Civil and Environmental Engineering

Civil engineering is a profession that deals with the infrastructure of society. Civil engineers design bridges, buildings, and other structures; develop and design water resources, waste treatment, and environmental management facilities; plan and design highway and transportation systems; and design foundations, earth and rock structures, and tunnels. Students completing a civil engineering program have an opportunity for professional employment with industry; utilities; consulting firms; contractors; local, state, and federal government agencies; research laboratories; and academia.

Mission Statement

The mission of the UWM undergraduate Civil Engineering Program is to educate students to become civil engineering professionals who plan, design, build, and manage the infrastructure needed for a modern urban society and the environment.

Programs

• Civil Engineering, BSE (http://catalog.uwm.edu/engineering-applied-science/civil-environmental-engineering/civil-engineering-bse)
• Structural Engineering, Minor (http://catalog.uwm.edu/engineering-applied-science/civil-environmental-engineering/structural-engineering-minor)

Civil and Environmental Engineering Courses

CIV ENG 150 Builders for Civilization and Environment
3 cr. Undergraduate.
Explores the role of civil engineering in society through the use of case studies, including water and society, bridges, building and transportation.
Prerequisites: none.
General Education Requirements: NS
Last Taught: Fall 2008, Fall 2007, Fall 2006, Fall 2005.
Current Offerings: http://uwm.edu/schedule

CIV ENG 201 Statics
3 cr. Undergraduate.
Principles of mechanics force systems, equilibrium structures, distributed forces, centroids and friction.
Prerequisites: Math 232(P).
Current Offerings: http://uwm.edu/schedule

CIV ENG 202 Dynamics
3 cr. Undergraduate.
Kinematics and kinetics of particles and rigid bodies with applications of Newton’s second law and the principles of work-energy and impulse momentum.
Prerequisites: Civ Eng 201(P), Math 233(C).
Current Offerings: http://uwm.edu/schedule

CIV ENG 250 Engineering Surveying
3 cr. Undergraduate.
Horizontal and vertical distance measurement, angles and direction, traverses, errors, control and construction surveys, coordinate systems, land records, and coordinate geometry. Office and field practice.
Prerequisites: soph st, Math 232(P).
Last Taught: Spring 2018, Fall 2017, Spring 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule

CIV ENG 280 Computer Based Engineering Analysis
3 cr. Undergraduate.
Computer based methods for analysis of data and relationships in engineering practice. Data reliability, experimental design, statistical significance, database systems, curve fitting, interpretation of relationships.
Prerequisites: CompSci 132(P) or one sem H.S. programming; & Math 231(P) or 226(P).
Last Taught: Spring 2018, Fall 2017, Spring 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule

CIV ENG 303 Strength of Materials
4 cr. Undergraduate.
Stress and strain, torsion, bending of beams, shearing stress in beams, combined stresses, principal stresses, deflections of beams, statically indeterminate members and columns. Lec & lab.
Prerequisites: Civ Eng 201(P) & Math 233(C).
Current Offerings: http://uwm.edu/schedule

CIV ENG 311 Introduction to Energy, Environment and Sustainability
3 cr. Undergraduate.
Energy system and resources, environmental system and resources, global climate change, life cycle assessment, green chemistry and materials, sustainable technologies.
Prerequisites: jr st.
Last Taught: Fall 2017.
Current Offerings: http://uwm.edu/schedule

CIV ENG 335 Soil Mechanics
3 cr. Undergraduate.
Fundamentals of soil mechanics; soil classification; seepage analysis; principle of effective stress; stress distribution; 1-D consolidation theory; shear strength; laboratory experience.
Prerequisites: jr & admis to an Eng major or grad st; Civ Eng 303(P).
Last Taught: Spring 2018, Fall 2017, Spring 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule

CIV ENG 360 Introduction to Structural Analysis
3 cr. Undergraduate.
Elementary structural analysis techniques; beams, trusses, statically determinate frames, influence lines; analysis of indeterminate structures by superposition and computer analysis.
Prerequisites: Civ Eng 303(P).
Last Taught: Fall 2017, Summer 2017, Fall 2016, Summer 2016.
Current Offerings: http://uwm.edu/schedule
**CIV ENG 372 Introduction to Structural Design**  
4 cr. Undergraduate.  
Intro to design of reinforced concrete, steel, and wood structures; material properties; codes; design for flexure, shear and axial loads; connections.  
**Prerequisites:** jr st; Civ Eng 303(P).  
**Last Taught:** Spring 2018, Fall 2017, Spring 2017, Fall 2016.  
**Current Offerings:** http://uwm.edu/schedule

