CISH-6510 Web Application Design and Development

Students will learn approaches to the design, development, and maintenance of Web sites. Students will study software and information architectures for the Web, design techniques for distributed Web-based applications, and methods and tools for the creation and maintenance of Web sites. Study will encompass the major components of a Web site, including browsers and client applications, Internet protocols that link the client to the server, and server applications. Issues of performance, security, and usability will be examined. Prerequisites: CISH-4200 or CISH-2300, prior experience with HTML and Java, ECSE-4670 and CSCI-4380 recommended. Fall and spring terms annually.

3 credit hours

CISH-6900 Computer Science Seminar

For students near the end of their program, a two semester course that meets once per month from September through March and one Saturday in April when students give their presentations. Registration is accepted during fall registration only. Students are required to attend all eight meetings in order to fulfill the Seminar requirement. This course, combined with two additional graduate credit hours, will be the equivalent of one advanced three-credit-hour elective.

1 credit hour

CISH-6940 Readings in Computer and Information Sciences

1 to 3 credit hours

CISH or CSCI-6960 Topics in Computer and Information Sciences

1 to 3 credit hours

CISH-6970 Professional Project

Active participation in a semester-long project, under the supervision of a faculty adviser. A professional project often serves as a culminating experience for a professional master’s program but, with departmental or school approval, can be used to fulfill other program requirements. With approval, students may register for more than one professional project. Professional projects must result in documentation established by each department or school, but are not submitted to the Office of Graduate Education and are not archived in the library. Grades of A,B,C, or F are assigned until the thesis has been approved by the faculty adviser and accepted by the Office of Graduate Education to be archived in a standard format in the library. Grades will then be listed as S.

1 to 9 credit hours

CISH-6990 Master’s Thesis

Active participation in research, under the supervision of a faculty adviser, leading to a master’s thesis. Grades of IP are assigned until the thesis has been approved by the faculty adviser and accepted by the Office of Graduate Education. Prerequisite: ECSE-4670 or equivalent basic concept computer and communication networks course.

3 credit hours

CIVL Civil Engineering (SOE)

CIVL-2030 Introduction to Transportation Engineering

Introduction to the planning, design, and analysis of transportation problems. Studies of costs of providing transportation, level of service offered to travelers, and demand for transportation services. Evaluation of various service strategies and the policy implications of each alternative. Various modes of travel and their physical facilities. Prerequisite: MATH-2400. Corequisite: ENGR-2600. Fall term annually.

4 credit hours

CIVL-2040 Professional Practice

Contract essentials; types of contracts for construction and engineering services. Bidding procedure, surety bonds, insurance, litigation. Standard contract documents, the compilation of specifications. Engineering ethical principles and codes. Fall term alternate years.

3 credit hours

CIVL-2130 Surveying

The organization, planning, instrumentation, and execution of surveys for engineering projects including precise control systems for both horizontal and vertical control, astronomic observations for the establishment of precise directions, terrestrial and photogrammetric mapping, statewide plane coordinate systems, and the legal aspects of boundary surveys. Fall term alternate years.

3 credit hours

CIVL-2630 Introduction to Geotechnical Engineering

The application of the basic laws and phenomena of science to particulate matter, specifically soils. Basic physical and mechanical structural characteristics of soil. Equilibrium and movement of water. Flow through porous media. Effective stress. Stress-strain-time relations. Basic laboratory work as related to practice. Prerequisite: ENGR-2530. Fall term annually.

4 credit hours, 6 contact hours

CIVL-2670 Introduction to Structural Engineering

Introduction to the elastic behavior of structural components. Analysis of statically determinate systems. Deflection calculations by virtual work and elastic load methods. Analysis of simple statically indeterminate structures. Influence lines. Interaction of structural compo-
ments. Typical structural engineering loads. Prerequisite: ENGR-2530 or equivalent. Fall term annually.
4 credit hours

CIVL-2940 Readings in Civil Engineering
1 to 3 credit hours

CIVL-4010 Foundation Engineering
Subsurface investigation. The application of the principles of soil mechanics to the design of footings, retaining walls, pile foundations, bulkheads, cofferdams, bridge piers and abutments, and underpinnings. Prerequisites: ENGR-2530 and CIVL-2630 or equivalent. Fall term annually.
3 credit hours

