Civil, Construction and Environmental Engineering

Chairperson: Daniel H. Zitomer, PhD, PE, BCEE, FWEF
Department of Civil, Construction and Environmental Engineering website (http://www.marquette.edu/engineering/civil_environmental/)

The department of civil, construction and environmental engineering offers curricula that lead to a bachelor of science degree in civil engineering or a bachelor of science degree in construction engineering. Students that pursue a bachelor of science degree in civil engineering may select from civil engineering or environmental engineering majors. Students who pursue a bachelor of science degree in construction engineering select the construction engineering major.

Civil, construction and environmental engineering is the art and science used in the creation of the infrastructure critical to our everyday life: airports, buildings, bridges, dams, harbors, highways, irrigation systems, transportation systems, wastewater treatment systems, and water supply systems. Civil, construction and environmental engineers are also stewards of the land, its resources and environment. Modern society depends on this contribution from these engineers, whose education is systematically developed from a strong background in mathematics and the physical and engineering sciences. The civil, construction and environmental engineer must relate to society and be aware of how the engineering principles can be applied for the benefit of others through sustainable infrastructure solutions.

Mission

The mission of the department of civil, construction and environmental engineering is to educate students in the Catholic, Jesuit tradition. These students will be competent in their technical fields, appreciate the moral and ethical impact of their professional work and continue their professional development throughout their careers. The students and faculty of the department will advance the state of technical and scientific knowledge through research and provide service to civic and professional communities.

Areas of Study

Civil, construction and environmental engineering is a very broad profession. The breadth of courses offered in the department is well-suited to allow specialization in one of the major divisions of this branch of engineering: Construction Engineering (CNEN); Environmental and Water Resources Engineering (ENWR); Structural Engineering and Structural Mechanics (SESM); and Transportation Engineering and Materials (TEMA). However, it is not necessary to make a commitment to only one area of concentration while in the undergraduate college. The curriculum at Marquette permits students to prepare themselves in civil engineering and construction engineering by completing the courses which provide the necessary fundamentals and the opportunity to select elective courses to acquire additional depth in one or more of the areas of specialization. All of the electives which the department offers are open to students with the required prerequisites. Selection of the courses for a general program requires careful planning between the student and an academic adviser. Students in the civil engineering and construction engineering degree programs are able to complete elective courses in a chosen area or areas of specialization.

Non-Civil or Non-Construction Engineering Majors or Minors

Students in the civil engineering curriculum who are interested in obtaining a major or minor in any other area outside the civil or construction engineering degree programs should consult with the Engineering Academic Advising Center to discuss the requirements of these minors. Careful planning with an academic adviser can minimize the number of additional hours beyond the normal graduation requirements.

Five-Year B.S./M.S. Program

The department offers a five-year combined B.S./M.S. program known as the Accelerated Degree Program (ADP). This program enables students to earn both a bachelor of science degree in either civil engineering or construction engineering and a master of science degree in civil engineering in just five years (or six with completion of a co-op). Students currently enrolled in an undergraduate degree program in the department of civil, construction and environmental engineering at Marquette University (with a GPA of 3.500 or above) may apply for admission to the ADP during their junior year. Students must submit an application to the Marquette University Graduate School, indicate their interest in the ADP, and meet all other admission criteria as stated in the Application Requirements section of the Graduate Bulletin.

In addition to completing their undergraduate degree requirements, students take master's level courses during their senior year. The remaining master's level course work is taken during the student's fifth year. A maximum of 6 credits of course work may be applied to both the undergraduate and graduate degree requirements but these double-counted credits must be courses that carry graduate credit (i.e., courses numbered 5000 or above). Students are strongly encouraged to pursue Plan A (thesis option), in which work on the thesis research should begin during the summer between the junior and senior years. Students continue to gain research experience during the summer between senior and fifth years, continuing throughout the fifth year and culminating in preparation of a written thesis and defense. Accelerated degree programs following Plan B (course work option) may also be designed. See the Graduate Bulletin for further details.

- Civil Engineering, BCE (https://bulletin.marquette.edu/engineering/civil-construction-environmental-engineering/civil-engineering-bs/)
- Civil Engineering, Minor (https://bulletin.marquette.edu/engineering/civil-construction-environmental-engineering/civil-engineering-minor/)
- Construction Engineering, BCN (https://bulletin.marquette.edu/engineering/civil-construction-environmental-engineering/construction-engineering-bs/)

- Environmental Engineering, BCE (https://bulletin.marquette.edu/engineering/civil-construction-environmental-engineering/environtmental-engineering-bs/)
- Environmental Engineering, Minor (https://bulletin.marquette.edu/engineering/civil-construction-environmental-engineering/environmental-engineering-minor/)

Graduate Programs

- Civil Engineering, MS (https://bulletin.marquette.edu/graduate/civil-engineering-ms/)
- Civil Engineering, PHD (https://bulletin.marquette.edu/graduate/civil-engineering-phd/)

Civil & Environmental Engineer Courses

CEEN 1200 Introduction to Infrastructure (3 credits)
Introduction to civil, construction and environmental engineering with emphasis on civilian infrastructure and the built environment. Introduction to the natural environment and environmental infrastructure, structural infrastructure and construction, transportation infrastructure, civil engineering history and heritage and civil infrastructure systems. Discussion of planning and energy, sustainability, environmental, economic, ethics and security considerations in relation to civilian infrastructure. Introduction to analysis and design as they pertain to infrastructure and the built environment.
Prerequisite: Enrollment in the Opus College of Engineering.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%201200)

CEEN 1210 Introduction to Computing, Analysis, Design and Communication (3 credits)
Introduction to computational tools, graphical communication tools and economic analysis principles as they relate to civil, construction and environmental engineering. Introduction to sketching as a means with which to convey and communication of ideas and workflow. Algorithm development and graphical display of engineering ideas and information in commercially available programs and programming environments. Implementation of infrastructure engineering analysis and design concepts and procedures from CEEN 1200 using commercially available programs and programming environments.
Prerequisite: BIEN 1100, CEEN 1200, EECE 1200, or GEEN 1200; enrollment in the Opus College of Engineering.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%201210)

CEEN 2320 Introduction to Civil Infrastructure, Geo-Spatial and Environmental Modeling (3 credits)
Introduction of parametric and geo-spatial modeling and its uses in civil, construction and environmental engineering applications to civilian infrastructure. Activities will focus on Geospatial Information Systems (GIS), civil site modeling, road infrastructure modeling, bridge modeling, watershed modeling/mapping and the use of surveying data in the layout of civil infrastructure. Students learn construction sequencing, infrastructure systems terminology and modeling principles as they relate to civil infrastructure.
Prerequisite: CEEN 1210.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%202320)

CEEN 3160 Geotechnical Engineering (3 credits)
Fundamental properties and engineering characteristics of soil as a particulate mass aggregate are studied. The formation and the development of soil deposits, the physical and hydraulic properties and the methods of predicting the stress-strain behavior of soils for engineering applications are examined. Laboratory experiments are conducted and reports are required. 2 hrs. lec., 1.25 hrs. lab.
Prerequisite: Jr. stndg. and CIEN, ENEN or CNEN major.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%203160)

CEEN 3210 Hydraulic Engineering (3 credits)
Fundamentals and applications of hydrostatics and hydrodynamics including pressurized pipe flow and pipeline network design, open channel flow, and sewer design, pump selection and flow measurement. Laboratory assignments and demonstrations. 2 hrs. lec., 1.25 hrs. lab.
Prerequisite: MEEN 3320 which, may be taken concurrently.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%203210)

CEEN 3320 Civil Engineering Materials (3 credits)
Introduction to the properties and fundamental behavior materials used by civil engineers with emphasis on concrete, asphalt and steel. Lab experiments are used to demonstrate the behavior or materials subjected to various load levels and orientations. Use of spreadsheets and statistical analysis of experimental data are required. 2 hrs. lec; 1.25 hrs. lab.
Prerequisite: Soph. stndg. and CIEN, ENEN or CNEN major.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%203320)