**CIV ENG 401 Intermediate Strength of Materials**  
3 cr. Undergraduate/Graduate.  
Area moment, conjugate beam, deflection due to shear, bending of unsymmetrical beams, curved beams, shear flow, shear center, stresses in open sections, theories of failure, plastic stress-strain relations, plastic deformation, limit analysis, energy methods, laboratory investigation.  
**Prerequisites:** jr st, Civ Eng 303(P).  
**Last Taught:** Fall 2001, Fall 2000, Fall 1999, Fall 1998.  
**Current Offerings:** http://uwm.edu/schedule

**CIV ENG 411 Engineering Principles of Water Resources Design**  
3 cr. Undergraduate/Graduate.  
Principles of hydraulics; steady and non-steady flow in closed conduits and open channels; hydraulic design of structures, surge tanks; hydraulic model studies.  
**Prerequisites:** jr st & admis to an Eng major or grad st; MechEng 320(P).  
**Last Taught:** Spring 2018, Fall 2017, Spring 2017, Fall 2016.  
**Current Offerings:** http://uwm.edu/schedule

**CIV ENG 412 Applied Hydrology**  
3 cr. Undergraduate/Graduate.  
Applied hydrology with emphasis on analysis of rainfall, runoff and streamflow processes, hydrologic forecasting and simulation, urban hydrology, hydrologic design and modelling.  
**Prerequisites:** jr st; Math 233(P) & MechEng 320(P).  
**Last Taught:** Spring 2018, Spring 2017, Spring 2016, Spring 2015.  
**Current Offerings:** http://uwm.edu/schedule

**CIV ENG 413 Environmental Engineering**  
3 cr. Undergraduate/Graduate.  
Water pollution and control; hazardous substances and risk assessment; water and wastewater treatment systems; air-pollution and emission control; solid wastes; design of treatment facilities.  
**Prerequisites:** jr st & admis to an Eng major or grad st; MechEng 320(P).  
**Last Taught:** Spring 2018, Fall 2017, Spring 2017, Fall 2016.  
**Current Offerings:** http://uwm.edu/schedule

**CIV ENG 431 Materials of Construction**  
3 cr. Undergraduate/Graduate.  
Investigation covering engineering properties of metals, timber, concrete, masonry, plain and reinforced plastics, glues; thermal effects.  
**Prerequisites:** jr st; Civ Eng 303(P).  
**Last Taught:** Fall 2017, Fall 2016, Fall 2015, Spring 2015.  
**Current Offerings:** http://uwm.edu/schedule

**CIV ENG 456 Foundation Engineering**  
3 cr. Undergraduate/Graduate.  
Site investigation; foundation bearing capacity and settlement; design of spread and combined footings; lateral earth pressures; retaining wall design; slope stability analysis; pile foundations.  
**Prerequisites:** jr st; Civ Eng 335(P).  
**Last Taught:** Fall 2017, Fall 2016, Spring 2015, Fall 2014.  
**Current Offerings:** http://uwm.edu/schedule

**CIV ENG 463 Introduction to Finite Elements**  
3 cr. Undergraduate/Graduate.  
**Prerequisites:** jr st; ElecEng 234(P), Civ Eng 303(P), MechEng 320(C), 311(C) or 321(C).  
**Course Rules:** Not open to students with cr in MechEng 463, which is identical to Civ Eng 463.  
**Last Taught:** Spring 2018, Spring 2017, Spring 2016, Spring 2015.  
**Current Offerings:** http://uwm.edu/schedule

**CIV ENG 466 Mechanics of Composite Materials**  
3 cr. Undergraduate/Graduate.  
Basic concepts, materials, and characteristics of composites. Micromechanics and Macromechanics of Elastic Response. Failure, design and optimization of composite structures.  
**Prerequisites:** jr st & Civ Eng 303(P)  
**Course Rules:** Civ Eng 466 & MechEng 466 are jointly offered; they count as repeats of one another.  
**Last Taught:** Spring 2018, Fall 2015, Spring 2014, Spring 2013.  
**Current Offerings:** http://uwm.edu/schedule

**CIV ENG 469 Introduction to Biomechanical Engineering**  
3 cr. Undergraduate/Graduate.  
Mathematical modeling of human body; dynamics of human motion; neuromuscular control human movement; stress analysis of bones and joints; concurrent mechanical problems in medicine.  
**Prerequisites:** Civ Eng 202(P) & 303 (P); or cons instr.  
**Course Rules:** MechEng 469 & Civ Eng 469 are jointly offered and count as repeats of one another.  
**Last Taught:** Fall 2012.  
**Current Offerings:** http://uwm.edu/schedule

