

COASTAL ENGINEERING CONCENTRATION

Core:

CIV 520 Advanced Engineering Analysis I. (3 Hours) A comprehensive course to familiarize engineering professionals with advanced applied mathematics as it relates to solving practical engineering problems. The course of intensive study blends the theoretical underpinnings of advanced applied mathematics with an understanding of how these powerful tools can be used to solve practical engineering problems. The course of intensive study blends the theoretical underpinnings of advanced applied mathematics with an understanding of how these powerful tools can be used to solve practical engineering problems. The material covered includes Ordinary Differential Equations; Linear Algebra, Vector Calculus; Fourier Analysis and Partial Differential Equations.

CIV 538 Coastal Structures. (3 Hours) The types and functions of coastal structures studies include seawalls, groins, revetments, bulkheads, dikes, detached breakwaters, reef breakwaters, storm surge barriers and others. A coastal structure will be assigned to each student to provide the class a lecture and to prepare a term paper on the coastal structure assigned. Determination of the design wave climate for coastal structures is investigated as it pertains to the functional types of coastal structures. Invited guest lecturers will appear as available.

CIV 539 Advanced Coastal Engineering Design. (3 Hours) This course provides a comprehensive advanced investigation of the coastal engineering design process. It includes the Planning and Design Process, Site Characterization, Shore Protection Projects, Beach Fill Design, Navigation Projects, Sediment Management at Inlets and Environmental Enhancement. A design project will be assigned to each student to provide the class a power point presentation and to prepare a term paper on the design project assigned. Invited guest design professionals will appear and present lectures as available.

CIV 558 Sedimentation and River Engineering. (3 Hours) Hydraulics of sediment transport; erosion and sedimentation problems; river mechanics and morphology; mathematical modeling of river hydraulics; sediment transport and river channel changes. Design and environmental problems; erosion control and river training. Prerequisites: CIV 465 or permission of Department.

CIV 631 Linear Theory of Ocean Waves. (3 Hours) Governing equations in free surface flow, deterministic and probabilistic wave theories, wave transformation, wave-induced coastal currents. The formulation and solution of the governing boundary value problem for small amplitude waves are developed and the kinematic and pressure fields for short and long waves are explored.

CIV 636 Spectral Wave Analysis. (3 hours) Measurement techniques of ocean waves. Introduction and basic concept of wave spectrum. Harmonic analysis and mathematical formulation of wave spectrum. Maximum entropy and maximum likelihood methods. Idealized wave spectral models. Wave energy balance equation and its applications. Nonlinear wave-wave interaction and diffraction. Wave hindcast and forecast modeling in coastal waters.

CIV 637 Advanced Design for Breakwater Rehabilitation. (3 hours) Advanced analysis and design considerations for breakwaters are investigated for the most complex challenges. These challenges are associated with rehabilitation and/or reconstruction of damaged breakwaters. Design considerations are explored from an analysis of breakwater failures at Sines, Nawiliwili, Kahului and others. Toe design, crest evaluation, crown design, core alternatives, runup, overtopping, design waves, head design, constructability and functionality are explored.

Electives

CIV 521 Advanced Engineering Analysis II. (3 Hours) A comprehensive course to familiarize engineering professions with advanced and applied mathematics as it relates to solving practical engineering problems. The course of intensive study blends the theoretical and advanced applied mathematics with an understanding of how these powerful tools can be used to solve practical engineering problems. The material covered includes Complex Analysis; Numerical Methods; Optimization; Graphs; and Probability and Statistics.

CIV 530 Advanced Pavement Analysis and Design. (3 Hours) Development of models for and analysis of pavement systems; use of transfer functions relating pavement response to pavement performance; evaluation and application of current pavement design practices and procedures; analysis of the effects of maintenance activities on pavement performance; and economic evaluation of highway and airport pavements. Prerequisite: CIV 475 or permission of Department.

CIV 531 Traffic Engineering. (3 Hours) Study of fundamentals of traffic engineering; analysis of traffic stream characteristics; capacity of urban and rural highways; design and analysis of traffic signals and intersection; traffic control; traffic impact studies; and traffic accidents. Prerequisite: CIV 390 or permission of Department.

CIV 532 Pavement Materials and Design. (3 Hours) Properties and control testing of bituminous materials, aggregates for bituminous mixtures, and analysis and design of asphalt concrete and liquid asphalt cold mixtures; structural properties of bituminous mixes; surface treatment design; and recycling of mixtures. Introduction to Superpave mix design and applications. Prerequisite: CIV 390 or permission of Department.