CEEN 3410 Structural Analysis (3 credits)
Determining the loads that act on structures and load combinations. Basic concepts in structural analysis of determinate beams, trusses, and frames. Deflections of determinate beams by moment area and conjugate beam methods. Development of basic virtual work concept to obtain deformations in determinate trusses, beams, and frames. Introduction to the solution of indeterminate structures by using the method of superposition. Influence lines for determinate beams.
Prerequisite: GEEN 2130.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%203410)

CEEN 3430 Structural Steel Design (3 credits)
Introduction to building codes, design standards and design specifications as they relate to the physical behavior and design of steel structures. Design of structural steel members subjected to tensile loading; compression loading (columns); and bending (beams). Design of mechanical fasteners, welds and connecting elements. Analysis and design of members subjected to combined loading (beam-columns). Emphasis on AISC Specifications.
Prerequisite: CEEN 3320 and CEEN 3410.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%203430)

CEEN 3440 Reinforced Concrete Design (3 credits)
Fundamental concepts of reinforced concrete theory and design. Use of current design code for the analysis and design of basic structural members; strength design for flexure, shear and development of reinforcement.
Prerequisite: CEEN 3410 and CEEN 3320.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%203440)

CEEN 3510 Environmental Engineering (3 credits)
Introduction to environmental engineering with a focus on the water environment. Topics include water quality, water resources, water supply, municipal water and wastewater systems, air quality, and solid and hazardous waste management.
Prerequisite: Jr. stndg. and CIEN, ENEN or CNEN major.
Level of Study: Undergraduate
Interdisciplinary Studies: Environmental Studies, Environmental Ethics
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%203510)

CEEN 3610 Transportation Engineering (3 credits)
Airport airside systems based on FAA guidelines. Road user and vehicle characteristics, applications of equations of motion, geometric design of roadways including horizontal and vertical alignment and cross-sectional elements. Also includes traffic calming, signalized intersections, parking lot design and traffic flow models. Emphasis on explaining technical details in writing.
Prerequisite: Jr. stndg. and CIEN, ENEN or CNEN major.
Level of Study: Undergraduate
Marquette Core Curriculum: NSM Basic Needs & Justice
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%203610)

CEEN 4145 Advanced Strength and Applied Stress Analysis (3 credits)
Basic concepts of mechanics of deformable bodies. Two- and three-dimensional stress-strain relationships and theories of failure. Unsymmetrical bending analyses. Shear flow and shear center. Torsion of thin-walled sections (tubular and non-tubular). Composite beams. Stress concentration. Energy principles: strain and complementary energy. Castigliano's theorem.
Prerequisite: GEEN 2130.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2021 Fall Term, 2011 Fall Term, 2009 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204145)

CEEN 4230 Urban Hydrology and Stormwater Management (3 credits)
Distribution and properties of water on the earth. Concept of the hydrologic cycle and basic principles governing water movement in the environment: precipitation, evapotranspiration, infiltration, runoff generation, streamflow and groundwater flow. Engineering methods of design of flood protection, stormwater management and stormwater pollution abatement systems.
Prerequisite: CEEN 3510 or MEEN 3320.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204230)

CEEN 4310 Geographical Information Systems in Engineering and Planning (3 credits)
Fundamentals of GIS, databases, data management, map projections, representations of spatial attributes, GIS analysis and GIS software systems such as ARC Info, ARC View, Grass. GIS use and expanded capabilities are taught. Case studies including environmental, transportation and economic applications are discussed.
Prerequisite: Sr. stndg. and CIEN, ENEN or CEMA major.
Level of Study: Undergraduate
Last four terms offered: 2013 Spring Term, 2012 Spring Term, 2011 Spring Term, 2010 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204310)

CEEN 4340 Urban Planning for Civil Engineers (3 credits)
Concepts and principles underlying urban planning and development. Land use, transportation, utility, community facility planning problems, procedures, and techniques. The master plan and implementation devices such as zoning, subdivision control, official mapping, capital budgeting, and urban renewal.
Prerequisite: Sr. stndg. and CIEN, ENEN or CNEN major.
Level of Study: Undergraduate
Interdisciplinary Studies: Urban Affairs
Last four terms offered: 2023 Fall Term, 2021 Fall Term, 2020 Fall Term, 2019 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204340)

