Civil and Environmental Engineering

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Environmental Engineering: R. Ryan Dupont, Utah Water Research Laboratory 319, (435) 797-3227, rdupo@cc.usu.edu

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Transportation Systems Engineering: Anthony Chen, Engineering Laboratory 211F, (435) 797-7109, achen@cc.usu.edu

Degrees offered: Bachelor of Science (BS) in Civil Engineering; BS in Environmental Engineering; Master of Engineering (ME), Master of Science (MS), Civil Engineer (CE) and Doctor of Philosophy (PhD) in Civil and Environmental Engineering

Graduate specializations: Environmental Engineering, Fluid Mechanics and Hydraulic Engineering, Geotechnical Engineering, Hazardous Waste Management, Structural Engineering and Mechanics, Transportation Engineering, Water Engineering, Water Resources Engineering and Hydrology

Undergraduate Programs

Objectives

Civil and Environmental Engineering is concerned with planning, designing, constructing, and operating various physical works; developing and utilizing natural resources in an environmentally sound manner; providing the infrastructure which supports the highest quality of life in the history of the world; and protecting public health and renovating impacted terrestrial and aquatic systems from the mismanagement of toxic and hazardous wastes. The Department of Civil and Environmental Engineering offers Bachelor of Science degrees in Civil Engineering and in Environmental Engineering. Both degrees are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC/ABET).

The objectives of the undergraduate programs in Civil Engineering and Environmental Engineering are to graduate engineers who have a broad educational background and experiences in engineering, the sciences, and the humanities; who have passed the Fundamentals of Engineering examination; and who are prepared to enter graduate school, other professional training, or the workplace as effective professionals. These graduates will understand the significance of life-long learning and will be qualified to become professional engineers and contribute significantly to the engineering profession and society as a whole.

Outcomes

Graduates with a BS degree in Civil Engineering from Utah State University will have:

1. Proven themselves proficient in mathematics; the sciences; and the structures, geotechnical, hydraulics, and transportation areas of civil engineering.

2. Demonstrated the ability to solve engineering problems, utilizing fundamental engineering principles, as well as the latest technologies and engineering tools, in the process of engineering analysis and design. They will have done this as individuals and as members of multidisciplinary teams.

3. Shown a capacity for investigation and experimentation into physical (engineering) phenomena, along with the ability to analyze and interpret engineering data in at least two of the following areas of civil engineering: structures, geotechnical, hydraulics, and transportation.

4. Demonstrated the capability to communicate verbally, in writing, and through the use of engineering communication media. They will also have shown the capacity to present the outcomes of their problem solving and design projects for groups of engineers and lay persons.

5. Exhibited an understanding of the role civil engineering plays in our modern global society, that much is to be learned from the past and applied to the present, and that a responsible engineer is ethical and will continue to increase his or her knowledge throughout his or her lifetime.

Graduates with a BS degree in Environmental Engineering from Utah State University will have:

1. Knowledge of basic science and engineering principles fundamental to the practice of environmental engineering including: mathematics, biology, chemistry, soil science, physics, fluid and solid mechanics, hydrology, and engineering economics.

2. Knowledge of environmental engineering practice in the areas of water supply and treatment; environmental systems dynamics; environmental chemistry and analysis; wastewater, air quality, and solid and hazardous waste management; and public health and industrial hygiene.

3. Advanced knowledge of science and engineering principles in two of the following program emphasis areas: water, solids, natural systems, and public health.

4. Integration of advanced science and engineering principles in a multidisciplinary team environment for the solution of a comprehensive design problem in one of the program emphasis areas incorporating: applicable design standards; state-of-the-practice design tools; real-life economic, social, regulatory, political, ethical, and business design constraints; and applicable considerations for contemporary issues, such as product manufacturability, process sustainability, health and safety concerns, and system constructability.

