

The University Senate of Michigan Technological University
Proposal 80-21
(Voting Units: Academic)

Establishment of a New Graduate Certificate in Water, Sanitation, and Hygiene (WASH) Engineering

Submitted by: Department of Civil and Environmental Engineering

1. Proposal Date:

May 13, 2020

2. Proposing Contacts and Department:

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3. Sponsor Department Approvals

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4. General Description and Characteristics of Program:

4.1 General Description of Certificate

The Environmental Engineering program at Michigan Technological University proposes a nine-credit graduate certificate in water, sanitation, and hygiene (WASH) engineering. This graduate certificate targets engineers in environmental engineering and related disciplines who are interested in applying fundamental scientific principles and engineering design approaches to improve the availability and quality of water, sanitation, and hygiene in developing world and disaster-relief settings. This cross-disciplinary graduate certificate will expand the career opportunities available to graduates beyond the traditional environmental engineering realm (primarily environmental engineering consulting firms, environmental compliance and engineering departments in industrial firms, and regulatory agencies).

4.2 Catalog Description

The cross-disciplinary Certificate in Water, Sanitation, and Hygiene (WASH) Engineering is designed to provide students with skills in community engagement, sustainability-based decision-making processes, and social sciences, and the technological knowledge needed to select, design, and implement appropriate technologies for the protection of public health and environmental quality in developing-country and disaster-relief settings.

5. Rationale for Certificate:

Traditional undergraduate and graduate environmental engineering programs focus on teaching the fundamental principles and design approaches for treatment technologies that protect human health and limit environmental degradation in the U.S. and other developed countries. However, a substantial number of students are drawn to the environmental engineering discipline because they are interested in doing work that improves the human condition in developing countries or in disaster-relief settings. At Michigan Tech, many of the undergraduate students who share these interests are currently involved with Engineers Without Borders and/or choose to complete an international senior design experience.

Undergraduate students will also be able to obtain a minor in Humanitarian Engineering in the future. Currently however, no programs exist at Michigan Tech to fulfill the needs of environmental engineering graduate students who are interested in working in developing countries or disaster relief settings. In the past, the popular Peace Corps Masters International (PCMI) program in environmental engineering had an enrollment of approximately five to ten students from 2005 through 2016, when the Peace Corps phased out all PCMI programs (<https://www.mtu.edu/peacecorps/programs/civil/theses/>). Since the PCMI environmental engineering program was discontinued, there has been a drop in enrollment in the Environmental Engineering M.S. program. The graduate certificate in WASH Engineering would, in part, fill the gap left by the PCMI program and may attract new students to Michigan Tech. It will also appeal to undergraduate students at Michigan Tech who are involved with EWB, international senior design, and/or the humanitarian engineering minor and allow them to build on these experiences and grow their expertise in WASH engineering.

To prepare students to be successful environmental engineers in *developed* countries, we focus on teaching them the fundamental science underlying treatment processes, and the approaches used to design treatment technologies based on these scientific principles. Environmental engineers working in *developing* countries also need strong science and engineering skills, but to be successful in improving WASH engineering, they also need to understand and engage the local community, communicate effectively, and be able to identify technologies and human behaviors that are appropriate within a particular cultural context. The WASH engineering graduate certificate will primarily focus on providing students with these non-technical skills, and assumes they have obtained the necessary environmental engineering background through completion of a complementary degree or certificate, such as the Environmental Process Engineering graduate certificate.

The targeted audience of the WASH engineering graduate certificate will be students who have earned B.S. degrees in engineering at Michigan Tech or other institutions and wish to pursue graduate studies on campus. The success of the PCMI environmental engineering program and enduring popularity of the Michigan Tech chapter of EWB and the international senior design experience provide ample evidence that the WASH engineering certificate will attract graduate students.

6. Related Programs:

The Waters Institute at the University of North Carolina is a prominent institute focusing on WASH-related matters (<https://waterinstitute.unc.edu>); however, the Waters Institute is a research institute and does not offer educational certificates.

The Colorado School of Mines offers a graduate certificate in humanitarian engineering (<https://humanitarian.mines.edu/mshes/>).

