Appendix M: General CEGE Classes

CEGE 5094 - Civil Engineering Research
(1.0 - 4.0 cr [max 4.0 cr]; Prereq-#; fall, spring, every year)
Research or independent study in concrete, structural steel, soils, hydraulics, hydrology/municipal, environmental, or transportational problems. Investigations, reports, tests, designs.

CEGE 5170 - Internet Based Study
(1.0 - 5.0 cr [max 15.0 cr]; Prereq-Upper div CSE; A-F or Aud, fall, offered periodically)
Internet based teaching with bi-weekly exercises on topic of concern.

CEGE 5180 - Special Topics
(1.0 - 4.0 cr [max 4.0 cr]; Prereq-#; A-F or Aud, fall, spring, offered periodically)
Topics vary depending on faculty and student interests.

CEGE 8094 - Civil Engineering Research
(1.0 - 4.0 cr [max 12.0 cr]; Prereq-#; fall, spring, summer, every year)
Research or independent study in concrete, structural steel, soils, hydraulics, hydrology, and municipal, environmental, or transportational problems. Investigations, reports, tests, or designs.

CEGE 8333 - FTE: Master's
(1.0 cr; Prereq-Master's student, adviser and DGS consent; No Grade, fall, spring, summer, every year)
(No description)

CEGE 8444 - FTE: Doctoral
(1.0 cr; Prereq-Doctoral student, adviser and DGS consent; No Grade, fall, spring, summer, every year)
(No description)

CEGE 8490 - Special Topics
(1.0 - 4.0 cr [max 8.0 cr]; Prereq-#; A-F or Aud, fall, spring, offered periodically)
Topics vary depending on faculty and student interests.

CEGE 8666 - Doctoral Pre-Thesis Credits
(1.0 - 6.0 cr [max 12.0 cr]; Prereq-Doctoral student who has not passed prelim oral; no required consent for 1st/2nd registrations, up to 12 combined cr; % for 3rd/4th registrations, up to 24 combined cr; doctoral student admitted before summer 2007 may register up to four times, up to 60 combined cr; No Grade, fall, spring, summer, every year)
(No description)

CEGE 8777 - Thesis Credits: Master's
(1.0 - 18.0 cr [max 50.0 cr]; Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only]; No Grade, fall, spring, summer, every year)
(No description)
CEGE 8888 - Thesis Credit: Doctoral
(1.0 - 24.0 cr [max 100.0 cr]; Prereq-Max 18 cr per semester or summer; 24 cr required; No Grade, fall, spring, summer, every year)
(No description)

Stream Restoration Certificate

CEGE 8601 - Introduction to Stream Restoration
(3.0 cr; A-F or Aud, fall, every year)
Background material required to participate in a stream restoration project. How to assimilate geologic, hydrologic, and ecological data at watershed and reach scales to plan a restoration project and evaluate/critique existing stream restoration projects.

CEGE 8602 - Stream Restoration Practice
(2.0 cr; = [ESCI 8602, EEB 8602]; Prereq-8601 or Geo 8601; S-N only, summer, every year)
Field experience, group design project. Students provide a stream restoration context for each other’s elective coursework, complete critical assessments of stream restoration projects, and design a stream restoration site.
Environmental/Water Resource Engineering Classes

CEGE 5511 - Urban Hydrology and Land Development
(4.0 cr; Prereq - CEGE 4501; A-F or Aud, fall, every year)
Urban hydrology for small watersheds and the management of storm water quality and quantity.

CEGE 5541 - Environmental Water Chemistry
(3.0 cr [max 4.0 cr]; Prereq-3501, Chem 1021, Chem 1022; A-F or Aud, fall, every year)
Introduction to water chemistry. Physical chemical principles, geochemical processes controlling chemical composition of waters, behavior of contaminants that affect the suitability of water for beneficial uses.

CEGE 5542 - Experimental Methods in Environmental Engineering
(3.0 cr; Prereq-3501, Chem 1021, Chem 1022; A-F or Aud, fall, spring, offered periodically)
Tools necessary to conduct research in environmental engineering and chemistry. Theory of operation of analytical equipment. Sampling and data handling methods, statistical analyses, experimental design, laboratory safety. Lecture, laboratory.

