CHINESE

See Linguistics and Oriental and African Languages

CIVIL AND SANITARY ENGINEERING

College of Engineering

Civil Engineering

251. Elementary Surveying
Fall, Spring. 4(3-3) Trigonometry, EGR 160 or 267. 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. Public Land System, observation for meridians.

252. Surveying I
Fall, Spring. 5(4-3) Trigonometry. Instruments, theory of measurements, error analysis, stadia, horizontal and vertical curves, U.S. Public Land System, observation for meridians.

253. Surveying II
Spring. 4(3-3) 251 or 252. Continuation of 252 including photogrammetric methods, astronomical observations for latitude, longitude and meridian. Introduction to geodetic methods.

301. Structural Mechanics I
Winter, Spring. 4(4-0) MTH 215 and GEH 141. Stress and strain, compatibility and load-deformation relations. Structure; composition; physical, mechanical and rheological properties of non-metallic construction materials. Emphasis on aggregates, asphalt, inorganic cements, concrete, and wood.

302. Structural Mechanics II
Spring. 4(3-3) MTH 215 and GEH 141 or 121, MTH 113, CPS 120. Stress and deflection of structures. Two and three dimensional determinate structures. Indeterminate analysis by displacement and force methods based upon equilibrium, compatibility and load-deformation relations.

311. Urban Utilities
Winter. 3(3-0) Capacity, limitations and cost of public and semi-public utilities as they relate to the planning and design of the urban environment. Topics include transportation, water supply, storm drainage, sewage collection and treatment, solid waste and municipal finance.

312. Soil Mechanics I
Spring, Summer. 4(3-3) MTH 215. 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.

313. Introductory Fluid Mechanics
Fall, Winter, Spring. 4(3-2) MTH 215. Fluid properties; hydraulics; 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.

342. Survey of Transportation Systems
Fall. 4(4-0) Juniors; not open to majors. Survey of engineering aspects of all forms of transportation with emphasis on highway transportation including highway systems, planning, economic and financial aspects, geometries and traffic studies.

344. Transportation
Fall, Winter, Summer. 3(3-0) MTH 215. Planning, design and evaluation of transportation systems. Operational characteristics of transportation modes, traffic flow and techniques for system selection.

345. Transportation Facilities
Winter. 4(3-3) or 251 or 252. Geometric design of highway and airport facilities at these considerations affect capacity, traffic control and economics of transport systems. Financing and administration of transport systems.

375. Surveying I
Spring. 4(3-3) 251 or 252. Continuation of 252 including photogrammetric methods, astronomical observations for latitude, longitude and meridian. Introduction to geodetic methods.

376. 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.

377. Construction Estimating
Fall, Winter. 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.

378. 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 315 and CPS 120. Analysis of civil engineering problems by numerical and statistical methods. Approximate methods and error analysis. Application to computer use.

400. Structural Mechanics II
Spring, Summer. 4(3-3) 301. Energy methods in static and dynamic structural analysis, including the principles of virtual displacements and virtual forces. Influence matrices. Matrix analysis of structures, influence and stiffness coefficients. Computer facilities are used.

401. Structural Design in Steel
Fall, Winter. 4(4-0) 301. Beams, columns, tension and compression members, connections. Elastic, plastic and ultimate strength concepts.

402. Structural Design in Concrete
Winter, Spring. 4(4-0) 301. 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) 405, 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
Fall. 4(4-0) 406. Beam-columns, elastic buckling, thin-walled members. Elementary theory with special reference to structures. Elements of plates and shells. Introduction to inelastic behavior of structures.

419. Soil Mechanics II
Fall. 4(4-0) 312. 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
Fall. Spring. 4(4-3) 390, 321, 390 or M E 351. Hydrology hydrology; frequency and precipitation analysis; streamflow analysis and the unit hydrograph; flood prediction; rainfall-runoff correlations; urban hydrology.

422. Hydraulic Systems
Winter. 4(3-3) 321, 390 or M E 351. Steady flow in pipe networks; open channel flow; turbulence; groundwater hydraulics; introduction to unsteady flows. Applications to water supply systems; aquifer analysis; surface and water hammer.

441. Highway Operations
Spring. 3(3-0) 349 or 342. Driver and vehicle characteristics affecting traffic flow, traffic flow density, headway and speed measurements; signaling and signal control for efficient intersection operation, packaging characteristics and capacity analysis.

442. Airport Planning and Design
Fall. 3(3-0) 346. 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.

445. Transportation Planning
Winter. 3(3-0) 342 or 346. 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(2-2) 308, 347. Design concepts of roadways, facilities, drainage and pavement design. Maintenance, construction and supervision methods and procedures.

471. Scheduling Construction Activities
(971.) 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 (487) Fall. 4(3-2) 250.

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) 280, 421, 432 or concurrently. 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 sedimentation, activated sludge, trickling filter, and anaerobic digesters.

485. Environmental Health Engineering
Winter. 3(3-0) MPH 200, C E 280. Epidemiology of communicable disease transmitted by air, water, food and arthropods. Engineering measures to control disease spread; incidence and prevalence rates, well design, cross-connections, disinfection, sanitary inspection. Case studies.

499. Civil Engineering Projects
Fall, Winter, Spring, Summer. Variable credits. May re-enroll 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 presentation describing problem required prior to approval.

500. Operations Research Techniques for Civil Engineers
Fall. 3(3-0) Graduate standing. Elements of deterministic methods of operations research with emphasis on computational techniques and applications to civil engineering problems such as structural design, water supply, transportation, and construction management.