The Mortensen Center in Global Engineering at the University of Colorado-Boulder offers a Professional Master's Degree in Global Engineering (<https://www.colorado.edu/center/mortenson/graduate-education/professional-masters-degrees>), and a graduate certificate

<https://www.colorado.edu/center/mortenson/education/graduate-education/graduate-certificate>)

This is not an exhaustive list; however, WASH engineering graduate certificates do not appear to be very common.

7. Projected Enrollments:

Semester	On-campus Enrollment	On-line Enrollment
Fall 2021	3-4	0
Fall 2022	5-6	0
Fall 2023	6-8	0
Fall 2024	8-10	0

8. Scheduling Plans:

No change in the regular scheduling of the existing courses is anticipated.

9. Curriculum Design:

The course plan shown below was designed assuming that a student has completed an environmental engineering undergraduate degree including the following WASH-related courses:

- BL 3310 (Environmental Microbiology), or equivalent;
- CEE 4501 (Environmental Engineering Chemical Processes), or equivalent;
- CEE 4502 (Wastewater Treatment Principles and Design), or equivalent;
- CEE 4503 (Drinking Water Treatment Principles and Design), or equivalent.

If a student has not previously taken these courses, they should be taken in addition to the courses required to complete the WASH graduate certificate courses to ensure that students have adequate technical competency.

Required Coursework: 3 credits

CEE 5993: Engineering with Developing Communities (3)

Elective Coursework: 6 credits (select two of the following courses, at least one elective course must be at the 5000 level and only one SS course may be selected)

BL 3970:	Current Health Issues (3)
ENG 5510:	Introduction to Sustainability and Resilience (3)
FW 4010:	Public Health and the Environment (3)
HU 3261:	Topics in Communicating Across Cultures (3)
KIP 4740:	Epidemiology (3)
SS 4120:	Anthropology of International Development (3)
SS 5325:	Water Policy, History and Governance (3)

Course Descriptions:

BL 3970: Current Health Issues

Introduction to health issues, such as: infectious diseases, obesity, mental health, healthcare disparities, health insurance, drug addiction, and vaccines. Students will analyze health issues from a diverse cultural, ethical, social, and global perspective.

- **Credits:** 3.0
- **Lec-Rec-Lab:** (3-0-0)
- **Semesters Offered:** Spring, Summer
- **Restrictions:** May not be enrolled in one of the following Class(es): Freshman
- **Prerequisite(s):** UN 1015 and (UN 1025 or Modern Language - 3000 level or higher)

CEE 5993: Engineering with Developing Communities

Study of applying appropriate, community-based, and sustainable engineering in developing communities. Concepts of human-centered design and sustainable development are covered. Topics are drawn from several areas of engineering, including water and wastewater treatment, construction materials, solid waste, energy, and information systems.

- **Credits:** 3.0
- **Lec-Rec-Lab:** (2-1-0)
- **Semesters Offered:** Fall
- **Prerequisite(s):** (ENG 2120 or MEEM 2150) and (BE 3350 or CM 2120 or ENG 3200 or MEEM 3201)

ENG 5510: Introduction to Sustainability and Resilience

Introduction to sustainable development, resilience, and global grand challenges with emphasis on socio-technical systems. Key topics include earth systems literacy, policy development, corporate social responsibility, ecological economics, sustainability indicators, and industrial/societal applications (e.g. agricultural, mining sustainability, etc.).

- **Credits:** 3.0
- **Lec-Rec-Lab:** (3-0-0)
- **Semesters Offered:** Fall

FW 4010: Public Health and the Environment

Explores how the environment impacts the health of individuals and entire populations. Topics will include exposure to environmental hazards and natural disasters, access to green and blue space and the built environment.

- **Credits:** 3.0
- **Lec-Rec-Lab:** (2-1-0)
- **Semesters Offered:** Spring
- **Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore

HU 3261: Topics in Communicating Across Cultures

Examines communication practices and styles across selected cultures and multicultural groups, drawing on an interdisciplinary range of research fields. May address social issues, language and cultural differences, gender, race, ethnicity, class, disabilities, age, religion, family and national identity.

