

CIVIL ENGINEERING (CE)

CE 115 Introduction to Civil Engineering

1 credit

Introduction to civil engineering problem solving skills, development of software use skills, graphical analysis, data analysis, and oral and written communication skills. One weekly two hour laboratory with up to 3 out-of-class activities.

Prereq: Major in civil engineering .

CE 200 (s) Seminar

Credit arranged.

CE 203 (s) Workshop

3 credits.

CE 204 (s) Special Topics

Credit arranged.

CE 211 Engineering Surveying

3 credits

Theory of measurements, basic equations for survey computations, types of distribution of errors, topographical and land surveying introduction to geographic information systems and global positioning systems, coordinate geometry and coordinate transformations, site engineering projects using land development software, application of surveying methods to construction; site engineering, and civil engineering projects surveying instruments. Two lecture and one 3-hour lab a week; periodic field data collection and one or two field trips.

Prereq: MATH 143 or MATH 170 or MATH 175, and ENGR 105. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 215 Civil Engineering Analysis and Design

3 credits

Application of basic science, mathematics, and fundamental engineering principles to solution of civil engineering design problems; use of structured programming concepts in design; develop oral and written communication skills.

Prereq: CE 115, ENGR 105, and MATH 170. A minimum grade of 'C' or better is required for all pre/coreqs.

Coreq: PHYS 211/PHYS 211L. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 298 (s) Internship

Credit arranged.

CE 299 (s) Directed Study

Credit arranged.

CE 322 Hydraulics

4 credits

Applied principles of fluid mechanics; closed conduit flow, hydraulic machinery, open channel flow; design of hydraulic systems. Laboratory exercises on closed conduit flow, hydraulic machinery, open channel flow and mixing process. Three lec a week and 4-6 labs a semester.

Prereq: CE 215, MATH 310, PHYS 211, ENGR 220 and ENGR 335. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 325 Fundamentals of Hydrologic Engineering

3 credits

Cross-listed with BE 355

Principles of hydrologic science and their application to the solution of hydraulic, hydrologic, environmental, and water resources engineering problems.

Prereq: MATH 310, STAT 301, and ENGR 335. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 330 Fundamentals of Environmental Engineering

3 credits

Principles of engineered environmental systems, including physical, chemical, and microbiological processes; types and effects of pollutants; regulations; treatment of water, wastewater, sludges, and solid waste; control of air and agricultural pollution. Two lectures and one 3-hour lab a week.

Prereq: ENGR 335, CHEM 111, CE 215 and MATH 310. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 342 Theory of Structures

3 credits

Stresses and strains in statically determinate and indeterminate beam, truss, and rigid frame structures; effects of moving loads; matrix displacement method. Two lec and one 3-hr lab a wk.

Prereq: ENGR 350, MATH 275, MATH 310, and PHYS 211/PHYS 211L. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 357 Properties of Construction Materials

4 credits

Principles of construction materials, composition, physical and mechanical properties, test methods, data analysis and interpretations, and report writing; materials covered are aggregates, cements, concretes, metals, wood, and composites. Three lec and two hrs of lab.

Prereq: CE 215, ENGR 350, MATH 310. A minimum grade of 'C' or better is required for all pre/coreqs.

Coreq: STAT 301. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 360 Fundamentals of Geotechnical Engineering

4 credits

Soil composition, descriptions, and classification systems; permeability and seepage; capillarity and suction; total, effective, and neutral stresses, compression and volume changes; shear strength; compaction. Three lectures, and 2 hours of lab a week.

Prereq: CE 215, ENGR 335, ENGR 350, and MATH 310. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 372 Fundamentals of Transportation Engineering

3 credits

Intro to planning, design, and operation of highway and traffic, public transportation, and airport systems. Three lectures a week; periodic field data collection and one or two field trips.

Prereq: STAT 301 and CE 211. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 398 (s) Internship

Credit arranged.

CE 400 (s) Seminar

Credit arranged.

CE 403 (s) Workshop

Credit arranged.

CE 404 (s) Special Topics

Credit arranged.

CE 411 Engineering Fundamentals

1 credit

Review of basic engineering and science material covered in Fundamentals of Engineering exam. Offered for the nine to ten week period prior to the exam date. Graded P/F.

Prereq: Senior standing or Permission.

CE 413 Bridge Design

3 credits

Joint-listed with CE 513.

Structural systems for bridges, loading analysis by influence lines, slab and girder bridges, composite design, pre-stressed concrete, rating of existing bridges, specifications and economic factors.

Prereq: CE 441 or CE 444 .

