Module Code	CEU33A08
Module Name	3A8 Geology for Engineers
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Sara Pavia/ Sean Mc Clenaghan
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Recognise standard terminology, including basic classification systems for geological materials, and terminology applied to important plate tectonic, surface and climatic processes. LO2. Describe the formation and internal structure of planet Earth and describe plate tectonic theory. LO3. Explain how natural hazards such as earthquakes, tsunamis and volcanoes relate to plate tectonic processes, and explain difficulties in predicting natural disasters. LO4. Explain the generation of hydrocarbons within sedimentary basins, use simple exploration techniques, and compare technologies for hydrocarbon exploration and extraction. LO5. Describe the roles of glacial, fluvial, hill slope, coastal and submarine processes in forming the natural environment, and appraise whether engineering solutions are appropriate in managing surface processes. LO6. Explain the major controls on global climate, describe evidence for natural climate change in the geological record, and assess the engineer's role in managing anthropogenic climate change. LO7. Explain the sources and distribution of radon in Ireland, describe engineering solutions to alleviate high indoor radon levels.

[1] TEP Glossary

LO8. Solve mathematical problems concerned with geophysical surveys, rock discontinuities and slope stability.

LO9. Appraise rock behaviour in a variety of contexts, such as how to identify and then deal with the occurrence of karst features in construction.

Graduate Attributes: levels of attainment
To act responsibly - Enhanced
To think independently - Introduced
To develop continuously - Attained
To communicate effectively - Introduced

Module Content

Please provide a brief overview of the module of no more than 350 words written so that someone outside of your discipline will understand it.

Geology for Engineers introduces several areas of Earth Sciences that impact the engineer, including geological materials, earth surface processes, hydrocarbon exploration and production, natural disasters and climate change. Engineers often need to work with geologists. This module will enable the student to operate effectively in such a team by explaining terminology and concepts in the fields stated above. The module also provides the engineer with a natural, regional-scale context in which to place site-specific questions. Financial and time pressures on the engineer necessarily force him/her to concentrate on the site-specific aspects of geology, such as the mechanical properties of the ground and the local risk of natural hazards like flooding, subsidence or earthquakes. This module provides examples of how such local-scale phenomena can be better predicted using knowledge of regional-scale geological processes. The student will learn the kind of questions that geologists can answer, allowing him/her to better assess how much time/money to spend on geological investigations for any given project.

- **Planet Earth [Dr. Sean McClenaghan]**
  - Earth's internal structure: core, mantle, crust
  - Plate tectonics – Deformation of the plates: faulting and folding
  - Earthquake seismology
  - Describing and classifying rocks and minerals
  - Measuring geological time
- **Volcanic Processes [Dr. Sean McClenaghan]**
  - Controls on physical properties of magma

- Principles of multi-phase geophysical flows
- Eruption dynamics
- Important mineral deposits produced by volcanic processes

- **Sedimentary basins and Hydrocarbons [Dr. Sean McClenaghan]**
  - Imaging sedimentary basins using reflection seismology
  - Types of sedimentary basin
  - Generation of hydrocarbons within sedimentary basins
  - Hydrocarbon exploration techniques
- **Geology of Ireland [Dr. Sean McClenaghan]**
  - Tectonic overview
  - Basement structure
  - Examples of igneous rock
  - Main occurrences of metamorphic rock
  - Clastic and carbonate sediments
- **Earth surface processes [Dr. Sean McClenaghan]**
  - Glacial landforms and sediments
  - Weathering, slope and river processes
  - Coastal processes
  - Role of society in controlling surface processes
- **Natural hazards [Dr. Sean McClenaghan]**
  - Earthquakes
  - Tsunamis
  - Volcanic hazards
  - Radon and other radiological hazards
- **Climate [Dr. Sean McClenaghan]**
  - Role of atmosphere, oceans and the solid Earth in controlling climate
  - The Greenhouse Effect
  - Milankovitch cycles
  - Role of society in moderating climate change
- **Geology of Mineral Deposits [Dr. Sean McClenaghan]**
  - Natural Resources and their extraction
  - Mine Engineering
  - Acid Rock Generation
- **Rock mechanics, Karst and Sink holes [Prof. Sara Pavia]**
  - Mechanical behaviour of rock and mortars/concretes
  - Strength and deformation
  - Karst and evaporite sink holes: development and remediation
  - Analysis of rock properties, field identification.
  - Hazardous compositions and implications for design.
  - Standard laboratory tests

- **Structural Geology. Properties of rock mass [Dr. Marie Flemming]**
  - Logging and discontinuity analysis
  - Stereographic projection
  - Behaviour of rock mass
  - Slope failures in rock
  - Analysis of slope stability
  - Slope failure – landslide, plane failure, wedge failure.
  - Factors of safety against sliding: the Mohr-Coulomb equation.

Teaching and Learning Methods

Lectures, seminars, online learning via VLE, field trips, laboratories, practicals.

Assessment Details[2]
Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Examination	2 hour written examination	LO1-8	100%	

Reassessment Requirements

Contact Hours and Indicative Student Workload[2]

Contact hours: approx. 30 hours
Independent Study (preparation for course and review of materials): approx. 40 hours; Researching journals; reading text books recommended in module booklist; reviewing lecture material and class notes
Independent Study (preparation for assessment, incl. completion of assessment):): approx. 30 hours; literature review, review of lectures and tutorial questions.

[2] TEP Guidelines on Workload and Assessment

Recommended Reading List	***Geology for Engineers*** *Understanding Earth* (second edition), Press & Siever *The Solid Earth* (second edition), Fowler *Geology Basics for Engineers, Parriaux* ***Engineering geology*** Waltham, T (2009) *Foundations of Engineering geology*, Third edition, Spon Press Hoek, E & Bray, JW (1981). *Rock slope engineering*. E & FN Spon.
Module Pre-requisite	No Pre- or Co requisite
Module Co-requisite	No Pre- or Co requisite
Module Website	
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	Geology/Natural Sciences
Module Approval Date	
Approved by	
Academic Start Year	January 2025
Academic Year of Date	2025/26