing and critiquing research reports.
- 940. Seminar in Communication Theory and Research**
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 45 credits. Approval of department.
Theoretic and research issues in communication.
- 990. Special Problems**
Fall, Winter, Spring, Summer. 1 to 6 credits. Approval of department.
- 999. Research**
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

COMPUTER SCIENCE CPS

College of Engineering

- 110. FORTRAN Programming**
Fall, Winter, Spring, Summer. 3(3-0)
Students may not receive credit in both 110 and 120.
Introduction to FORTRAN programming; use of library programs; applications from various areas.

- 120. Elements of Computer Programming**
Fall, Winter, Spring, Summer. 3(3-0)
MTH 111 concurrently. Students may not receive credit in both 110 and 120.
FORTRAN programming; arithmetic and logical operations; functions and subroutines.
- 300. Computer Programming**
Fall, Winter, Spring, Summer. 3(2-4)
110 or 120.
Programming techniques, digital representation of data, computer structure and organization. Recent developments in computing.
- 301. Digital Computers**
Fall, Winter, Spring. 4(4-0) 110 or 120 or approval of department.
Computer arithmetic including number systems, operations, logic organization, instructional codes.
- 302. Machine and Assembly Languages**
Winter, Spring, Summer. 4(4-0) 301.
Characteristics of machine languages; details of computer instructions; contrasts with compiler languages; structure of assembly languages including fixed and relocatable addresses, mnemonic codes, pseudo instructions, program linkage and macro instructions.
- 303. Compiler Languages and Monitors**
Fall, Spring, Summer. 4(4-0) 302.
Implementation of compilers; function and implementation of higher level systems; multi-programming.
- 305. List Processing Languages**
Winter. 3(3-0) 110 or 120 or approval of department.
The mechanics of a typical list-processing language will be presented with illustrative problems; characteristics, advantages and disadvantages of the language will be considered.
- 306. COBOL Programming**
Spring. 3(3-0) 110 or 120 or approval of department.
The mechanics of COBOL, a business data processing language, will be presented with illustrative problems; characteristics, advantages and disadvantages of the language will be considered.
- 411. Information Theory**
Winter. 3(3-0) 303, STT 441.
Information measure, coding, transmission and recognition associated with man-machine systems.
- 421. Digital Computer Design**
Fall. 3(3-0) 303, PHY 288.
Number systems; Boolean algebra; switching problems using combinational logic; minimization of combinational networks.
- 422. Sequential Machines I**
Winter. 3(3-0) 421.
Digital computer operations and the associated design of control elements using synchronous and combinational switching circuits.
- 423. Sequential Machines II**
Spring. 3(3-0) 422.
Design of arithmetic, memory, and input-output units including the use of asynchronous switching circuits.
- 451. Mechanical Language I**
Fall. 3(3-0) 303; MTH 215.
The basis of mechanical language, conventions, literals and variables; arithmetic and logical operations; structured operands.
- 452. Mechanical Language II**
Winter. 3(3-0) 451.
Search and scanning methods for ranking; key transformations; metaprograms.
- 453. Mechanical Language III**
Spring. 3(3-0) 452.
Computation graphs and minimization techniques relating to memory use; compiled instruction generation and special register allocation.
- 490. Special Problems**
Fall, Winter, Spring, Summer. 1 to 5 credits. Approval of department.
Investigation of a topic in the computer area, either hardware or software.
- 801. Special Problems**
Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 8 credits. Approval of department.
- 811. System Methodology and Simulation**
Fall. 3(2-3) MTH 215; STT 441 or concurrently. Interdepartmental with Systems Science and Social Science (College of) and administered by Systems Science.
First of three courses providing a working knowledge of the design and control of multi-process systems by simulation. Needs analysis, feasibility analysis, preliminary design using simulation models, microscopic simulations—Monte Carlo, analog, digital and hybrid simulation of macroscopic systems, simulation languages, applications to physical and socioeconomic systems.
- 812. System Identification**
Winter. 3(2-3) SYS 811. Interdepartmental with Systems Science and Social Science (College of) and administered by Systems Science.
Identification of system structure from operating data; correlation function, frequency response, multi-point boundary value, econometric and other methods, applications to physical and socioeconomic systems.
- 813. System Project**
Spring. 3(1-6) SYS 812. Interdepartmental with Systems Science and Social Science (College of) and administered by Systems Science.
Team application of simulation methods to the design and/or control of a multi-process system. Projects will be taken from case studies or new problem areas where appropriate.
- 817. Parametric Pattern Recognition**
Winter. 3(3-0) STT 441, computer programming.
The decision-theoretic approach to pattern recognition using decision rules, parameter estimation, sub-optimum strategies, optimum strategy without learning, learning, and sequential recognition.
- 818. Nonparametric Pattern Recognition**
Spring. 3(3-0) 817.
The non-statistical approach to pattern recognition. Discriminant functions, clustering, non-parametric learning, and algorithms for recognition.
- 825. Theory of Combinational Circuits**
Fall. 3(3-0) 423 or approval of department.
Switching algebra and related group and lattice theory; decomposition; the synthesis of multiple-output switching functions using multi-level combinational circuits.
- 826. Theory of Digital Machines**
Winter. 3(3-0) 825.
Sequential machines; machine specification in terms of states and transitions; decomposition; state minimization and assignment.
- 827. Switching Theory**
Spring. 3(3-0) 826.
Asynchronous and speed independent circuits; static and dynamic hazards; use of race conditions.
- 831. Operator Precedence Grammars**
Fall. 3(3-0) 453 or approval of department.
Grammar definition; techniques of recognition; matrix representation of precedence relations; sentence decomposition using precedence matrices.
- 832. Bounded Context Translation**
Winter. 3(3-0) 831.
Algorithms for analyzing bounded context grammars; introduction to transformational grammars.
- 833. Formal Programming Systems**
Spring. 3(3-0) 832.
Coconstruction of a formal programming language; processors for formal languages.
- 835. Data Structures in Information Processing**
Fall. 3(3-0) 453.
Memory hierarchy and allocation algorithms; information collection; management, processing, retrieval and display; implications for machine, language and problem organization.
- 836. Simulation of Stochastic Systems**
Winter. 3(3-0) 835.
Computational aspects of the development, verification, and utilizations of algorithms for simulating models of discrete, stochastic systems; processing using Random Walks and Markov Chains.
- 837. Computer-Aided Design of Deterministic Systems**
Spring. 3(3-0) 835.
Formal language specification of time-dependent, deterministic systems; automatic production, management, and solution of system-associated equations.
- 911. General Automata Theory I**
(E E 981.) Fall. 3(3-0) SYS 827 or approval of department. Interdepartmental with the Electrical Engineering Department.
Characterization of machines and programs as finite automata; structure and decomposition of finite automata.
- 912. General Automata Theory II**
(E E 982.) Winter. 3(3-0) 911. Interdepartmental with the Electrical Engineering Department.
Linear bounded automata; turing machines; recursive sets; degree of difficulty of computations.
- 913. General Automata Theory III**
(E E 983.) Spring. 3(3-0) 912. Interdepartmental with the Electrical Engineering Department.
Reliability and redundancy of finite automata; threshold logic nets; pattern recognition automata; command and control automata.

CROP SCIENCE CSC

College of Agriculture and
Natural Resources101. Crop Science
Fall. 3(3-0)

Principles of identification, adaptation, management, and utilization of field crops for food and fiber. Fundamentals of crop management, breeding, weed control, crop quality, and tropical crops in world agriculture.