



POLITÉCNICA

INTERNATIONAL
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LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros de Minas y
Energía

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

63000254 - Soil And Grondwater Geochemistry

DEGREE PROGRAMME

06CA - Master Universitario En Contaminación De Suelos Y Aguas Subterráneas

ACADEMIC YEAR & SEMESTER

2024/25 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	63000254 - Soil And Grondwater Geochemistry
No of credits	4 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	06CA - Master Universitario en Contaminación de Suelos y Aguas Subterráneas
Centre	06 - Escuela Técnica Superior De Ingenieros De Minas Y Energía
Academic year	2024-25

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Miguel Izquierdo Diaz (Subject coordinator)	423	miguel.izquierdo@upm.es	M - 15:00 - 18:00 Th - 15:00 - 18:00 Please request in advance by email
Fernando Barrio Parra	432	fernando.barrio@upm.es	M - 10:00 - 13:00 Tu - 10:00 - 13:00 Please request in advance by email

Eduardo De Miguel Garcia	439	eduardo.demiguel@upm.es	M - 11:30 - 13:30 M - 14:30 - 15:30 W - 11:30 - 13:30 W - 14:30 - 15:30 Please request in advance by email
Antonio Leoncio Callaba De Roa	439	antonio.callaba@upm.es	F - 16:00 - 19:00 Please request in advance by email

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Geology
- Inorganic and Organic Chemistry

4. Skills and learning outcomes *

4.1. Skills to be learned

CB06 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

CB07 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio

CB08 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios

CB09 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CE06 - Aplicar conceptos geoquímicos y geofísicos al estudio del reparto de los contaminantes en las distintas fases del subsuelo

CE09 - Manejar e interpretar modelos de comportamiento de fases libres en el subsuelo

CG01 - Manejar las herramientas científicas necesarias para estimar la distribución, transporte y degradación de contaminantes en los suelos y las aguas subterráneas

CT01 - Emitir juicios en función de criterios, de normas externas o de reflexiones personales

CT02 - Desarrollar habilidades para trabajar en contextos internacionales, respetando y considerando entornos socioculturales y científico-técnicos distintos, en los trabajos y proyectos realizados

CT04 - Gestionar la información procedente de diversas fuentes, valorando su relevancia, fiabilidad y pertinencia para un propósito determinado, analizándola y organizándola

CT05 - Proponer alternativas creativas y originales, valorando su viabilidad en la solución de problemas en el ámbito de la ingeniería

CT08 - Utilizar la lengua inglesa para la comunicación oral y escrita a nivel avanzado en entornos académicos y profesionales

4.2. Learning outcomes

RA14 - Analyze the effect of the contaminants' physical-chemical properties on their behaviour in soil and groundwater

RA15 - Apply physical-chemical tools to evaluate a contaminant' phase partition in soil and groundwater

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

This course deals with the geochemical processes that determine the fate and transport of organic and inorganic contaminants in soils and groundwater.

5.2. Syllabus

1. Soil: A multi-phase system & its properties.
2. Solubility in water and non-polar solvents.
3. Volatilization & Degradation.
4. Sorption.
5. Multi-phase partition of contaminants. Mass balance & fugacity approaches.
6. Introduction to dissolved and free-phase contaminant transport.

6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Introduction Duration: 01:00 Lecture Soil as a multi-phase system. Properties (1/2) Duration: 03:00 Lecture			
2	Soil as a multi-phase system. Properties (2/2) Duration: 02:00 Lecture Solubility (1/3) Duration: 02:00 Lecture			Assignment #1 Individual work Progressive assessment Not Presential Duration: 01:00
3	Solubility (2/3) Duration: 02:00 Lecture Solubility (3/3) Duration: 01:30 Lecture	Solved assignment #1 Duration: 00:30 Problem-solving class		Assignment #2 Individual work Progressive assessment Not Presential Duration: 01:00
4	Volatilization & Degradation Duration: 01:30 Lecture	Solved assignment #2 Duration: 00:30 Problem-solving class Lab session #1: Soil properties Duration: 02:00 Laboratory assignments		Assignment #3 Individual work Progressive assessment Not Presential Duration: 02:00 Lab report #1 Group work Progressive assessment Not Presential Duration: 03:00
5	Sorption (1/2) Duration: 02:00 Lecture Sorption (2/2) Duration: 01:30 Lecture	Solved assignment #3 Duration: 00:30 Problem-solving class		Assignment #4 Individual work Progressive assessment Not Presential Duration: 06:00
6	Phase partition (1/2) Duration: 02:00 Lecture Phase partition (2/2) Duration: 01:30 Lecture	Solved assignment #4 Duration: 00:30 Problem-solving class Lab session #2: Partition coefficients Duration: 02:00 Laboratory assignments		Assignment #5 Individual work Progressive assessment Not Presential Duration: 03:00 Lab report #2 Group work Progressive assessment

