

**The University Senate of Michigan Technological University**

**Proposal 21-21**

**Establishment of a New Graduate Certificate in Natural Hazards and Disaster Risk Reduction**

**Submitted by:**

**Department of Geological and Mining Engineering and Sciences**

**1. Proposal Date:** 1 June 2020

**2. Proposing Contacts and Departments:**

Luke J. Bowman, Research Assistant Professor, Graduate Program Coordinator  
Gregory P. Waite, Associate Professor

**3. Sponsor Department Approvals:** Not Applicable

**4. General Description and Characteristics of Certificate**

**4.1. General Description:**

The Geology program at Michigan Technological University proposes a nine credit Certificate in Natural Hazards and Disaster Risk Reduction. The graduate certificate in Natural Hazards and Disaster Risk Reduction has the following three objectives:

- i. to attract students from various disciplines who wish to understand the complex interplay between human activities and hazards from geophysical and meteorological events;
- ii. to teach students basic skills in communication, hazard analysis and vulnerability assessment; and,
- iii. to provide students the opportunity to gain fundamental skills to analyze the complex factors that contribute to a hazard event's occurrence, impact on society, and the strategies to minimize losses.

**4.2. Catalog Description:**

Certificate in Natural Hazards and Disaster Risk Reduction is designed to develop skills and competencies in hazard analysis and effective communication to lessen the impact of hazard events on communities. In addition, the curriculum integrates building skills in communication and teamwork while working on data from real-world problems.

## 5. Rationale for the Certificate:

The Certificate in Natural Hazards and Disaster Risk Reduction will serve two student populations. First, the certificate may serve students, not currently enrolled in another graduate program at Michigan Tech, with a path to upskilling and gaining new knowledge in the field of natural hazards. This pathway would likely consist of students enrolled online. Professionals who work in hazard mitigation, but who have not had courses in geophysical and social aspects of hazard mitigation should find value in the certificate.

Additionally, current Michigan Tech graduate students from other MS programs within GMES could obtain the certificate. The proposed Graduate Certificate will provide academic training to students from backgrounds including physical sciences, geosciences, social sciences, computational sciences, and civil and environmental engineering. This nine-credit certificate will provide a strong foundation in skills that most of these students can fit into their curriculum.

Students from both groups could elect to continue their education by applying to enter the Geology or Geophysics MS program.

As an interdisciplinary certificate, tuition rates would follow that of Geology.

## 6. Related Programs:

There has been a proliferation of Natural Hazards Mitigation and Management programs in the last five years. Most certificate programs have an emphasis on management and are offered in departments that specialize in geography and urban planning. Our certificate program is focused on the physical and social aspects of natural disasters. Here is a sampling of graduate certificate programs:

- [University of North Carolina Chapel Hill - Natural Hazards Resilience Certificate](#)

This program is designed for researchers and practitioners who can help the public, non-profit, and private sectors become more resilient in the face of natural hazards and disasters and adapt to the effects of a changing climate

- [American Military University - Environmental Hazard Mitigation and Restoration](#)

This graduate certificate in environmental hazard mitigation and restoration from American Military University (AMU) provides students with an advanced understanding of emergency and disaster management and environmental science and restoration. Students study environmental hazards, environmental hazard response, hazard mitigation planning, recovery functions, and the restoration and enhancement of damaged lands or habitat. Students learn the principles of ecological restoration in a post-disaster environment, as well as how to assess and navigate the complex relationships between societies and their use of natural resources.

- [United Nations Institute for Training and Research - Graduate Certificate in Disaster Risk Reduction \(DRR\)](#)

The University of Newcastle, CIFAL Newcastle and UNITAR are pleased to offer the Graduate Certificate in Disaster Risk Reduction to provide graduates and professionals with the knowledge to manage the DRR process across all sectors of society. Students of the program will learn fundamental disaster risk concepts and receive training in the use of the most globally adopted DRR tools and protocols, some of these through direct engagement with UNITAR resources. At the end of the programme, students will be capable of conducting disaster risk evaluations and guiding the subsequent development of disaster risk mitigation and management strategies for the organisation in which they work. This program will equip graduates to apply the Sendai Framework for Disaster Risk Reduction to public, private, NGO and civil society organisations. The programme combines flexibility to study anywhere at any time as it is available both online and face-to-face on campus. Upon graduation, in addition to the university degree, students will receive UN co-certification from the United Nations Institute for Training and Research (UNITAR) and the United Nations International Office for Disaster Reduction (UNISDR).

### 7. Projected Enrollments:

Initially, the program will have most of the enrollment from currently enrolled Michigan Tech graduate students. An online offering will expand the number of students enrolled. Given the current level of interest, we expect the program to grow before stabilizing enrollment. If interest exceeds this projected enrollment, in particular through online enrollment, additional resources will be required (see section 15 below).

| Semester    | On-campus Enrollment | Online Enrollment |
|-------------|----------------------|-------------------|
| Spring 2021 | 5                    | 2                 |
| Fall 2021   | 15                   | 5                 |
| Fall 2022   | 16                   | 10                |
| Fall 2023   | 18                   | 15                |

|           |    |    |
|-----------|----|----|
| Fall 2024 | 20 | 20 |
|-----------|----|----|

### 8. Scheduling Plans:

The on-campus coursework will be offered during regular instructional time periods and will not require changes to the scheduling of classes.