**CIV ENG 480 Software Applications for Civil Engineering**  
3 cr. Undergraduate.  
General knowledge and techniques in using computer software in civil engineering design. Software packages include Autodesk Civil 3D and Revit Structure.  
**Prerequisites:** jr st, Civ Eng 303.  
**Current Offerings:** http://uwm.edu/schedule

**CIV ENG 490 Transportation Engineering**  
3 cr. Undergraduate/Graduate.  
Technological and common elements of all modes of transportation; their effect on performance, demand, and outputs of a transportation system. Development of new transportation systems.  
**Prerequisites:** jr st & admis to an Eng major; Civ Eng 280(P), or grad st.  
**Last Taught:** Spring 2018, Fall 2017, Spring 2017, Fall 2016.  
**Current Offerings:** http://uwm.edu/schedule

**CIV ENG 492 Environmental Impact Assessment**  
3 cr. Undergraduate/Graduate.  
Study and evaluation of the impacts of large scale projects on the quality of the environment with emphasis on the assessment of physical and community impacts. Impact statement preparation.  
**Prerequisites:** sr st.  
**Last Taught:** Spring 2018, Spring 2016, Spring 2015, Spring 2014.  
**Current Offerings:** http://uwm.edu/schedule
CIV ENG 494 Principles of Civil Engineering Design
1 cr. Undergraduate.
Project identification and planning for senior design project; proposals, project management and team procedures. Technical communications. Professional engineering responsibilities. Intended for first semester seniors.
Prerequisites: sr st in Civ Eng; Civ Eng 335(C), 372(C), 411(C), 413(C), & 490(C).
Last Taught: Spring 2018, Fall 2017, Spring 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule

CIV ENG 495 Senior Design
3 cr. Undergraduate.
Team design project involving application of fundamental civil engineering concepts. Discussion of specifications, contracts and implementation. Written and oral presentations. Intended for second semester seniors.
Prerequisites: Civ Eng 335(P), 372(P), 411(P), 413(P), 490(P), 494(P) or cons instr.
Last Taught: Spring 2018, Fall 2017, Spring 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule

CIV ENG 499 Ad Hoc:
1-12 cr. Undergraduate.
Course created expressly for offering in a specified enrollment period. Requires only dept & assoc dean approval. In exceptional circumstances, can be offered in one add'l sem.
Prerequisites: none; add'l prereqs may be assigned to specific topic.
Course Rules: May be retaken w/chg in topic.
Current Offerings: http://uwm.edu/schedule

CIV ENG 502 Experimental Stress Analysis
3 cr. Undergraduate/Graduate.
Basic stress strain relations; demonstration of experimental methods of determining stresses and strains; use of mechanical strain, electric strain, and strain gages, optical photoelastic equipment, brittle lacquers, models.
Prerequisites: jr st & Civ Eng 303(P).
Current Offerings: http://uwm.edu/schedule

CIV ENG 511 Water Supply and Sewerage
3 cr. Undergraduate/Graduate.
Resources of water supply quality and quantity requirements. Principles of hydraulic design of water supply and sewerage systems; pumping stations. Principles of sewage disposal. Problems of management involving hydrological, engineering, institutional, legal and economic aspects. Design project.
Prerequisites: jr st; Civ Eng 411(P).
Last Taught: Fall 2017, Fall 2016, Fall 2015, Fall 2014.
Current Offerings: http://uwm.edu/schedule

CIV ENG 521 Water Quality Assessment
3 cr. Undergraduate/Graduate.
Laboratory techniques for detecting and measuring physical, chemical and biological characteristics of water and wastewater. Water quality requirements. Design of sampling programs.
Prerequisites: sr st; Civ Eng 411(P).
Last Taught: Fall 2017, Fall 2016, Fall 2015, Fall 2014.
Current Offerings: http://uwm.edu/schedule

CIV ENG 527 Design of Masonry Structures
3 cr. Undergraduate/Graduate.
Topics in design of masonry structures; materials, loads, design codes, reinforced & unreinforced axial & flexural members, composite & cavity walls, shear walls, seismic requirements.
Prerequisites: jr st; Civ Eng 360(C), 372(P).
Last Taught: Fall 2016, Fall 2014, Fall 2010, Fall 2005.
Current Offerings: http://uwm.edu/schedule