CIVL-4020 Computer-Aided Design in Civil Engineering
The course introduces concepts in computer automation in civil engineering analysis and design. Topics include geometric modeling, optimization, symbolic computations and numerical techniques for civil engineering problems. Various software tools involved in computer-aided design process are introduced. Application to civil engineering problems is emphasized. Prerequisites: ENGR-2530, CSCI-1100, and ENGR-1200 or equivalent. Fall term annually.
3 credit hours

CIVL-4070 Steel Design
3 credit hours

CIVL-4080 Concrete Design
Analysis and design of reinforced concrete structures using ultimate strength methods. Design for flexure and shear, column design, development of reinforcing bars. Footing design. Prerequisite: CIVL-2670. Spring term annually.
3 credit hours

CIVL-4100 Civil Engineering Instrumentation and Sensors
Various experimental techniques for the collection and analysis of laboratory and field data. Theory and application of electrical resistance strain gages and other data gathering equipment are introduced. Students are also introduced to the concepts involved with the interfacing of personal computers to machines for data acquisition and control. Prerequisite: ENGR-2530 and ENGR-2600. Fall term annually.
4 credit hours

CIVL-4140 Geoenvironmental Engineering
The application of geotechnical engineering to the environmental area. Deals with waste disposal, waste containment systems, waste stabilization and landfills. Emphasis on design of such facilities. Includes related topics necessary for design, e.g., geosynthetics, groundwater, contaminant transport and slurry walls. Some field trips are possible. (Students cannot receive credit for both this course and CIVL-6550.) Fall term annually.
3 credit hours

CIVL-4150 Experimental Soil Mechanics
Second course in geotechnical engineering, emphasizing experimental aspects of soil behavior. Laboratory experiments to measure the following soil properties: consolidation, compressibility, shear strength, permeability, various moduli, and bearing capacity. Theory, practical applications of theory, and laboratory. Prerequisite: CIVL-2630 or equivalent. Spring term annually.
3 credit hours

CIVL-4240 Introduction to Finite Elements
An introductory course in use of the Finite Element Method (FEM) to solve one- and two-dimensional problems in fluid mechanics, heat transfer, and elasticity. The methods are developed using weighted residuals. Algorithms for the construction and solution of the governing equations are also covered. Students will be exposed to the use of commercial finite element software. (Cross listed as MANE-4240. Students cannot obtain credit for both this course and MANE-4240.) Prerequisites: ENGR-2250 or ENGR-2530 or ECSE-4160 and senior standing. Fall and spring terms annually.
3 credit hours

CIVL-4270 Construction Management
Application of engineering principles to planning construction operations. Network scheduling (CPM, PERT), resource allocation. Cost engineering and control. Prerequisite: senior standing. Spring term annually.
3 credit hours

CIVL-4440 Structural Analysis
3 credit hours

CIVL-4570 Analytical Methods in Infrastructure Engineering
Analysis methods and software used to manage highway and transit systems, pipeline systems, building campuses, and other large networks of civil engineering structures. Topics include: performance evaluation and forecasting, life-cycle cost analysis, capital programming and budget allocation, optimization, databases and management systems, information and knowledge modeling, expert systems, decision analysis techniques, and uncertainty in decision making. Prerequisite: CIVL-4580 or equivalent professional experience. Spring term annually.
3 credit hours

CIVL-4580 Infrastructure Engineering
Principles and fundamental analytical methods required for the preservation of the civil engineering infrastructure. Included are determination of condition of existing struc-
tures, deterioration models, data analysis and management, project- and system-level analysis. Methodologies are synthesized in the form of modern infrastructure management systems. Emphasis is placed on pavements and bridges. Fall term annually. 3 credit hours

CIVL-4620 Mass Transit Systems
The basic concepts of planning, design, and operation of urban mass transit systems. Topics include travel demand, network configurations, communication and control systems, power systems, vehicle technology, guideway and vehicle support and guidance technology, routing and scheduling, operating practice, marketing and financing of transit service, interface design, and implementation. These topics are discussed with relation to bus transit systems, guided transit systems, and several new systems. Several case studies examined. Prerequisite: CIVL-2030. Spring term odd-numbered years. 3 credit hours

