Universidad Zaragoza

Academic Year/course: 2022/23

60386 - Environmental Pollution

Syllabus Information

Academic Year: 2022/23
Subject: 60386 - Environmental Pollution
Faculty / School: 100 - Facultad de Ciencias
Degree: 624 - Master's in Geology: Techniques and Applications
ECTS: 6.0
Year: 1
Semester: Second semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

Contamination problems nowadays are associated to many human activities (agriculture, farming, mining, industrial and urban-related activities). Therefore, there are also many different contaminant substances prone to pollute the environment (organic compounds like oil-derived ones, pesticides, etc.; and inorganic compounds like heavy metals, salts, fertilisers, etc.) with different social and economic consequences. In this context, the main aim of this course is to provide the student with a global perspective about the contamination problems affecting our surface environment (sediments, soils and waters) and about the possible ways to manage their assessment, mitigation and remediation.

These objectives are in the line of the following Sustainable Development Goals of the UN 2030 Agenda (https://www.un.org/sustainabledevelopment/), in such a way that the acquisition of the knowledge given in this course provides the ability and competence to contribute to their achievement:

SDG 4: Quality Education

SDG 6: Clean Water and Sanitation

SDG 9: Industry, Innovation and Infrastructure

SDG 11: Sustainable Cities and Communities

SDG 12: Responsible consumption and production

1.2. Context and importance of this course in the degree

This course offers an advanced view of the contamination processes affecting soils, sediments and natural waters (surface and groundwater), three key interrelated environmental reservoirs in the dispersion of contaminants. Being an interdisciplinary course, the students will be able to use the specific conceptual background taught in the course, but also knowledge from other, more general geological disciplines focused on the management of contamination problems. This course is suitable for students interested in future research activities and/or in a professional career related to the environmental sciences.

1.3. Recommendations to take this course

The students should have a general knowledge in Petrology, Geochemistry, Mineralogy and Hydrogeology. It is highly recommended that the course is approached by the student with a continuous and daily working plan. There are different supporting ways to help the students through the learning curve, including tutorial sessions, orientation and evaluation sessions.

2. Learning goals

2.1. Competences

After passing this course, the student will be more competent for...

CB6: To have and understand knowledge which provides the ground or opportunity to be innovative in the development and/or application of ideas, often in a research-based context.

CB7: To have the ability to apply the acquired knowledge and problem solving capacities in new or little-known environments in larger (or multidisciplinary) contexts related to a field of study.

CB8: To have the ability to integrate knowledge and to face the complex work of formulating judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.

CG1: To predict and control the evolution of complex situations by developing new and innovative methodologies adapted to the scientific, research and/or professional geological areas.

CG3: To be able to assess the problems related with the representativity, accuracy and uncertainty of the activities related to sampling, and to the acquisition of field and laboratory data.

CG4:To have the ability to manage, interpret and present data using the most suitable qualitative and quantitative methodologies and software.

CG6: To be able to assume the responsibility of the own professional development and specialisation in one or more geological fields.

CT1: To use the English language to obtain information and to transfer it.

CT2: To manage and select the suitable sources of bibliographic information.

CE2: To have the ability to integrate evidences in order to propose and test hypothesis through the scientific method in the framework of the geological research.

2.2. Learning goals

Students will be able:

- to identify the different types of contamination in soils, sediments and waters caused by anthropic activities (mining, industry, farming, etc.);
- to select and use the most suitable methods and techniques for soil/sediment/water sampling and analyses when facing a contamination study;
- to describe the mechanisms controlling fate of contaminants in the exogenous environment;
- to relate pollution issues with the general methodology of risk management;
- to use the information about contamination and remediation published in Spanish and English, and
- to use the English language to mine information, write summaries and prepare oral presentations.

2.3. Importance of learning goals

This course will help the students to increase their theoretical and practical knowledge for the management of different contamination problems in soils, sediments and waters. It will also help them to develop other abilities very useful in other areas of scientific research or professional practice.