CEGE 5543 - Introductory Environmental Fluid Mechanics
(4.0 cr; Prereq-3502 or AEM 4201 or ChEn 3005; A-F or Aud, fall, odd academic years)
Divergence theorem, Convective flux, Mass conservation, Biological reactions, Random walk and diffusive flux, Receptors and channels, Momentum conservation, Navier-Stokes equations, Boundary layer, Chemotaxis, Phototaxis, Shear dispersion, Turbulent flows.

CEGE 5551 - Environmental Microbiology
(3.0 cr; Prereq-[Upper div or grad] student; A-F or Aud, fall, every year)
Role of microorganisms in environmental bioremediation, pollution control, water/wastewater treatment, biogeochemistry, and human health. Lecture.

CEGE 5552 - Environmental Microbiology Laboratory
(1.0 cr; Prereq-5551 or &5551; A-F only, fall, every year)
Basic microbiological techniques: isolation, identification/enumeration of bacteria, BOD, biodegradable kinetics, disinfection. Lab.

CEGE 5561 - Air Quality Engineering
(3.0 cr; Prereq-Grad student in engineering or #; A-F only, spring, every year)
Introduction to air pollution problems/solutions, local to global. Quantitative analysis of chemistry and physics of atmospheric pollutants. Sources, sinks, and controls; atmospheric transport and transformation; air quality management and regulation; health impacts; global issues.

CEGE 5570 - Design for Sustainable Development: Discovery
(1.0 - 3.0 cr [max 3.0 cr]; Prereq-Juniors or seniors with minimum 3.0 GPA or grad student; A-F only, fall, every year) Intensive, experiential learning opportunity on infrastructure, development, environment issues in Delhi, India.
CEGE 5571 - **Design for Sustainable Development: Innovate**  
(3.0 - 4.0 cr [max 8.0 cr]; Prereq-#; A-F only, fall, spring, every year)  
Hands-on training evaluating technologies to improve health/quality of life in developing countries.  
Students work in teams/students in India to select technology or service. Design business serving low-income community in India.

CEGE 5572 - **Design for Sustainable Development: Create I**  
(2.0 cr [max 4.0 cr]; Prereq-#; A-F only, spring, every year)  
Hands-on experience regarding entrepreneurship/social entrepreneurship.

CEGE 5573 - **Design for Sustainable Development: Create II**  
(1.0 cr [max 2.0 cr]; S-N only, spring, every year)  
Weekly discussion on social or environmental venture.

CEGE 8500 - **Environmental Seminar**  
(1.0 cr [max 3.0 cr]; Prereq - grad CEGE major or #; S-N or Aud, spring, every year)  
Broad coverage of topics in environmental engineering and science. Speakers consist primarily of graduate students in these areas, but presentations may also be given by University faculty and guest speakers.

CEGE 8501 - **Environmental Fluid Mechanics I**  
(4.0 cr; Prereq - 3502 or equiv or #; A-F or Aud, fall, every year)  
Basic laws of mass, energy, and momentum transport in environmental fluid flow. Exact and approximate solutions for viscous flow. Irrotational flow; gravity waves. Similitude and inspectional analysis. Laminar boundary layers and slender flows. Application to engineering and environmental problems.

CEGE 8502 - **Environmental Fluid Mechanics II**  
(4.0 cr; Prereq-8501 or #; A-F or Aud, fall, spring, every year)  
Reynolds equations. Developed and developing turbulent boundary layers and slender flows, and their interaction with inviscid flow. Jets, plumes, wakes and shear layers. Statistical description of turbulence; data analysis.

CEGE 8503 - **Environmental Mass Transport**  
(4.0 cr; Prereq-3502, 3501 or equiv or #; A-F or Aud)  
Principles of intraphase and interfacial chemical transport and fate in the environment, specifically the processes of diffusion, dispersion, and convection. Application to surface water and atmospheric mixing, dispersion in groundwater, and transport between these media.

CEGE 8504 - **Theory of Unit Operations**  
(4.0 cr; Prereq-5541; A-F or Aud, fall, spring, offered periodically)  
Theoretical basis, design, operation of chemical/physical processes used in treating/controlling water quality. Adsorption, ion exchange, sedimentation, thickening, filtration, gas transfer, coagulation, flocculation, membrane processes, disinfection.
CEGE 8505 - Biological Processes
(3.0 cr; Prereq-4502, 4501 or #; A-F or Aud, spring, every year)
Theoretical principles underlying chemical and biological wastewater treatment processes, including aerobic and anaerobic treatment for organic carbon and nutrient removal. Mathematical models of microbial growth kinetics and mass transport in suspended growth and attached film applications are developed.

CEGE 8506 - Stochastic Hydrology
(4.0 cr; Prereq-Stat 3021 or equiv or #; A-F or Aud)
Analysis and synthesis of hydrologic series and systems; derived distributions; uncertainty and risk analysis; flood frequency analysis; multivariate time series analysis; correlation and spectral analysis; series of long-range dependence; linear estimation; geostatistics; sampling networks; hydrologic forecasting.

CEGE 8507 - Advanced Methods in Hydrology
(4.0 cr; Prereq-8506; A-F or Aud)
Notions of scale-invariance, scaling, and multiscaling in geophysical processes; methods of multiscale analysis; wavelet transforms; time-frequency-scale analysis and fractal analysis. Applications in atmospheric, hydrologic, and geomorphologic processes.

CEGE 8508 - Ecological Fluid Mechanics
(4.0 cr; Prereq-3502 or equiv; A-F or Aud, fall, every year)
Fluid mechanics of microbiological processes in lakes, rivers, and wetlands. Small-scale fluid motion, nutrient uptake, growth kinetics, ecosystem metabolism, scaling, lab/field microstructure measurements.

CEGE 8511 - Mechanics of Sediment Transport
(3.0 cr; = [ESCI 8511]; Prereq-3502 and 4501 or #; A-F or Aud, fall, every year)

CEGE 8521 - The Atmospheric Boundary Layer
(4.0 cr; Prereq-CSE or COAFES grad student or #; A-F or Aud, summer, offered periodically)
Land-atmosphere interactions and turbulent transport in the atmospheric boundary layer (ABL), the lowest part of the atmosphere. ABL development and dynamics. Turbulence, surface energy balance, spectral analysis, similarity theory. Flow over homogeneous and heterogeneous surfaces. Atmospheric stability, measurement, simulation of turbulent fluxes.

CEGE 8541 - Aquatic Chemistry
(3.0 cr; Prereq-4541 or #; A-F or Aud, spring, offered periodically)
Advanced course on water chemistry; physical chemical principles and geochemical processes controlling the chemical composition of natural waters, soil- and sediment-water interactions. Emphasizes behavior of inorganic contaminants in natural waters and engineered systems and dissolved natural organic matter.
CEGE 8542 - Chemistry of Organic Pollutants in Environmental Systems
(3.0 cr; Prereq-[4541, 5541] or #; A-F or Aud)
Structural characteristics and physico-chemical properties of organic contaminants in aquatic systems. Emphasizes PCBs, PAHs, dioxins, insecticides, herbicides, and chlorinated solvents. Factors affecting their transport/transformation. Structure- and property-activity relationships, their use in predicting organic chemical behavior.

CEGE 8551 - Environmental Microbiology: Molecular Theory and Methods
(4.0 cr; A-F or Aud, fall, even academic years)
Introduction to microbial genetics and molecular phylogeny. Application of nucleic-acid techniques in environmental microbiology and microbial ecology.

CEGE 8552 - Groundwater Microbiology: Laboratory
(4.0 cr; Prereq-grad CEGE major or #, exposure to basic environmental engineering and microbiology; A-F or Aud)
Subsurface microbial ecology, biogeochemical cycling, metabolic classification of subsurface bacteria, modeling bacterial transport, diagnosis of microbial induced fouling (MIF) events, bioremediation of contaminated aquifers. Lectures and four lab hours per week.