CIV ENG 531 Water Supply and Sewerage
3 cr. Undergraduate/Graduate.
Resources of water supply quality and quantity requirements. Principles of hydraulic design of water supply and sewerage systems; pumping stations. Principles of sewage disposal. Problems of management involving hydrological, engineering, institutional, legal and economic aspects. Design project.
Prerequisites: jr st; Civ Eng 411(P).
Last Taught: Fall 2017, Fall 2016, Fall 2015, Fall 2014.
Current Offerings: http://uwm.edu/schedule

CIV ENG 555 Sustainable Construction Materials and Technologies
3 cr. Undergraduate/Graduate.
Sustainable construction materials and methodologies related to commercial construction, LEED/Green certifications, material selection.
Prerequisites: jr st.
Last Taught: Spring 2017.
Current Offerings: http://uwm.edu/schedule

CIV ENG 560 Intermediate Structural Analysis
3 cr. Undergraduate/Graduate.
Topics in traditional analysis methods; indeterminate structures, load & load paths, moment distribution, approximate methods, elementary plate analysis.
Prerequisites: jr st; Civ Eng 360(P), 372(P).
Current Offerings: http://uwm.edu/schedule

CIV ENG 564 Earthquake Engineering
3 cr. Undergraduate/Graduate.
Earthquake mechanics and effects, structural dynamics, seismic hazard analysis, design guidelines, design of steel and concrete buildings for earthquake loads.
Prerequisites: jr st; Civ Eng 571(P) or 572(P); or cons instr; or grad st.
Course Rules: Counts as repeat of Civ Eng 891 w/same subtitle.
Current Offerings: http://uwm.edu/schedule

CIV ENG 571 Design of Concrete Structures
3 cr. Undergraduate/Graduate.
Topics in reinforced concrete design; indeterminate reinforced concrete beams and frames; length effect in columns; torsion; two way floor systems; yield line theory.
Prerequisites: jr st; Civ Eng 360(P), 372(P).
Last Taught: Fall 2017, Fall 2016, Fall 2015, Fall 2014.
Current Offerings: http://uwm.edu/schedule

CIV ENG 572 Design of Steel Structures
3 cr. Undergraduate/Graduate.
Topics in design of steel structures; tension, compression, and beam members; combined axial and bending; connections; frames; serviceability.
Prerequisites: jr st; Civ Eng 360(C), 372(P).
Current Offerings: http://uwm.edu/schedule

CIV ENG 573 Design of Masonry Structures
3 cr. Undergraduate/Graduate.
Topics in design of masonry structures; materials, loads, design codes, reinforced & unreinforced axial & flexural members, composite & cavity walls, shear walls, seismic requirements.
Prerequisites: jr st; Civ Eng 360(C), 372(P).
Last Taught: Fall 2016, Fall 2014, Fall 2010, Fall 2005.
Current Offerings: http://uwm.edu/schedule

CIV ENG 574 Design of Prestressed Concrete Structures
3 cr. Undergraduate/Graduate.
Design of prestressed concrete structures; methods of prestressing; loss of prestress; design for flexure, shear, torsion; camber and deflections; continuity; connections; fire rating; circular prestressing.
Prerequisites: jr st; Civ Eng 360(C), 372(P).
Current Offerings: http://uwm.edu/schedule

CIV ENG 579 Earthquake Engineering
3 cr. Undergraduate/Graduate.
Earthquake mechanics and effects, structural dynamics, seismic hazard analysis, design guidelines, design of steel and concrete buildings for earthquake loads.
Prerequisites: sr st; Civ Eng 571(P) or 572(P); or cons instr; or grad st.
Course Rules: Counts as repeat of Civ Eng 891 w/same subtitle.
Current Offerings: http://uwm.edu/schedule
CIV ENG 580 Engineering Analysis in Applied Mechanics
3 cr. Undergraduate/Graduate.
Engineering analysis of initial and boundary value problems in applied mechanics. Application of various methods to investigate a variety of engineering situations.
Prerequisites: jr st; ElecEng 234(P).
Course Rules: Not open to students with cr in MechEng 580, which is identical to Civ Eng 580.
Last Taught: Fall 1998, Fall 1996, Fall 1993.
Current Offerings: http://uwm.edu/schedule