5. Experience in written and oral communication using state-of-the-practice presentation methods throughout the course of their Professional Program in Environmental Engineering which include: laboratory reports and presentations, research paper presentations, design proposal and progress reports and presentations, and final design project presentations to both technical and lay audiences.

6. Experience in one of the environmental engineering practice areas in the design and conduct of experiments; collection, analysis, and interpretation of data; and modeling and representation of experimental results and presentation of experimental findings.

Assessment

The Civil and Environmental Engineering Department employs several methods to assess the quality of the two BS programs offered by the department. Assessments are made prior to graduation by measuring the performance of students in each class. In addition, the results of the FE exam, senior exit interviews, and faculty reviews of student portfolios are used. Postgraduate assessment of Civil and Environmental Engineering graduates is also conducted up to six years after graduation. Assistance from outside reviewers is also obtained in making the assessment.

Requirements

Admission Requirements. Admission requirements for the Department of Civil and Environmental Engineering are the same as those described for the University on pages 15-18. Students in good standing may apply for admission to the department. In addition, students must maintain the academic requirements outlined for the College of Engineering on pages 107-109.

Bachelor of Science Degrees. The Department of Civil and Environmental Engineering offers two Bachelor of Science degrees: one in Civil Engineering and one in Environmental Engineering. The four-year programs leading to these two degrees are listed below. During the first two years, students are in a pre-engineering program. Students must successfully complete the pre-engineering program or, in the case of transfer students, substantially equivalent coursework at another institution before they are accepted into the professional program. Transfer students may apply for permission to take upper-division courses in cases where postponement of these courses will prolong the student's time to graduate.

Design is a cornerstone of engineering that requires creative thinking, technical knowledge, the ability to organize and solve complex problems, and teamwork. Engineering design activities begin during the first two years and progress in-depth as each student's proficiency increases. These design activities culminate in a major senior design course, which integrates past engineering coursework into a focused, realistic design project. An important feature of the senior design experience is that students work in teams to complete the project.

The student who is majoring in or planning to major in Civil Engineering or Environmental Engineering needs to be aware of the College of Engineering requirements concerning admission to the college, pre-engineering program, admission to professional engineering programs, University Studies, and other academic requirements. Additional information concerning these items is given in the College of Engineering write-up on pages 107-109. It is the responsibility of the student to be aware of these rules and regulations. **Passing the Fundamentals of Engineering Exam is required for graduation**.

The Civil and Environmental Engineering Department strongly recommends that students have a high-end calculator, such as an HP calculator, that has the capabilities to do units, matrices, and programs in BASIC. Although not a requirement at this time, CEE students are strongly encouraged to have a modern desktop or laptop personal computer. Since computer technology is changing rapidly, students should seek advice from a knowledgeable professional on hardware and software requirements before purchasing a computer.

Students in the Civil Engineering program must establish proficiency in at least four areas of Civil Engineering. Proficiency is established through a combination of material covered in required courses, as well as by establishing depth through the selection of technical electives. Proficiency must be established in four of the following areas: Environmental Engineering, Fluid Mechanics/ Hydraulics, Geotechnical, Structures, Transportation, or Water Resources. The courses must be selected from the approved Technical Elective courses.

Undergraduate Course Requirements for Civil Engineering

Preengineering Program (freshmen and sophomore years): CEE 1880, 2240, 2870; ENGR 2000, 2020, 2040, 2200, 2210; ITE 2270; BIOL 1010; CHEM 1210, 1230; ENGL 1010, 2010; GEOL 1150; MATH 1210, 1220, 2250; PHYX 2200 (or High School AP Physics with passing score), 2220.

