ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

63000155 - Reservoir Simulation

DEGREE PROGRAMME

06AF - Máster Universitario En Ingeniería De Minas

ACADEMIC YEAR & SEMESTER

2023/24 - Semester 2

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	63000155 - Reservoir Simulation
No of credits	3 ECTS
Type	Optional
Academic year ot the programme	Second year
Semester of tuition	Semester 4
Tuition period	February-June
Tuition languages	English
Degree programme	06AF - Máster Universitario en Ingeniería de Minas
Centre	06 - Escuela Técnica Superior De Ingenieros De Minas Y Energía
Academic year	2023-24

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Ramon Rodriguez Pons-Esparver (Subject coordinator)	604	ramon.rodripons@upm.es	Tu - 11:00 - 14:00 W - 11:00 - 14:00

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

3. Skills and learning outcomes *

3.1. Skills to be learned

CE01 - Capacidad para abordar y resolver problemas matemáticos avanzados de ingeniería, desde el planteamiento del problema hasta el desarrollo de la formulación y su implementación en un programa de ordenador. En particular, capacidad para formular, programar y aplicar modelos analíticos y numéricos avanzados de cálculo, proyectos, planificación y gestión, así como capacidad para la interpretación de los resultados obtenidos, en el contexto de la ingeniería de minas.

CG18 - Conocimientos adecuados de los aspectos científicos y tecnológicos de métodos matemáticos, analíticos y numéricos de la ingeniería, mecánica de fluidos, mecánica de medios continuos, cálculo de estructuras, carboquímica, petroquímica y geotecnia

3.2. Learning outcomes

RA105 - Comprender los procesos básicos asociados a un yacimiento de hidrocarburos y a un almacenamiento de CO2

RA107 - Comprender los modelos fundamentales de simulación en yacimientos de hidrocarburos

RA106 - Conocer los parámetros fundamentales para su caracterización

RA108 - Plantear y desarrollar las ecuaciones diferenciales de flujo de hidrocarburos en medio poroso

RA109 - Aplicar el método de diferencias finitas a la simulación del flujo en yacimientos de hidrocarburos

RA110 - Aplicar la simulación numérica, a través de herramientas informáticas empleadas por la industria, a distintos casos reales de producción y almacenamiento

* 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.

4. Brief description of the subject and syllabus

4.1. Brief description of the subject

This subject allows an approach to the reservoir simulation and gas storage. For that purpose, after knowing the fundamentals and the mathematic formulation of the main involved processes that appear in the reservoir simulation, numerical techniques are applied for the resolution of two phase and three phase flow problems in a porous media. For this task, commercial software is used, as it is done in the oil & gas industry.

4.2. Syllabus

1. Introduction to reservoir simulation and to NG and CO2 storage
2. Fluid flow equations in a porous media
3. Numerical discretization and solution of the fluid flow equations (1, 2 & 3 phases)
4. Real applications to two-phase and three-phase reservoir and CO2 & NG storage problems