3. Assessment (1st and 2nd call)

3.1. 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 Assessment:

- **Task 1 (lectures)** will be assessed through individual quizzes for each course unit. This activity is worth 25% of the final grade.

- **Task 2 (practice problems)** will be assessed through the evaluation of the lab reports handed over by the students after the practice sessions. This activity is worth 25% of the final grade.

- **Task 3 (seminars)** will be assessed through individual quizzes about the topics of the seminars. This activity is worth 10% of the final grade.

- **Task 4 (laboratory practice)** will be assessed through the evaluation of the reports (optionally in an audiovisual format) from the lab sessions. This activity is worth 20% of the final grade.

- **Task 5 (field trip)** will be assessed through the evaluation of a report (optionally in an audiovisual format) on the activities carried out during the fieldtrip and the conclusions that can be drawn therof. This activity is worth 20% of the final grade.

Each quiz/exercise or presentation will be graded on a scale from 0 to 10. Each item will be passed with a grade equal or greater than 5. The final/global grade will be calculated applying the corresponding weights for each activity, provided every activity 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 course by continuous assessment, will have to pass a final written exam 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 grade of 5.

Off-site students Exams

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

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course provides the students with the necessary link between the theoretical knowledge and its practical application in the resolution of actual contamination problems. Students will develop competences to deal with different issues related to the characterisation, monitoring, mitigation and remediation of different contamination problems.

A wide range of teaching and learning tasks are implemented, such as lectures, practice sessions with computer problems, laboratory practices, seminars and a field trip. They are complementary to each other and correspond to the assessment tasks described in the previous section.

4.2. Learning tasks

The course includes the following learning tasks:

- **Learning task 1 - Lectures** (2 ECTS). Development of the concepts and theoretical basis of the course.
- **Learning task 2 - Practice Sessions** (2 ECTS). Management and assessment of real and/or theoretical-practical cases about the different types of contamination.
- **Learning task 3 - Chemistry Lab Sessions** (0.8 ECTS). Gain practical skills in the most important physical and chemical analysis techniques of soils, sediments and water in relation to pollution problems.
- **Learning task 4 - Seminars** (0.4 ECTS). Debates, discussions and presentations on some real and socio-economical important contamination problems.
- **Learning task 5 - Field trip** (0.8 ECTS). Design and deploy a soil, sediment and water sampling campaign for the assessment of the level of contamination of a selected site.

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

Learning and assessment tasks will be under the on-site mode except if the authorities indicate the obligation of doing everything on-line due to the Covid-19 health situation.

Note: *The approach, methodology and evaluation indicated in this guide are prepared to be the same under any teaching scenario. They will be adjusted to the socio-sanitary conditions at any time, as well as to the instructions given by the competent authorities.*

4.3. Syllabus

The course will address the following topics:

Topic 1. Pollution as a risk management problem (4 hours, including 2 hours of practicals)

Topic 2. Pollution sources and types of contaminants (4 hours, including 2 hours of practicals)

Topic 3. Physics of the fate and transport of contaminants (6 hours, including 4 hours of practicals)

Topic 4. Chemistry of the fate and transport of contaminants (8 hours, including 4 hours of practicals)

Topic 5. Sampling and analysis of contaminated sites (12 hours, including 2 hours of practicals and 8 hours of geochemistry lab)

Topic 6. Case study: acid mine drainage (12 hours, including 6 hours of practicals)

Topic 7. Remediation and remediation technologies (14 hours, including 4 hours of seminars and a 1-day fieldtrip)

4.4. Course planning and calendar

6 ECTS:

- Hours of lectures: 20
- Hours of Practice/Problem classes: 20
- Hours of Laboratory: 8
- Hours of Field Trips: 8
- Hours of Seminars: 4
- Hours of autonomous work and evaluation: 90

Total hours: 150

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

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=60386