CIV ENG 590 Urban Transportation Planning
3 cr. Undergraduate/Graduate.
Techniques used to plan urban transportation systems; data collection, trip generation, trip distribution, factors underlying the choice of mode, traffic assignment, modeling and evaluation techniques.
Prerequisites: sr st.
Last Taught: Fall 2017, Fall 2016, Fall 2015, Fall 2013.
Current Offerings: http://uwm.edu/schedule

CIV ENG 592 Traffic Control
3 cr. Undergraduate/Graduate.
Control of transportation systems with emphasis on traffic engineering principles. Data collection, capacity analysis, traffic improvements, signalization, signs and markings, channelization, intersection, speeds and safety considerations.
Prerequisites: sr st.
Current Offerings: http://uwm.edu/schedule

CIV ENG 594 Physical Planning and Municipal Engineering
3 cr. Undergraduate/Graduate.
Organization and structure of local government, zoning and planning, subdivision layout, street design, transit service, urban drainage, storm and sanitary sewer, water supply and other public works activities.
Prerequisites: sr st.
Current Offerings: http://uwm.edu/schedule

CIV ENG 596 Transportation Facilities Design
3 cr. Undergraduate/Graduate.
Physical design of transportation facilities including geometric design and terminals for highway, rail, air and water transportation. Student project work will be required.
Prerequisites: jr st; Civ Eng 490(P).
Last Taught: Fall 2017, Fall 2016, Fall 2015, Fall 2014.
Current Offerings: http://uwm.edu/schedule

CIV ENG 598 Pavement Analysis and Design
3 cr. Undergraduate/Graduate.
Pavement types, design factors, traffic loading and volume, materials characterization, drainage design, flexible and rigid pavements design, stresses and deflections, overlay design, pavement rehabilitation.
Prerequisites: jr st & Civ Eng 335(P); or grad st.
Current Offerings: http://uwm.edu/schedule

CIV ENG 610 Introduction to Water and Sewage Treatment
3 cr. Undergraduate/Graduate.
Characteristics of water and sewage. Principles of physical, chemical and biological processes for water and sewage treatment. Design project.
Prerequisites: sr st; Civ Eng 413(P).
Current Offerings: http://uwm.edu/schedule

CIV ENG 614 Hazardous Waste Management
3 cr. Undergraduate/Graduate.
Hazardous waste; regulatory process; fate and transport of contaminants; treatment and disposal methods; site remediation; quantitative risk assessment; design project.
Prerequisites: jr st; Civ Eng 413(P).
Last Taught: Fall 2017, Fall 2016, Fall 2014, Spring 2013.
Current Offerings: http://uwm.edu/schedule

CIV ENG 616 Computational Hydraulics and Environmental Flows
3 cr. Undergraduate/Graduate.
Numerical analysis applied to fluid flows and transport phenomena. Applications in environmental flows, water quality models, transport of pollutant, long wave propagation, etc.
Prerequisites: jr sr, Civ Eng 411(P).
Course Rules: Counts as repeat of Civ Eng 691 w/same topic.
Last Taught: Spring 2018, Fall 2015, Fall 2011.
Current Offerings: http://uwm.edu/schedule

CIV ENG 691 Topics in Civil Engineering:
1-3 cr. Undergraduate/Graduate.
Topics vary. Study of topics in theory and practice of civil engineering. Specific topics and any additional prerequisites will be announced in Schedule of Classes each time the course is offered.
Prerequisites: jr st.
Course Rules: May be retaken to a max of 6 cr.
Current Offerings: http://uwm.edu/schedule

CIV ENG 699 Independent Study
1-3 cr. Undergraduate/Graduate.
Prerequisites: jr st; cons instr.
Course Rules: May be retaken to max of 6 cr toward the undergraduate degree.
Last Taught: Spring 2018, Fall 2017, Fall 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule

CIV ENG 700 CEAS Graduate Seminar
1-3 cr. Graduate.
Seminar in professional ethics, oral and written communication, contemporary social issues, career development, time management, and laboratory safety.
Prerequisites: grad st
Course Rules: Civ Eng 700, CompSci 700, ElecEng 700, Ind Eng 700, MatlEng 700 & MechEng 700 are jointly offered and count as repeats of one another.
Last Taught: Spring 2018, Fall 2017, Spring 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule
CIV ENG 701 Advanced Strength of Materials
3 cr. Graduate.
Beams of elastic foundations; advanced energy methods; thick walled cylinders; torsion of non-circular sections; approximate methods for stresses in plates, stress concentrations, contact stresses, interaction curves, elastic and inelastic buckling, introduction to elasticity. Some laboratory, matrix, and tensor applications.
Prerequisites: grad st; Civ Eng 303(P) & 401(C) or cons instr.
Last Taught: Spring 2018, Fall 2016, Fall 2014, Fall 2013.
Current Offerings: http://uwm.edu/schedule