- **Credits:** 3.0; Repeatable to a Max of 6
- **Lec-Rec-Lab:** (0-3-0)
- **Semesters Offered:** On Demand
- **Restrictions:** May not be enrolled in one of the following Class(es): Freshman
- **Prerequisite(s):** UN 1015 and (UN 1025 or Modern Language - 3000 level or higher)

KIP 4740: Epidemiology

An introduction to the principles and methods of epidemiology to understand the distribution and determinants of health in a population. Topics include basic epidemiological statistics, study design, and sources/impact of bias and error.

- **Credits:** 3.0
- **Lec-Rec-Lab:** (3-0-0)
- **Semesters Offered:** Spring

SS 4120: Anthropology of International Development

Advanced anthropology course that focuses on cultural, social structural, historical, and environmental analyses of international development. Students engage with relevant social theory and practical applications in international development case studies.

- **Credits:** 3.0
- **Lec-Rec-Lab:** (3-0-0)
- **Semesters Offered:** Fall - Offered alternate years beginning with the 2019-2020 academic year
- **Prerequisite(s):** UN 1015 and (UN 1025 or Modern Language - 3000 level or higher)

SS 5325: Water Policy, History, and Governance

This seminar will explore the global history, politics, and governance of freshwater resources. Topics will include the effects of forestry, mining, watershed management, sanitation systems, privatization, climate change, fisheries, emerging contaminants, and agriculture on water systems and policies. **Credits:** 3.0

- **Credits:** 3.0
- **Lec-Rec-Lab:** (3-0-0)
- **Semesters Offered:** Fall - Offered alternate years beginning with the 2020-2021 academic year

10. Model Schedule Demonstrating Completion Time

The certificate is designed to be completed in two semesters (Fall and Spring).

An example schedule in which the certificate is completed in two semesters is as follows:

Fall Semester

CEE 5993: Engineering with Developing Communities (3)

ENG 5510: Introduction to Sustainability and Resilience (3)

Spring Semester

SS 5325: Water Policy, History, and Governance (3)

11. Library and other Learning Resources

No library or other learning resources are required at this time.

12. Faculty Resumes

The following faculty will be supporting the program.

Dr. Robert Handler

<https://www.mtu.edu/sfi/about/faculty-staff/handler/>

Dr. Kari Henquinet

<https://www.mtu.edu/social-sciences/department/faculty/henquinet/cv/kari-bergstrom-henquinet-cv-apr2019v3.pdf>

Dr. Kelly Kamm, Assistant Professor, Kinesiology and Integrative Physiology

<https://www.mtu.edu/kip/department/faculty-staff/faculty/kamm/kamm-cv.pdf>

Dr. Nancy Langston, Professor of Social Sciences

<https://www.mtu.edu/social-sciences/department/faculty/langston/cv/march2019langston-cv-short.pdf>

Prof. David Watkins, Professor of Civil and Environmental Engineering

<https://www.mtu.edu/cee/people/faculty-staff/faculty/watkins/watkins-cv.pdf>

13. Equipment

No additional equipment will be required.

14. Program Costs

Offering the certificate will not incur additional costs, but as enrollment grows additional instructional resources will be needed.

15. Space

There are no new space requirements.

16. Policies, Regulations, and Rules

Not applicable

17. Accreditation Requirements

Michigan Tech is accredited by the [Higher Learning Commission](#) (HLC). The proposed certificate will meet HLC criteria 3 and 4. The proposed certificate will not seek additional accreditation.

18. Planned Implementation Date

Fall 2021

19. Assessment

Upon completion of this certificate, students will be able to understand and engage the local community, communicate effectively, and identify technologies and human behaviors that are appropriate within a particular cultural context to solve WASH engineering problems in developing-world and disaster-relief settings.

Approval Process

Departmental Graduate Committee [~~delete if not appropriate~~]: **May 28, 2020**

Department: **May 29, 2020**

College of Engineering: **June 2, 2020**

Graduate School

Provost's Office and Deans' Council

Approved by the Senate:

Approved by the President: