

The University Senate of Michigan Technological University
Proposal 10-24

Minor in Ecological Engineering

Basic Program Information

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Program/Degree type: Undergraduate Minor

Program Title: Minor in Ecological Engineering

Planned Implementation Date: Fall 2024

Program location/modality: Face to Face and/or online

Target student population: Environmental Engineering and Forestry Majors

General description and characteristics of program

The Department of Civil, Environmental, and Geospatial Engineering proposes a new minor called “Ecological Engineering”. The minor is designed for students to gain more experience working with natural systems, gain additional outdoor lab and field experience, and broaden their expertise in engineering disciplines related to earth sciences. Students who complete the minor will be able to utilize knowledge of thermodynamics, fluid dynamics, chemistry, microbiology, and ecology to remediate and prevent environmental and ecological damage through the design thinking process. They will also be able to blend engineering and science, particularly ecology, in order to design sustainable systems in natural, urban, and/or agricultural settings that are consistent with ecological principles and integrate human activities into the natural environment to the benefit of both.

This program will be administered by the Department of Civil, Environmental, and Geospatial Engineering. Drs. Morse and Barkdoll will serve as co-advisors for this minor. The advisors will seek guidance from other programs (Biological Sciences and CFRES) with courses listed in the core, via the Department Chairs, annually.

Rationale

The introduction of this minor addresses the importance of applying ecological principles to engineering designs, particularly those interacting directly with the natural environment. This minor will help students to apply engineering principles to natural systems.

In particular, this minor targets civil, environmental, and geospatial engineering students interested in applying engineering principles to ecology and natural systems. There is already a strong trend among environmental engineering students to also pursue an ecology minor. There are also a substantial number of students who switch their major from environmental engineering to something related to environmental science or ecology and vice versa. In the fall 2022 semester, a survey was distributed to first- and second-year students, primarily in the environmental engineering program, with the purpose of gauging interest in this proposed minor. A total of eighteen students responded to the survey. Fourteen students (78%) responded “yes” to the question “If Michigan Tech offered an Ecological Engineering Minor, would you be interested in pursuing it?” and four students (22%) responded “I would take a class or two to learn more about it” to this same question. See Figure 1 for this breakdown. Approximately 80% of the responses were from environmental engineering students.

If Michigan Tech offered an Ecological Engineering Minor, would you be interested in pursuing it?

18 responses

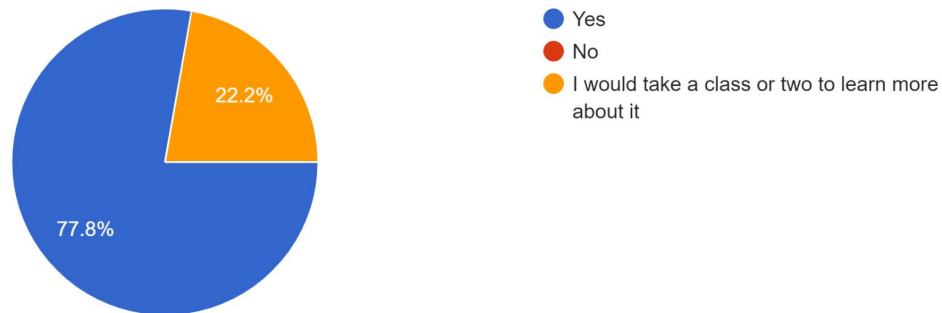


Figure 1: Student Responses from Interest Survey

Related programs: within MTU and at other institutions

BS in Applied Ecology and Environmental Science in the MTU College of Forest Resources and Environmental Sciences. This program does not address engineering aspects, as this proposed minor would.

BS in Wildlife Ecology and Conservation in the MTU College of Forest Resources and Environmental Sciences. This program does not address engineering aspects, as this proposed minor would.

BS in Applied Biology and Environmental Sciences in the MTU Department of Biology. This program does not address engineering aspects, as this proposed minor would.

Engineering Sustainability and Health at the University of San Diego. This is an online-only program.

BS in Ecological Engineering at Oregon State University. This program addresses engineering in ecological issues but is a full degree, not a minor, as is being proposed here.

BS in Ecological and Environmental Engineering at the University of Nebraska-Lincoln. This program addresses engineering in ecological issues but is a full degree, not a minor, as is being proposed here.

BS in Food, Biological, and Ecological Engineering at the Ohio State University. This program addresses engineering in ecological issues but is a full degree, not a minor, as is being proposed here.