CIV ENG 702 Elastic Stability
3 cr. Graduate.
Sending of bars under simultaneous action of axial and lateral loads; buckling of compressed bars, rings, and tubes; lateral buckling of beams; torsion of i-beams; buckling of thin plates.
Prerequisites: grad st. Civ Eng 401(P) ElecEng 234(P).
Current Offerings: http://uwm.edu/schedule

CIV ENG 708 Fate and Transport of Micro and Nano Particles in the Environment
3 cr. Graduate.
Fundamentals governing fate and transport of micro and nano particles, e.g. inorganic particles, bacteria, viruses and protozoan in aquatic environment and porous media including soil, sand and filtration system.
Prerequisites: grad st; Civ Eng 411(P) or 413(P) or cons instr
Last Taught: Spring 2015.
Current Offerings: http://uwm.edu/schedule

CIV ENG 710 Industrial Waste Treatment
3 cr. Graduate.
Prerequisites: grad st; Civ Eng 521(P) & 610(P) or cons instr.
Current Offerings: http://uwm.edu/schedule

CIV ENG 714 Unit Operations in Environmental Engineering
3 cr. Graduate.
Unit operations of physicochemical and biological aspects employed in water and wastewater treatments. In-situ treatment of contaminated groundwater. Theory and development of design criteria.
Prerequisites: grad st; Civ Eng 610(P); cons instr.
Current Offerings: http://uwm.edu/schedule

CIV ENG 716 Sediment Transport
3 cr. Graduate.
Physical properties of sediment; incipient motion, bed forms, suspended load, bed load, total load, natural river processes.
Prerequisites: grad st; Civ Eng 411(P).
Current Offerings: http://uwm.edu/schedule

CIV ENG 717 Open Channel Flow
3 cr. Graduate.
Basic equations of continuity, mechanical energy and momentum; uniform, gradually varied, and spatially varied flows; hydraulic structures; governing equations of unsteady flow and numerical solutions.
Prerequisites: grad st; Civ Eng 411(P) or equiv.
Last Taught: Fall 2016, Spring 2010, Fall 2007, Fall 2005.
Current Offerings: http://uwm.edu/schedule

CIV ENG 718 Biological Processes for Water and Wastewater Treatment
3 cr. Graduate.
Biological and engineering principles related to trickling filters, activated sludge plants, lagoons, rotating biological contactors, aerobic and anaerobic digesters, nutrient removal and bioremediation.
Prerequisites: grad st; Civ Eng 413(R) or 610(R)
Last Taught: Spring 2017, Fall 2011.
Current Offerings: http://uwm.edu/schedule

CIV ENG 719 Pollutant Dispersion Process
3 cr. Graduate.
Classical diffusion theories; longitudinal dispersion, vertical and transverse mixing in free-surface turbulent flow, application to natural channels.
Prerequisites: grad st; Civ Eng 411(P).
Last Taught: Spring 2017, Fall 2014, Fall 2010.
Current Offerings: http://uwm.edu/schedule

CIV ENG 721 Advanced Water Analysis
3 cr. Graduate.
Advanced analytical methods for evaluating sources, distribution patterns, concentrations, and biological effects of pollutants in natural waters. Tracers, nuclear techniques, organics, metals, bioassays. Lecture and laboratory.
Prerequisites: grad st; Civ Eng 521(P) or cons instr.
Current Offerings: http://uwm.edu/schedule

CIV ENG 725 Finite Element Methods in Engineering
3 cr. Graduate.
Prerequisites: grad st.
Current Offerings: http://uwm.edu/schedule
CIV ENG 726 Mechanical Vibrations
3 cr. Graduate.
Free and forced vibrations of multiple degree of freedom systems using
modern matrix methods.
Prerequisites: grad st; MechEng 475 or equiv.
Course Rules: Not open to students who have cr in MechEng 726, which
is identical to Civ Eng 726.
Current Offerings: http://uwm.edu/schedule

CIV ENG 731 Properties of Concrete
3 cr. Graduate.
Advanced course in portland cement concrete; proportioning methods,
theories of hardening and setting, properties, prefabricated concrete,
precast concrete, construction methods, light-weight aggregates and
concrete, causes of disintegration, protective treatments, specifications,
cost estimates.
Prerequisites: grad st; cons instr.
Last Taught: Fall 2017, Fall 2015, Spring 2014, Fall 2011.
Current Offerings: http://uwm.edu/schedule