CE 421 Engineering Hydrology

3 credits

Hydrologic design including: statistical methods, rainfall analysis and design storm development, frequency analysis, peak discharge estimation, hydrograph analysis and synthesis, flow routing, and risk analysis.

Prereq: CE 325 or BE 355. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 422 Hydraulic Structures Analysis and Design

3 credits

Hydraulic design and stability analysis of hydraulic structures, such as dams, weirs, spillways, stilling basins, culverts, levees, fish ladders etc. Project oriented problems. Extra design projects or different design projects for grad cr. One field trip. Cooperative: open to WSU degree-seeking students.

Prereq: CE 322 or Equivalent, ENGR 360, or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 428 Open Channel Hydraulics

3 credits

Hydraulics of uniform and varied flow in open channels with fixed and movable beds. Recommended Preparation: CE 322. Cooperative: open to WSU degree-seeking students.

CE 431 Design of Water and Wastewater Systems I

3 credits

Joint-listed with CE 511

Application of fundamental engineering science to the design of systems for the treatment of domestic and industrial water supplies; treatment and re-use of domestic sewage and industrial wastes. Additional projects/assignments required for graduate credit.

Prereq: CE 322, CE 330, or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 432 Design of Water and Wastewater Systems II

3 credits

Joint-listed with CE 532

Application of unit operations and processes to design of integrated wastewater treatment systems; critical analysis of existing designs. Additional projects/assignments required for grad credit. Cooperative: open to WSU degree-seeking students.

Prereq: CE 431. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 433 Water Quality Management

3 credits

Joint-listed with CE 533

Physical, chemical, and biological techniques for analysis of water quality management problems; development of design criteria for corrective systems. Additional projects/assignments required for grad credit.

Prereq: Permission .

CE 441 Reinforced Concrete Design

3 credits

Strength design method in accordance with latest ACI code. Two lectures and one 2-hour lab a week.

Prereq: CE 342. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 444 Steel Design

3 credits

Structural steel design using latest AISC specifications. Two lectures and one 2-hour lab a week.

Prereq: CE 342. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 445 Matrix Structural Analysis

3 credits

Joint-listed with CE 545

Formulation of the analysis of trusses, beams, and frames using the stiffness method of matrix structural analysis; development of element properties, coordinate transformations, and global analysis theory; special topics such as initial loads, member and joint constraints, and nonlinear analysis. Special project demonstrating mature understanding of materials reqd for grad cr.

Prereq: CE 342 or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 460 Geotechnical Engineering Design

3credits

Applications of soil mechanics in design of shallow and deep foundations, earth retaining structures, excavations, and soil exploration.

Prereq: CE 360 or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 473 Highway Design

3 credits

Theory and practice in highway design, highway functional classification concepts, design controls and criteria, geometric design of highways and streets, cross section and roadside design, and highway safety manual applications.

Prereq: CE 211. A minimum grade of 'C' or better is required for all pre/coreqs.

Coreq: CE 372. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 474 Traffic Systems Design

3 credits

Analysis and design of network traffic systems; system evaluation using computer optimization and simulation; development and testing of alternative system design. Two lec and one 3-hr lab a wk; field data collection and field site visits. Cooperative: open to WSU degree-seeking students.

Prereq: CE 372 or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 475 Pavement Design and Evaluation

3 credits

Pavement design processes; stress-strain analysis in multi-layer elastic system; materials selection and characterization methods; traffic loads, design methods for flexible and rigid pavements; performance evaluation of existing pavements; condition survey and ratings; introduction to pavement maintenance and rehabilitation techniques.

Prereq: CE 357 or Equivalent, or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 484 Engineering Law and Contracts**3 credits**

Project engineering techniques for planning, scheduling, and controlling typical engineering and construction projects. Contract law and application to engineering services agreements and construction contracts; preparing technical specifications, torts, professional liability, and alternate dispute resolution.

Prereq: Senior standing in engineering.

CE 491 Civil Engineering Professional Seminar**1 credit**

Employment and technical topics; preparation and presentation of professional paper. Course to be taken in last semester before graduation. Graded P/F.

Prereq: Senior standing in Civil Engineering.

CE 494 Senior Design Project**3 credits**

Gen Ed: Senior Experience

Comprehensive civil engineering design project. Requires integration of skills acquired in civil engineering elective courses, written reports, and oral presentations.

Prereq: Senior standing in Civil Engineering and Permission.

CE 498 (s) Internship**CE 499 (s) Directed Study**

Credit arranged.

CE 500 Master's Research and Thesis

Credits arranged.

CE 501 (s) Seminar

Credit arranged

Conferences and reports on current developments.