CEEN 4350 Law for Engineers (3 credits)
Basic legal principles and awareness of typical legal questions that arise when engineers and law interact. Topics include: American judicial system, law of contracts, forms of association, construction contracts, professional liabilities of engineers and torts.
Prerequisite: Sr standing and CIEN major or ENEN major; or Jr standing and CNEN major.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204350)

CEEN 4411 Matrix Structural Analysis (3 credits)
Introduction to symbolic and numerical linear algebra computations using commercial software. Modeling axial, bending, and torsion deformations in structural members using polynomials. Application of the principle of virtual work to compute deflections for statically determinate and indeterminate problems. Formulation of the matrix stiffness method via the principle of virtual displacements and the matrix flexibility method via the principle of virtual forces. Application of the matrix stiffness method for solving statically indeterminate structural analysis problems. Use of approximate methods of structural analysis (cantilever and portal methods) for critical evaluation of software-generated solutions. Use of commercial software for structural analysis.
Prerequisite: CEEN 3410.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2020 Fall Term, 2019 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204411)

CEEN 4431 Advanced Structural Steel Design (3 credits)
Continuation of CEEN 3430. Design of plate girders, composite beam and slab systems, composite columns and composite beam-columns, simple connections, moment connections, hollow structural shape (HSS) connections, bracing systems and single and multi-story steel framed building systems. Emphasis on AISC Specifications
Prerequisite: CEEN 3430.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2021 Spring Term, 2020 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204431)

CEEN 4441 Advanced Reinforced Concrete Design (3 credits)
Presents advanced concrete design applications to reinforced concrete statically indeterminate systems, two-way slabs, short and slender columns, footings, and walls. Emphasis on ACI code requirements.
Prerequisite: CEEN 3440.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204441)

CEEN 4443 Prestressed Concrete Design (3 credits)
Introduction to basic principles and procedures for the design and analysis of prestressed concrete members, including calculations of prestress loss, flexural analysis and design, shear, bond and anchorage requirements, member deflections and cable layouts. Emphasis on ACI and PCI code requirements.
Prerequisite: CEEN 3440 or equiv.
Level of Study: Undergraduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204443)

CEEN 4450 Bridge Design (3 credits)
Introduction to bridge engineering and construction including: an abbreviated history of bridge construction; bridge types; bridge nomenclature; lessons from failures; design philosophies; and the construction process. Analysis of single-and multi-span bridge superstructures using classical techniques and commercial software. Design of single-span reinforced concrete slab bridges; reinforced concrete bridge decks; and single-span slab-bridges in prestressed concrete.
Prerequisite: CEEN 3430 and CEEN 3440.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204450)

CEEN 4505 Air Quality Engineering (3 credits)
Applies engineering principles to identify, quantify and mitigate sources of air pollution. Takes a systems approach to quantify sources of air pollution, model fate and transport in the environment, identify public health and welfare aspects, develop monitoring and measuring programs, interpret regulatory framework, and design engineering solutions. Atmospheric physics and chemistry are applied in air dispersion modeling to predict air quality impacts. Air pollution control technologies are evaluated to design practical and economic solutions.
Level of Study: Undergraduate
Last four terms offered: 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204505)

CEEN 4515 Environmental Chemistry (3 credits)
Chemical stoichiometry, equilibrium, and kinetics relating to natural and engineered environmental systems. Basic concepts from organic and inorganic chemistry including oxidation-reduction reactions, acid-base chemistry, the carbonate system, alkalinity and acidity. Equilibrium and kinetic theories of chemical partitioning among gas, liquid and solid phases governing chemical fate and transport in the environment. Coordination chemistry describing metal-ligand interactions, precipitation and bioavailability of materials.
Prerequisite: CEEN 3510 and CHEM 1002.
Level of Study: Undergraduate
Marquette Core Curriculum: NSM Basic Needs & Justice
Interdisciplinary Studies: Environmental Studies
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2021 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204515)

