60440 - Underground geological repositories

Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	541 - Master's in Geology: Techniques and Applications
ECTS	5.0
Year	1
Semester	Second semester
Subject Type	Optional
Module	---

1.General information

1.1.Introduction

The study of geological storage and disposal integrates different issues associated to most of the geological disciplines (Petrology, Stratigraphy, Tectonics, Geochemistry, Hydrogeology, etc.) and with a clear focus on 1) the problem of wastes management and 2) the use and exploitation of geological resources. The understanding of a wide set of theoretical principles and the knowledge of the use of many different methodologies is necessary in order to be able to deal with this type of problems. Therefore, the course is focused on the study of the general geological aspects of the different storage media in general and on the particular and specific issues related to the different materials to be stored or disposed, with special emphasis on radioactive wastes, CO2 and gas.

1.2.Recommendations to take this course

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

The classes will start at the beginning of the second semester following the academic calendar of the Sciences Faculty.

2.Learning goals

2.1.Learning goals

Students should:

- know the different geological environments suitable as storage and/or disposal media;
- recognise the different properties that condition the suitability of a geological environment as a storage media;
- learn the different techniques for exploration, characterisation and assessment of the geological storage systems;
- be able to decide when a rock formation is suitable as a storage media, based on its tectonic, petrophysical, geochemical and hydrogeological properties;
- learn the methodologies for the monitoring and assessment of the geological disposal systems and their effects on the environment; and
- learn to use multidisciplinar information from different sources and to integrate and summarise that in a comprehensive report and oral presentation.

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2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

To understand the main theoretical principles behind geological storage and disposal and the specific characteristics and methodologies applied to the different materials and concepts.

3.2.Competences

Students should:

- know the different geological environments suitable as storage and/or disposal media;
- recognise the different properties that condition the suitability of a geological environment as a storage media;
- learn the different techniques for exploration, characterisation and assessment of the geological storage systems;
- be able to decide when a rock formation is suitable as a storage media, based on its tectonic, petrophysical, geochemical and hydrogeological properties;
- learn the methodologies for the monitoring and assessment of the geological disposal systems and their effects on the environment; and
- learn to use multidisciplinar information from different sources and to integrate and summarise that in a comprehensive report and oral presentation.

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

The student will have to show that has reached the learning outcomes through the following evaluation activities:

Continuous Assessement:

- Activity 1 will be assessed through individual questionaires with theoretical-practical content uf each course unit (maximum one per thematic unit). This activity is worth 45% of the final grade.

- Activity 2 will be assessed through the evaluation of the reports from the practical sessions. This activity is worth 10% of the final grade.

- Activity 3 will be assessed through the two individual or in group works that will be presented by each student about one chosen subject related to the two main units of the course. The active participation on the debates will also be considered. This activity is worth 45% of the final grade.

Each questionaire/exercise or presentation will be graded between 0 and 10. The issue will be passed with a grade equal or greater than 5. The final/global calification will be calculated applying the corresponding weights for each activity as far as every one has a grade greater than 4.

Final Assessement

The student that decides to take only the final exam, or the student that has not passed the continuous assessement, will

have to pass a final assessement consisting of several theoretical-practical questions about the units treated during the course. The exam will be graded from 0 to 10 and it will be considered passed with a calification of 5.

Off-site students Exams

The off-site students will be evaluated with the same final/global assessement indicated in the previous section.

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

The methodology followed in this course provides the students with the necessary link between the theoretical knowledgement and its practical use in the solving of actual problems in different types of geological storage. Students will develop competences to deal with different issues related to the characterisation, monitoring and assessment of different geological storage systems.

A wide range of teaching and learning tasks are implemented, such as lectures, practice sessions and seminars.

5.2.Learning tasks

The course includes the following learning tasks:

- **Activity 1 - Lectures** (1.5 ECTS). Development of the concepts and theoretical basis of the course.
- **Activity 2 - Practice Sessions** (2 ECTS). Management and assessment of real and/or theoretical-practical cases about the different types of storage systems described in the course.
- **Activity 3 - Seminars** (1.5 ECTS). Debates, discussions and presentations on the alternatives, problems and the present and past issues related to the geological storage.

The duration of the sessions will be of 4 hours and will combine Lectures with Practice sessions or Seminars, depending on the syllabus.

5.3.Syllabus

The course will address the following topics:

Lectures

Topic 1. Introduction. Geological storage and disposal, concept and types.

Topic 2. Radioactive waste disposal.

Topic 3. Geological storage of gas and CO2.

Topic 4. Geothermics.

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Topic 5. Effects, risks and consequences of the geological disposals.

Practice sessions

There are several practice sessions and seminars on the topics covered during the lectures that will be given in parallel to them.

- The practice sessions will involve solving practical cases related to the exploration and assessment of suitable geological areas for different underground repositories in Spain and other European countries. Additionally, some examples of geothermic use in local areas, and the assessment of the environmental effects of some underground facilities, will be analysed by using some conventional and specific calculation programs.
- The seminars will include the discussion and debate of different topics related to the worldwide socio-political, economic and scientific context, responses and positions with respect to the geological storage and disposal. Every student will prepare an oral presentation about one of the topics proposed by the lecturers at the beginning of the course.

5.4.Course planning and calendar

The course includes the following learning tasks:

- Hours of autonomous work: 75
- Hour of Lectures/Seminars: 30
- Hours of Practice/Problem Classes: 20
- Days of Fieldwork: 0

5.5.Bibliography and recommended resources

Course materials will consist of lecture notes, lecture Powerpoint presentations and practical class handouts. Recommended texts are:

Advances in the Geological Storage of Carbon Dioxide. Springer, Netherlands. Lombardi et al. (2006).

Principles and standards for the disposal of long-lived radioactive wastes. Waste Management Series, Volume 3, Pergamon, Elsevier. Chapman, N. and McCombie, Ch. (2003).

Geological disposal of carbon dioxide and radioactive wastes: a comparative Assessment. Springer. Toth (2011).

Geological repository systems for safe disposal of spent nuclear fuels and radioactive waste. Woodhead Publishing Limited. Ahn and Apted (2010).