CIVL-4640 Transportation Facility Design and Planning
Approaches to the planning, design, and engineering of airports, rail yards, and marine terminals. Special attention is paid to the operational requirements of each mode of transportation and the impact these have on facility design. Innovative designs are encouraged through a series of design projects. Prerequisite: CIVL-2030. Spring term odd-numbered years. 3 credit hours

CIVL-4660 Traffic Engineering
Basic characteristics of traffic, including driver, vehicle, volume, speed delay, capacity, and accidents; traffic surveys, administration, laws and ordinances; traffic regulation and control, signs, markings, signals, and signal systems. Prerequisite: CIVL-2030. Fall term annually. 3 credit hours

CIVL-4670 Highway Engineering
Principles of geometric design of highways, intersections, interchanges, and terminals. Practical issues of vertical and horizontal curvature, highway evaluation, driver and vehicle dynamics, and traffic safety are also addressed. Computer-aided design and modeling. Prerequisite: CIVL-2030. Spring term even-numbered years. 3 credit hours

CIVL-4920 Civil Engineering Capstone Design
Open-ended design project in which students work in teams. Oral presentations and written reports cover alternatives considered, design assumptions, cost, safety, and feasibility. This is a writing-intensive course. Prerequisites: senior status and CIVL-4070 and CIVL-4080, or CIVL-4010 and CIVL-4150, or CIVL-2030 and CIVL-4660 or CIVL-4640. Spring term annually. 3 credit hours

CIVL-4940 Readings in Civil Engineering
1 to 3 credit hours

CIVL-4960 Topics in Civil Engineering
3 credit hours

CIVL-4960 Topics in Civil Engineering

CIVL-6170 Mechanics of Solids
Introduction to Cartesian tensors, infinitesimal strain kinematics, equations of motion. Models of material behavior: isothermal linear isotropic and anisotropic elasticity, thermoelasticity, linear viscoelasticity and rate-independent plasticity. General principles in elasticity: minimum potential and complementary energy, reciprocal theorem. Formulation of linear elastic boundary value problems, methods of solutions for 2-D and 3-D elasticity problems. Correspondence principle of linear viscoelasticity, applications to simple structural components. Use of symbolic computations in the solution of BVP. (Cross listed as MANE-6170. Students cannot obtain credit for both this course and MANE-6170.) Spring term annually. 3 credit hours

CIVL-6180 Mechanics of Composite Materials
Micromechanics of elastic heterogeneous solids. Plasticity of composite materials. Thermoelastic and thermoplastic behavior. Mechanics of distributed damage. Mechanical behavior. (Cross listed as MANE-6180. Students cannot obtain credit for both this course and MANE-6180.) Prerequisite: one graduate course in mechanics of solids. Fall term annually. 3 credit hours

CIVL-6200 Plates and Shells
Preliminaries on linear, three-dimensional elasticity theory. Reduction of the elasticity theory to theories of plates and shells. Anisotropy, Nonlinear theories. Applications. (Cross listed as MANE-6200. Students cannot obtain credit for both this course and MANE-6200.) Annually. 3 credit hours

CIVL-6210 Structural Stability
Concepts of stability pertaining to structural and mechanical systems. Static and dynamic theories of stability. Configurations include bars, plates, shells, and structural complexes. (Cross listed as MANE-6210. Students cannot obtain credit for both this course and MANE-6210.) Annually. 3 credit hours

CIVL-6230 Transportation Economics
Economic concepts, drawn from micro- and macro-economic theory, as they apply to transportation. Location theory, demand analysis, cost analysis, pricing, regulation, pertinent current problem areas, cost/benefit analysis. Prerequisites: CIVL-2030, ECON-2010, and DSES-4140 or their equivalents. Fall term even-numbered years. 3 credit hours

CIVL-6240 Intelligent Transportation Systems
This course covers concepts and models applicable to intelligent transportation systems (ITS). ITS uses information system technology to create seamless multi-modal transportation systems with enhanced performance and productivity. Term projects focus on assessment and evaluation of candidate ITS treatments for site-specific locations based on network models that capture real-time phenom-
torsional design. Effects of semi-rigid connections on structural stability. Prerequisite: CIVL-4070 or equivalent. Spring term annually. 3 credit hours