Curriculum Details

- I. Title of Minor: Ecological Engineering
- II. Catalog Description: This minor focuses on expanded knowledge in ecological principles, field work, and natural systems in order to engineer solutions to a variety of ecological and environmental problems. Course options include a variety of hydrological engineering topics, field experience, and specialized knowledge of various ecological principles.
- III. List of Courses:

Required Core Courses (11 credits)

Principles of Biology (BL1400) is the foundation for most Biology and Forestry classes, making it a required course. Water Resources Engineering (CEE3620) is the foundation for many CEE courses, and is directly applicable to Ecological Engineering. It provides an engineering perspective of water resources, while Wetlands (FW4220) provides an ecological perspective of water resources. Furthermore, FW4220 provides lab experience, and knowledge of a biome that is crucial to the environment. FW4220 will also provide an engaging outdoor lab experience where students visit wetlands all across the Keweenaw. For a visual representation of how the

Ecological Engineering Minor could be implemented into the Environmental Engineering Major, see the flowchart at the end of the proposal. This visual is intended to show the ease at which this minor could be adopted by existing students and flow charts could be developed for students in other majors.

BL1400 Principles of Biology (3) F Su

Pre-Requisite(s): None

FW4220 Wetlands (4) F

Pre-Requisite(s): BL1100 or BL1400 or BL2160

CEE3620 Water Resources Engineering (4) F S Su

Pre-Requisite(s): ENG3200 and (MA3710 or MA2710 or MA2720 or CEE3502 or CEE3710)

Electives Group A (Choose 3-4 Credits)

Group A consists of civil and environmental engineering courses as well as technical lab courses. This group of courses will provide technical knowledge and experience in the field of engineering.

FW2051 Field Techniques (2) F

Pre-Requisite(s): None

FW3540 An Introduction to the Geographic Information Systems for Natural Resource Management (4) S

Pre-Requisite(s): MA2710 or MA2720 or MA3710 or ENVE3502 or CEE3502

CEE 4505 Surface Water Quality Engineering (3) F

Pre-Requisite(s): CEE 3501 or CEE 3503

CEE4665 Stream Restoration (3) S

Pre-Requisite(s): CEE3620

CEE4620 River and Floodplain Hydraulics (3) F

Pre-Requisite(s): CEE3620

CEE4518 Aquatic Biogeochemistry (3) F

Pre-Requisite(s): CEE4501 (C) and CEE4505 (C)

CEE4640 Stormwater and LID (3) Su

Pre-Requisite(s): CEE3620

CEE4993 Engineering with Developing Communities (3) F

Pre-Requisite(s): (ENG2120 or MEEM2150) and (BE3350 or CM3110 or ENG3200 or MEEM3201)

CEE4521 Bioremediation Engineering (3) S

Pre-Requisite(s):(CEE3501 or CEE3503) and BL3310

BL4120 Environmental Remediation (4) F

Pre-Requisite(s): BL1020 or BL1040 or (BL1200 and BL1210) or (BL1400 and BL1410)

GE3850 Geohydrology (3) S

Pre-Requisite(s): None

GE2100 Environmental Geology (3) S

Pre-Requisite(s): None

ENG4515 Introduction to Sustainability and Resilience (3) F

Pre-Requisite(s): None

Electives Group B (Choose 3-4 Credits)

Group B consists of animal ecology and water ecology courses in the forestry and biology departments to provide specialized knowledge in each student's area of interest.

FW3020 Forest Ecology (3) F

Pre-Requisite(s): FW 2051(C)

FW4380 Landscape Ecology and Planning (3) S

Pre-Requisite(s): MA 2720 or CEE 3502

FW4370 Forest and Landscape Hydrology (3) S

Pre-Requisite(s): None

BL2001 Valuing the Great Lakes (3) F Su

Pre-Requisite(s): None

BL3490 Principles of Ecology and Evolution (4) F

Pre-Requisite(s): BL 1010 or BL 1040 or (BL 1100 and BL 1110) or (BL 1400 and BL 1410)

BL4070 Environmental Toxicology (3) S

Pre-Requisite(s): BL1020 or (BL1200 and BL1210) or BL1040 or (BL1400 and BL1410) and CH1150 and CH1160

BL4447 Stream Ecology (3) Su

Pre-Requisite(s): BL1010 or (BL1100 and BL1110) or BL1040 or (BL1400 and BL1410) or BL3400

BL4450 Limnology (3) S

Pre-Requisite(s): None

BL4461 Ecosystem Ecology (On-demand)

Pre-Requisite(s): BL 3400 and CH 1122 or (CH 1160 and CH 1161)

TOTAL REQUIREMENTS: 18 credits

IV. Prerequisites not listed in the Minor: N/A, all prerequisites listed in Section III, List of Courses

V. Student Learning Objectives:

1. Explain the difference in natural and engineered systems.
2. Design sustainable systems in natural, urban, and/or agricultural settings that are consistent with ecological principles and integrate human activities into the natural environment to the benefit of both.

6. New Course Descriptions:

No new courses are being proposed for this minor at this time.

7. Estimated Costs:

At this time, the only estimated costs, or resources needed are personnel's time. Julie Ross is the academic advisor for the CEGE Department. Her time may be needed in promoting and answering questions about the minor when the primary faculty member and advisory committee cannot be reached.

The primary faculty advisor and advisory committee members' time will be needed in promoting and recruiting students to participate in the minor.

Approved by the CEGE Department: December 2022