Professional Engineering Program (junior and senior years): CEE 3010, 3020, 3030, 3080, 3210, 3430, 3500, 3510, 3610, 3640, 3870, 4200, 4300; Civil Engineering Design Elective, one course chosen from: CEE 3780, 5070, 5230, 5350, 5460, 5540, 5470; one course chosen from CEE 5190, 5220, 5230, 5240, 5350, 5380, 5450, 5460, 5470; Design project consisting of CEE 3880, 4870, and 4880; Technical electives (15 credits) chosen from: CEE 3670, 3780, 5010, 5050, 5070, 5080, 5100, 5190, 5220, 5230, 5240, 5350, 5380, 5430, 5450, 5460, 5470, 5500, 5540, 5550, 5690, 5700, 5860, 5870, 5880, 5900, MAE 2060, 2400; University Studies courses (see College of Engineering University Studies requirements).

Undergraduate Course Requirements for Environmental Engineering

Preengineering Program (freshman and sophomore years): CEE 1880, 2240, 2890; ENGR 2000, 2020, 2040, 2200; ITE 2270; MAE 2400; BIOL 1210, 3300; CHEM 1210, 1230, 2300; ENGL 2010; MATH 1210, 1220, 2250; PHYX 2200 (or High School AP Physics), 2220.

Professional Engineering Program (junior and senior years): CEE 3030, 3430, 3500, 3510, 3640, 3670, 3780, 3870, 3890, 4200, 5610, 5860; PUBH 3310; Environmental Engineering Design Elective, one class chosen from: CEE 5690, 5740, 5810, 5880; Design project consisting of CEE 3890, 4790, 4890. Technical Electives (5 credits), with one course chosen from Area 1, 2, or 3, and one course chosen from Area 4 or 5: *1—Solids:* CEE 5670, 5680, 5730, 5830, 5870, 5880; *2—Water:* CEE 5430, 5620, 5730, 5810; *3—Air:* BMET 4300, CEE 5710, 5750, 5790, 5870; *4—Natural Systems:* AWER 4500, 4530, CEE 5690, 5700, 5740; *5—Occupational Safety and Health:* PUBH 5310, 5320, 5330, CEE 5670, 5710, 5790. University Studies courses (see College of Engineering University Studies requirements).

Additional Information

For more information about Bachelor of Science requirements and the sequence in which courses should be taken, see major requirement sheet, available from the Civil and Environmental Engineering Department.

Departmental honors can be earned by completing 20 credits of upper-division honors engineering courses. Students should work with the department in selecting appropriate courses.

Concurrent BS/Master's Program

The concurrent BS/Master's program allows engineering students to begin taking graduate-level classes during their senior year. This permits them to complete requirements for *both* the BS degree *and* the master's degree concurrently during two years. Students in this program have a greater selection of graduate courses, since many graduate courses are taught during alternate years. In addition, the student's senior design project could be a start for a graduate design project or thesis. After completing their BS degree, students in the program can earn a master's degree in only one additional year. Both the BS and the master's degree can generally be earned with 150 total credits, although students should note that a Plan C MS requires 3 extra credits. Finally, students with a master's degree can expect a much higher starting salary following graduation. (For more information, see *College of Engineering* section of this catalog, page 109.)

Graduate Programs

The ME degree emphasizes professional practice and coursework. A minimum of 30 credits of technical and scientific coursework is required. The MS degree emphasizes research and the preparation of a significant publication. A minimum of 30 credits, 6 to 9 of which shall be thesis research, is required for an MS. In special cases, as decided by the student's supervisory committee, a second MS is available with a Plan B option, which requires 30 credits, including 3 credits of CEE 6970, Thesis Research. The CE degree, which prepares students for professional engineering careers, requires 60 credits beyond the bachelor's degree, or 30 credits beyond the master's degree, including a technical engineering report. The PhD degree represents high scholarly achievement demonstrated by independent research and competence in a area of specialization approved by the student's supervisory committee.

Admission Requirements

See general admission requirements, pages 90-91. Admission committees consider GRE scores and experience, undergraduate record and curriculum, and formal recommendations. A student without an undergraduate civil and environmental engineering background may be required to complete selected undergraduate courses prior to admission as a fully matriculated graduate student.

Graduate Program Divisions

The graduate program in the Department of Civil and Environmental Engineering is administered through five academic divisions, as described below.