CEEN 4520 Industrial Wastewater Management (3 credits)
Review of federal legislation and state regulations with regard to industrial wastewater management practices. Consideration of industrial process modifications and wastewater treatment options with respect to their effect on industrial user fees. Pretreatment standards and discharge permit requirements. Case studies of specific industrial applications.
Prerequisite: CEEN 3510.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2021 Spring Term, 2019 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204520)

CEEN 4525 Treatment Plant Design and Operation (3 credits)
Review of water and wastewater characteristics, drinking water, receiving water and effluent standards. Basic design methodology and operational features of common physical, chemical and biological processes for the treatment of waters and wastewaters. Introduction to the processing and disposal of sludges and other treatment plant residuals.
Prerequisite: CEEN 3510.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204525)

CEEN 4530 Hazardous and Industrial Waste Management (3 credits)
Overview of hazardous waste management, disposal and soil and ground water remediation. Review of RCRA, CERCLA-SARA, TSCA and Wisconsin's NR 700 and other regulations. Definition of hazardous wastes and characterization of industrial waste stream. Chemical, physical and biological properties of hazardous wastes. Introduction to hazardous waste remediation/treatment methods and technologies. Landfills and the RCRA Land Ban regulations. Site assessments, field investigations and laboratory analytical techniques. Environmental risk assessments, cleanup objectives and waste minimization.
Prerequisite: Sr. stndg.; CIEN or ENEN major.
Level of Study: Undergraduate
Last four terms offered: 2022 Spring Term, 2020 Spring Term, 2018 Spring Term, 2016 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204530)

CEEN 4535 Environmental Engineering Microbiology (3 credits)
Includes microbiological and biochemical properties of microorganisms important in environmental engineering practice. General fundamentals of environmental microbiology and their application to drinking water treatment and distribution, water pollution control and natural systems.
Prerequisite: CEEN 3510.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204535)

CEEN 4550 Water Resources Planning and Management (3 credits)
Planning and management of water resources. Institutional frameworks for water resources engineering. Comprehensive integration of the engineering economic, social and legal aspects of water resources planning and management. Case studies of water use and environmental resources are studied.
Level of Study: Undergraduate
Interdisciplinary Studies: Environmental Studies
Last four terms offered: 2023 Fall Term, 2021 Fall Term, 2019 Fall Term, 2018 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204550)

CEEN 4595 GIS Applications in Water Resources (3 credits)
Use of Geographical Information Systems (GIS) concepts and methods to solve water resources problems. GIS fundamentals such as databases, map projections, spatial analysis and raster analysis. Applications for water resources engineering including terrain analysis, watershed characterization and hydrologic analysis and modeling. Approaches to GIS integration with modeling software and online tools.
Level of Study: Undergraduate
Last four terms offered: 2023 Spring Term, 2022 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204595)

CEEN 4615 Highway Planning and Design (3 credits)
Emphasis on highway planning, alternate highway alignments and alternate evaluation. Geometric design of highways including horizontal and vertical alignment, cross-section design. Projects on detailed design of reverse curves (plan and profile views); intersection design; cross-section and earthwork quantities. Legal aspects of engineering. Use of American Association of State Highway and Transportation Officials design guidelines.
Prerequisite: CEEN 3610.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2022 Spring Term, 2021 Spring Term, 2019 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204615)

CEEN 4640 Traffic Characteristics and Design (3 credits)
Components of the traffic system: vehicle and road user characteristics, geometric design and traffic controls. Intersection types, cross-section design elements and typical dimensions. Basic variables of traffic flow, observed traffic flow values. Freeway operations. Signalized intersections: flow, capacity, level of service. Projects addressing: intersection existing conditions (traffic, geometry, signalization); approach delay; safety performance; capacity; suggestions for improvements. Use of the Highway Capacity Manual and the Highway Capacity Software. Emphasis on technical report-writing and presentation.
Prerequisite: CEEN 3610.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204640)

