

Descriptions — Chemistry

of Courses

862. Advanced Synthetic Organic Chemistry
Spring, 3(3-0) CEM 860 or approval of department.

The strategy and methods of organic synthesis will be discussed.

880. Atomic and Molecular Structure
Fall, 3(3-0) CEM 462 or approval of department.

Basic concepts of non-relativistic quantum mechanics will be developed and employed in a description of atomic and molecular structure.

881. Thermodynamics
Winter, 3(3-0) Approval of department.

Laws of thermodynamics and their application to pure substances and solutions.

883. Chemical Kinetics
Spring, 3(3-0) CEM 880.

Rates and mechanisms of chemical reactions, reaction rate theory, kinetic theory of gases, photochemistry.

890. Graduate Problems and Reports
Fall, Winter, Spring, Summer, 1 to 6 credits. May reenroll for a maximum of 12 credits. Approval of department.

899. Master's Thesis Research
Fall, Winter, Spring, Summer, Variable credit. Approval of department.

Research in inorganic, analytical, organic, and physical chemistry.

913. Selected Topics in Inorganic Chemistry
Fall, Spring, 3(3-0) May reenroll for a maximum of 9 credits if different topic is taken.

Rare earth elements, recent advances in the chemistry of metals or nonmetals, high-temperature chemistry. Coordination chemistry and nonaqueous solvents.

918. Seminar in Inorganic Chemistry
Fall, Winter, Spring, 1(2-0) May reenroll for a maximum of 3 credits.

Discussions of recent advances and reports by graduate students on research problems.

924. Selected Topics in Analytical Chemistry
Fall, Winter, Spring, 3(3-0) or 2(2-0) May reenroll for a maximum of 9 credits if different topic is taken.

Among topics which may be discussed are: advances in electroanalytical chemistry or spectroscopy; nonaqueous solvents; complexation equilibria; surface chemistry; analytical chemistry of polymers.

938. Seminar in Analytical Chemistry
Fall, Winter, Spring, 1(1-0) May reenroll for a maximum of 3 credits.

Discussions of recent advances and reports by graduate students on research problems.

956. Selected Topics in Organic Chemistry
Fall, Winter, Spring, 2(2-0) or 3(3-0) May reenroll for a maximum of 12 credits if different topic is taken. Approval of department.

Topics may be selected from heterocyclic chemistry, natural products, free radicals, carbonium ions, organic sulfur or nitrogen compounds, acidity functions, isotope effects, photochemistry and others.

958. Seminar in Organic Chemistry
Fall, Winter, Spring, 1(2-0) May reenroll for a maximum of 3 credits.

Discussions of recent advances and reports by graduate students on research problems.

985. Statistical Thermodynamics
Winter, Spring, 3(3-0) May reenroll for a maximum of 9 credits if different topic is taken. Approval of department.

Partition functions, spectroscopic measurements and thermodynamic applications. Nonequilibrium statistical mechanics and thermodynamics. Time correlation functions and spectroscopic lineshapes, light scattering, and magnetic relaxation. Transport properties of fluids and gases.

987. Selected Topics in Physical Chemistry
Fall, Winter, 3(3-0) May reenroll for a maximum of 9 credits if different topic is taken. Approval of department.

Mathematical preparation for quantum chemistry. Selected topics as: kinetics and photochemistry, macromolecular and surface chemistry, molecular spectroscopy, electro and magnetic properties of matter, application of statistical mechanics to chemical problems.

988. Selected Topics in Physical Chemistry
Winter, Spring, 3(3-0) May reenroll for a maximum of 9 credits if different topic is taken. Approval of department.

Topics may be chosen from analysis and interpretation of the spectra of molecules, advanced molecular structure, magnetic resonance, spectroscopy, X-rays and crystal structure, statistical mechanics.

991. Selected Topics in Quantum Chemistry
Fall, Winter, 3(3-0) May reenroll for a maximum of 9 credits if different topic is taken. Approval of department.

Principles of quantum mechanics and application to chemical problems. Selected topics from spectroscopy, properties of atoms and molecules in electric and magnetic fields, and theories of molecular electronic structure.

998. Seminar in Physical Chemistry
Fall, Winter, Spring, 1(1-0) May reenroll for a maximum of 3 credits.

Discussions of recent advances and reports by graduate students on research problems.

999. Doctoral Dissertation Research
Fall, Winter, Spring, Summer, Variable credit. Approval of department.

Research in analytical, inorganic, organic, and physical chemistry.

CHINESE

See Linguistics and Germanic, Slavic, Asian and African Languages.

CIVIL AND SANITARY ENGINEERING

College of Engineering

Civil Engineering

CE

251. Elementary Surveying
Fall, Spring, 4(3-3) Not open to majors.

Use of the tape, compass, level, and transit with simple maps; traverse closure and area computations. Profile, cross section and stadia surveys, U.S. land system.

252. Surveying I
Fall, Spring, 5(4-3) Engineering majors or approval of department.

Instruments, theory of measurements, error analysis, stadia, horizontal and vertical curves, U.S. Public Land System, observation for meridian.

280. Introduction to Environmental Engineering
Fall, Winter, Spring, 4(4-0) CEM 141, or CEM 131, MTH 112, CPS 120.

Hydrology; ground water and surface water supply systems; wastewater treatment, methods of pollution control for solid waste, air, and noise.

305. Structural Mechanics I
Winter, Spring, 4(4-0) MMM 211.

Stability and determinacy of structures. Two and three dimensional determinate structures. Indeterminate structural analysis by displacement and force methods based upon equilibrium, compatibility and load-deformation relations.

308. Engineering Materials I
Fall, Winter, Spring, 4(3-3) MMM 211 or concurrently.

Structure; composition; physical, mechanical and rheological properties of non-metallic construction materials. Emphasis on aggregates, asphalt, inorganic cements, concrete, and wood.

312. Soil Mechanics I
Winter, Spring, Summer, 4(3-3) MMM 211.

Engineering properties of soils and their measurement. Effective stress concept; permeability; fluid flow in soils; stress-strain behavior; soil strength; compaction and consolidation of soils; field exploration and design problems.

321. Introductory Fluid Mechanics
Fall, Winter, Spring, 5(4-2) MMM 306.

Fluid properties; hydrostatics; control volume approach to conservation of mass, momentum and energy; dimensional analysis and dynamic similitude; fluid resistance; pipe and open channel flows; boundary layer concepts.

346. Transportation
Winter, Spring, Summer, 3(3-0) MTH 113.

Planning, design and evaluation of transportation systems. Operational characteristics of transportation modes, traffic flow and techniques for system selection.

347. Transportation Facilities
Fall, Winter, 4(3-3) C E 252.

Geometric design of highways and airports as these considerations affect capacity, construction costs, financing and safety.

370. Cost and Optimization Engineering

Fall, Winter. 3(3-0) MTH 113.

Formulation of engineering decisions governed by current and future costs and returns. Comparison and optimization of alternative engineering projects, products and processes.

372. Construction Estimating

Fall, Spring, 3(3-0) Juniors.

Cost studies of construction activities with emphasis on labor productivity and operating characteristics of equipment under various site conditions. Interpretation of drawings and specifications.

374. Legal Aspects of Engineering

Spring, 3(3-0) Juniors.

The professional engineer's relationship with the legal aspects of engineering. Special emphasis on contract documents.

390. Civil Engineering Analysis

Fall, Spring. 4(4-0) MTH 310, CPS 120.

Analysis of civil engineering problems by numerical and statistical methods. Approximate methods and error analysis. Application to computer use.

392. Civil Engineering Fundamentals for Planners

Winter. 4(4-0) Junior Urban Planning and Landscape Architecture majors.

Site planning; utility systems; subdivision review including street design, grading, density, and costs; transportation planning; and project evaluation.

400. Structural Mechanics II

Fall, Summer. 4(4-0) C E 305, C E 390.

Miscellaneous topics in displacement calculation by virtual work. Matrix formulation of the general principles of framed structural analysis. Exhaustive study of the flexibility and stiffness methods.