5. Schedule

5.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	**Introduction to reservoir simulation and to NG and CO2 storage** Duration: 01:00 Lecture	**Introduction to reservoir simulation and to NG and CO2 storage** Duration: 01:00 Problem-solving class		**Full participation (8 weeks)** Other assessment Continuous assessment Presential Duration: 00:00
2	**Introduction to reservoir simulation and to NG and CO2 storage** Duration: 02:00 Lecture	**Introduction to reservoir simulation and to NG and CO2 storage** Duration: 02:00 Problem-solving class		**Full participation (8 weeks)** Other assessment Continuous assessment Presential Duration: 00:00
3	**Fluid flow equations in a porous media** Duration: 02:00 Lecture	**Fluid flow equations in a porous media** Duration: 02:00 Problem-solving class		**Full participation (8 weeks)** Other assessment Continuous assessment Presential Duration: 00:00
4	**Fluid flow equations in a porous media** Duration: 01:00 Lecture	**Fluid flow equations in a porous media** Duration: 03:00 Problem-solving class		**Full participation (8 weeks)** Other assessment Continuous assessment Presential Duration: 00:00
5	**Numerical discretization and solution of the fluid flow equations (1, 2 & 3 phases)** Duration: 02:00 Lecture	**Numerical discretization and solution of the fluid flow equations (1, 2 & 3 phases)** Duration: 02:00 Problem-solving class		**Full participation (8 weeks)** Other assessment Continuous assessment Presential Duration: 00:00
6	**Numerical discretization and solution of the fluid flow equations (1, 2 & 3 phases)** Duration: 01:00 Lecture	**Real applications to two-phase and three-phase reservoir and CO2 & NG storage problems** Duration: 03:00 Problem-solving class		**Full participation (8 weeks)** Other assessment Continuous assessment Presential Duration: 00:00
7		**Real applications to two-phase and three-phase reservoir and CO2 & NG storage problems** Duration: 04:00 Problem-solving class		**Full participation (8 weeks)** Other assessment Continuous assessment Presential Duration: 00:00
8		**Real applications to two-phase and three-phase reservoir and CO2 & NG storage problems** Duration: 02:00 Problem-solving class		**Full participation (8 weeks)** Other assessment Continuous assessment Presential Duration: 00:00
9				

10				
11				
12				
13				
14				
15				**Final work presentation** Individual work Continuous assessment Presential Duration: 02:00 **Final exam** Problem-solving test Final examination Presential Duration: 02:00
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.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Full participation (8 weeks)	Other assessment	Face-to-face	00:00	2.5%	/ 10	
2	Full participation (8 weeks)	Other assessment	Face-to-face	00:00	2.5%	/ 10	
3	Full participation (8 weeks)	Other assessment	Face-to-face	00:00	2.5%	/ 10	
4	Full participation (8 weeks)	Other assessment	Face-to-face	00:00	2.5%	/ 10	
5	Full participation (8 weeks)	Other assessment	Face-to-face	00:00	2.5%	/ 10	
6	Full participation (8 weeks)	Other assessment	Face-to-face	00:00	2.5%	/ 10	
7	Full participation (8 weeks)	Other assessment	Face-to-face	00:00	2.5%	/ 10	
8	Full participation (8 weeks)	Other assessment	Face-to-face	00:00	2.5%	/ 10	
15	Final work presentation	Individual work	Face-to-face	02:00	80%	4 / 10	CG18 CE01

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
15	Final exam	Problem-solving test	Face-to-face	02:00	100%	5 / 10	CG18 CE01

6.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

6.2. Assessment criteria

Continuous assessment is recommended in this subject. In this way the student, following the steps proposed, will know both the theoretical and practical fundamentals and the simulation tools for the different analyzed problems.

This continuous assessment is carried out as follows: 20% corresponds to the student participation whether in the classroom or laboratory. The other 80% corresponds with the oral presentation and defense, including the presentation document, of the simulation work proposed in this course and developed with ECLIPSE software.

It is not recommendable the assessment only by final exam in both examinations, ordinary and extraordinary. In any case, it will consist in developing a simulation model with the informatics tools used along the course period.
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7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Moodle platform	Web resource	In this platform are available all the contents of the course and also some links to further resources.
Course notes	Others	Reservoir Simulation. Department of Petroleum Engineering and Applied Geophysics. Norwegian University of Science and Technology. 2020

Principles of Applied Reservoir Simulation	Bibliography	FANCHI, J.R. Principles of Applied Reservoir Simulation. Gulf Publishing Company, 2006.
Reservoir Simulation	Bibliography	MATTAX, C.C and DALTON, R.L. Reservoir Simulation. SPE Monograph Series, Vol 13, 1990.

8. Other information

8.1. Other information about the subject

The software lab practices and work will be developed in the computer room (M2, CEPSA Fundation Lab). Reservoir dynamic software (ECLIPSE) will be used thanks to the partnership of Schlumberger.