CIVL-6250 Transportation Systems Planning
The analysis and planning of transportation systems. Study of the basic interaction between transportation supply and demand. Modeling these relationships for a variety of transportation problems. Role of transportation systems analysis in the social, environmental, and political framework of policy decision making. Prerequisite: CIVL-2030. Spring term even-numbered years. 3 credit hours

CIVL-6260 Transportation Algorithms
Quantitative techniques applied in transportation analysis. Included are shortest path algorithms, equilibrium traffic assignment, routing and scheduling heuristics, demand forecasting techniques. Computer applications stressed. GIS-based packages employed. Prerequisites: CIVL-2030, MATH-2400. Spring term annually. 3 credit hours

CIVL-6270 Traffic Control Systems
Detailed exploration of advanced traffic control systems with emphasis on design and analysis. Topics include control system functions, hardware and software technology; isolated, arterial, and network applications. Several sessions focus on state-of-the-art software packages including CORSIM, TRANSYT-7F, HCS, VISSIM, and Sim Traffic. An ITS perspective maintained and stressed. Prerequisite: CIVL-4660. Spring term odd-numbered years. 3 credit hours

CIVL-6280 Infrastructure Asset Management Systems
Engineering methods and decision processes for managing engineered facilities and related assets. Topics include: engineering asset types; integrated asset management; traditional infrastructure management systems; development and implementation issues; key issues during design, construction, maintenance, and rehabilitation phases of ownership; strategic planning and budgeting decision processes; analysis of tradeoffs, economic consequences of decisions; and benchmarking of system performance. Prerequisite: CIVL-4570. Fall term alternate years. 3 credit hours

CIVL-6310 Advanced Concrete Structures
Advanced analysis and design of reinforced concrete structures. Design of deep beams, slender columns, two-way floor systems. Deflection computations. Design for torsion. Prestressed concrete fundamentals. Prerequisite: CIVL-4080 or equivalent. Fall term annually. 3 credit hours

CIVL-6320 Advanced Steel Design
Advanced analysis and design of complex metal structures. Flexible, semi-rigid, and rigid connections. Plate girders, torsional design. Effects of semi-rigid connections on structural stability. Prerequisite: CIVL-4070 or equivalent. Spring term annually. 3 credit hours

CIVL-6450 Structural Dynamics
Analysis of elastic and inelastic single and multiple degree-of-freedom structural systems under time-dependent loads including harmonic, impulse, earthquake, and other general dynamic loads. Development of equations of motion. Analytical and numerical evaluation of free and forced vibration response. Identification of dynamic system properties; modal analysis. Vibration isolation and force transmissibility. Dynamic measurement sensors. Shock loading spectrum. Frequency-domain analysis. Prerequisite: CIVL-4440. Fall term annually. 3 credit hours

CIVL-6460 Advanced Structural Dynamics
Stochastic response of lumped parameter and continuous systems to random excitation, wave propagation, power spectral densities, covariance and cross covariance functions, transfer functions, application of procedure to wind and earthquake engineering. Review of current literature. Prerequisite: CIVL-6450. Spring term alternate years. 3 credit hours

CIVL-6480 Designing with Geosynthetics
Civil Engineering applications of geosynthetics including geotextiles, geogrids, geonets, geomembranes, geosynthetic clay liners, geoslope, and geocomposites. Designing by function, including separation, reinforcement, filtration, drainage, liquid barrier, and combined functions. Applications in the areas of landfills, groundwater drains, geotextile reinforced walls and slopes, roadways, and other civil engineered type structures. Prerequisite: CIVL-2630 or equivalent. Spring term alternate years. 3 credit hours

CIVL-6490 Earthquake Engineering
Seismology concepts including plate tectonics, fault mechanics, quantification of earthquake size, and wave propagation. Dynamic sensors for earthquake ground motion measurement. Estimation of ground motion parameters using attenuation relationships. Linear and nonlinear dynamic analyses for evaluation of the seismic response of structures. Code-based approach to the seismic analysis and design of structural systems. Seismic design considerations for various construction materials. Base isolation and energy dissipation systems for seismic protection of structures. Prerequisite: CIVL-6450. Spring term alternate years. 3 credit hours

