843. Traffic Engineering Characteristics
Winter. 3(3-0) 346. STT 421.
Safety analyses, flow and capacity characteristics, statistical properties of traffic, queueing characteristics at intersections, delay characteristics and analyses.

844. Traffic Engineering Theory and Control
Spring. 3(3-0) 843.
Application of the theory of traffic flow to the design and control of traffic streams. Dispersion, scheduling, and network analysis. Application to highways, airport operation and urban transportation modes.

846. Highway Planning
Fall. 3(3-0) 349 or approval of department.
Highway inventory, road use studies and programming, analysis of highway costs, economic considerations in location and design.

847. Geometric Design of Highways
Winter. 3(3-0) 346 or approval of department.
Design of streets and highways including intersections, parking facilities, capacity, channelization and roadway appurtenances.

848. Transportation Models
Spring. 3(3-0) 448.
Analysis of transportation modeling process, including error propagation and parameter sensitivity analysis. Comparative attributes of zonal size and model sequence decisions on the evaluation of system alternatives.

880. Special Problems in Civil Engineering
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
Research problems of limited scope not pertaining to thesis accomplished under 899 or 999.

899. Research
(EGR 899.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

904. Advanced Structural Theory II
Spring. 4(4-0) 604 or approval of department.
Energy (variational) approach to formulation and solution of problems in structural mechanics: stresses, displacements and stability of continuum and structural elements. Approximation methods including Rayleigh-Ritz and finite element.

905. Advanced Theory and Design of Reinforced Concrete II
Spring. 3(3-0) 605.
Continuation of 605 with application of theory to analysis and design of tanks, rigid frames, and shells.

906. Advanced Structural Steel Design
Spring. 3(3-0) 406.
Analysis and design of multiple-story building frames, continuous trusses and rigid-frame girder bridges in structural steel. Plastic design.

908. Numerical Methods in Structural Engineering
Winter. 3(2-3) Approval of department.
Solution of mathematical equations by means of appropriate numerical approximations and the application of these numerical methods to structural problems.

909. Elastic Thin Shells
Spring. 4(4-0) 804 or MMM 815 or approval of department; MTH 421. Interdepartmental with the Metallurgy, Mechanics and Materials Science Department.
Elements of differential geometry, membrane theory of shells, D'Alembert's stress function, deformation and bending of shells of revolution and shallow shells.

912. Theory of Plates
Winter. 4(4-0) 804 or MMM 815 or approval of department; MTH 422. Interdepartmental with and administered by the Metallurgy, Mechanics and Materials Science Department.
Bending of thin elastic plates with various shapes and boundary conditions; application of energy principles and approximate methods of solution, thick plates; large deflection theory; sandwich plates.

915. Advanced Soil Mechanics II
Spring. 3(3-0) 817 recommended.
Earth structures including natural and cut slopes, embankments and earth dams; mechanisms of flow slides, slope stability analysis and design problems; seepage applications including confined and unconfined flow of water through soils.

916. Advanced Soil Mechanics III
Summer. 3(3-0) 817.
Soil dynamics including design of foundations for machinery; effects of ground motion on earth slopes and earth dams; stress-strain behavior of soil during transient and repeated loadings; and relation of soil properties to wave velocity.

999. Research
(EGR 999.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

Sanitary Engineering

983. Treatment of Industrial Wastes
Spring. 3(3-0) 483.
Physical, chemical and biological treatment methods for industrial wastes.

985. Water Treatment Principles
Winter. 3(3-0) C E 483.
Chemical and physical principles of water treatment.

986. Sewage Collection and Treatment
Spring. 3(3-0) C E 483.
Chemical, physical and biological principles of sewage collection and treatment.

989. Research
(EGR 899.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

Classical Studies
See Romance Languages

Communication

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
Fall, Winter, Spring, Summer, 3(3-0)
Continuation of 100, with greater emphasis on speaking and writing, and on analyzing increasingly complex communication situations.