CIV ENG 732 Fatigue in Engineering Materials
3 cr. Graduate.
Influence of repeated stress in engineering design, fatigue testing
machines, and procedures, factors influencing fatigue properties, theories
of fatigue failure.
Prerequisites: Civ Eng 401(P) or cons instr.
Last Taught: Spring 2015, Fall 2012, Fall 2010, Fall 2008.
Current Offerings: http://uwm.edu/schedule

CIV ENG 735 Advanced Soil Mechanics
3 cr. Graduate.
Advanced treatment and application of theories and principles of
soil mechanics; permeability and seepage; elastic theories of stress
distribution; consolidation theories; shearing strength and failure criteria;
plastic equilibrium.
Prerequisites: grad st; Civ Eng 456(P).
Last Taught: Fall 2016, Fall 2014, Fall 2011, Spring 2006.
Current Offerings: http://uwm.edu/schedule

CIV ENG 756 Advanced Foundation Engineering
3 cr. Graduate.
Critical study of actual engineering projects; introduction to existing
design procedures and the basis for foundation recommendations.
Prerequisites: grad st; Civ Eng 456(P).
Current Offerings: http://uwm.edu/schedule

CIV ENG 761 Advanced Structural Analysis
3 cr. Graduate.
Analysis of structures utilizing matrix stiffness techniques; material and
geometric nonlinearities, volume changes, extreme loadings.
Prerequisites: grad st; Civ Eng 360(P); Civ Eng 463(P).
Current Offerings: http://uwm.edu/schedule

CIV ENG 771 Advanced Concrete Design
3 cr. Graduate.
Advanced topics in design of concrete structures; structural systems &
bracing, two-way slab, walls, construction phase assessment, joints &
ductility, design for fire, seismic design.
Prerequisites: grad st; Civ Eng 571(P).
Current Offerings: http://uwm.edu/schedule

CIV ENG 772 Advanced Steel Design
3 cr. Graduate.
Advanced topics in design of steel structures; plate girders, moment
resisting frames, stability & bracing, connections, torsion, seismic design,
fatigue & fracture. Prereq: grad st; Civ Eng 572(P).
Prerequisites:
Last Taught: Fall 2017, Fall 2015, Fall 2013, Fall 2011.
Current Offerings: http://uwm.edu/schedule

CIV ENG 773 Advanced Dynamics
3 cr. Graduate.
General theory of dynamic behavior from the viewpoint of Lagrangian and
Hamiltonian mechanics. Application of energy principles to dynamical
analysis of mechanical systems.
Prerequisites: grad st; MechEng 580(P) or Civ Eng 580(P); or cons instr.
Course Rules: Not open to students who have cr in MechEng 773, which
is identical.
Current Offerings: http://uwm.edu/schedule

CIV ENG 774 Shock and Vibration Analysis
3 cr. Graduate.
Dynamic response of mechanical systems to complex shock and
vibration conditions; application of the eigenvalue and transform
methods of analysis to the solution of engineering problems.
Prerequisites: grad st; MechEng 475(P) & 580(P).
Course Rules: Not open to students who have cr in MechEng 774, which
is identical to Civ Eng 774.
Current Offerings: http://uwm.edu/schedule

CIV ENG 775 Analysis and Design of Bridges
3 cr. Graduate.
Bridge types; loads and AASHTO specifications; analysis and design of
superstructures; substructure design; computer applications.
Prerequisites: grad st; Civ Eng 463(P); 571(P); 572(P) or cons instr.
Current Offerings: http://uwm.edu/schedule

CIV ENG 777 Design of Multistory Buildings
3 cr. Graduate.
Topics in design of multistory building systems; planning &
environmental criteria, loading, analysis, design, construction, lateral
systems, foundation, cladding, building service & management.
Prerequisites: grad st; Civ Eng 463(P); 571(P); 572(P).
Last Taught: Fall 2016, Fall 2014, Fall 2012, Fall 2010.
Current Offerings: http://uwm.edu/schedule