Structural Engineering. The structural engineer is involved in the design, construction, repair, and retrofit of all types of structures: buildings, bridges, dams, and many others. The safety of the structures we occupy and utilize every day is the responsibility of structural engineers. They must be able to evaluate the loads placed on a structure, determine their effects on the structure, and select the appropriate materials and structural elements, or repair strategy, to withstand these loads. Today's structural engineer is using new space materials in the design of new structures or the retrofit of older structures.

Mathematics, physics, and materials science constitute a foundation for structural engineering. Structural analysis and design are added to this foundation and become the focus of the structural engineering program. Graduate students in the structures program also engage in structural mechanics, numerical methods, structural dynamics, geotechnical engineering, and the study of new structural materials. Current research in the structures area is focusing on the dynamic characteristics of structures, their potential response to earthquakes, and new seismic retrofit measures, using advanced composite materials, for older structures. Materials research is focusing on cementious materials and constitutive modeling.

Geotechnical Engineering. Engineering studies of soils are concerned with the physical and engineering properties of soils and how these are related to engineering projects.

Traditional geotechnical engineering includes the application of engineering principles to the analysis and/or design of building foundations, earth embankments, retaining walls, drainage sys-

tems, earthquake motion, buried structures, and other systems involving soil and rock. Engineers and architects cannot ignore the problems of investigating properties of soils in connection with engineering construction. Undergraduate and graduate courses offered by the department provide the basic knowledge necessary for the design of foundations and various types of earth structures. Fundamental concepts and their application are emphasized so that the student will be properly trained for his or her initial job, as well as being prepared to understand future development in this field.

The Geotechnical Engineering Division, in cooperation with the Environmental Engineering Division, is offering a new program in Geoenvironmental Engineering. This new program uses the strengths of both divisions to provide a program involving the geotechnical aspects of hazardous waste management, the investigation of hazardous waste sites, and the design of hazardous waste containment systems.

The geotechnical division has a strong research program. Current research projects in this division include studies on liquefaction, seismic slope stability, pile foundations, landslides, mechanically stabilized embankments, risk analysis of dams, finite element analysis of soil-structure systems, and the long-term properties of clay soils used in hazardous waste containment systems.

Water Engineering. The water engineering program is a multidisciplinary graduate program in the College of Engineering and is intended to enable engineers and scientists interested in water to obtain graduate degrees in the areas of fluid mechanics and hydraulics, hydrology, groundwater, and water resources engineering. Core courses and departmental offerings cover these fundamental areas, as well as essential numerical and statistical methods. The water engineering faculty are committed to a strong academic program. The curriculum offered is one of the most comprehensive offered in the U.S. Elements of ongoing research projects are routinely and effectively incorporated into the classes. The program combines training, research, and experience to understand the water issues and water resources management challenges in the United States and internationally. Graduate students can supplement departmental offerings by selecting courses in Mathematics and Statistics; Computer Science; Aquatic, Watershed, and Earth Resources; Environment and Society; Forest, Range, and Wildlife Sciences; Economics; Political Science; Geology; Biological and Irrigation Engineering; Mechanical and Aerospace Engineering; Plants, Soils, and Biometeorology; Biology; Chemistry and Biochemistry; and Physics. This ensures that graduates are well-grounded in the fundamentals, but have a breadth of training and are prepared to contribute professionally to the solution of multidisciplinary local, national, and international water problems. Graduate students in the water program have the opportunity for research support through the Utah Water Research Laboratory (UWRL) while working on theses or dissertations. Excellent laboratory and computing facilities are available. Strong, continuous state and federal research funding keeps the research topics and facilities current. Specialty areas within the program comprise fluid mechanics and hydraulics, hydrology, groundwater, and water resources engineering.