CEGE 8553 - Biofilms
(3.0 cr; Prereq-4551 or #; A-F or Aud)
Science/engineering concepts to investigate formation/function of biofilms. Properties/composition of biofilms, transport/transformation processes in biofilms, communication in biofilms, mathematical modeling. Applications in environmental engineering.

CEGE 8561 - Analysis and Modeling of Aquatic Environments I
(3.0 cr; Prereq-One sem grad work or #; A-F or Aud, spring, every year)

CEGE 8562 - Analysis and Modeling of Aquatic Environments II
(3.0 cr [max 6.0 cr]; Prereq-One sem grad work or #; fall, spring, offered periodically)
Models for transport/transformation of pollutants, nutrients, particulates, ecosystems, etc., from recently completed theses, articles, or research in progress. Students review assigned recent papers, make presentations, and analyze a topic of their choice.

CEGE 8563 - Industrial Waste Treatment
(3.0 cr; Prereq-3501, 4501, 4502, or equiv or #; A-F or Aud)
Introduction to industrial waste treatment. Individual industries, emphasizing constituents of the waste-stream and how best to recycle, recover, or reduce wastes. Cost concerns and regulations. Field trips to various industries to gain first-hand knowledge of processes involved in treatment.
CEGE 8571 - **Hydraulic Measurements**  
(3.0 cr; Prereq-3502 or #; A-F or Aud)  
Lab and field methods and instruments for measuring hydraulic pressure, velocity, and discharge.

CEGE 8572 - **Computational Environmental Fluid Dynamics**  
(4.0 cr; Prereq-grad student in CSE or COAFES or #; A-F or Aud, spring, offered periodically)  
Finite difference methods, their application to solution of one-/two-dimensional problems in environmental fluid dynamics. Stability, convergence, consistency, and accuracy of numerical schemes. Navier-Stokes equations, their physical meaning, and their numerical solution. Turbulence modeling: RANS and LES.

CEGE 8581 - **Research and Professional Ethics in Water Resources and Environmental Science**  
(0.5 cr; = [WRS 8581]; Prereq-[Environmental engineering or water resource science] grad student or #; S-N or Aud, spring, every year)  
Ethics of water resources science and environmental engineering research/practice. Societal responsibility, plagiarism, recording-keeping, authorship, confidentiality, conflicts of interest, professional relationships, fraud, reporting misconduct. Meets during first eight weeks of spring semester.
Geomechanics Engineering Classes:

CEGE 5311 - Experimental Geomechanics
(3.0 cr; Prereq-Upper div CSE or grad, 4301, or #; A-F or Aud, fall, odd academic years)

CEGE 5341 - Wave Methods for Nondestructive Testing
(4.0 cr; Prereq-[AEM 2021, AEM 3031] or #; A-F or Aud, fall, offered periodically)
Introduction to contemporary methods for nondestructive characterization of objects of civil infrastructure (e.g., highways, bridges, geotechnical sites). Imaging technologies based on propagation of elastic waves such as ultrasonic/resonant frequency methods, seismic surveys, and acoustic emission monitoring. Lecture, lab.

CEGE 5351 - Advanced Mathematics for Civil Engineers
(3.0 cr; Prereq-[Math 2263 or Math 2374 or equiv], [sr or grad student] in civil engineering]) or #; A-F or Aud)
Emphasizes skills relevant for civil engineers. Mathematical principles explained in an engineering setting. Applications from various areas in civil engineering.

CEGE 8300 - Seminar: Geomechanics
(1.0 - 3.0 cr [max 4.0 cr]; = [GEOE 8300]; S-N or Aud, fall, spring, every year)
Presentations on various topics.

