

Description of Courses

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 material covered includes Ordinary Differential Equations; Linear Algebra, Vector Calculus; Fourier Analysis and Partial Differential Equations.

CPE 521 Advanced Engineering Analysis II. (3 Hours) A comprehensive course to familiarize engineering professions with advanced applied mathematics as it relates to solving practical engineering problems. The course of intensive study blends the theoretical un of 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 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, Prerequisite: 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 in Civil and Environmental Engineering. (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 560 Environmental Engineering II. (3 Hours) The physical, chemical, and biological environmental engineering systems that are used to protect health and the environment. Examples include drinking water treatment, wastewater treatment, hazardous waste treatment, and air pollution control. Prerequisite: permission of Department.

CIV 561 Chemistry for Environmental Engineering.

(3 Hours) The principles of physical, equilibrium, inorganic, and organic chemistry as they apply to drinking water treatment, wastewater treatment, natural water quality, air quality, and air pollution control. Applications in engineering design. Prerequisite: CIV 340, or CIV 560, 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 563 Microbiology for Environmental Engineering.

(3 Hours) The microbiological principles that apply to wastewater treatment, drinking water protection, water quality, and disease transmission. Applications in engineering design. Prerequisite: CIV 560 or permission of Department.

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 565 Wetland Management for Environmental Engineering. (3 Hours) (3 Hours) The physical, chemical, biological, and regulatory aspects of wetland ecosystems. The impacts of engineered structures on wetland systems, and the factors involved with developing specifications for wetland creation and restoration. Prerequisite: permission of Department.

CIV 566 Air Pollution and Control. (3 Hours) The sources of and engineering principles to prevent or control air pollution and to design and operate processes. Topics include the risks of air pollution to which the public is exposed, the principle and factor underlying the generation of pollutants, physical principles describing how pollution affects the atmosphere and human well-being, regulations which engineers will be expected to understand and comply with. The engineering aspects including principles governing pollutant production from stationary and mobile combustion systems, modeling of the generation and transport of pollutants in the atmosphere, methods for separation and removal of gases and particulates from a process gas stream. Prerequisite: permission of Department.

CIV 567 Environmental Remediation. (3 Hours) The course covers current engineering solutions for the remediation of soils and waters contaminated by hazardous waste or spills. The technologies to be covered include bioremediation, oxidation, soil vapor extraction, soil washing, surfactant-enhanced remedy, thermal treatment, air stripping, solidification/stabilization, electrokinetic decontamination, underground barriers, permeable reactive treatment walls, and other newly-emerging technologies. The engineering principles behind the remediation technologies are emphasized. Examples of successful applications of the remediation technologies are discussed. Prerequisite: permission of Department.

CIV 568 Land Disposal of Waste. (3 Hours) Theoretical, regulatory, and practical aspects of the disposal of waste on lands. Decontamination and reclamation of lands contaminated by industrial activities and spills of industrial chemicals. The usefulness and environmental impact of the disposal of municipal and industrial wastes via land treatment and land filling. (3 Hours) Design considerations and engineering problems associated with the land disposal of septic tank effluent, municipal garbage, sewage sludge, sewage effluent, industrial and hazardous waste, and radioactive wastes. Prerequisite: permission of Department.

CIV 569 Environmental Systems Modeling. (3 Hours) Mathematical modeling of environmental systems, including rivers, lakes, estuaries, and air. Prerequisite: permission of Department.

CIV 571 Principles of Geoenvironmental Engineering.

(3 Hours) Topics in geoenvironmental engineering in an urban environment. landfill design and incineration options. Stability of landfills, geotechnical characteristics of landfills, liner systems. Waste characterization, minimization, collection, treatment, transport and disposal. Leachate characteristics and potential groundwater contamination, design constraints. Legal and ethical considerations. Prerequisite: permission of Department. (Cross reference: CIV 471)

CIV 573 Environmental Geology for Engineers. (3 Hours) Defines the role of Environmental Geology in the engineering design of remedial activities dealing with a wide range of geotechnical engineering problems. Fundamental concepts of environmental unity and the rising human population will be addressed. Topics will range from earthquakes to coastal processes with particular emphasis on landslides and water problems. Prerequisite: permission of Department.

CIV 574 Engineering Hydrogeology. (3 Hours) Defines the role of Hydrogeology in the engineering design of activities dealing with the interaction of ground and surface water. The course will address a wide range of topics including the role of water in earthquakes and landslides, land subsidence, swelling clay foundations, geothermal energy, engineered wetlands, cave and karst formation, contaminant transport, and water resources with emphasis in engineering design. Prerequisite: permission of Department.

