Universidad Zaragoza

**Academic Year/course: 2024/25**

# 60379 - Geothermics and its applications

## Syllabus Information

**Academic year:** 2024/25
**Subject:** 60379 - Geothermics and its applications
**Faculty / School:** 100 - Facultad de Ciencias
**Degree:** 624 - Master's in Geology: Techniques and Applications
**ECTS:** 3.0
**Year:** 1
**Semester:** Second semester
**Subject type:** Optional
**Module:**

## 1. General information

The objective of this subject is to introduce the student to the basic and applied aspects of geothermal energy and geothermal resources. To this end, it is essential that the student learns how a geothermal system works, the different types of geothermal systems, the different ways of using geothermal energy and its environmental impact, and the different methodologies for prospecting geothermal resources.

## 2. Learning results

Upon completion of the subject, the student will be able to:

- Quantify the key processes in a geothermal system, including physical processes (heat transfer through conduction and convection) and chemical processes (composition changes in geothermal fluids due to mixing, boiling, and temperature variations).
- Identify and differentiate between various types of geothermal systems, understanding their energy uses and environmental impacts.
- Apply theoretical knowledge to practical problems in the exploration, the estimation of the geothermal potential, and the eventual exploitation of geothermal energy in a given area.

## 3. Syllabus

Theory:

Topic 1. Fundamentals of geothermal energy.

Topic 2. Classification of geothermal systems.

Topic 3. High temperature hydrothermal systems. Geothermal power plants.

Topic 4. Petrothermal systems.

Topic 5. Medium and low temperature geothermal systems. Shallow geothermal energy.

Topic 6. Exploration and prospecting of geothermal systems.

Topic 7. Evaluation of geothermal potential.

Topic 8. Impacts of geothermal energy use.

Practical classes:

Practice 1. Heat flow maps.

Practice 2. EGS potential in Spain.

Practice 3. Geothermometric calculations.

Practice 4. Calculation of heat flux in Aragon springs.

Seminar:

Assessment of geothermal energy utilization in the world.

## 4. Academic activities

**Activity 1: master classes** (14h). Development of the theoretical bases of the subject, according to the program detailed in section 3.

**Activity 2: classroom-based and computer practices** (12h). Solving problems related to the contents of activity 1, using both

general-purpose and dedicated computer programs.

**Activity 3: seminars** (4h). Preparation by the students of a brief presentation on a topic or problem proposed in advance by the teachers, followed by a group discussion.

**Activity 4: student's personal work** (45h non face-to-face). Time needed to consolidate knowledge and prepare reports.

## 5. Assessment system

**Activity 1** (master classes). Assessment by means of an individual theoretical-practical questionnaire at the end of the subject **(20%** of the subject grade).

**Activity 2** (classroom-based practicals and case studies). Assessment of the reports of each practical session, delivered within the established deadline **(50%** of the subject´s grade).

**Activity 3** (seminars). Assessment of the written report (individual or in group) and the oral presentation (**30%** of the subject´s grade).

Final grade of the subject: weighted average of the grades of each activity, provided that the grade of each one is equal to or higher than 5.

Overall assessment

For those students who have not opted for continuous assessment or who have not passed the subject through continuous assessment activities, a written theoretical-practical exam will be taken to assess the acquisition of the same competencies as through continuous assessment. The exam may include questions related to scientific texts whose references will be provided at least one week prior to the date of the exam.

## 6. Sustainable Development Goals

7 - Affordable and Clean Energy
9 - Industry, Innovation and Infrastructure
13 - Climate Action