Fluid mechanics and hydraulic engineering covers both fundamental principles and theory and their applications in a variety of engineering fields. Elementary fluid mechanics, based on fundamental principles of conservation of mass, energy, and momentum, is the logical core for all water-related engineering programs. Consequently, other specialties in water engineering study fluid mechanics. Students specializing in fluid mechanics and hydraulics emphasize theoretical fluid mechanics, hydraulic design, numerical methods, and laboratory hydraulic techniques. A good variety and balance of courses supporting research in theoretical fluid mechanics, open channel hydraulics, hydraulic design, transients, sedimentation, municipal water system design, and cavitation are available at the graduate level. Graduates in fluid mechanics and hydraulics find employment in a broad range of professional engineering fields, including consulting, university teaching and research, and state and federal government agencies.

Hydrology is a branch of geoscience concerned with the origin, distribution, movement, and properties of waters of the earth. The hydrologic cycle encompasses the atmosphere, the land surface, lakes and oceans, and the subsurface. Complex, interacting processes at varied time and space scales describe the hydrologic cycle. The concepts and practice of hydrology derive from an integration of field observations, laboratory investigations, and conceptual, mathematical, chemical, statistical, and probabilistic models.

The hydrology program at USU has strength in both theoretical and applied aspects of modern hydrology. Past and present research focuses on a broad spectrum of hydrologic problems. These range from climate modeling, rainfall processes, floods, droughts, terminal lake analyses, soil erosion, and stream water quality models to groundwater contamination characterization and remediation and watershed analyses. A particular emphasis of the program is on an understanding of the global water and energy cycles at nested scales from the hemisphere to the continent to the watershed from a holistic perspective that recognizes the two-way linkages between water reservoirs and fluxes through oceans, atmosphere, land surface and subsurface, and biota.

Groundwater engineering is concerned with the transport of fluids in the subsurface environment. It encompasses the theory of flow in porous media; groundwater hydrology and hydraulics; fate and transport of contaminants in subsurface; and analytical, numerical, and stochastic modeling of such processes. Emphasis is placed on the quantitative analysis of physical and chemical principles governing these processes and on the application of these principles to practical field problems, with all their difficulties related to the complex structure of subsurface formations. Examples of such problems include groundwater supply and management, subsurface cleanup technologies, and analysis and remediation of groundwater contamination. These problems are of a multidisciplinary nature, and their solutions require a multidisciplinary approach, involving, among others, soil and water chemistry, chemical engineering, and economics. The groundwater professional is an important team player in solving such problems.

The groundwater emphasis has a strong research component. Current research activities cover a well-balanced variety of topics, from theoretical (e.g., stochastic analysis of transport of contaminants in groundwater) to practical problems (e.g., design of cleanup technologies for gasoline-contaminated sites).

Water Resources Engineering prepares engineers to be lead members in water resources planning teams, often charged with coordinating the information and concepts supplied from other disciplines. This need for breadth requires considerable flexibility in the training and arrangement of degree programs.

Water resources engineers draw principles from hydrology, fluid mechanics, hydraulics, environmental engineering, economics, ecology, political science, and other disciplines in the design

and operation of projects and nonstructural methods for water resources planning and management. They need a sound understanding of how water storage, delivery, and other management systems function; of criteria used in evaluating and selecting among alternatives; of the techniques of operations research that can be used in systems design; and of the institutional aspects of decision-making in the public sector. A focus area of the program is to develop decision support systems for sustainable water quantity and quality management in the United States and in developing regions of the world. Evolving information sources and tools, such as spatial data sets encoded in geographical information systems, climate forecasts, and cognitive models of the human decision process and societal group dynamics, are being integrated in representative institutional contexts.

An internationally-recognized specialized program has been developed in dam safety risk assessment. Students take classes in dam engineering; hydrology and hydraulics; geotechnical engineering; geology; decision analysis; risk assessment; probability and statistics; and natural resources economics, planning, and management. Students work on practical applications, as well as research projects, for improving the state-of-the art.

