<table>
<thead>
<tr>
<th><strong>Module Code</strong></th>
<th>CEU33A08</th>
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<tr>
<td><strong>Module Name</strong></td>
<td>3A8 GEOLOGY FOR ENGINEERS</td>
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<tr>
<td><strong>ECTS Weighting</strong></td>
<td>5 ECTS</td>
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<tr>
<td><strong>Semester taught</strong></td>
<td>Semester 2</td>
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<tr>
<td><strong>Module Coordinator/s</strong></td>
<td>Sean Mc Clenaghan / David O’Connell</td>
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**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.
LO8. Explain the occurrence of groundwater, apply equations of groundwater flow to simple engineering problems, and give examples of the application of hydrogeology to environmental engineering.

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 provides an introduction to 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 McClanaghan]
  - 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

- **Hydrogeology [Dr. David O’Connell]**
  - Hydrogeological terms
  - Occurrence of groundwater
  - Groundwater head and groundwater flow
Teaching and Learning Methods

- Application of hydrogeology to landfill site selection and design
- Groundwater protection

e.g., lectures, seminars, laboratories, practice-based etc...
Teaching will be through direct lectures and/or online, discussions groups, in-class tutorials and problem solving. Potentially we will have entirely online teaching depending on covid-19.
### Assessment Details

Please include the following:

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

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<tr>
<th>Assessment Component</th>
<th>Assessment Description</th>
<th>LO Addressed</th>
<th>% of total</th>
<th>Week due</th>
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</thead>
<tbody>
<tr>
<td>Examination</td>
<td>2 hour written examination</td>
<td>LO1-8</td>
<td>100%</td>
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### Reassessment Requirements

100% written examination

### Contact Hours and Indicative Student Workload

**Contact hours:** approx 30 hours

**Independent Study (preparation for course and review of materials):** approx 40 hours; Researching journals; reading textbooks 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.

### Recommended Reading List

- *Understanding Earth* (second edition), Press & Siever
- *The Solid Earth* (second edition), Fowler
- *Geology Basics for Engineers*, Parriaux
- *Introducing Groundwater* (second edition), Price
- *Water wells and boreholes*, Misstear, Banks & Clark

### Module Pre-requisite

No Pre- or Co requisite

### Module Co-requisite

No Pre- or Co requisite

### Module Website
<table>
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<tr>
<th>Are other Schools/Departments involved in the delivery of this module?</th>
<th>Geology/natural sciences</th>
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<td>If yes, please provide details.</td>
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<tr>
<td>Module Approval Date</td>
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<tr>
<td>Approved by</td>
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<tr>
<td>Academic Start Year</td>
<td>January 2022</td>
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<tr>
<td>Academic Year of Date</td>
<td>2021-22</td>
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**COVID-19 contingency statement:**

While the intention is to deliver some lectures, tutorials and labs face-to-face, there is uncertainty due to the Covid-19 situation and the entire module delivery may need to change to an online delivery if required by government restrictions. In the case of a possible new lockdown scenario during teaching term:

- All lectures, tutorials and labs will be delivered online using Blackboard. Some of these sessions will be *live* sessions and your attendance at live sessions is required.
- Assignments and examinations will be conducted and submitted online.