CIV 533 Evaluation, Maintenance, and Rehabilitation of Public Works Infrastructure. (3 Hours) Evaluation, maintenance, and rehabilitation of deteriorated infrastructure systems by considering life cycle costs and long-term performance. Understanding rehabilitation alternatives using in the practical field and designing rehabilitation based on the non-destructive testing methods and economic considerations. Prerequisite: CIV 390 and CIV475. (Cross Reference: CIV 479)

CIV 534 Urban Transportation Engr System Design (3 Hours) Advanced design of highway systems, vehicle and driver characteristics, highway capacity, design of urban streets and expressways. Design constraints. Individual and team design projects oriented toward the solution of local urban transportation problems, societal and economic considerations. Prerequisite: CIV 390, CIV 310 and CIVL 310 or permission of Department. (Cross reference: CIV 470)

CIV 540 Advanced Structural Analysis. (3 Hours) A unified formulation of displacement and force methods of analysis including the topological view of the structure as an assemblage of members; matrix techniques of formulation; considerations for automatic computations; and evaluation of truss, grid, and frame models for the response of real structures. Prerequisite: CIV 320 or permission of Department.

CIV 541 Structural Dynamics. (3 Hours) Analysis of the dynamic response of structures and structural components to transient loads and foundation excitation; single degree-of-freedom and multi-degree-of-freedom systems; response spectrum concepts; simple inelastic structural systems; and introduction to systems with distributed mass and flexibility. Prerequisite: CIV 320 or permission of Department.

CIV 542 Advanced Design of Concrete Structures. (3 Hours) Theory and design of reinforced concrete continuous beams, slender columns, two-way-slabs, footings, retaining walls, shear walls and multi-story buildings. Design for torsion and design constraints. Framing systems and loads for buildings and bridges, design constraints and a major design project. Prerequisite: CIV 420. (Cross reference: CIV 477)

CIV 550 Engineering Hydrology. (3 Hours) Principles and theory of surface water and groundwater flow and quality; understanding and determination of water budget, hydrologic cycle, Darcy's law, and water resources management at the watershed scale. Water quality parameters including data analysis and interpretation, laboratory tests, and maintenance of water quality. Applications in engineering design, Perquisite: CIV 370 or permission of Department.

CIV 551 Advanced Fluid Mechanics. (3 Hours) Kinematics of fluid flow; plane irrotational and incompressible fluid flow; Navier-Stokes equations; two-dimensional boundary layers in incompressible flow; dimensional analysis and dynamic similitude; hydrodynamic stability; turbulence; real life problems; Engineering applications and system approach. Prerequisite: CIV 330 or permission of Department.

CIV 552 GIS Applications. (3 Hours) This course introduces students to the basic concepts and skills necessary to engage applied Geographic Information Systems (GIS) with the field of Civil and Environmental Engineering. Students will gain basic theoretical knowledge required for development and successful use of GIS and practical training on use of a GIS software. This course will consist of lecture sessions, lab exercises and GIS project. While the principles taught will be general in nature, the students will be taught how to use the ArcView GIS software program, and working through several exercises that emphasize its use in Civil and Environmental Engineering. Selected topics include: GIS analysis procedures, integration of survey control for data acquisition and rectification, hardware software selection criteria, and error propagation analyses, Global Positioning Systems (GPS) and their use with GIS. Prerequisite: Permission of the Department.

CIV 553 Experimental Methods in Civil Engineering. (3 Hours) Introduction to experimental methods, instrumentation, data acquisition and data processing; experimental aspects of static and dynamic testing in the various areas of civil engineering; overview of laboratory work with several hands-on applications in the laboratory. Prerequisite: Permission of Department.

CIV 554 Water Resources Engineering Planning and Management. (3 Hours) Managing water resources; the planning process, systems analysis methods; institutional framework for water resources engineering; comprehensive integration of engineering, economic, environmental, legal and political considerations in water resources development and management. Prerequisite: Permission of the Department.

CIV 556 Groundwater Engineering. (3 Hours) Groundwater hydrology, theory of groundwater movement, steady-state flow, potential flow, mechanics of well flow, multiple-phase flow, salt water intrusion, artificial recharge, groundwater contamination and models. Prerequisite: CIV 370 or permission of Department.

CIV 557 Computational Fluid Dynamics. (3 Hours) Finite-difference and finite-volume methods and basic numerical concepts for the solution of dispersion, propagation and equilibrium problems commonly encountered in real fluid flows; theoretical accuracy analysis techniques. Prerequisites: CIV330 and knowledge of one programming language.

CIV 558 Sedimentation and River Engineering. (3 Hours) Hydraulics of sediment transport; erosion and sedimentation problems; river mechanics and morphology; mathematical modeling of river hydraulics; sediment transport and river channel changes. Design and environmental problems; erosion control and river training. Prerequisites: CIV465 or permission of Department.

