CE 317: Geologic Hazards

Course Description

The course will present a process based approach to understanding Earth hazards. Material presented will explore the why, how and impacts of processes including mass movements, earthquakes, tsunamis, flooding and other natural events that cause episodic and catastrophic impacts on the surface of the Earth. The course will use applied geomorphology to examine the landscape to understand the susceptibility to geologic hazards, identify past events and predict potential future events.

Course Materials

Hunt, RE, 2019. Geologic Hazards – A Field Guide for Geotechnical Engineers, 1st Edition. CRC Press; ISBN: 978-0367389413

Course Instruction Team

Primary Instructor	Dr Allen Gontz Professor, Applied Geology
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Office Hours	TBA

About the Primary Instructor

Dr Allen Gontz is a Quaternary Geologist and Geophysicist who studies aspects of landscape evolution over various spatial and temporal scales. His research includes examining the Earth's records to understand how and why landscapes have changed through various in the dominant Earth process. He has conducted research all over the world, including Antarctica, Australia, New Zealand, Europe and North America

Course Format

CE 317 will be offered as an in-person, lecture-based course. The course will rely heavily on flipped classroom modalities and hybrid activities. These approaches are designed to facilitate in-class discussions and group work on specific problems.

The course will meet twice a week for 1.25 hours during the 15 week semester. There will be two in-class exams and one final exam. Numerous assignments, reflections and a semester-long project will be used to assess student progress and achievement of course, departmental and ABET outcomes.

Textbook and Materials

The course will require the use of the following materials:

- Hunt, RE, Geologic Hazards – A Field Guide for Geotechnical Engineers. ISBN: 978-0-367-38941-3
- Google Earth Pro

Rationale for CE 317

CE 317 is designed to fulfill the BASIC SCIENCE elective for the BS in Civil Engineering and the EARTH SCIENCE elective for the BS in Environmental Engineering.

The evolution of the surface of the Earth is not a slow-moving series of events. It is often characterized by a series of major changes that are based on dynamic equilibrium and thresholds. The major events present hazards born out of shifting from one dynamic equilibrium to another and represents threats to communities, societal infrastructure and the natural world.

Processes such as plate tectonics, climate/weather and gravity all cause events that create events that pose catastrophic impacts on landscapes and any societal infrastructure created on the landscape.

The course will investigate topics that relate to volcanoes, tsunamis, sea level change, flooding and mass movents (landslides). Students will be able recognize the tell-tale features that suggest an event is about to happen, understand the processes that govern the event, realize the impacts of the event and recognize past events on the landscape.

As engineers and scientists, your future will be greatly controlled by evolution of the Earth's surface. In order to adequately address concerns of society, a deep understanding of how and why the Earth's processes operate coupled with how such changes will impact the natural and built world are required. Such knowledge will assist in designing new infrastructure, repairing damages and mitigating the impacts.

CE 317 will apply current understanding from the Earth Sciences, including sedimentology, paleontology, geomorphology, hydrology and meteorology. It will also include aspects of chemistry, astronomy and biology as applied to understanding the impacts on the Earth through applied Earth Science.

Course Outcomes

Upon completion, should be able:

1. Describe the drivers of Earth processes
2. Infer impacts of Earth processes
3. Evaluate the potential hazard to a site using a process-based approach
4. Project future scenarios based on changing processes

Individual course outcomes will be assessed during specific assignments, reflections and in-class exams. A synergistic linkage of the course outcomes will be assessed through the project and final exam.

Relationship of CE 317 to Department and ABET Outcomes

The accrediting body for engineering degrees, ABET has specified seven (7) student outcomes. The Clarkson University Department of Civil and Environmental Engineering strives to develop each course to support the

development of the engineering degree. CE 317, as a course fulfilling a restricted elective, endeavors to link the course content and activities to support he ABET outcomes. The departmental outcomes are inherently linked to the ABET criterion and outcomes. The below table illustrates how the course outcomes link to the ABET Criterion 3, ABET Outcomes and Departmental Program goals for Civil and Environment degrees.

Links to the relationship between Departmental Outcomes and the ABET Criterion and Outcomes are located in the CEE Departmental Undergraduate Handbook and at https://www.clarkson.edu/pages/engineering-objectives

The course's activities will support Outcomes SO1a, SO3b, SO4a and aspects of SO1c and SO1d. With respect to SO1c and SO1d, students will be provided contextual knowledge to develop engineering designs and will be assessed on the acquisition of knowledge. However, CE 317 does not have a design component.

Relationship of CE 317 to UN Sustainability Development Goals

The United Nations has released a series of 17 goals for sustainability. This course will endeavor to provide context that relates to the following goals:

SDG	Where Highlighted (Stage #)	Course Outcome
SDG-6: Clean Water & Sanitation	Prologue,3,4	2.3.4
SDG-13: Climate Action	Prologue,1,2,3,4	1,2,3,4
SDG-15: Life on Land	Prologue,1,2,3,4	1,2,3,4

The goals will be highlighted in lectures and activities, where appropriate and students will be asked to fold the goals into several assignments throughout the course to show an understanding of how the goals and the course content link to ultimately demonstrate the relationships between climate change, climate impacts, science, engineering and these goals.