502. Structural Dynamics I
Fall. 3(3-0) 405, 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.

504. Advanced Structural Theory I
Winter. 4(4-0) 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.

505. Advanced Theory of Reinforced Concrete I
Winter. 3(3-0) 406. Deflection, torsion, shrinkage, plastic flow, and ultimate strength of concrete structures. Prestressed concrete.

507. Model Analysis
Fall. 3(3-3) 406. Basic theory of the analysis of structures by means of models. Laboratory work on models; Begg's deformation and electric resistance type gauges for the measuring of static and dynamic strains.

509. Finite Element Method
Spring. 3(3-0) Approval of department. Interdepartmental with the departments of Metallurgy, Mechanics and Materials Science and Agricultural Engineering and 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.

515. Principles of Highway and Airport Soils
Winter. 4(4-0) 347. Foundation problems as related to highways and airports, related to subsoil conditions to design and construction, analytical review of laboratory and field results.

517. Mechanical Properties of Soils
Fall. 4(3-3) 419 or approval of department. Mechanical properties of soil including stress-strain behavior; compaction; bearing capacity; shear strength, consolidation theory and permeability. Laboratory determination of soil properties including interpretation of experimental data for use in practice.

518. Advanced Soil Mechanics
Winter. 4(4-0) 419, 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 embankments and cofferdams.

519. Soil Stabilization in Geotechnical Engineering
Summer. 3(3-0) 419. Techniques to improve the performance of soil in engineering applications; compaction, blending, admixture, grouting, electrosmosis, vibration, compaction piles, thermal treatment, load bearing and hydraulic fill, precompaction, reinforced earth.

520. Geotechnical Engineering for Cold Regions
Spring. 3(3-0) 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.

521. Flow of Fluids in Porous Media
Fall. 3(3-0) 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. Permeability and conformal mapping. Permeability in an anisotropic medium.

527. Environmental Fluid Mechanics
Spring of even-numbered years. 4(4-0) 432 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 dispersion in rivers, estuaries, lakes and the ocean environment.

528. Open Channel Flow
Winter. 3(3-0) 423 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) 828 or approval of department. 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, sinuosity and models. For students interested in fluid mechanics.

840. Pavement Design
Spring of even-numbered years. 3(3-0) 449. Pavement types and wheel loads, stresses in flexible pavements, stresses in rigid pavements, pavement behaviors under loads, climate effects on pavement performance, evaluating subgrade strengths, subgrades, and pavement design criteria.

841. Optimization of Urban Traffic Flow
Fall. 3(3-0) Approval of department. Interdepartmental with and administered by Systems Science. Traffic flow models used in design of computerized traffic control systems. Optimal ramp metering algorithms. Offline and online optimization of traffic signal timing.

842. Pavement Rehabilitation
Spring of odd-numbered years. 4(4-0) 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. 3(3-0) 346, ST5 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. Dispatching, scheduling and network analysis. Application to highways, airport operation and urban transportation modes.

845. Environmental Impacts of Transportation Facility Design Decisions
Spring. 3(3-0) 342 or 346, 418, 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. 3(3-0) 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. 3(3-0) 349 or approval of department. Design of streets and highways including intersection, 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.

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

Sanitary Engineering  
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802. Physical Chemical Processes of Environmental Engineering  
Fall. 4(3-3) 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. 5(4-3) MPH 200, C E 280, 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  
Theory and design of water treatment processes. Coagulation and flocculation; softening; sedimentation; filtration; disinfection.

814. Wastewater Treatment Plant Design  
(WSS.) Spring. 4(3-3) C E 370, 483, 828, S E 804.  
Theory and design of wastewater treatment processes. Tanks, screens, sedimentation basins, trickling filters, aeration tanks, digesters.

816. Treatment of Industrial Wastes  
(WSS.) Spring. 3(3-0) 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) 802 or concurrently.  
Characteristics of air contaminants and noise; sources and source inventory; microenvironmental and pollutant transport; pollutant effects, introduction to sampling and control.

922. Air Pollution Control  
Winter of odd-numbered years. 4(3-3) C E 321, S E 808, 822.  
Application of physical and chemical principles to control of gaseous and particulate air pollutants. Cyclohexane, bag houses, electrostatic precipitators, adsorption, absorption, combustion.

924. Air Sampling and Analysis  
Spring of odd-numbered years. 4(3-3) 822.  
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. Research  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

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CLASSICAL STUDIES  

See Romance and Classical Languages.

COMMUNICATION  

College of Communication Arts and Sciences†

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, Summer. 3(3-0)  
Majors and minors only. 101.  
Major theoretical orientations toward communication. Primary tools of scholarly inquiry.

205. Persuasion  
Fall, Winter, Spring, Summer. 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  
Fall, 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. The Effects of Mass Communication I  
Fall, Winter, Spring, Summer. 4(3-0)  
Majors must enroll in 300R concurrently.  
Major social effects of mass media on audience behavior. Political communication, media effects on children. Message strategies producing attitude change. Interrelationship of mass media and interpersonal communication. Decision making in mass media.

300R. Effects of Communication II  
Fall, Winter, Spring, Summer. 1 credit.  
Majors. 300 concurrently.

In-depth consideration of effects of communication.

315. Organizational Communication  
Spring. 4(4-0) 101.  
Principles and practice in the management of communication systems, with emphasis on conflict resolution, information exchange, innovativeness, and information management.

†Name changed effective July 1, 1975. Formerly College of Communication Arts.