405. Structural Design in Steel

Fall, Winter. 4(4-0) C E 305, C E 390.

Beams, columns, tension and compression members, connections. Elastic, plastic and ultimate strength concepts.

406. Structural Design in Concrete

Winter, Spring. 4(4-0) C E 305, C E 308, C E 390.

Reinforced concrete beams, columns, slabs, footings and retaining walls. Elastic theory and ultimate strength concepts. Prestressed theory and design.

407. Structural Design Concepts

Spring. 3(3-0) C E 405, C E 406.

Develop and expand design concepts through study, investigation and project design of various structural systems. Criteria for material selection and creative design of unusual structural systems pursued.

410. Structural Mechanics III

Winter, 4(4-0) C E 400, CPS 120.

Continuation of C E 400. Matrix analysis of framed structures. Introduction to inelastic behavior of structures. Use of programmed computer solution techniques.

419. Soil Mechanics II

Fall, Spring. 4(4-0) C E 312, C E 390.

Foundation engineering. Immediate, consolidation, and secondary settlements; stress distribution in soil masses; lateral earth pressures on structures; bearing capacity of shallow foundations; introduction to stability analysis of earth structures.

421. Hydrology

Spring. 4(3-2) C E 280, C E 321, C E 390.

Engineering hydrology; frequency and precipitation analysis; streamflow analysis and the unit hydrograph; flood prediction; rainfall-runoff correlations; urban hydrology.

422. Hydraulic Systems

Fall, Winter. 4(3-2) C E 321, C E 390 or M E 351.

Steady flow in pipe networks; open channel flow; turbomachinery; groundwater hydraulics; introduction to unsteady flows. Applications to water supply systems; aquifer analysis; surges and water hammer.

441. Highway Operations.

Fall. 3(3-0) C E 346 or C E 342, C E 390.

Driver and vehicle characteristics affecting traffic flow; traffic flow density, headway and speed measurements; signing and signal control for efficient intersection operation, parking characteristics and capacity analysis.

442. Airport Planning and Design

Fall, Spring. 4(3-2) C E 346, C E 390.

The planning and design of the components of the airport system including ground access facilities; aircraft characteristics; the air traffic control system; airport configuration; capacity analysis; management systems.

443. Transportation Planning

Winter. 3(3-0) C E 342 or C E 346, C E 390.

Urban transportation facilities needs and programs. Design of transportation models for urban highways and public transit including trip generation, trip distribution, mode split and traffic assignment. Transport agencies function and services.

449. Highway Engineering

Spring. 3(3-0) C E 308, C E 347, C E 390.

Design concepts of roadways, facilities, drainage and pavement design. Maintenance, construction and supervision methods and procedures.

471. Scheduling Construction Activities

Winter. 3 credits. Approval of department.

Techniques for coordinating and controlling construction projects. Scheduling under the constraints of deadlines, uncertain time estimates and limited resources. Computer programs and data files for effective management.

481. Water and Wastewater Analysis

Fall. 4(3-3) C E 280, C E 390.

Quantitative analysis; bacteriologic and chemical characteristics of water and wastewater; principles of softening, iron removal, coagulation and chlorination; laboratory examination of water and wastewater including turbidity, solids, coliforms, chlorine, etc.

483. Water and Wastewater Treatment

Spring. 4(3-2) C E 280, C E 422. Not open to graduate majors in sanitary engineering.

Water treatment theory and design including sedimentation, coagulation, softening, iron removal and chlorination; wastewater treatment theory and design including grit chambers, activated sludge, trickling filter, and anaerobic digesters.

485. Environmental Health Engineering

Winter. 4(3-2) MPH 200, C E 280, C E 321, C E 390.

Design of small water, waste water and solid waste facilities. Epidemiology of communicable disease transmission by air, water, food and arthropods. Engineering measures to control disease spread.

494. Civil Engineering Design Project

Fall, Winter, Spring. 3(2-2) May reenroll for a maximum of 6 credits. Seniors, approval of department.