### 9. Curriculum Design:

This 9-credit certificate consists of two 3-credit required courses and one 3-credit elective. Only three credits may be at the 4000 level. The required and elective course list with the course descriptions are given below.

#### Required Courses - 2 courses, 6 credits

GE5150 - Advanced Natural Hazards (3 cr.)

GE5680 - Social Dimensions of Natural Hazards (3 cr., new, [see Course Add Proposal](#))

#### Elective Courses - 3 credits (select 1 course)

GE5515 - Advanced Geoinformatics (3 cr.)

GE5180 - Volcanology (3 cr.)

GE5195 - Volcano Seismology (3 cr.)

SS4120 - Anthropology of International Development (3 cr.)

### 10. Course Descriptions:

Course Descriptions for each respective course are as follows:

#### GE5150 - Advanced Natural Hazards (3 cr.)

The course explores the causes and mitigation of a range of natural hazards and their impacts on society, including the concepts of risk and risk perception. An emphasis will be placed on volcanoes, earthquakes, and floods and their related hazards; current activity will be investigated as it happens. In addition to technical aspects of these hazards, we will examine the agencies that are responsible for hazard mapping, warnings, and planning.

#### GE5515 - Advanced Geoinformatics (3 cr.)

This course covers topics on GIS analysis methods, including network analysis, cost distance analysis, site selection and optimization, interpolation, multi-layer raster data analysis and more. Basic concepts and techniques associated with the analysis of spatial relationships and patterns are introduced using application examples in geophysical ecological, environmental, epidemiological, and transportation research.

GE5180 - Volcanology (3 cr.)

This course explores volcanoes and how they work. Students examine volcanic products, their recognition, and significance. The course applies chemistry, physics, and fluid mechanics in a volcanological context.

GE5195 - Volcano Seismology (3 cr.)

Will prepare students, including those with no seismology background, to interpret seismic and acoustic signals from volcanoes. Topics: basic seismology, monitoring techniques, tectonic and volcanic earthquakes, infrasound, deformation over a range of time scales.

GE5680 - Social Dimensions of Natural Hazards (3 cr., New Course, see Course Add Proposal)

This course introduces students to the interdisciplinary nature of natural hazards as well as the complexities of engaging with people of other cultures about geological hazards. The course is designed for and open to any student interested in gaining a global perspective on natural hazards, disaster risk, and social aspects of hazard mitigation

SS4120 - Anthropology of International Development (3 cr.)

In this course, students consider theories of social change, power relations, choice and agency while examining a wide swath of global initiatives and actors under the umbrella of “development.” Students synthesize research and apply this knowledge in constructive critiques of development projects. They also contribute remotely to a collaborative project between Michigan Tech, a non-profit, and university in El Salvador on climate change, water resources, and rural agriculture. In this hands-on project, students apply theory and methods to study social and cultural change, history, political economy, and environmental sustainability in a real field site in the world of international development. This is a useful course for students interested in global projects, sustainable development, and applied and community-focused research.

**11. Model Schedule Demonstrating Completion Time:**

The Certificate can be completed in a two-semester sequence or spread over three semesters (depending on student preference and scheduling requirements). The courses are offered in the semester listed below.

Fall Semester

Spring Semester

|        |        |
|--------|--------|
| GE5150 | GE5680 |
| SS4120 | GE5180 |
|        | GE5195 |
|        | GE5515 |

**12. Library and Other Learning Resources:**

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

**13. Faculty Resumes:**

The following faculty are assigned to teach the curriculum:

GE5150 - Gregory Waite, Associate Professor, <https://pages.mtu.edu/~gpwaite/>

GE5680 - Luke Bowman, Research Assistant Professor

Additional faculty associated with the Geology program may also be the instructors for these courses: <https://www.mtu.edu/geo/department/faculty/> and <https://www.mtu.edu/social-sciences/department/faculty/henquinet/>

**14. Equipment:**

No additional equipment will be required.

**15. Program Costs:**

Initial costs for offering the certificate to on-campus students will not incur additional costs, but will require continued funding for Geology graduate teaching support and positions.

The online offering of the certificate will also require continued backing of the graduate teaching support as well as agreement and support between the respective departments and Graduate school for faculty teaching loads for the online sections.

We anticipate that the initial enrollment load can be covered with our current faculty. However, many courses in the Natural Hazards and Disaster Risk Reduction Certificate could be impacted by increased enrollments. Therefore, teaching support to fulfill increased needs will need to be evaluated regularly.

**16. Space:**

No additional space will be required.

**17. Policies, Regulations, and Rules:**

Not applicable

**18. 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.

**19. Planned Implementation Date:**

Available as Remote Instruction Starting Spring 2021

**20. Assessment:**

Students achieving the learning objectives for this certificate will be able to:

1. Identify geophysical as well as sociocultural aspects pertaining to natural geological hazards.
2. Compose a complete hazard mitigation plan that includes appropriate physical hazards and social vulnerabilities/risks that pertain to real settings and demonstrate the sharing of the plan to various stakeholders appropriate to the chosen settings.
3. Demonstrate proficiency in using computational tools commonly used for hazard mapping.