Environmental Engineering. The Division of Environmental Engineering is a multidisciplinary graduate program in the College of Engineering and provides coursework and research experience to enable engineers and scientists interested in the environment to obtain graduate degrees relating to potable water and waste treatment, toxic and hazardous wastes management, air quality management, natural systems engineering, and environmental impact assessment. The program provides an interdisciplinary educational approach to fundamental principles that can be applied to environmental phenomena. Research and training projects are a part of the program and provide the student with appropriate research experience leading to a thesis or dissertation.

Hazardous Waste Management. This specialization has been developed within the broader scope of the environmental engineering program to provide an integrated approach for students with a BS in engineering or natural sciences to deal with the complex issues of toxic and hazardous waste. Aspects of toxic/hazardous waste management, including characterization, treatment, disposal, control, monitoring, and environmental impacts, are dealt with in this program.

Natural Systems Engineering is the study of the interaction of engineered systems with nature, emphasizing impacts to aquatic ecosystems. Techniques include assessment of aquatic habitat through computer simulation and model verification, quantification of aquatic habitat using remote sensing systems, and data analysis and display through integrated statistical and GIS approaches. These tools are used to evaluate impacts on threatened and endangered species, habitat enhancement, instream flow assessments, fish habitat, stream sediment, and hydraulic features.

A *bioprocess engineering* program has been developed as a cooperative effort between the Division of Environmental Engineering and the Biological and Irrigation Engineering Department. This program provides students with specialized coursework and research experience in areas of bioreactor processing of environmental materials and engineering scale-up of biologically-based environmental reactions. Areas of specialization include waste to energy, fermentation, composting, and industrial waste (agricultural and chemical) reuse, recycling, and technologies based on biological processes, as well as engineering optimization of aquatic habitats.

Transportation Systems Engineering. The graduate program in Transportation Systems Engineering offers education and research opportunities in transportation systems planning, design, and management. It is designed to enable aspiring planners, engineers, and managers to obtain advanced degrees while specializing in infrastructure management, traffic network analysis, facility design, traffic operations, transportation economics and finance, and project appraisal. Up-to-date computer and laboratory facilities, as well as the Transportation Division's close links with local and state transportation agencies, enable students to gain hands-on experience and practical perspectives.

Past and present research undertaken by the Transportation Division faculty and researchers ranges from microscopic traffic flow simulation, dynamic route assignment, and network reliability to traffic accident modeling, pavement management, video image processing, and intelligent transportation systems. The focus remains on efficient and effective solutions to transportation problems.

Transportation Division course offerings expose students to the theoretical and practical aspects of goods and passenger transportation. State-of-the-art analytical tools and new research findings are introduced into the courses through periodic revision of notes, examples, problem sets, and computer software. Students are encouraged to design their own programs of study according to their personal and professional goals. Due to the multi-disciplinary nature of transportation, students are encouraged to include in their program of study course offerings from other programs in CEE, as well as from Mathematics and Statistics, Environment and Society, Economics, Business Administration, and Sociology.

Financial Assistance

Both departmental and formal grant support are available to graduate students and are awarded on a competitive basis. Students requesting financial support should apply to the department by March 15 for the coming academic year.

A number of fellowships are available through the University and the department. Teaching assistantships are available through the department and research assistantships are available through the Utah Water Research Laboratory and departmental faculty members who have ongoing projects or who hold special research grants from the University, private companies, or state and federal agencies.

Acceptance to pursue graduate studies in the Civil and Environmental Engineering Department does not guarantee the student financial assistance. Inasmuch as funds are limited, the assistantships are awarded by the department to cover specific teaching assignments and by the faculty members to provide for research as funds are available.