Planning, specifications and design of a civil engineering project or facility.

499. Civil Engineering Projects

Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 6 credits. Approval of department.

Original civil engineering problem of specific interest to the student and a faculty member. Student's proposal describing problem required prior to approval.

802. Structural Dynamics I

Fall. 3(3-0) C E 405, C E 406, or approval of department.

Basic concepts in structural dynamics; dynamic loading on structures due to blasts and earthquakes; dynamic properties of structures; methods of analysis; design approach to blast and earthquake resistant structures; dynamic behavior of bridges and other topics.

804. Advanced Structural Theory I

Winter. 4(4-0) C E 400, or approval of department.

Energy principles and their application in the analysis of elastic structures. Advanced force and displacement methods and their matrix formulation. Introduction to finite element methods.

805. Advanced Theory of Reinforced Concrete I

Winter. 3(3-0) C E 406.

Deflection, torsion, shrinkage, plastic flow, and ultimate strength of concrete structures. Prestressed concrete.

809. Finite Element Method

Fall. 4(4-0) Approval of department. Interdepartmental with the departments of Metallurgy, Mechanics, and Materials Science and Agricultural Engineering. Administered by the Department of Metallurgy, Mechanics, and Materials Science.

Theory and application of the finite element method to the solution of continuum type problems in heat transfer, fluid mechanics and stress analysis.

812. Rock Mechanics

Fall of odd-numbered years. 3(3-0) MMM 211; C E 312.

Engineering classification of rocks. Behavior of rocks under compressive, tensile and shear loads. Failure criteria. Design of openings in rock. Modes and mechanics of failure of rock slopes.

815. Principles of Highway and Airport Soils

Fall. 4(4-0) C E 347.

Foundation problems as related to highways and airports, relation of subsoil conditions to design and construction, analytical review of laboratory and field results.

817. Mechanical Properties of Soils

Fall. 4(3-3) C E 419 or approval of department.

Mechanical properties of soil including stress-strain behavior; conditions of failure and shear strength; consolidation theory and permeability. Laboratory determination of soil properties including interpretation of experimental data for use in practice.

818. Advanced Soil Mechanics

Winter. 4(4-0) C E 419; C E 817 recommended.

Foundations and earth retaining structures; bearing capacity, lateral resistance and settlement of deep foundations; earth pressures on braced excavations and sheet pile walls; design of caissons and cofferdams.

Descriptions — Civil and Sanitary Engineering

of

Courses

819. **Soil Stabilization in Geotechnical Engineering**
Summer. 3(3-0) C E 419.

Techniques to improve the performance of soil in engineering applications; compactions, blending, admixture, grouting, electrosmosis, vibroflotation, compaction piles, thermal treatment, load bearing and hydraulic fills, precompression, reinforced earth.

820. **Geotechnical Engineering for Cold Regions**
Spring. 3(3-0) C E 419 or approval of department.

Physical and thermal properties of ice and frozen soils; ground thermal regime; mechanical properties of frozen ground; thaw consolidation problems; foundation design; slope stability problems; and artificial freezing for construction.

821. **Flow of Fluids in Porous Media**
Fall. 4(4-0) C E 422 or approval of department.

Structure and properties of porous media. Fluid flow in saturated and unsaturated media. Two-phase flow. Darcy's and Navier Stokes equations. Two-dimensional sink flow. Multiple sources and sinks. Potential theory and conformal mapping. Permeability in an anisotropic medium.

827. **Environmental Fluid Mechanics**
Spring of even-numbered years. 4(4-0) C E 422 or approval of department.

Review of turbulent flow and transport processes in water quality control. Analysis and solution of ecological problems related to diffusion and disposal in rivers, estuaries, lakes and the ocean environment.

828. **Open Channel Flow**
Winter. 3(3-0) C E 422 or approval of department.

Fundamentals of free surface flow; steady uniform and nonuniform concepts; energy and momentum principles; subcritical and supercritical regimes; gradually and rapidly varied flow; design applications.