CEGE 8301 - Fracture of Geomaterials
(3.0 cr; = [GEOE 8301]; Prereq-CSE grad student, 5321, or #; A-F or Aud, fall, offered periodically)

CEGE 8302 - Soil/Rock Plasticity and Limit Analysis
(4.0 cr; Prereq-CSE grad student, CEGE 4300 or #; A-F or Aud, spring, odd academic years)

CEGE 8311 - Advanced Rock Mechanics
(3.0 cr; = [GEOE 8311]; Prereq-CSE grad student, 4311 or #; A-F or Aud, fall, offered periodically)
Stress transformations; principal stresses and directions. Friction and behavior of rock joints; stability of frictional sliding. Elastic waves; acoustic emission and seismic measurements. Fragmentation and rock breakage.
CEGE 8321 - Thermoporoelasticity
(4.0 cr; = [GEOE 8321]; Prereq-CSE grad student, 5321 or #; A-F or Aud, fall, offered periodically)

CEGE 8322 - Storage and Flow of Granular Materials
(3.0 cr; Prereq-CSE grad student, 4301 or #; A-F or Aud, fall, offered periodically)

CEGE 8331 - Modeling Geomechanical Processes
(3.0 cr; = [GEOE 8331]; Prereq-CSE grad student, 5321; A-F or Aud, fall, offered periodically)

CEGE 8336 - Boundary Element Methods I
(3.0 cr; = [GEOE 8336]; Prereq-CSE grad student; A-F or Aud, fall, even academic years)
Introduction to boundary element methods for elastostatics; stress discontinuity, displacement discontinuity, and direct boundary integral methods. Derivation of basic mathematical solutions from the theory of elasticity. Applications in geomechanics.

CEGE 8337 - Boundary Element Methods II
(3.0 cr; = [GEOE 8337]; Prereq-8336, or #; A-F or Aud, fall, offered periodically)
Transient and nonlinear problems.

CEGE 8341 - Dynamics of Soils and Foundations
(4.0 cr; Prereq-Basic courses in soil mechanics/dynamics or #; A-F or Aud)

CEGE 8351 - Advanced Groundwater Mechanics I
(3.0 cr; Prereq-4351 or GeoE 4351, CSE grad student or #; A-F or Aud, fall, spring, offered periodically)
Solute transport; shallow flow in leaky aquifers; complex variable methods in groundwater flow. Analytic element method: potentials for line sinks, line doublets, line dipoles, area sinks, and special analytic elements; singular Cauchy integrals; analytic elements in domains with closed boundaries.

CEGE 8352 - Advanced Groundwater Mechanics II
(3.0 cr; = [GEOE 8352]; Prereq-4351, CSE grad student or #; A-F or Aud, fall, offered periodically)
Applying complex methods, including conformal mapping, in groundwater mechanics; solving problems with free boundaries using the hodograph method; drains in aquifers with free boundaries; superposition
of solutions with drains; singular Cauchy integrals; boundary elements.

CEGE 8361 - **Engineering Model Fitting**
(3.0 cr; Prereq-CSE grad student or #; A-F or Aud, fall, even academic years)
Parameter estimation and inverse modeling for civil and geological engineering. Formulating engineering model fitting problems; comparing and selecting various fit criteria; implementing numerical algorithms; analyzing and interpreting results using both statistical and qualitative tools; designing future measurement plans.
Structures Engineering Classes

CEGE 5411 - Applied Structural Mechanics
(3.0 cr; Prereq-[Upper div CSE or grad student] or #; A-F or Aud, fall, every year)
Principal stresses and failure criteria in 3 dimensions. Introduction to plane elasticity, energy methods, torsion of beams, and bending of unsymmetrical beams.

CEGE 5414 - Prestressed Concrete Design
(3.0 cr; Prereq-[Grade of at least C- in 4401, [upper div CSE or grad student]] or #; A-F or Aud, fall, every year)
Design of prestressed concrete structures. Time dependent effects, behavior, flexure, shear, torsion, deflections, and continuous systems.