CIV 559 Environmental Hydraulics. (3 Hours) The application of fluid mechanics principles in the analysis of environmental flows. Topics include: Stratified flows, turbulent jets and plumes, wastewater and thermal diffusers, cooling ponds and cooling channels and the control of environmental problems. Prerequisites: CIV330 or permission of Department.

CIV 562 Hazardous Waste Engineering. (3 Hours) Comprehensive study of the complex, interdisciplinary engineering principles involved in hazardous waste handling, collection, transportation, treatment, and disposal. Also covered are waste minimization, site remediation, and regulations important for engineering applications. Design constraints, engineering judgment, and ethical responsibility are covered. Contemporary hazardous waste issues and urban issues are also addressed. Prerequisite: CHEM 241, CHML 241, CIV 340, CIVL 340, or permission of Department. (Cross reference: CIV 468)

CIV 564 Surface Water. (3 Hours) Water quantity, water quality, regulation of, and management of rivers, lakes, and wetlands. Applications in engineering design. Prerequisite: Permission of Department.

CIV 632 Tides and Long Waves. (3 Hours) A systematic development of the theory of ocean tides, tidal forcing functions, near shore tidal transformations and tidal forcing functions, near shore tidal transformations and tidal propagation in harbors and estuaries. An introduction to the response of harbors to long waves and the study of the generation of long ocean waves.

CIV 633 Airport Planning and Design. (3 Hours) Basic principles of airport facilities design to include aircraft operational characteristics, noise, site selection, land use compatibility, operational area, ground access and egress, terminals, ground service areas, airport capacity, and special types of airports. Prerequisite: CIV 390 or permission of Department.

CIV 640 Finite Element Methods. (3 Hours) Theory and application of the finite element method; stiffness matrices for triangular, quadrilateral, and isoparametric elements; two- and three-dimensional elements; algorithms necessary for the assembly and solutions; direct stress and plate bending problems for static, nonlinear buckling and dynamic load conditions; displacement, hybrid, and mixed models together with their origin in variational methods. Prerequisite: CIV 540 or permission of Department.

CIV 650 Small Watershed Hydrology. (3 Hours) The role of land conditions in dealing with engineering problems of applied hydrology with emphasis on the small watershed, limited data, and land management situations Gain a physically-based understanding of hydrologic processes that define the functions of small watersheds; Effects of natural and human disturbances on the components of the hydrologic cycle; Investigate special characteristics of small watersheds; Approaches for dealing with limited data; Use the understanding of applied hydrology to predict the impacts of various land use activities on terrestrial and aquatic ecosystems; Develop analytic tools to integrate land use and catchments characteristics to predict catchments response and guide watershed management. Topics include stream flow generation, hill slope hydrology, stream channel hydraulics, hydrograph separation, evapotranspiration, hydrologic tracers, riparian zone hydrology, and hyporheic zone hydrology. Applications in engineering design. Prerequisite: CIV 550 or permission of Department.

CIV 652 Hydraulic Engineering Design. (3 Hours) Design of water supply and transport systems; Design and analysis of structures for controlling and conveying water in both the built and natural environment; Engineering applications of hydraulic and hydrologic engineering; Analytic methods and computer models for the design and evaluation of water resource projects such as flood control and river basin development; Common models, and typical applications for water resource systems; Reservoir design, flood routing; and design of water distribution and storm water management systems, and sanitary sewers. Prerequisite: CIV 370 or permission of Department.

CIV 659 Advanced Topics in Water Resources Engineering. (Variable 1-3 Hours) Course will focus on a variety of topics in the field of water resources engineering. May be repeated for credit. Prerequisite: Permission of Department.

CIV 670 Rock Mechanics. (3 Hours) Classification of rock masses, stress and strain in rock, elastic and time-dependent behavior of rock, state of stress in rock masses, failure mechanisms, construction applications, geological and engineering applications. Prerequisite: Permission of Department.

CIV 695 Scientific Writing Seminar. (1 Hour) Exercises in scientific writing format and style, with particular emphasis on writing abstracts and manuscripts for publication in referred archival journals.

CIV 696 Seminar. (1 Hour) Presentation of papers, projects and reports by visiting lecturers, graduate students, engineers, and community leaders.

CIV 697 Internship. (Variable 1-3 Hours) Supervised graduate internship and externship in various areas. Prerequisite: Permission of Department.

CIV 698 Independent Study. (Variable 1-4 Hours) Intensive study of a special project including research and literature review selected in accordance with student interests and arranged in consultation with the adviser. Topics will vary. Student will make period reports, and will prepare a scholarly paper at the end of semester. Prerequisite: Permission of Department.

CIV 699 Thesis Research. (Variable 1-6 Hours) Master's thesis representing an independent and original research. Prerequisite: Permission of adviser.