829. **Fluid Transients**
Spring of odd-numbered years. 4(4-0) C E 828 or approval of department. Interdepartmental with the Department of Mechanical Engineering.

Application of unsteady flow concepts and wave mechanics to hydraulic engineering; method of characteristics; surges and waterhammer in piping systems; unsteady open channel flow; oscillatory waves; similitude and models.

830. **Intermediate Fluid Mechanics**
Fall. 3(3-0) M E 332 or C E 321. Interdepartmental with and administered by the Department of Mechanical Engineering.

Deformable control volumes, Navier-Stokes equations, dimensionless variables, vorticity and circulation, turbulent flow, inviscid flow, and boundary layer theory.

840. **Pavement Design**
Spring of even-numbered years. 3(3-0) C E 449.

Pavement types and wheel loads, stresses in flexible pavements, stresses in rigid pavements, pavement behaviors under loadings; climate effects on pavement performance, evaluating subsoil strengths, subgrades, and pavement design criteria.

841. **Optimization of Urban Traffic Flow**
(SYS 841.) Fall of odd-numbered years. 3(3-0) Approval of department. Interdepartmental with Systems Science.

Traffic flow models used in design of computerized traffic control systems. Optimal freeway ramp metering algorithms. Offline and online optimization of traffic signal timing.

842. **Pavement Rehabilitation**
Spring of odd-numbered years. 4(4-0) C E 449.

Strengthening existing pavements, pavement overlay design criteria, epoxy and polyester resin repair and rehabilitation, evaluation of resurfacing practices for bituminous and cement pavements.

843. **Traffic Engineering Characteristics**
Winter of odd-numbered years. 3(3-0) C E 346, STT 421.

Safety analyses, flow and capacity characteristics, statistical properties of traffic, queuing characteristics at intersections, delay characteristics and analyses.

844. **Traffic Engineering Theory and Control**
Spring of odd-numbered years. 3(3-0) C E 843.

Application of the theory of traffic flow to the design and control of traffic streams. Dispatching, scheduling and network analysis. Application to highways, airport operation and urban transportation modes.

845. **Environmental Impacts of Transportation Facility Design Decisions**
Spring of even-numbered years. 3(3-0) C E 342 or C E 346, C E 448; or approval of department.

The context in which current transportation planning and design decisions are made; legislation; socio-economic effects; air, noise, and water pollution. Preparation of environmental impact statements.

846. **Highway Planning**
Fall of odd-numbered years. 3(3-0) C E 346 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 of even-numbered years. 3(3-0) C E 347.

Design of streets and highways including intersections, parking facilities, capacity, channelization and roadway appurtenances.

848. **Transportation Models**
Spring of odd-numbered years. 3(3-0) C E 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. 1 to 6 credits. May reenroll for a maximum of 12 credits in C E 880 and S E 880 combined. Approval of department.

Research problems of limited scope not pertaining to thesis accomplished under C E 899 or C E 999.

899. **Master's Thesis Research**
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

905. **Advanced Theory and Design of Reinforced Concrete II**
Spring. 3(3-0) C E 805.

Continuation of C E 805 with application of theory to analysis and design of tanks, rigid frames, and shells.

906. **Advanced Structural Steel Design**
Spring. 3(3-0) C E 406.

Analysis and design of multiple-story building frames, continuous trusses and rigid-frame girder bridges in structural steel. Plastic design.

909. **Elastic Thin Shells**
Spring. 4(4-0) C E 804 or MMM 815 or approval of department; MTH 421. Interdepartmental with the Department of Metallurgy, Mechanics, and Materials Science.

Elements of differential geometry, membrane theory of shells, Pucher's stress function, deformation and bending of shells of revolution and shallow shells.

912. **Theory of Plates**
Winter. 4(4-0) C E 804 or MMM 815 or approval of department; MTH 422. Interdepartmental with and administered by the Department of Metallurgy, Mechanics, and Materials Science.

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. **Earth Structure**
Spring. 3(3-0) C E 817 or approval of department.

Embankments, earth dams, natural and cut slopes, stability of circular and composite slip surfaces; performance of embankments on soft foundations; seepage through earth dams; instrumentation for field performance evaluation.