CIVL-6510 Advanced Soil Mechanics
An intensive study of the fundamentals of soil mechanics at the graduate level. Transmission of stresses between particles. Soils in which the pore water is either stationary or flowing under steady conditions. Soils in which pore pressures are influenced by applied loads, and hence the pore water is flowing under transient conditions. Prerequisite: CIVL-4150. Fall term annually. 3 credit hours
CIVL-6520 Advanced Foundations and Earth Structures
The applications of the principles of soil mechanics to the design of foundations, at the graduate level. Subsurface investigation. Design of footings, retaining walls, pile foundations, flexible retaining structures, anchor tie-backs, bridge piers, abutments, embankments and natural slopes. Slope stability analysis and landslide prevention. Earthquake effects. Case studies. Prerequisite: CIVL-4100, CIVL-4150. Spring term annually. 3 credit hours

CIVL-6530 Seepage, Drainage, and Groundwater
Introduction to groundwater hydrology, well hydraulics, permeability, seepage, flow nets, filter criteria, dewatering, slope stabilization, practical applications. Prerequisite: CIVL-2630 or equivalent. Spring term alternate years. 3 credit hours

CIVL-6540 Dynamics of Soil and Soil-Foundation Systems
Basics of dynamic response of soil and soil-foundation systems, including applications to earthquake engineering and machine foundations. Systems studies include shallow and deep foundations, buried structures, earth structures, slopes, and earthquake site response. Prerequisite: CIVL-6450. Spring term annually. 3 credit hours

CIVL-6550 Advanced Geoenvironmental Engineering
An intensive study of the application of geotechnical engineering to the environmental area. Deals with waste disposal, waste containment systems, waste stabilization and landfills. Emphasis on design of such facilities. Includes related topics necessary for design, e.g., geosynthetics, groundwater, contaminant transport, and slurry walls. Some field trips are possible. This course meets concurrently with CIVL-4140. CIVL-6550 students are required to do a term paper and/or project, read additional professional papers and publications, and do additional laboratory experiments. (Students cannot receive credit for both this course and CIVL-4140.) Fall term annually. 3 credit hours

CIVL-6660 Fundamentals of Finite Elements
Graduate-level course on the fundamental concepts and technologies underlying finite element methods for the numerical solution of continuum problems. The course emphasizes the construction of integral weak forms for elliptic partial differential equations and the construction of the elemental level matrices using multi-dimensional shape functions, element level mappings and numerical integration. The basic convergence properties of the finite element method will be given. This course serves as preparation for students working on finite element methods. (Cross listed as MANE-6660. Students cannot obtain credit for both this course and MANE-6660.) Prerequisite: differential equations. Fall term annually. 3 credit hours

CIVL-6670 Nonlinear Finite Element Methods
The formulations and solution strategies for finite element analysis of nonlinear problems are developed. Topics include the sources of nonlinear behavior (geometric, constitutive, boundary condition), derivation of the governing discrete equations for nonlinear systems such as large displacement, nonlinear elasticity, rate independent and dependent plasticity and other nonlinear constitutive laws, solution strategies for nonlinear problems (e.g., incrementation, iteration), and computational procedures for large systems of nonlinear algebraic equations. (Cross listed as MANE-6670. Students cannot obtain credit for both this course and MANE-6670.) Prerequisite: CIVL-6660 or MANE-6660. Fall term odd-numbered years. 3 credit hours

CIVL-6680 Finite Element Programming
Examines the implementation of finite element methods. Consideration is first given to the techniques used in classic finite element programs. Attention then focuses on development of a general geometry-based code which effectively supports higher order adaptive technique. Technical areas covered include: effective construction of element matrices for p-version finite elements, ordering of unknowns, automatic mesh generation, adaptive mesh improvement, program and database structures. Implementation of automated adaptive techniques on parallel computers is also covered. (Cross listed as MANE-6680. Students cannot obtain credit for both this course and MANE-6680.) Prerequisite: CIVL-6660, MANE-6660, CSCI-6860 or MATH-6860. Spring term odd-numbered years. 3 credit hours