CIV 575 Applied Geological Engineering. (3 Hours) Applications of geological concepts including geomorphology and structural geology in solving geological engineering problems. Study of engineering principles and properties of earth materials. Exploration during engineering design and methods of site investigations. Applications of instrumentation and equipment used for soil, rock, and water analyses. Prerequisite: permission of Department.

CIV 631 Linear Theory of Ocean Waves. (3 Hours) A systematic theoretical development of the linear theory of simple harmonic ocean gravity waves, water particle kinematics, shoaling, refraction, diffraction, and reflection.

CIV 631L Linear Theory of Ocean Waves' Laboratory.

(1 Hour) Laboratory for linear ocean wave theory generation and propagation of linear waves, measurement of wave properties and observation of wave transformations in shallow water.

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 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 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 catchment characteristics to predict catchment 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 653 Advanced Design of Hydraulic Structures.

(3 Hours) Analysis and characteristics of flow in open channels (natural and artificial); channel design considerations including uniform flow (rivers, sewers), flow measuring devices (weirs, flumes), gradually varied flow (backwater and other flow profiles, flood routing), rapidly varied flow (hydraulic jump, spillways), and channel design problems (geometric considerations, scour, channel stabilization, sediment transport); analysis and design of hydraulic structures such as dams, spillways etc. based on economic, environmental, ethical, political, societal, health and safety considerations. Prerequisite: CIV 370 or permission of Department. (Cross-Reference: CIV 466)

CIV 660 Physiochemical Processes in Water and Wastewater Treatment. (3 Hours) Fundamental principles, analysis, modeling, and design considerations of physical and chemical processes for water and wastewater treatment processes and operations. Drinking water treatment processes will be focused on while parallel wastewater treatment schemes also being discussed. Relevant water quality characteristics, standards, and regulations in engineering design will be reviewed. Prerequisite: CIV 561 or permission of Department.

CIV 661 Biological Processes in Wastewater Treatment. (3 Hours) Theory and applications of the biological processes available for the treatment of wastewaters. Fundamentals of biological degradations and transformation of pollutants. Microbial growth kinetics and modeling. Wastewater treatment processes, both aerobic and anaerobic, including suspended growth biological processes and attached growth processes. Emphasis on engineering design considerations and parameters. Prerequisite: CIV 660.

CIV 663 Design of Environmental Engineering Facilities. (3 Hours) Analysis and design considerations and constraints for environmental engineering facilities such as water and wastewater treatment plants, solid and hazardous waste landfills, and resources recovery facilities. Design of municipal wastewater treatment plant including site selection, plant layout, hydraulic profile, preliminary treatment processes (screening, sedimentation, flow equalization, etc.), secondary treatment processes (activated sludge, trickling filter), waste stabilization ponds/constructed wetland), and sludge treatment and disposal (thickening, centrifugation, belt press, anaerobic digestion, thermal process and land disposal). Completion of one major design project and two minor design projects. Prerequisite: CIV 661 or permission of Department. (Cross reference: CIV 460)

CIV 664 Limnology for Environmental Engineering.

(3 Hours) The study of aquatic ecosystems, with an emphasis on lakes. The physical characteristics of water and lakes; the chemical characteristics of aquatic systems; the dominant plants and animals in lakes, streams, and wetlands. The impacts of pollution, engineered structures, and man-made alterations of lakes and streams. Prerequisite: permission of Department.

CIV 665 Environmental Law. (3 Hours) The major federal statutes and regulations that govern environmental protection. Included are the National Environmental Policy Act, the Clean Air Act, the Clean Water Act, Superfund, and others. Prerequisite: permission of Department.

CIV 666 Advanced Waste Treatment Processes in Environmental Engineering. (3 Hours) An in-depth study of the biological processes used to treat wastewater, with an emphasis on recently published information. Prerequisite: CIV 661 or permission of Department.

CIV 667 Biological Process Engineering. (3 Hours) Applications of the principles of microbial kinetics and heat transfer to the analysis and design of biological engineering processes. Emphasis on applications in environmental engineering processes or projects. Prerequisite: permission of Department.

CIV 668 Bioenvironmental Engineering. (3 Hours) Engineering principles for the design of systems for the biological treatment and utilization of organic by-products from animal and crop production and from industrial processes such as food and crop processing industries. Design of best management practices to protect bioenvironmental resources by minimizing non-point pollution (off-site movement of sediment, nutrients and other constituents) and by minimizing nuisance odors associated with land applied organic residues, inorganic fertilizers and pesticides. Economic utilization of beneficial components of typical wastes. Prerequisite: permission of Department.

CIV 669 Advanced Topics in Environmental Engineering. (Variable 1-3 Hours) Course will focus on a variety of topics in the field of environmental engineering. May be repeated for credit. 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 1-3 Hours) Intensive study of a special engineering 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.