916. **Soil Dynamics**
Winter. 4(4-0) C E 817 or approval of department.

Characteristics of ground motions during earthquakes; dynamic soil properties; liquefaction and settlement under transient and repeated loadings; foundation design for vibratory loads; wave propagation in soil media.

941. **Mass Transit Routing and Scheduling**
Fall of even-numbered years. 3(3-0) C E 848 or approval of department.

Routing algorithms for mass transit vehicles in urban networks; dispatching of vehicles by dynamic programming and other algorithms; variable headway, variable route transit system studies.

999. **Doctoral Dissertation Research**
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

Sanitary Engineering S E

800. **Environmental Engineering Seminar**
Fall, Winter, Spring. 1(1-0) May reenroll for a maximum of 3 credits. Graduate major in C E or S E.

Current research, reports, and literature reviews.

802. **Physical Chemical Processes of Environmental Engineering**
Fall. 5(4-3) C E 481, C E 483 or concurrently.

Analysis of physical and chemical principles which form the basis of air and water pollution control and solid waste disposal; process dynamics, sedimentation, coagulation, filtration, adsorption, absorption, oxidation.

804. **Biological Processes of Environmental Engineering**
Winter. 4(4-0) MPH 200, S E 802.

Aerobic and anaerobic degradation of liquid and solid wastes. Biochemical reactions; activated sludge and trickling filter kinetics; sludge digestion and composting.

812. **Water Treatment Plant Design**
Winter. 4(3-3) C E 370, C E 483, C E 828, S E 802.

Theory and design of water treatment processes. Coagulation and flocculation; softening; sedimentation; filtration; disinfection.

814. Wastewater Treatment Plant Design
Spring. 4(3-3) C E 370, C E 483, C E 828, S E 804.

Theory and design of wastewater treatment processes. Racks, screens, sedimentation basins, trickling filters, aeration tanks, digesters.

816. Treatment of Industrial Wastes
Spring. 4(3-3) S E 804.

Theory of industrial waste management. Application of physio-chemical and biological treatment to selected industries. Examples include: apparel; food processing; materials processing and chemical industry.

822. Air Resource Management
Fall of even-numbered years. 4(4-0) S E 802 or concurrently.

Characteristics of air contaminants and noise; sources and source inventory; microclimatology and pollutant transport; pollutant effects, introduction to sampling and control.

880. Special Problems in Environmental Engineering

Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 12 credits in C E 880 and S E 880 combined. Approval of department.

Solution of environmental engineering problems, of limited scope not pertaining to thesis.

899. Master's Thesis Research

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

924. Air Sampling and Analysis

Spring of odd-numbered years. 4(3-3) S E 922.

Theory and design of air sampling programs. Quantitative analysis of ambient air samples and stack samples. Analysis for sulfur oxides, nitrogen oxides and particulates.

999. Doctoral Dissertation Research

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

CLASSICAL STUDIES

See Romance and Classical Languages.

COMMUNICATION COM

College of Communication Arts and Sciences

100. Human Communication

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.

115. Oral Communication

Fall, Winter, Spring, Summer. 3(3-0) COM 100 or approval of department.

Principles and practice in adapting to audiences, creating and structuring messages, and developing effective delivery of formal and informal speeches. Critical evaluation of speeches by instructor and peers.

125. Interpersonal Communication

Fall, Winter, Spring, Summer. 3(3-0) COM 100.

Develop students' abilities to become more effective, responsible participants in interpersonal communication relationships, with emphasis on relating communicatively with others.

199. Methods of Inquiry

Fall, Winter, Spring, Summer. 3(3-0) COM 125.

Major theoretic orientations toward communication. Primary tools of scholarly inquiry.

205. Persuasion

Fall, Winter, Spring, Summer. 4(4-0) COM 100.

Process of influencing human behavior through persuasive communication. Experience in creating persuasive messages and in evaluating the acceptability of persuasive attempts.

210. Leadership and Group Communication

Fall, Winter, Spring, Summer. 4(4-0) COM 100.