CIV ENG 785 Dynamics of Structures
3 cr. Graduate.
Analysis and design of structures subjected to dynamic loads; effects of
damping and inelastic action; multi-degree of freedom and continuous
systems; numerical techniques; seismic design.
Prerequisites: grad st; Civ Eng 463(P) or cons instr.
Current Offerings: http://uwm.edu/schedule
CIV ENG 790 Transportation Systems Design
3 cr. Graduate.
Principles of systems analysis as they relate to the planning, design and operation of transportation systems. Model building, evaluation, systems management.
Prerequisites: grad st; Civ Eng 590(P).
Last Taught: Fall 2013, Fall 2011, Spring 2006, Fall 2003.
Current Offerings: http://uwm.edu/schedule

CIV ENG 792 Methods of Transportation Analysis
3 cr. Graduate.
Mathematical tools useful in analysis of transportation systems. Process of modeling and simulation, matrix techniques, network analysis, statistical analysis, etc. As related to transportation. Use of standard packaged computer programs. Class project may be utilized to develop these skills.
Prerequisites: grad st; CompSci 151(P) or equiv. Civ Eng 590(P).
Last Taught: Fall 2017, Fall 2016, Fall 2014, Spring 2009.
Current Offerings: http://uwm.edu/schedule

CIV ENG 794 Traffic Planning and Operations
3 cr. Graduate.
Planning and design of traffic systems, delay and capacity of signalized intersections, freeway controls, traffic system management and optimization, queues, traffic assignment and simulation.
Prerequisites: grad st; Civ Eng 592(C).
Current Offerings: http://uwm.edu/schedule

CIV ENG 801 Applied Elasticity
3 cr. Graduate.
Equations of elasticity in two and three dimensions; two dimensional problems in rectangular polar and curvilinear coordinates; torsion of noncircular shafts; bending of prismatic bars.
Prerequisites: grad st; Civ Eng 401(P) or cons instr.
Current Offerings: http://uwm.edu/schedule

CIV ENG 804 Theory of Plasticity
3 cr. Graduate.
Yield conditions, stress strain relations; plastic potential, hardening theories, torsion, bending, thick walled spherical and cylindrical shells under internal pressure; plane strain of perfectly plastic material.
Prerequisites: Civ Eng 805(P).
Current Offerings: http://uwm.edu/schedule

CIV ENG 880 Bioengineering Seminar
1 cr. Graduate.
Presentations by bioengineering affiliated faculty, invited speakers, and graduate students.
Prerequisites: grad st
Course Rules: MechEng 880, ElecEng 880, CompSci 880, MatlEng 880, IndEng 880 & Civ Eng 880 are jointly offered and count as repeats of one another. May be repeated to 3 cr. max.
Last Taught: Spring 2018, Fall 2015, Spring 2015, Fall 2014.
Current Offerings: http://uwm.edu/schedule

CIV ENG 888 Candidate for Degree
0 cr. Graduate.
Available for graduate students who must meet minimum credit load requirements.
Prerequisites: grad st.
Course Rules: Fee for 1 cr assessed.
Last Taught: Fall 2016, Fall 2015, Summer 2015, Spring 2015.
Current Offerings: http://uwm.edu/schedule

CIV ENG 891 Advanced Topics in Civil Engineering:
1-3 cr. Graduate.
Topics vary. Study of advanced topics of theory and practice of structural engineering. Specific topic and any additional prerequisites will be announced in the schedule of classes each time the course is offered.
Prerequisites: grad st.
Course Rules: Retakeable with change in topic to max of 9 cr.
Current Offerings: http://uwm.edu/schedule

CIV ENG 940 Topics in Transportation:
1-3 cr. Graduate.
Topics vary. Topics and problems of current interest in transportation; readings and review of recent literature and development of a critical analysis or paper. Subject matter may be student initiated. Specific topic and any additional prerequisites will be announced in the schedule of classes each time the course is offered. Retakeable with change in topic to max of 9 cr.
Current Offerings: http://uwm.edu/schedule

CIV ENG 990 Masters Thesis
1-9 cr. Graduate.
Prerequisites: grad st; cons instr.
Current Offerings: http://uwm.edu/schedule

CIV ENG 998 Doctoral Thesis
1-12 cr. Graduate.
Prerequisites: grad st; cons instr & grad prog Comm.
Current Offerings: http://uwm.edu/schedule

CIV ENG 999 Advanced Independent Study
1-3 cr. Graduate.
Prerequisites: grad st; cons instr & grad prog committee.
Current Offerings: http://uwm.edu/schedule
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<tr>
<th>Name</th>
<th>Rank</th>
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<th>School</th>
<th>Graduate Faculty</th>
<th>Emeritus Faculty</th>
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<td>Edward A. Beimborn</td>
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<td>Hector R. Bravo</td>
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