# COURSE OUTLINE

## (1) GENERAL

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|---|---|---|---|
| SCHOOL | SCHOOL OF ENGINEERING | | |
| ACADEMIC UNIT | DEPARTMENT OF MINERAL RESOURCES ENGINEERING | | |
| LEVEL OF STUDIES | UNDERGRADUATE | | |
| COURSE CODE | MRE824 | SEMESTER | 8 |
| COURSE TITLE | SCIENCE AND TECHNOLOGY OF GEOTHERMAL FIELDS | | |

| INDEPENDENT TEACHING ACTIVITIES<br>*if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits* | WEEKLY TEACHING HOURS | CREDITS |
|---|---|---|
| LECTURES | 2 | |
| LABORATORY EXERCISES | 2 | |
| TOTAL | 4 | 5 |
| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).* | | |

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|---|---|
| COURSE TYPE<br>*general background, special background, specialised general knowledge, skills development* | Specialised general knowledge |
| PREREQUISITE COURSES: | |
| LANGUAGE OF INSTRUCTION and EXAMINATIONS: | Greek |
| IS THE COURSE OFFERED TO ERASMUS STUDENTS | Yes |
| COURSE WEBSITE (URL) | https://eclass.uowm.gr/courses/MRE168/ |

## (2) LEARNING OUTCOMES

**Learning outcomes**

*The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.*

*Consult Appendix A*

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of the course, students will:

- gain a global knowledge of geothermal activity and the formation of geothermal fields.
- become familiar with the methods and techniques applied in geothermal research and the exploitation of geothermal energy.
- know the main global and domestic geothermal fields.
- be able to assess the environmental impact of exploiting geothermal energy.

**General Competences**

*Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?*

*Search for, analysis and synthesis of data and information, with the use of the necessary technology*
*Adapting to new situations*
*Decision-making*
*Working independently*
*Team work*
*Working in an international environment*
*Working in an interdisciplinary environment*
*Production of new research ideas*
*Project planning and management*
*Respect for difference and multiculturalism*
*Respect for the natural environment*
*Showing social, professional and ethical responsibility and sensitivity to gender issues*
*Criticism and self-criticism*
*Production of free, creative and inductive thinking*
*……*
*Others…*
*…….*

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Decision-making
- Working independently
- Project planning and management
- Production of new research ideas
- Respect for the natural environment

## (3) SYLLABUS

The course aims to provide the necessary knowledge on Geothermal issues. More specifically, the following topics are taught:

- Heat of the earth's interior and thermal flow
- Geothermal energy and potential
- Geothermal fields and processes in them
- High-medium-low enthalpy geothermal energy and fluid composition
- Methods of research and identification of geothermal fields
- Development of geothermal fields
- Applications – Uses of geothermal energy
- Technical problems in the exploitation of geothermal energy and environmental impacts in geothermal application areas
- Geothermal energy in Greece
- Cost Analysis

## (4) TEACHING and LEARNING METHODS - EVALUATION

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|---|---|
| **DELIVERY**<br>*Face-to-face, Distance learning, etc.* | Face-to-face lectures, distance seminars, laboratory exercises on the computer using special software |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**<br>*Use of ICT in teaching, laboratory education, communication with students* | Use of a projection system, special software installed in computer units of a special laboratory, organization and programming of the course and communication with students through the asynchronous e-learning platform open eclass. |
| **TEACHING METHODS**<br>*The manner and methods of teaching are described in detail.*<br>*Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.*<br><br>*The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS* | *Activity* / *Semester workload*<br>Lectures: 28<br>Theory study: 34<br>Lab exercises: 28<br>Study and analysis of bibliography: 20<br>Essay writing: 20<br>Seminars / site visits: 20<br>Course total: **150** |
| **STUDENT PERFORMANCE EVALUATION**<br>*Description of the evaluation procedure*<br><br>*Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other*<br><br>*Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | Final written examination of theory and exercises (60% of the total grade of the course), intermediate written examination of theory (20%), assignments (20%).<br>The evaluation criteria are given on the relevant page of the course on the asynchronous e-learning platform open e-class and are analyzed to the students at the beginning of the semester. |

## (5) SUGGESTED BIBLIOGRAPHY

*- Suggested bibliography:*


*Βραχόπουλος Μ., 2016, Κανονική Γεωθερμία – Αρχές Σχεδιασμού Γεωθερμικών Συστημάτων και Εφαρμογές, Ελληνικά Ακαδημαϊκά Ηλεκτρονικά Συγγράμματα και Βοηθήματα - Αποθετήριο "Κάλλιπος".*
*Glassey W., 2014, Geothermal Energy: Renewable Energy and the Environment, CRC Press, 410 pages*
*Καρυδάκης Γ., 2005, Γεωθερμική Ενέργεια, Εκδόσεις ΧΡ.ΙΩΑΝΝΟΥ - ΑΙΜ.ΓΟΛΕΜΗΣ Ο.Ε., 355 pages*
*Κιοσκερίδης Ι., 2019, Ανανεώσιμες Πηγές Ενέργειας, Εκδόσεις Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε., 896 pages*
*Rosen M., Koohi-Fayegh S., 2016, Geothermal Energy: Sustainable Heating and Cooling Using the Ground, Wiley, 391 pages*
*Stober I., Bucher K., 2013, Geothermal Energy – From Theoretical Models to Exploration and Development, Springer, 290 pages*
*Φυτίκας Μ., Ανδρίτσος Ν., Γεωθερμία, Εκδόσεις Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε., 416 pages*


*- Related academic journals:*

*Energies, MDPI*
*Geothermal Energy, Springer*
*Geothermics, Elsevier*