CEGE 5415 - Masonry Structures
(3.0 cr; Prereq-[Grade of at least C- in 3401, [upper div CSE or grad student]] or #; 4401 recommended; A-F or Aud, fall, offered periodically)

CEGE 8022 - Numerical Methods for Free and Moving Boundary Problems
(3.0 cr; Prereq-8401 or #; A-F or Aud)
Examples of free and moving boundary problems: metal solidification, filling, polymer molding, flow in porous media, ground freezing. Solutions: analytical, fixed finite difference, fixed finite element, front tracking schemes, general deforming finite element methods.

CEGE 8400 - Seminar: Structures
(1.0 cr [max 3.0 cr]; S-N or Aud, fall, spring, every year)
Content depends on instructor and student. Sample topics: theory of elasticity, optimization, reliability, wave propagation, soil dynamics, experimental equipment, wind forces on structures, structural failures, modern construction practices.

CEGE 8401 - Fundamentals of Finite Element Method
(3.0 cr; Prereq-4411 or #; A-F or Aud, spring, every year)
Elements of calculus of variations; weak and strong formulations of linear continuum and structural problems. Isoparametric elements and numerical integration. Basic concepts of error analysis and convergence. Analysis of plates and shells. Introduction to mixed methods and time dependent problems.

CEGE 8402 - Nonlinear Finite Element Analysis
(3.0 cr; Prereq-8401 or #; offered alt yrs; A-F or Aud)
CEGE 8411 - Plate Structures
(3.0 cr; Prereq-5411 or #; offered alt yrs; A-F or Aud)

CEGE 8412 - Shell Structures
(3.0 cr; Prereq-CSE grad or #; A-F or Aud, fall, offered periodically)

CEGE 8413 - Fracture and Scaling
(3.0 cr; Prereq-5411; A-F only, spring, offered periodically)
Linear elastic fracture mechanics, cohesive fracture, scaling, strength statistics.

CEGE 8421 - Structural Dynamics
(3.0 cr; Prereq-[3401, AEM 2012] or #; & 4411 recommended; A-F or Aud, fall, every year)

CEGE 8422 - Earthquake Engineering
(3.0 cr; Prereq-8421 or #; A-F or Aud, spring, offered periodically)
Introduction to earthquake engineering; response spectra; energy absorption capacity of structures; estimation of damping; earthquake resistant design; seismic design codes; base isolation; soil-structure interaction. Blast resistant design. Wind effects on structures.

CEGE 8431 - Structural Stability
(3.0 cr; Prereq-CSE grad student or #; A-F or Aud, fall, spring, offered periodically)
Classification of discrete/continuous conservative/nonconservative systems. Buckling analysis of, e.g., structural members, frameworks, and plates by classical/numerical methods. Offered alternate years.

CEGE 8432 - Analysis of Thin-Walled Members
(3.0 cr; Prereq-5411 or #; offered alt yrs; A-F or Aud)
Analysis of thin-walled structural members based on Vlasov theory and its modifications. Members with open and closed cross sections. Second-order effects and buckling. Influence of inelastic material behavior on buckling.

CEGE 8441 - Ductile Behavior of Steel Structures
(3.0 cr; Prereq-4411 or eqiv; A-F or Aud, fall, even academic years)
CEGE 8442 - **Nonlinear Analysis of Structural Systems**  
(3.0 cr; Prereq-4411, 4413 or #; offered alt yrs; A-F or Aud)  
Advanced theory and computational techniques for analyzing complex structural building systems. Using comprehensive geometric and material nonlinear analysis for designing steel and composite structures.

CEGE 8443 - **Fracture of Materials and Structures**  
(3.0 cr; Prereq-4401 or #; A-F or Aud, spring, every year)  

CEGE 8451 - **Behavior of Reinforced Concrete Structures**  
(3.0 cr; Prereq-4412 or #; A-F or Aud, fall, spring, every year)  
Advanced topics; experimental and theoretical background to design code provisions. Moment-curvature analysis of members. Shear; torsion; disturbed regions. Beam column joints; shear walls. Effects of earthquake loading. Limit analysis.

