Department of Civil and Environmental Engineering
UNIVERSITY OF WISCONSIN–MADISON

Master of Engineering in Civil and Environmental Engineering
Environmental Engineering Option (MEng EnvE)
Course Planning Guide, February 26, 2025

Curriculum Requirements (Some flexibility may be possible; consult your academic advisor.)	
The MEng EnvE degree requires 30 credits, with the following minimum requirements:	
Students must complete two courses from the following group of three courses (all may be taken): CEE 721 – Biological Principles of Environmental Engineering (3 cr) CEE 722 – Chemical Principles of Environmental Engineering (3 cr) CEE 723 – Energy Principles of Environmental Engineering (3 cr)	Credits: 6 to 9
Students must complete one course from the following group of two courses (both may be taken): CEE 821 – Environmental Engineering: Biological Treatment Processes (3 cr) CEE 822 – Environmental Engineering: Physical-Chemical Treatment Processes (3 cr)	 3 to 6
Students must complete the following three courses: CEE 820 – Hydraulics and Applied Fluid Mechanics for Environmental Engineers (3 cr) CEE 823 – Environmental Engineering Design Project (3 cr) CEE 929 – Seminar - Environmental Engineering (1 cr)	 7
Students must complete elective courses to suit their program and to achieve the requirement of 30 total credits: CEE 320 – Environmental Engineering (3 cr) [1] CEE 414 – Hydrologic Design (of Urban Stormwater Systems) (3 cr) CEE 423 - Air Pollution Effects, Measurement and Control (3 cr) CEE 426 – Design of Wastewater Treatment Plants (3 cr) CEE 427 – Solid and Hazardous Waste Engineering (3 cr) CEE 428 – Water Treatment Plant Design (3 cr) CEE 522 – Hazardous Waste Management (3 cr) CEE 621 –Biological Treatment Process Modeling (1 cr) CEE 629 – Special Topics in Environmental Engineering (e.g., Infrastructure Sustainability and Climate, 3 cr) CEE 699 – Mentored Independent Study (1-6 cr) EPD 690 – Special Topics in Engineering Professional Development (e.g., Sustainable Microgrids, 3 cr) EPD 701 – Writing for Professionals (1 cr) EPD 702 – Professional Presentations (1 cr) EPD 708 – Creating Breakthrough Innovations (1 cr) EPD 713 – Key Legal Concepts for Professionals (1 cr) CEE 729 – Environmental Sustainability Tools (3 cr) CEE 721, 722, 723 – One of these may be taken as an elective if only two are taken to meet above requirement CEE 821, 822 – One of these may be taken as an elective if only one is taken to meet above requirement	 8 to 14
Total	**30**

- **Minimum enrollment**: Students must maintain enrollment in a *minimum* of 2 credits in Fall and Spring semesters. No minimum enrollment is required for summer terms. However, students must be enrolled in a minimum of 2 credits during the final, graduating term (**including Summer**). If you receive financial aid, the minimum credit load is higher, depending on the program. For more details, see Graduate School Academic Policies and Procedures *Enrollment Requirements* at: https://grad.wisc.edu/academic-policies/
- A minimum of 16 credits must be conferred as "residence credits," meaning by the University of Wisconsin-Madison.
- For more details see Graduate Guide, (https://guide.wisc.edu/graduate/) Civil and Environmental Engineering, M.Eng, Environmental Engineering Named Option: https://guide.wisc.edu/graduate/civil-environmental-engineering/civil-environmental-engineering-meng/civil-environmental-engineering-environmental-engineering-meng/#text

[1] This introductory course is recommended, or may be required, for students in the online master's program who have not had coursework in environmental engineering as an undergraduate. Students who have already taken an introductory environmental engineering course should not take/retake this course.

