

## MODULE DESCRIPTOR

### Module Title

Geothermal Energy

Reference	EN4202	Version	1
Created	September 2023	SCQF Level	SCQF 10
Approved	February 2024	SCQF Points	15
Amended		ECTS Points	7.5

### Aims of Module

To provide the students with in-depth knowledge of concepts and principles applicable to geothermal energy exploration, development, and operation and an awareness of the roles of geothermal energy in energy transition and mitigation of GHG emission.

### Learning Outcomes for Module

On completion of this module, students are expected to be able to:

- 1 Develop a comprehensive understanding of the origin and sources of geothermal energy resources.
- 2 Critique the main scientific and engineering principles and concepts of fluid flow, heat transfer, and energy balance to optimise geothermal energy systems
- 3 Examine geothermal well drilling including transient well testing approaches.
- 4 Examine the economics of geothermal energy development.

### Indicative Module Content

Indicative module content includes geology and properties of geothermal reservoirs, origin of geothermal heat, geothermal exploration, geothermal well drilling, development and operation of geothermal resources. Specifically, the course will cover geothermal reservoirs, origin of geothermal heat, geothermal exploration, geothermal well drilling, Geothermal well testing, Geothermal well completion, fundamentals of geothermal well testing, downhole tools in geothermal wells development, Geothermal Operation and management of geothermal wells, Geothermal energy development and utilisation infrastructure, geothermal energy economics; role of geothermal energy in energy transition and mitigation of GHG emission.

### Module Delivery

The module is taught through lectures and tutorial, supported by guided self-study.

<b>Indicative Student Workload</b>	Full Time	Part Time
Contact Hours	35	35
Non-Contact Hours	115	115
Placement/Work-Based Learning Experience [Notional] Hours	N/A	N/A
<b>TOTAL</b>	<b>150</b>	<b>150</b>
<i>Actual Placement hours for professional, statutory or regulatory body</i>		

## ASSESSMENT PLAN

If a major/minor model is used and box is ticked, % weightings below are indicative only.

### Component 1

Type: Examination Weighting: 100% Outcomes Assessed: 1, 2, 3, 4  
 Description: Closed book exam

## MODULE PERFORMANCE DESCRIPTOR

### Explanatory Text

Component 1 constitutes 100% of the module grade. To pass the module, a D grade is required.

Module Grade	Minimum Requirements to achieve Module Grade:
<b>A</b>	A
<b>B</b>	B
<b>C</b>	C
<b>D</b>	D
<b>E</b>	E
<b>F</b>	F
<b>NS</b>	Non-submission of work by published deadline or non-attendance for examination

## Module Requirements

Prerequisites for Module	EN3570
Corequisites for module	None.
Precluded Modules	None.

## INDICATIVE BIBLIOGRAPHY

- 1 Dincer, I. & Ozturk, M. 2021 Geothermal Energy Systems; Elsevier ISBN: 978-0-12-820775-8.
- 2 DiPippo, R. 2015 Geothermal Power Plants; Butterworth-Heinemann; ISBN 978-0-08-100879-9
- 3 Grant, M. A. & Bixley, P. F. 2011 Geothermal Reservoir Engineering (2nd Ed), Academic Press; ISBN: 978-0-12-383880-3
- 4 Toth A. 2015 Flow and Heat Transfer in Geothermal Systems: Basic Equations for Description and Modeling Geothermal Phenomena and Technologies; Elsevier; ISBN 978-0-12-800277-3.
- 5 Zarrouk, S. J. & McLean, K. 2019 Geothermal Well Test Analysis ? Fundamentals, Applications and Advanced Techniques, Academic Press; ISBN 9780128192665