199. Methods of Inquiry
Fall, Winter, Spring, Summer, 3(3-0)
Major theoretical orientations toward communication. Primary tools of scholarly inquiry.

205. Persuasion
(305. S T 305.) Fall, Winter, Spring. 4(4-0)
Process of influencing human behavior through persuasive communication. Experience in creating persuasive messages and in evaluating the acceptability of persuasive attempts.

210. Leadership
(116, 116.) Fall, Winter, Spring. 3(3-0)
Principles and practice in the utilization of communication for effective leadership.

299. Individual Projects
Fall, Winter, Spring, Summer. Variable credit. May re-credit 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 I
Fall, Winter, Spring, Summer, 4(4-0)
100; majors must enroll in 300R concurrently.
Examination of the dimensions of communication effects.

300R. Effects of Communication II
Fall, Winter, Spring, Summer, 1 credit.
Majors. 300R concurrently.
In-depth consideration of effects of communication.

315. Organizational Communication
(311, 311.) Spring. 4(4-0)
Principles and practice in the management of communication systems, with emphasis on conflict resolution, information exchange, innovativeness, and information management.

350. Signs and Sign-Behavior I
Fall, Winter, Spring, Summer. 4(4-0)
100; majors must enroll in 350R concurrently.
Theories of man's symbolic behaviors. Semiotics and general semantics.
350R. Signs and Sign-Behavior II
Fall, Winter, Spring, Summer. 1 credit. Major: 350 concurrently. In-depth consideration of signs and sign behavior.

351. Message Analysis
(440) Winter. 4(4-0) 350. Methods of describing messages and message codes, with emphasis on the concept of information.

352. Non-Verbal Communication
(320) Spring. 4(4-0) 350. Continuation of 351 with emphasis on non-verbal codes: gesture, expression, time and space, light.

360. Critical Perspectives on Communication
Fall, Winter, Spring. 4(3-0) 100. Interdependence of communication and other societal factors, emphasizing criteria for ethical and social appropriateness.

399. Seminar
(400) Fall, Winter, Spring, Summer. 4(4-0) Major only. 365. Contemporary issues in communication.

405. Research in Communication Strategies and Styles
Fall, Spring, Summer. 5(5-0) Seniors. 365. Research literature in communication strategies and styles.

413. Seminar in Communication Education
Fall, Winter, Spring, Summer. 4(4-0) ED 439. 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(4-0) Majors. Communication research strategy and methodology. Scientific processes, bases for derivation and verification of hypotheses, and basic methods of designing research in communication.

808. Communication Research Winter. 5(4-0) 805. Continuation of 805.

815. Organizational Communication
Winter, Spring. 4(4-0) Structure and function of communication in organizations, with emphasis on concepts and principles needed for effective management of organizational communication processes.

820. Communication Theory and Process
Fall, Summer. 3(3-0) Theoretic models of communication, with emphasis on the applications of communication theory to various professional communication areas.

821. Behavioral Research in Mass Communication
(921) Fall, Spring. 4(4-0) Current behavioral science theories and research, e.g., media institutions, decision-making, mass media exposure patterns, diffusion of news and influence, effective message strategies, political communication, and mass media in socialization.

822. Interpersonal Communication
(920) Winter, Summer. 4(3-0) Current theories and research in interpersonal communication with emphasis on persuasion. The role of interpersonal communication in such processes as conflict resolution and information exchange will be considered.

828. Cross-Cultural Communication
(428) Winter, Spring, Summer. 4(4-0) Role of communication in the economic, social and political development of less developed countries. Problems in communicating across cultural boundaries.

830. Nonverbal Communication
Fall. 4(4-0) A review of theory and empirical research on nonverbal communication with implications for application.

850. Seminar in Research Utilization
Fall. 4(4-0) 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.

570. 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.

580. Special Problems
Fall, Winter, Spring. Summer. 1 to 6 credits. Approval of department. Special problems as arranged with instructor.

990. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

905. Communication Research Design
Fall, Winter, Spring. 4(4-0) May re-enroll for a maximum of 12 credits. 899. 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. 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.