CIVL-6690 Advanced Finite Element Formulations
This course focuses on generalized weighted residual methods and multifield variational principles for constructing approximate solutions to sets of governing differential equations and associated boundary conditions. Topics include hybrid and mixed methods, boundary element formulations, p-version finite elements, global/local procedures, and penalty methods. Problem areas include solid mechanics (nearly incompressible solids, plates, and shells), fluid mechanics including compressible flows, and heat transfer. (Cross listed as MANE-6690. Students cannot obtain credit for both this course and MANE-6690.) Prerequisite: CIVL-6660 or MANE-6660. Spring term even-numbered years. 3 credit hours

CIVL-6700 Finite Element Methods in Structural Dynamics
Solutions to the free vibration and transient dynamic responses of two- and three-dimensional structures by the finite element method are considered. The governing finite element matrix equations are derived and numerical aspects of solving these time-dependent equations con-
sidered. Topics include the formulation of the eigenvalue problem, algorithms for eigenvalue extraction, time integration methods including stability and accuracy analysis, and finite elements in time. Modal analysis and direct time integration techniques are compared for a variety of two- and three-dimensional problems. (Cross listed as MANE-6700. Students cannot obtain credit for both this course and MANE-6700.) Prerequisite: CIVL-6660 or MANE-6660. Fall term odd-numbered years. 3 credit hours

CIVL-6780 Numerical Modeling of Failure Processes in Materials
State-of-the-art in computational modeling of failure processes in materials. Topics include numerical modeling of discrete defects, distributed damage and multiscale computational techniques including multiple scale perturbation techniques, boundary layer techniques, and various global-local approaches. (Cross listed as MANE-6780.) Prerequisite: CIVL-6660 or MANE-6660. Spring term even-numbered years. 3 credit hours

CIVL-6900 Civil Engineering Graduate Seminar
Civil engineering graduate students present seminars about their research to an audience composed of students and faculty and participate in discussions about the research of others. The course consists of one-hour weekly meetings. The faculty member in charge of the course helps the students develop their presentation skills. This course is required to be taken once by master’s students and twice by Ph.D. students. Spring term annually. 0 credit hours

CIVL-6910 Colloquium Series
Seminars by distinguished guest speakers. All undergraduates and graduates are strongly encouraged to attend as many lectures as possible. Fall and spring terms. 0 credit hours

CIVL-6940 Readings in Civil Engineering
1 to 3 credit hours

CIVL-6960 Topics in Civil Engineering
3 credit hours

CIVL-6970 Professional Project
Active participation in a semester-long project, under the supervision of a faculty adviser. A Professional Project often serves as a culminating experience for a Professional Master’s program but, with departmental or school approval, can be used to fulfill other program requirements. With approval, students may register for more than one Professional Project. Professional Projects must result in documentation established by each department or school, but are not submitted to the Graduate School and are not archived in the library. Grades of A, B, C, or F are assigned by the faculty adviser at the end of the semester. If not completed on time, a formal Incomplete grade may be assigned by the faculty adviser, listing the work remaining to be completed and the time limit for completing this work.

CIVL-6980 Master’s Project
Active participation in a master’s-level project under the supervision of a faculty adviser, leading to a master’s project report. Grades of IP are assigned until the master’s project has been approved by the faculty adviser. If recommended by the adviser, the Master’s Project may be accepted by the Office of Graduate Education to be archived in the Library. Grades will then be listed as S. 1 to 9 credit hours

CIVL-6990 Master’s Thesis
Active participation in research, under the supervision of a faculty adviser, leading to a master’s thesis. Grades of IP are assigned until the thesis has been approved by the faculty adviser and accepted by the Office of Graduate Education to be archived in a standard format in the library. Grades will then be listed as S. Variable credit hours

COMM Communication (HSSH)

COMM-1510 Introduction to Communication Theory
This course focuses on topics, theories, and research methods central to the study of human communication. The following kinds of issues and topics are considered: definitions/models of communication; what it means to use a language; how language affects the way we see the world; ancient and contemporary communication media; nonverbal communication; interpersonal and small-group communication. Fall and spring terms annually. 4 credit hours

COMM-2410 Perspectives on Photography
This course helps students understand the meaning and emotional complexity of visual images in our culture. Students examine photographic imagery through three perspectives. The first—formal—addresses the design components of the image, such as vantage point and contrast. The second—psychodynamic—concerns the emotional dynamics of viewing. The third—social political—explores photographs as instruments for preserving or challenging cultural values. No technical knowledge of photography is needed. Offered annually. 4 credit hours