				Not Presential Duration: 03:00
7	Free phases: Partition Equilibrium Duration: 02:00 Lecture	Lab session #3: Adsorption Isotherm Duration: 02:00 Laboratory assignments		Lab report #3 Group work Progressive assessment Not Presential Duration: 03:00
8	Fundamentals of NAPL fate & transport in the vadose and saturated zones (1/2) Duration: 02:00 Lecture	Solved assignment #5 Duration: 00:30 Problem-solving class		
	Fundamentals of NAPL fate & transport in the vadose and saturated zones (2/2) Duration: 01:30 Lecture			
9				Final Test Written test Progressive assessment Presential Duration: 04:00 Final Test Written test Global examination Presential Duration: 04:00
10				
11				
12				
13				
14				
15				
16				
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
2	Assignment #1	Individual work	No Presential	01:00	8%	0 / 10	CB10 CT04 CT08
3	Assignment #2	Individual work	No Presential	01:00	6%	0 / 10	CB07 CB10 CG01 CT01 CT04 CT08 CE06
4	Assignment #3	Individual work	No Presential	02:00	6%	0 / 10	CB07 CB08 CB10 CG01 CT01 CT04 CT05 CT08 CE06
4	Lab report #1	Group work	No Presential	03:00	4%	0 / 10	CB07 CB09 CT01 CT02 CT04 CT08
5	Assignment #4	Individual work	No Presential	06:00	12%	0 / 10	CB06 CB07 CB08 CB10 CG01 CT01 CT04 CT05 CT08 CE06 CE09

6	Assignment #5	Individual work	No Presential	03:00	6%	0 / 10	CB06 CB07 CB08 CB10 CG01 CT01 CT04 CT08 CE06 CE09
6	Lab report #2	Group work	No Presential	03:00	4%	0 / 10	CB08 CB09 CG01 CT02 CT04 CT08 CE06
7	Lab report #3	Group work	No Presential	03:00	4%	0 / 10	CB08 CB09 CG01 CT02 CT04 CT08 CE06
9	Final Test	Written test	Face-to-face	04:00	50%	3 / 10	CB06 CB07 CB08 CG01 CT01 CT04 CT05 CT08 CE06 CE09

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
9	Final Test	Written test	Face-to-face	04:00	100%	5 / 10	CB06 CB07 CB08 CB09 CB10 CG01 CT01 CT02 CT04 CT05 CT08 CE06 CE09

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Final Test	Written test	Face-to-face	04:00	100%	5 / 10	CB06 CB07 CB08 CB09 CB10 CG01 CT01 CT02 CT04 CT05 CT08 CE06 CE09

7.2. Assessment criteria

Laboratory practicals are **compulsory activities that cannot be retaken** and attendance to them during the academic year is **compulsory** in order to obtain a pass in the subject.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Course presentations & Notes	Web resource	Course web page (moodle)
Technical guides & reports	Bibliography	Course web page (moodle)
Chiou, C.T. (2002): Partition and adsorption of organic contaminants in environmental systems. John Wiley and Sons, Hoboken, NJ. (USA)	Bibliography	
Connell, D.W., Hawker, D.W., Warne M.S.J., Vowles, P.P. (1997): Basic Concepts of Environmental Chemistry. CRC Press, Boca Raton, Fl. (USA)	Bibliography	
Cozzarelli, I.M., Baehr, A.L. (2005): Volatile fuel hydrocarbons and MTBE in the Environment. In "Environmental Geochemistry". Elsevier, Oxford (UK)	Bibliography	
Crosby, D.G. (1998): Environmental Toxicology and Chemistry. Oxf. Univ.Press,NY. (USA)	Bibliography	
Fetter, C.W. (2001): Applied Hydrogeology, Fourth Edition. Prentice-Hall, New Jersey (USA)	Bibliography	

9. Other information

9.1. Other information about the subject

The subject is related to SDG6 (Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally), SDG14 (Target 14.1: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution) and SDG15 (Target 15.1: By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements).

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