Civil and Environmental Engineering Faculty

Professors

Loren R. Anderson, geotechnical engineering

A. Bruce Bishop, engineering systems and planning

David S. Bowles, risk assessment, hydrology, water resources engineering

William J. Doucette, environmental analytical chemistry

R. Ryan Dupont, hazardous waste management, bioremediation

William J. Grenney, Advanced Center for Transportation Studies
Christine E. Hailey, Associate Dean of College of Engineering, fluid and thermal sciences, engineering education
Thomas B. Hardy, ecological system modeling, statistical analysis
Daniel H. Hoggan, hydrologic and hydraulic modeling
Jagath J. Kaluarachchi, surface and groundwater, flow and contaminant transport
Marian W. Kemblowski, subsurface hydrology and transport processes
Mac McKee, water resources planning and analysis
William J. Rahmeyer, hydraulics, hydraulic structures, scour and erosion
Ronald C. Sims, hazardous waste management
David K. Stevens, treatment process analysis
David G. Tarboton, hydrology and water resources
Kevin C. Womack, structural mechanics
Muzz Yener, structural engineering and mechanics

Research Professor
Darwin L. Sorensen, aquatic microbiology

Professors Emeriti
Jay M. Bagley, hydrology, water resources
W. O. Carter, structures
Calvin G. Clyde, fluid mechanics and groundwater
Irving S. Dunn, geotechnical engineering
Gordon H. Flammer, hydraulics
Trevor C. Hughes, water resources systems analysis
C. Earl Israelsen, hydrology, hydraulics, water resources, erosion control
Roland W. Jeppson, numerical modeling
Fred W. Kiefer, Jr., geotechnical engineering
Elliot Rich, structural engineering
J. Paul Riley, water resources systems, hydrology
J. Paul Tullis, hydraulics, hydraulic structures, and hydromachinery
Reynold K. Watkins, geotechnical engineering

Adjunct Professors
Lloyd H. Austin, water resources
George G. Goble, deep foundations and structural dynamics
Jeffrey R. Keaton, geotechnical engineering, engineering geology
Upmanu Lall, climate modeling, statistical hydrology, water resource systems
Neil Parrett, performance and safety of dams
Norman E. Stauffer, Jr., engineering hydrology and computer modeling
Daniel A. Stone, environmental chemistry

Associate Professors
Joseph A. Caliendo, geotechnical engineering
Marvin W. Halling, structural dynamics, earthquake engineering
Sonia S. Manuel-Dupont, technical writing
Randal S. Martin, environmental engineering (air pollution)
Michael J. McFarland, environmental engineering
Gilberto E. Urroz-Aguire, hydraulics, hydraulic structures

Research Associate Professors
Joan E. McLean, fate and behavior of metals in subsurfaces
Judith L. Sims, fate and behavior of organic chemicals

Adjunct Associate Professors
Danny Marks, snow hydrology
Eva C. Nieminski, water quality
Mufeed M. Odeh, physical and mathematical modeling of hydraulic systems
Anthony Turhollow, transportation

Associate Professor Emeritus
J. Derle Thorpe, engineering materials, measurements

Assistant Professors
Paul J. Barr, reinforced concrete, bridge design
Luis Bastidas, hydrology
James A. Bay, geotechnical engineering
Anthony Chen, network analysis and logistics, transportation planning
Henry X. Liu, traffic modeling and simulation, artificial intelligence, telematics
Laurie S. McNeill, environmental engineering (drinking water)
Blake P. Tullis, hydraulics, hydraulics structures, and hydromachinery

Research Assistant Professors
Daniel P. Ames, watershed decision support systems
Sanjay Chauhan, dam safety, risk assessment, hydrologic modeling
Michael C. Johnson, hydraulics
Robert T. Pack, geomatics and engineering geology

Adjunct Assistant Professors
Steve Barfuss, hydraulics
Arnfinn J. Emdal, geotechnical
Charles H. Luce, forest hydrology

Affiliate Faculty
Robert W. Hill, professor, Biological and Irrigation Engineering
John E. Keith, professor, Economics
Jack Keller, professor emeritus, Biological and Irrigation Engineering
Wynn R. Walker, professor, Biological and Irrigation Engineering

Course Descriptions

Civil and Environmental Engineering (CEE), pages 358-365