CE 502 (s) Directed Studies

Credits arranged.

CE 503 (s) Workshop

Credit arranged.

CE 504 (s) Special Topics

Credit arranged.

CE 505 (s) Professional Development**CE 507 River Restoration****3 credits**

This course focuses on the principles and practices used in river restoration. The potential assumptions and errors with common restoration methodologies and possible ways to improve such channel designs are discussed. A number of case studies are used to evaluate the success of various restoration techniques. The course includes homework sets and individual projects and has a mandatory field trip to a local restored site. Recommended classes to take prior to this include at least one of the following: CE 535, CE 322, CE 428, or CE 520.

Prereq: ENGR 335 or Instructor Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 510 Advanced Mechanics of Materials**3 credits**

Cross-listed with ME 539.

Limitations of results of elementary mechanics of materials, complex situations of loading and structural geometry, applications to design of machines and structure, introduction to elasticity. Cooperative: open to WSU degree-seeking students.

Prereq: ME 341 or CE 342 .

CE 511 Design of Water and Wastewater Systems I**3 credits**

Joint-listed with CE 431

Application of fundamental engineering science to the design of systems for the treatment of domestic and industrial water supplies; treatment and re-use of domestic sewage and industrial wastes. Additional projects/assignments required for graduate credit.

Prereq: CE 322, CE 330, or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 512 Advanced Topics in Waste Management and Treatment**3 credits**

Modeling, analysis, and design of advanced and emerging engineering technologies and processes for waste management/treatment and resource recovery.

Prereq: Instructor Permission .

CE 513 Bridge Design**3 credits**

Joint-listed with CE 413.

Structural systems for bridges, loading analysis by influence lines, slab and girder bridges, composite design, pre-stressed concrete, rating of existing bridges, specifications and economic factors. Cooperative: Open to WSU degree-seeking students.

Prereq: CE 441 or CE 444 .

CE 519 Fluid Transients**3 credits**

Cross-listed with ME 519.

Development of concepts and modeling techniques for unsteady flow of liquid and gas in piping systems; extensive computer programming used to develop tools for analysis, design, and control of transients. (Alt/yrs)

Prereq: MATH 310 and ENGR 335. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 520 Fluid Dynamics**3 credits**

Cross-listed with ME 520.

Credit not granted for both ME 420 and ME 520. A second fluid dynamics course featuring vector calculus and integral and differential forms of the conservation laws. Topics include fluid properties, fluid statistics, inviscid flow; conservation of mass, momentum, and energy; and turbulence. Other topics may be covered. Additional projects/assignments reqd for grad cr.

Prereq: ENGR 335, MATH 310, or Permission.

CE 521 Sedimentation Engineering**3 credits**

Intro to river morphology and channel responses; fluvial processes of erosion, entrainment, transportation, and deposition of sediment. Cooperative: open to WSU degree-seeking students.

Prereq: CE 428 or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 522 Hydraulic Structures Analysis and Design**3 credits**

Hydraulic design and stability analysis of hydraulic structures, such as dams, weirs, spillways, stilling basins, culverts, levees, fish ladders etc. Project oriented problems. Extra design projects or different design projects for grad cr. One field trip. Cooperative: open to WSU degree-seeking students.

Prereq: CE 322 or Equivalent, ENGR 360, or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 526 Aquatic Habitat Modeling**3 credits**

The course objective is to learn the underlying principles of all components required for aquatic habitat modeling, to be able to perform such projects in riverine ecosystems including project design, data collection, data analysis and interpretation of the results and to learn the use of computational aquatic habitat models. Students will be working on their own modeling projects using the simulation model CASiMiR.

Prereq: CE 322 and CE 325 or BE 355; or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 531 Environmental Engineering Unit Operations**3 credits**

Analysis and design of physical and chemical operations of water and waste treatment; flow models, sedimentation, flocculation, filtration, and water conditioning. Cooperative: open to WSU degree-seeking students.

Prereq: Permission .

CE 532 Design of Water and Wastewater Systems II**3 credits**

Joint-listed with CE 432

Application of unit operations and processes to design of integrated wastewater treatment systems; critical analysis of existing designs. Additional projects/assignments required for grad credit. Cooperative: open to WSU degree-seeking students.

Prereq: CE 431. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 533 Water Quality Management**3 credits**

Joint-listed with CE 433

Physical, chemical, and biological techniques for analysis of water quality management problems; development of design criteria for corrective systems. Additional projects/assignments required for graduate credit.

Prereq: Permission .