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Typical Course Schedule (Check UW-Madison Course Search & Enroll App or Ask Instructor)									
Number	**Name**	**2024 – 2025 AY**			**2025 – 2026 AY**			**2026 – 2027 AY**	
		F24	**Sp25**	**Su25**	**F25**	**Sp26**	**Su26**	**F26**	**Sp27**	**Su27**
CEE 320	Environmental Engineering			X			X			X
CEE 414	Hydrologic Design (of Urban Stormwater Systems)			X			X			X
CEE 423	Air Pollution Effects, Measurement and Control		X			X			X	
CEE 426	Design of Wastewater Treatment Plants	X			X			X		
CEE 427	Solid Waste Engineering	X			X			X		
CEE 428	Water Treatment Plant Design		X			X			X	
CEE 522	Hazardous Waste Management		X			X			X	
CEE 621	Biological Treatment Process Modeling			X			X			X
CEE 699	Mentored Independent Study[2]	X	X		X	X		X	X	
CEE 721	Biological Principles of Environmental Engineering					X				
CEE 722	Chemical Principles of Environmental Engineering				X					
CEE 723	Energy Principles of Environmental Engineering	X						X		
CEE 729	Environmental Sustainability Tools			X			X			X
CEE 820	Hydraulics and Applied Fluid Mechanics for Environmental Engineers			X						X
CEE 821	Biological Treatment Processes		X						X	
CEE 822	Physical-Chemical Treatment Processes	X						X		
CEE 823	Environmental Engineering Design Project					X				
CEE 929	Environmental Engineering and Science Seminar	X	X		X	X		X	X	
For EPD courses, use the Course Search and Enroll App or contact studentservices@interpro.wisc.edu. For Special Topics courses, use the Course Search and Enroll App and contact academic advisor.									

Note that summer courses are typically on an accelerated 8- or 12-week schedule. EPD courses that are 1-credit and offered in spring or fall may also be 8-weeks. Use the Course Search and Enroll App and click on the course and section to see the schedule.

Note that when courses have more than one section, Section 003 is often reserved for the online MEng EnvE students. Use the Course Search and Enroll App and click on the course and section to see these details.

[2] This course may be taken in the summer by special arrangement with and approval by instructor-mentor.

Course Learning Outcomes or Topics (check *Guide* for up-to-date course description)		
Number	**Name**	**Learning Outcomes/Topics**
CEE 320	Environmental Engineering	• Describe a control volume and perform mass balance equations using conservation of mass and differential equations. • Describe phase changes that may occur for a substance, given changes in temperature and/or pressure. • Describe basic fundamentals of equilibrium chemistry, and apply skills in computing solutions to pH, and precipitation reactions. • Describe basic theory of batch, completely mixed, and plug flow reactors and apply skills to compute required residence times given reactor configuration and rate constants. • Describe basics of water and air quality regulation. • Describe basics of water supply and treatment, wastewater collection and treatment, solid waste management, air pollution control, and apply skills in performing related basic calculations.
CEE 414	Hydrologic Design (of Urban Stormwater Systems)	• Describe and apply models common to environmental and water resource engineering practice to predict hydrologic response of watersheds to storms of varying return frequency. • Describe and apply green practices to reduce peak stormwater flow rate and volume in the urban environment and improve stormwater quality. • Describe and apply built systems to convey, attenuate, treat and store stormwater in the urban environment.
CEE 423	Air Pollution Effects, Measurement and Control	• Describe the influence of human-caused pollution on the atmosphere, globally and locally. • Evaluate human health, economic, and aesthetic effects of air pollution. • Describe the techniques for measurement of atmosphere pollutant concentrations and determination of local and regional air quality. • Describe air pollution sources and methods for their control. • Describe the role of local, state, and federal government in air pollution control.
CEE 426	Design of Wastewater Treatment Plants	• Describe basics of preliminary investigations for capacity requirements. • Describe physical-chemical and biological unit operations applied in wastewater treatment. • Describe processes for thickening, stabilizing and dewatering solids generated in wastewater treatment. • Describe and apply the fundamentals of performance and design of wastewater treatment plant process units commonly used. • Apply basics of plant layout and hydraulics. • Demonstrate skills in team-based wastewater treatment design project.
CEE 427	Solid and Hazardous Waste Engineering[3]	• Describe types, sources of and generation rates for municipal solid waste (trash). • Describe fundamentals of waste reduction, recycling, resource recovery, collection, storage, and disposal methods including landfill disposal and incineration. • Describe key operational, political and legal aspects of engineered systems for solid waste management. • Demonstrate skills in team-based design project.
CEE 428	Water Treatment Plant Design	• Describe basics of preliminary investigations for capacity requirements. • Describe unit processes employed in water treatment, their performance factors, and sizing criteria. • Apply treatment concepts to groundwater and surface water source waters. • Describe methods for project control in design. • Demonstrate skills in team-based design project.

[3] This course is currently focused on solid waste engineering. Check with course instructor before taking this course if your interest is primarily in hazardous waste engineering; this may be available through CEE 522 or CEE 699.