CEGE 8461 - **Structural Reliability**  
(3.0 cr; Prereq-[4412, 4413] or #; A-F or Aud)  
Transportation Engineering Classes

CEGE 5211 - Traffic Engineering
(3.0 cr; Prereq-3201, Stat 3021 or equiv; spring, offered periodically)
Principles of vehicle and driver performance as they apply to the safe and efficient operation of highways. Design and use of traffic control devices. Capacity and level of service. Trip generation and traffic impact analysis. Safety and traffic studies.

CEGE 5212 - Transportation Policy, Planning, and Deployment
(4.0 cr; = [PA 5232]; Prereq-3201 or equiv; fall, every year)

CEGE 5213 - Transit Planning and Management
(3.0 cr; Prereq-CEGE Jr, Sr, CEGE Grad student or #; A-F only, fall, every year)

CEGE 5214 - Transportation Systems Analysis
(4.0 cr; Prereq-3201; fall, every year)
Systems approach, its application to transportation engineering/planning. Prediction of flows and level of service. Production functions, cost optimization, utility theory, demand modeling, transportation network analysis, equilibrium assignment, decision analysis, multidimensional evaluation of transportation projects.

CEGE 5253 - Asphalt and Portland Cement Concrete Materials
(4.0 cr; Prereq-[3402, upper div CSE] or grad student or #; spring, offered periodically)

CEGE 8200 - Seminar: Transportation
(1.0 cr [max 3.0 cr]; S-N or Aud, fall, spring, every year)
Content depends on instructor and student. Sample topics: traffic safety, traffic flow theory, transportation materials, transportation planning, transportation economics.

CEGE 8202 - Networks and Places: Transportation, Land Use, and Design
(4.0 cr; = [01169]; A-F or Aud, spring, every year)
Relationship between land use and transportation. Developing synthetic design skills for linking land use transportation in urban/regional settlements. Economic, political, legal, institutional frameworks for planning. Parallel computer lab, practicum assignment.
CEGE 8211 - Theory of Traffic Flow  
(4.0 cr; fall, every year)  

CEGE 8212 - Advanced Travel Demand Modeling and Supply Analysis  
(3.0 cr; Prereq-5211 or equiv, Stat 3021; fall, spring, odd academic years)  
Application of random utility theory to model travel demand; deterministic and stochastic trip assignment; network design problems; transportation planning software.

CEGE 8213 - Advanced Transportation Technologies Seminar  
(1.0 cr; = [ME 8772]; S-N or Aud, fall, spring, offered periodically)  
Advantaged technologies specifically related to transportation. Topics drawn from core science/technology areas of human factors, intelligent vehicles, traffic modeling/management, sensing, communications, and controls.

CEGE 8214 - Transportation Economics  
(4.0 cr; A-F or Aud, spring, offered periodically)  

CEGE 8215 - Transportation Data Analysis  
(3.0 cr; Prereq-[8210 or 8211], [STAT 5021 or equiv]; spring, odd academic years)  
Maximum likelihood methods for generalized linear models, with logit/probit models. Linear regression as special cases. Applications to gap acceptance, discrete choice, speed/headway distributions, accident modeling. Introduction to Bayesian inference.

CEGE 8216 - Urban Traffic Operations  
(3.0 cr)  
Capacity analysis techniques for urban streets, optimal traffic signal timing, coordination, real time control. Traffic signal hardware, including detectors/controllers. Operational techniques for traffic management. Use of computer program packages in traffic engineering practice. Freeway operations/control.

CEGE 8217 - Transportation Network Analysis  
(4.0 cr; A-F only, fall, odd academic years)  
CEGE 8231 - Advanced Pavement Engineering
(3.0 cr; Prereq-4231 or #)
Advanced concepts in pavement analysis and design; computation of stresses and strains in flexible and rigid pavement systems; review of Boussinesq theory, Burmeister model, and Westergaard model; load transfer in rigid pavements; temperature induced stresses; mechanics of drainage.

CEGE 8233 - Advanced Bituminous Materials Characterization
(3.0 cr; Prereq-[3402, grad student] or #)
Applications of viscoelasticity, rheology, elastoplasticity, and fracture mechanics to bituminous materials characterization. Lectures, discussions of advanced research reading assignments, laboratory assignments.