CE 534 Environmental Engineering Unit Processes**3 credits**

Aeration system design, biological oxidations, growth kinetics, process design of suspended growth and fixed film aerobic and anaerobic systems, biological nutrient removal, land treatment systems.

Cooperative: open to WSU degree-seeking students.

Prereq: CE 431 or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 535 Fluvial Geomorphology and River Mechanics**3 credits**

Hydraulic and morphologic processes of rivers. Drainage network development, channel hydraulics and shear stress partitioning via boundary layer theory, hydraulic geometry and cross-sectional form, sediment transport and bed material sampling, reach-scale morphologies and processes from headwater streams to lowland rivers, physical processes of forest rivers, sediment budgets, and river valley evolution. Field exercises emphasize quantitative analysis of fluvial processes and channel form, acquisition of field skills (measuring hydraulic and geomorphic variables, topographic surveying), and scientific writing. (Alt/ yrs)

Prereq: CE 428 or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 541 Reliability of Engineering Systems**3 credits**

Fundamentals of reliability theory, system reliability analysis including common-mode failures and fault tree and event tree analysis, time-dependent reliability including testing and maintenance, propagation of uncertainty, human reliability analysis, practical applications in component and system design throughout the semester. Cooperative: open to WSU degree-seeking students.

Prereq: Permission.

CE 542 Advanced Design of Steel Structures**3 credits**

Plate girder design; local and global buckling; plastic collapse analysis; shear and moment-resisting connections; eccentrically-loaded connections. Cooperative: open to WSU degree-seeking students.

Prereq: CE 444 or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 543 Dynamics of Structures**3 credits**

Equations of motion, free vibration, damping mechanisms, harmonic, impulse, and seismic loading; shock and seismic response spectra, time and frequency domain analysis, modal analysis, structural dynamics in building codes. Cooperative: open to WSU degree-seeking students.

CE 545 Matrix Structural Analysis**3 credits**

Joint-listed with CE 445

Formulation of the analysis of trusses, beams, and frames using the stiffness method of matrix structural analysis; development of element properties, coordinate transformations, and global analysis theory; special topics such as initial loads, member and joint constraints, and nonlinear analysis. Special project demonstrating mature understanding of materials reqd for grad cr.

Prereq: CE 342 or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 546 Finite Element Analysis**3 credits**

Cross-listed with ME 549.

Formulation of theory from basic consideration of mechanics; applications to structural engineering, solid mechanics, soil and rock mechanics; fluid flow. Cooperative: open to WSU degree-seeking students.

Prereq: ME 341 or CE 342. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 547 Advanced Reinforced Concrete**3 credits**

Composite design; slab design; limit state design; footings; retaining walls; deep beams; brackets and corbels; torsion; seismic design; shear walls. Cooperative: open to WSU degree-seeking students.

Prereq: CE 441. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 550 Experimental Methods in Fluid Dynamics**3 credits**

Cross-listed with ME 551.

The objective of this course is to develop the knowledge and skills to be able to design and perform fluid dynamics experiments (and experiments in related areas) and to interpret and report the results. Learn the words, the concepts, and experimental skills in areas including dimensional analysis and scaling of experiments, flow visualization, velocity and flow rate measurements, turbulence measurements, and sediment sizing and transport measurements. Additional projects/assignments reqd for grad cr. One 1-1/2 hr lec and one 3-hr lab a wk. Recommended Preparation: ENGL 317 and ENGR 335.

CE 554 Environmental Hydrodynamics**3 credits**

The course analyzes solute transport and mixing in rivers. It provides the derivation and analysis of the equations governing solute mixing and transport and shows the connection between mixing and flow field. It presents molecular and turbulent diffusion, dispersion, vertical, lateral, and longitudinal mixing, and the effects of river irregularities and curved channels. The course includes individual projects.

Prereq: CE 428 or permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 556 Properties of Highway Pavement Materials**3 credits**

Physical and mechanical properties of asphalt and Portland cement concrete materials; design of asphalt concrete mixes; introduction to viscoelastic theory; characterization methods, emphasizing fatigue, rutting and thermal cracking; modification and upgrading techniques. Three 1-hr lec a wk and variable number of lab hrs for demonstration. Cooperative: open to WSU degree-seeking students.

Prereq: CE 357 or Equivalent, or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 561 Engineering Properties of Soils**3 credits**

Physical properties, compressibility and consolidation, shear strength, compaction, saturated and unsaturated soils, laboratory and field methods of measurement, relations of physical and engineering properties, introduction to critical-state soil mechanics. Cooperative: open to WSU degree-seeking students.