Course Learning Outcomes or Topics (check *Guide* for up-to-date course description)		
Number	**Name**	**Learning Outcomes/Topics**
CEE 522	Hazardous Waste Management	• Describe fundamentals of applicable environmental regulations. • Describe basic principles of waste characterization. • Describe fundamentals of characterization of sites requiring remediation. • Describe fundamentals in the design and operation of hazardous waste remediation systems involving water, air, and groundwater pollution.
CEE 621	Biological Treatment Process Modeling	• Biological treatment process modeling using Biowin • Good modeling practices • Interpreting process monitoring results, model set up, model calibration, use of model for process design and optimization • Prerequisites: CEE 426, 721, or 821.
EPD 690	Various Special Topics in EPD: e.g., Sustainable Microgrids, Solar PV Development	Sustainable Microgrids: • Describe fundamentals of integrating various renewable energy resources such as solar, wind and biofuel systems, classical electrical utilities, electrical loads and energy storage systems to form microgrids. • Describe and apply basics of modeling and design approaches for each type of energy resource, integration approaches, and operation of microgrids from business and economic perspectives. Other topics: check Course Search and Enroll App frequently as topics and timing varies
CEE 699	Mentored Independent Study	• Increase knowledge and application skills in areas of special interest within the practice of environmental engineering. • Gain expertise in self-study and research. • Demonstrate written and verbal communication skills. • May be taken in increments of 1 or more credits at a time, for up to 6 credits total during program.
EPD 701	Writing for Professionals	• Prepare students to produce effective written communication that is suitable for inter-professional and inter-disciplinary audiences in a variety of workplaces. • Informal and formal workplace writing, including email, memos, proposals and executive summaries
EPD 702	Professional Presentations	• Describe best practices in presentation design and delivery in professional formats.
EPD 708	Creating Breakthrough Innovations	• Explore innovation and how design thinking is a driver of innovation. • Learn to use various design thinking methods and tools for analysis and decision-making.
EPD 713	Key Legal Concepts for Professionals	• Describe and apply basic legal rules and concepts regarding contracts • Describe and apply basic legal rules and concepts of intellectual property (including patents, copyrights, trademarks, trade secrets) to business methods • Describe and apply basic legal rules and concepts of product liability, safety, product labeling, and consumer protection regulations to business ventures
CEE 721	Biological Principles of Environmental Engineering	• Describe how microorganisms gain energy from chemical contaminants • Describe how organisms gain energy from sunlight • Perform calculations to quantitatively estimate the contribution of microorganisms to the transformation of chemical contaminants • Analyze different contaminant situations and estimate what nutrients are necessary for a microorganism to transform a chemical contaminant • Describe why we use microorganisms to produce biofuels • Analyze different types of pathogens and determine their life cycles, and their characteristics, and provide solutions for treatment of water containing these pathogens.

Course Learning Outcomes or Topics (check *Guide* for up-to-date course description)		
Number	**Name**	**Learning Outcomes/Topics**
CEE 722	Chemical Principles of Environmental Engineering	• Describe the relationships between principal chemicals of concern in the environment and human health and the health of ecosystems. • Describe principal chemical processes in the environment that are affected by human activities. • Describe methods for laboratory and in-situ measurement of principal chemicals of concern. • Apply knowledge, including knowledge of statistics, to describe significance of environmental datasets. • Apply chemical properties, concepts and reactions in processes to reduce or control chemical pollution in air, water and soil.
CEE 723	Energy Principles of Environmental Engineering	• Describe energy resources, availability and stocks, typical energy conversion efficiencies, and concept of energy returned on energy invested (EROEI). • Describe and apply ideal gas law relationships and use of physical constants in computations involving ideal gases. • Utilize specific heats of substances in calculations involving energy flow. • Utilize thermodynamic properties of liquids, gases and liquid-vapor systems in energy balance calculations. • Apply concepts of efficiency in systems involving energy, heat and power. • Apply energy equation to perform calculations involving heating, cooling and mechanical work. • Calculate thermodynamic properties of reactants and products. • Apply basic principles of thermal conductivity and heat transfer, and perform computations involving heating and cooling of structures and contents of process vessels and transferring heat using heating systems and heat exchangers.
CEE 729	Environmental Sustainability Tools	• Environmental impact must be quantified systematically and rigorously in order to inform decision making, process improvement, and policy. Life cycle assessment will be utilized in a project-based framework to evaluate the environmental impacts of products and process across multiple environmental impact categories.
CEE 820	Hydraulics and Applied Fluid Mechanics for Environmental Engineers	• Apply concepts of conservation of mass and conservation of energy related to fluid flow. • Describe principal factors affecting major and minor energy losses in conduit flow and analyze and apply those factors using accepted relationships to estimate total energy losses in a given flow system for water, other liquids, sludge/biosolids mixtures, or gas under steady flow conditions. • Describe problems of unsteady flow and transient flow conditions that may be encountered in environmental engineering, and how related problems may be addressed by design. • Describe systems normally employed for flow measurement and select appropriate method and equipment for application in conduits carrying water, liquids, sludge/biosolids mixtures or gases normally encountered in environmental engineering. • Apply theory and practice in the analysis and design of hydraulic control structures commonly employed in environmental engineering. • Analyze and design full-pipe and open channel systems, including pumping systems, for conveying liquids, sludge/biosolids mixtures and gases normally encountered in environmental engineering problems. • Using normal capacity factors, and knowledge gained in the course, analyze water and sewer needs for a small community and design associated systems. • Apply knowledge gained in the course to perform analyses and design of hydraulic components of plant facilities including sizing of hydraulic control structures, piping, channels, pumps, weirs, etc., for series and parallel flow distributive arrangements, and compute related hydraulic profiles.