Principles and practice in the utilization of communication for effective leadership, with special emphasis on group communication.

250. Argumentation

Fall, Winter, Spring, 4(4-0) COM 199.

Development and use of arguments; recent perspectives in argumentation; rhetorical and empirical study of argumentative messages.

299. Individual Projects

Fall, Winter, Spring, Summer. 1 to 15 credits. May reenroll for a maximum of 15 credits. COM 199, approval of project proposal by department.

Independent research, experience in communication laboratories, or tutorial work in communication skills.

300. The Effects of Mass Communication

Fall, Winter, Spring, Summer. 4(4-0)

Major social effects of mass media on audience behavior. Political communication. Media effects on children. Message strategies producing attitude change. Interrelationship between mass media and interpersonal communication. Decision making in mass media.

315. Organizational Communication

Fall, Winter, Spring. 4(4-0) COM 100.

Principles and practice in the management of communication systems, with emphases on conflict resolution, information exchange, innovativeness, and information management.

326. Communication in Business

Fall, Winter, Spring, Summer. 4(4-0) Juniors.

Study and analysis of business and industrial communication problems; extensive instruction and practice in writing.

350. Signs and Sign-Behavior

Fall, Winter, Spring, Summer. 4(4-0) COM 100.

Theories of symbolic behavior. Language structure and communicative functions.

352. Nonverbal Communication

Fall. 4(4-0) COM 100.

Major nonverbal communication codes and functions they perform. Codes: body movement, touch, physical appearance, paralanguage, use of space, time, artifacts. Opportunities to analyze nonverbal communication of self and others.

399. Special Topics in Communication

Fall, Winter, Spring, Summer. 4(4-0) May reenroll for a maximum of 8 credits. Juniors.

Contemporary issues in communication.

405. Quantitative Strategies in Communication Research

Fall, Spring. 4(4-0) Seniors.

Design and statistical strategies in communication research. Project design and evaluation schema. Basic data handling and presentation.

410. Classroom Communication

Spring. 3(3-0) Majors and minors or approval of department.

Classroom as a communication system with emphasis on operationalizing philosophies of education in the environment, teacher and student roles and styles, affective and cognitive interactions, methods of systematic observation.

411. Directing the Debate and Forensic Program

Fall. 3(3-0) Majors and minors or approval of department.

Principles of and practice in argumentation; methods of coaching debate and individual events and managing tournaments; observation of high school tournaments, practices, and student congress.

413. Seminar in Communication Education

Winter, Summer. 4(4-0) ED 327.

Philosophies of curricular and co-curricular programs in communication education. Internship experience in those programs.

425. Communication Campaign Analysis

Fall. 4(4-0) COM 300 or approval of department.

Design of persuasive and information campaigns. Techniques and strategies for analyzing and influencing mass audience. Principles and practice in constructing messages and selecting media. Political and public service campaign focus.

430. Information and Technology

Winter. 4(4-0) COM 315 or approval of department.

Concepts and principles of information and information technology, with emphasis on effects on organizational processes.

431. Conflict in Communication

Winter. 4(4-0) COM 125 or approval of department.

Elaboration of theories in conflict resolution; development of strategies to resolve conflict situations; personal analysis of communication patterns that can affect conflict.

460. Critical Perspectives on Communication

(360.) Fall, Winter, Spring. 4(4-0) COM 100.

Interdependence of communication and other societal factors, emphasizing criteria for ethical and social appropriateness.

475. Relational Communication

Spring. 4(4-0) COM 125.

Theories and current research on relational communication, including stages of relational communication development; verbal and nonverbal relational messages of intimacy, similarity, arousal, privacy and dominance; role of culture and context.

499. Special Projects

Fall, Winter, Spring, Summer. 1 to 15 credits. May reenroll for a maximum of 15 credits. Approval of project proposal by department.

Independent research, group research, student-directed group projects.

805. Communication Research

Fall. 4(4-0) First year graduate 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

Fall. 4(4-0) COM 805; second year graduate majors.

Continuation of COM 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.