Student Assessment

Grades will be determined through assessment of work in each of the below categories.

In Class Exams –	2 @ 10%	20%
Final Exam -	1 @ 15%	15%
Stage Activity -	3 @ 5%	15%
Reflections -	13 @ 1%	13%
Project -	1 @ 15%	15%
Short Assessments	13 @ 1%	13%
Participation		9%

In Class Exams - Two (2) in class exams will be given throughout the course. Each of these exams will focus on the content of material from the Stage associated with exam with a portion of the exam relying on information from previous stages. Stage 1 exam will be 100% Stage 1 material; Stage 2 exam will be 75% Stage 2 and 25% Stage 1 material.

Final Exam – The final exam will be a take home exam administered during the final exam period. It will consist of about 50% of Stage 3 and 4 material and 50% Stage 1 and 2 material.

Stage Activity – Each Stage will have a major activity associated with the Stage that will act as a synergistic activity to bring the entire stage into focus. Stage activities will vary and range from essays to problem sets to models. There will be three (3) Stage Activities.

Project – Students will be asked to complete a semester-long project that is synergistic in nature and is place-based. Each project will include an assessment of the science and impacts of climate change on a specific location.

Reflections – Each week students will be asked to complete a short reflection assignment to reinforce material and concepts from the week preceding. These will include activities such as photography, poetry, observations, journaling and others. There will 15 Reflections.

Short Assessment – Each week throughout the semester students will be asked to complete a short assignment that will use techniques such as current events, case studies, essays on readings, observation and others to bring context into the course from the world around them. Short assessments may include unannounced quizzes during lecture.

Participation – Students will be assessed based on their participation in discussions and class-based activities.

Class Lecture Schedule

Based on a 1.25 hr T/H offering

Class # Date	Topic	Reading
	PROLOGUE	
1	Introduction, Syllabus, Why Study Earth Processes	GH-1; HDT-1
2	What are Geologic Hazards	GH-1; HDT-1
	STAGE 1 – The Land Moves	
3	What Causes Mass Movement	GH-2,3
4	Types of Mass Movement	GH-2,3
5	Impacts of Mass Movement	GH-2,3
6	Impacts of Mass Movement	GH-2,3
7	Mitigation of Mass Movement	GH-2,3
8	Historic Mass Movement	GH-2,3
9	Historic Mass Movement	GH-2,3
10	***EXAM #1***	
	STAGE 2 – The Earth Shakes	
11	What Causes Earthquakes	GH-4
12	Types of Earthquakes	GH-4
13	Measuring Earthquakes	GH-4
14	Impacts of Earthquakes	GH-4
15	Impacts of Earthquakes	GH-4
16	Historic Earthquakes	GH-4
17	Historic Earthquakes	GH-4
18	Societies	GH-4
19	***EXAM #2***	
	STAGE 3 – The Earth Erupts	
20	What Causes Volcanism	HDT-2
21	Types of Volcanoes	HDT-2
22	Types of Volcanoes	HDT-2
23	Impacts of Volcanoes	HDT-2
24	Impacts of Volcanoes	HDT-2
25	Mitigation of Eruptions	HDT-2
26	Historic Eruptions	HDT-2
27	Historic Eruptions	HDT-2
	STAGE 4 – The Water Rises	
28	Rivers	HDT-3
29	Lakes	HDT-4
30	Oceans	HDT-5
TBD	***Final Exam***	

Readings:

GH – Geologic Hazards Textbook
HDT: Handout provided via Moodle

Class Assignment Schedule

Assignment	Assigned (Lecture #)	Due (Lecture #)
PROLOGUE		
Short Assessment 1 – PreCourse Questions	1	3
Reflection 1 – 100 Word Essay – What I Know	1	3
STAGE 1		
Semester Project	3	30
Stage 1 Activity –	3	11
Short Assessment 2 -	3	5
Reflection 2 -	3	5
Short Assessment 3	5	7
Reflection 3	5	7
Short Assessment 4	7	9
Reflection 4	7	9
Short Assessment 5	9	11
Reflection 5	9	11
Stage 1 Exam	10	10
STAGE 2		
Stage 2 Activity	11	20
Short Assessment 6	11	13
Reflection 6	11	13
Short Assessment 7	13	15
Reflection 7	13	15
Short Assessment 8	15	17
Reflection 8	15	17
Short Assessment 9	17	19
Reflection 9	17	19
Stage 2 Exam	19	19
STAGE 3		
Stage 3 Activity	20	27
Short Assessment 10	20	22
Reflection 10	20	22
Short Assessment 11	22	24
Reflection 11	22	24
Short Assessment 12	24	26
Reflection 12	24	26
STAGE 4		
Short Assessment 13	28	30
Reflection 13	28	30
Final Exam	TBD	TBD