Course Learning Outcomes or Topics (check *Guide* for up-to-date course description)		
Number	**Name**	**Learning Outcomes/Topics**
CEE 821	Biological Treatment Processes	• Describe how microbial communities work in synergistic ways to achieve removal of organic and inorganic contaminants from wastewater. • Describe the specific microbial metabolism associated with nitrogen and phosphorus removal in wastewater treatment plants. • Describe how anaerobic microbial communities function for removal of organic contaminants and production of bioenergy • Perform calculations to quantitatively estimate the contribution of specific microbial groups to the overall treatment process. • Perform calculations to predict the efficiency of different wastewater treatment processes. • Analyze data from biological treatment process to identify causes of poor performance.
CEE 822	Physical-Chemical Treatment Processes	• Apply advanced theory and applications of physical-chemical systems for the treatment of water and wastes. • Apply statistical methods for the design of experiments and analysis of data from laboratory and bench scale experiments to assess water and waste treatability and to provide design parameters. • Apply experimentally derived factors and experiential factors in the design of advanced physical-chemical unit operations.
CEE 823	Environmental Engineering Design Project	• Develop teamwork and leadership skills needed to plan and design solutions to open ended problems in environmental engineering. • Apply knowledge gained in ME EnvE curriculum and baccalaureate program to provide analysis of options and develop effective solution to an open-ended design challenge. • Develop written and spoken communication skills necessary to gain client and public input to solutions development and acceptance of a developed solution to an environmental engineering challenge. • Gain experience in preparing key deliverables required in environmental engineering practice.
CEE 929	Seminar: Environmental Engineering	• Weekly online seminar viewing and brief report on environmental engineering and science topics presented by faculty, invited speakers, in-residence graduate students, or others; optional forum discussions with fellow students and faculty concerning seminar information and conclusions. One seminar must be on professional development and lifelong learning.

Potential Program Schedule of Courses

Following are potential programs based on the degree requirements, the schedule of classes, and the timing of a student's entry to the program. Note that students may also enter the program in Summer term, and this is encouraged for students who have not had coursework in environmental engineering as an undergraduate and wish to start with CEE 320. Considerable flexibility is possible based on core courses and electives chosen.

Semester	Spring 2025 Entry	Summer 2025 Entry	Fall 2025 Entry	Spring 2026 Entry
Spring '25	CEE 423, 428 or 522			
Summer '25	CEE 820	CEE 820		
Fall '25	CEE 722	CEE 722	CEE 722	
Spring '26	CEE 721, CEE 929	CEE 721, CEE 929	CEE 721, CEE 929	CEE 721
Summer '26	CEE 621, CEE 699	CEE 621, CEE 699	CEE 621, CEE 699	CEE 621, CEE 699
Fall '26	CEE 723 or CEE 822	CEE 723 or CEE 822	CEE 723 or CEE 822	CEE 723, CEE 929
Spring '27	CEE 821	CEE 821	CEE 821	CEE 423, 428 or 522
Summer '27	CEE 414 or CEE 729	CEE 414 or CEE 729	CEE 820	CEE 820
Fall '27	CEE 426 or CEE 427	CEE 426 or CEE 427	CEE 426 or CEE 427	CEE 426, 427, or 722
Spring '28	CEE 823	CEE 823	CEE 823	CEE 823
Summer '28		CEE 414 or CEE 729	CEE 414 or CEE 729	CEE 414 or CEE 729
Fall '28			CEE 426 or CEE 427	CEE 822
Spring '29				CEE 821