CEEN 4650 Pavement Design (3 credits)
Study of the behavior and properties of highway pavements with emphasis on hot mix asphalt and jointed Portland cement concrete pavement. Pavement thickness designs are developed using current design methods and incorporating subgrade soil properties, traffic forecasts and pavement performance expectations. Use of spreadsheets and computer programs are required.
Prerequisite: CEEN 3160 and CEEN 3610.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204650)

CEEN 4660 Pavement Management (3 credits)
Study of the performance of pavement systems based on design, traffic and maintenance activities. Methods for evaluating in-service pavements including distress surveys and nondestructive testing are examined. Maintenance strategies are developed and life-cycle cost analysis of these strategies are studied.
Prerequisite: CEEN 3610.
Level of Study: Undergraduate
Last four terms offered: 2023 Spring Term, 2022 Spring Term, 2021 Spring Term, 2017 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204660)

CEEN 4670 Advanced Transportation Materials (3 credits)
Advanced study of materials used for constructing transportation facilities, with particular emphasis on subgrade soils, bound and unbound aggregates, hot mix asphalt and Portland cement concrete. Laboratory tests are conducted and analytical models used for characterizing transportation materials are examined.
Prerequisite: CEEN 3320 and CEEN 3160.
Level of Study: Undergraduate
Last four terms offered: 2016 Spring Term, 2005 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204670)

CEEN 4710 Engineering Fundamentals Review (1 credits)
Review of basic science, mathematics, engineering science and economics. S/U grade assessment.
Prerequisite: Sr. stndg. and CIEN or ENEN major.
Level of Study: Undergraduate
Last four terms offered: 2017 Spring Term, 2016 Fall Term, 2016 Spring Term, 2015 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204710)

CEEN 4715 Sustainable Engineering (3 credits)
Provides a framework for the theory and practice of sustainable engineering. Introduces the importance and role of technological, social and sustainable systems in the modern world, which is increasingly characterized by integrated human/natural/built complex adaptive systems at local, regional and global scales. Develops critical problem solving approaches, including life-cycle assessment, global awareness, consciousness of patterns in technological evolution, and strategies for addressing environmental, economic and social equity issues in engineering design.
Prerequisite: Sr. stndg. in College of Engineering.
Level of Study: Undergraduate
Interdisciplinary Studies: Environmental Studies
Last four terms offered: 2024 Spring Term, 2020 Spring Term, 2019 Spring Term, 2017 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204715)

CEEN 4720 Probabilities Concepts in Engineering (3 credits)
Applications of probability theory, statistics and decision analysis to engineering problems. Emphasis is placed on probabilistic modeling and analysis of engineering problems, and Bayesian statistics.
Prerequisite: Sr. stndg. and Engineering major.
Level of Study: Undergraduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204720)

CEEN 4850 FRP in Civil Engineering Infrastructure (3 credits)
Introduces Fiber Reinforced Polymer (FRP) material properties, FRP reinforced concrete, FRP prestressed concrete, FRP repaired and retrofitted structures and pure FRP structures.
Prerequisite: CEEN 3440.
Level of Study: Undergraduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204850)

CEEN 4931 Topics in Civil Engineering (1-3 credits)
Course content announced each term. Potential topics include: probability concepts in engineering, advanced roadway facility design, engineering economy, highway bridge analysis and design, structural engineering of sports facilities.
Prerequisite: Cons. of instr.
Level of Study: Undergraduate
Last four terms offered: 2023 Spring Term, 2021 Spring Term, 2020 Spring Term, 2019 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204931)

CEEN 4953 Environmental Seminar (0 credits)
Topics related to environmental engineering, including subjects such as air pollution, urban hydrology and stormwater management, wastewater treatment and hazardous waste management. SNC/UNC grade assessment.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Fall Term, 2023 Spring Term, 2022 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204953)

CEEN 4995 Independent Study in Civil and Environmental Engineering (1-3 credits)
Undergraduate independent study project of either a theoretical or experimental nature.
Prerequisite: Jr. stndg., 3.000 GPA, cons. of instr., and cons. of dept. ch.
Level of Study: Undergraduate
Last four terms offered: 2023 Spring Term, 2022 Spring Term, 2019 Spring Term, 2018 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204995)

CEEN 4998 Senior Design Project (4 credits)
Design of selected civil engineering projects including planning, preliminary analysis and final design. Different projects are selected each year. Students are assigned to project teams with specific tasks under the direction of a faculty course coordinator. Professional engineers from local firms propose projects and act as consultants to each design team. Emphasis is placed on student initiative, responsibility and resourcefulness in an open-ended project. A final written design report and oral presentation are required for each design team. Emphasis on technical communications, professional ethics and engineering practices. 1 hr. lec., 3 hrs. disc.
Prerequisite: CEEN 3430 or CEEN 3440; CEEN 3510, CEEN 3610, and CNEN 3810 for CIEN and ENEN majors. CNEN 3810, CNEN 4830 and CNEN 4845 for CNEN majors.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CEEN%204998)

Construction Engineering Courses

CNEN 3810 Introduction to Construction Management (3 credits)
Construction contracts, contract bonds, construction funding, cash flow analysis, labor productivity and cost. Analytical techniques for project planning and scheduling. Construction safety.
Prerequisite: Soph. stndg for CNEN, CIEN, and ENEN majors. Sr. stndg. for all other majors.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CNEN%203810)

CNEN 3860 Construction Materials and Methods (3 credits)
Introduction to materials and methods of building construction and construction drawings; foundation, structural framing, floor, room and wall systems; blueprint reading and quantity takeoff techniques; and an introduction to building information modeling.
Prerequisite: CNEN 3810.
Level of Study: Undergraduate
Marquette Core Curriculum: Engage Social Systms & Values 2
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CNEN%203860)

CNEN 4815 Mechanical and Electrical Systems for Buildings (3 credits)
Provides basic knowledge of electrical, plumbing and HVAC systems used in residential, commercial and industrial buildings. Studies the advantages and disadvantages of various systems, and how their design and installation integrates into the management of the building process. Particular attention is given to soliciting and managing mechanical and electrical subcontractors.
Prerequisite: CNEN 3810.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CNEN%204815)

CNEN 4830 Construction Planning, Scheduling, and Control (3 credits)
A study of principles and techniques used to plan, schedule and control costs on building construction projects. Network and linear scheduling models, resource allocation and time-cost analysis. Develops an appreciation of the resources required in a project and their limitations and introduces the techniques for analyzing and improving their use. Develops an understanding of the correlation between project planning and control and cost estimating and scheduling.
Prerequisite: CNEN 3860.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CNEN%204830)

CNEN 4840 Construction Cost Analysis and Estimating (3 credits)
Study of various cost estimating methods and their applications. Topics include: labor, material, equipment and indirect costs; quantity takeoff; analysis of historical cost data; forecasting and computerized estimating methods.
Prerequisite: CNEN 4845 or cons. of instr.
Level of Study: Undergraduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CNEN%204840)

CNEN 4845 Construction Equipment and Methods (3 credits)
Construction equipment and productivity analysis. Design of equipment fleet operations. Design of temporary structures used during construction such as earth retaining structures and concrete formwork systems. Construction equipment safety and safety standards related to earthwork and concrete forming operations.
Prerequisite: CNEN 3810 and Sr. stndg.
Level of Study: Undergraduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CNEN%204845)

CNEN 4931 Topics in Construction Engineering and Management (1-3 credits)
Course content announced each term.
Prerequisite: Cons. of instr.
Level of Study: Undergraduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CNEN%204931)

CNEN 4995 Independent Study in Construction Engineering (1-3 credits)
Undergraduate independent study project of either a theoretical or experimental nature.
Prerequisite: Jr. stndg., 3.000 GPA, cons. of instr., and cons. of dept. ch.
Level of Study: Undergraduate
Last four terms offered: 2022 Spring Term, 2020 Fall Term, 2020 Spring Term, 2015 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=CNEN%204995)