Prereq: CE 360. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 562 Advanced Foundation Engineering**3 credits**

Interpretation of in-situ tests for foundation design parameters, bearing capacity and settlement of axially loaded piles, pile groups, and drilled shafts, pile dynamics, laterally loaded deep foundations, downdrag and uplift of deep foundations, foundation load and integrity testing methods and data interpretation, mat foundations. Cooperative: open to WSU degree-seeking students.

Prereq: CE 360 or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 563 Seepage and Slope Stability**3 credits**

Cross-listed with GEOE 535.

Principles governing the flow of water through soils; mechanics of stability analysis of slopes, landslides, and embankments for soil and rock masses; probabilistic analyses; stabilization methods. Cooperative: open to WSU degree-seeking students. (Alt/even yrs, Spring only)

Prereq: CE 360 or GEOE 436; or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 566 Geotechnical Earthquake Engineering**3 credits**

Faulting and seismicity; site response analysis; probabilistic seismic hazard assessment; dynamic soil properties; influence of soil on ground shaking; response spectra; soil liquefaction; seismic earth pressures; seismic slope stability; earthquake resistant design. Cooperative: open to WSU degree-seeking students.

Prereq: CE 360 or Equivalent, or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 571 Traffic Flow Theory**3 credits**

Introduction to elements of traffic flow theory including principles of traffic stream characteristics, capacity, queuing theory, and shock waves; application of traffic flow theory to freeway and arterial traffic flow problems. Cooperative: open to WSU degree-seeking students. (Alt/yrs)

Prereq: Permission.

CE 572 Intersection Traffic Operations**3 credits**

Application of traffic simulation models to the design and operations of traffic facilities, including intersection, arterials; assessment and design of traffic signal timing strategies. Cooperative: open to WSU degree-seeking students. (Alt/yrs)

Prereq: Permission.

CE 573 Transportation Planning**3 credits**

Concepts and methods of transportation planning, including network modeling, travel demand forecasting, and systems evaluation of multi-modal transportation systems. Cooperative: open to WSU degree-seeking students. (Alt/yrs)

Prereq: Permission.

CE 574 Public Transportation**3 credits**

Concepts and principles of planning and operations of public transportation systems, including bus transit, rail transit, and paratransit modes. Cooperative: open to WSU degree-seeking students. (Alt/yrs)

Prereq: Permission.

CE 575 Advanced Pavement Design and Analysis**3 credits**

Design of new and rehabilitated asphalt and Portland cement concrete pavements; mechanistic-empirical design procedures; performance models; deflection-based structural analysis, overlay design, environmental effects; long-term pavement performance (LTPP), and introduction to research topics in pavement engineering. Cooperative: open to WSU degree-seeking students.

Prereq: CE 475 or Equivalent, or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 576 Highway Design and Traffic Safety**3 credits**

Geometric design of highways as related to operation and safety. Analysis of highway design alternatives and control strategies with respect to accident probabilities. Statistical models for safety analysis. Accident countermeasure selection and evaluation methodology. Risk management.

Prereq: Permission.

CE 577 Pavement Preservation and Management

3 credits

This course addresses several aspects of pavement evaluation, preservation, rehabilitation, and management. The primary objective of this course is to provide the civil engineering graduate students with state-of-the-art knowledge needed to maintain our roadways in serviceable condition. The course covers different methods used to evaluate the performance of pavements, distresses in flexible and rigid pavements, project and network level pavement management, various preservation and rehabilitation techniques and selection of the appropriate approaches for preservation and rehabilitation.

Prereq: CE 475 or Equivalent, or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 578 Highway Traffic Operations

3 credits

Theory of two-lane highway and freeway operations, application of traffic simulation models for the design and operations of highway, development and assessment of freeway management and control strategies including Intelligent Transportation Systems applications, field data collection and analysis. (Alt/yrs)

Prereq: Permission.

CE 579 Simulation of Transportation Systems

3 credits

This course introduces students to the simulation of transportation systems, including the algorithms that constitute most traffic simulation models and how the models are applied to the study of real transportation problems. The course considers the fundamental issues that the transportation engineer must consider when developing and applying simulation models, the core algorithms that constitute transportation simulation models, how to build and test a simulation network, the process for validating and calibrating a simulation model, how model results should be analyzed and presented, and the process for using and the value of hardware-in-the-loop simulation.

Prereq: *Permission* .

CE 598 (s) Internship

Credit arranged.

CE 599 (s) Non-thesis Master's Research

Credit arranged

Research not directly related to a thesis or dissertation.

Prereq: Permission.

CE 600 Doctoral Research and Dissertation

Credit arranged.