ANX-PR/CL/001-01
LEARNING GUIDE

SUBJECT

63000272 - Mine Planning And Design

DEGREE PROGRAMME

06AK - Master Universitario En Mineria Sostenible

ACADEMIC YEAR & SEMESTER

2024/25 - Semester 1

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	63000272 - Mine Planning And Design
No of credits	4 ECTS
Type	Compulsory
Academic year ot the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	06AK - Master Universitario en Mineria Sostenible
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 *
Juan Herrera Herbert (Subject coordinator)	208	juan.herrera@upm.es	M - 12:00 - 14:00 Tu - 12:00 - 14:00 F - 12:00 - 14:00 Students will have the possibility of tutoring by email at any time. For face-to-face (telco) tutoring, it is essential to request an appointment.

* 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

- Ingles

- Laboreo de Minas

4. Skills and learning outcomes *

4.1. Skills to be learned

C01 - Ability to evaluate a mining project

C02 - Ability to define a modern mining project

4.2. Learning outcomes

RA13 - Typology of operations. Technologies and operational tools applied and their influence on the end state of the mine operation

RA20 - Select the more appropriate mining method.

RA21 - Select the more appropriate excavation method

RA22 - Design (dimension) mine voids.

RA5 - Expert contracting of the more usual exploration methods, the interpretation of reports of results as a previous step for the assessment of the deposit discovered and the first design on the viability of a project at a conceptual level or pre-feasibility study.

RA6 - The development of studies and decision capability on the impact of mineral and energy resources extraction

in the environment, even in the first phase of the minerals beneficiation, foreseeing the future affection on the natural environment.

RA3 - Planning and application of the specific methodologies for the discovery of new mineral deposits or the increase of existing resources.

RA30 - Know the different backfill materials and methods. Select the more appropriate backfill method according to the mining method. -Know the methodology of laboratory tests to estimate backfill properties. Prepare a paste fill memorandum.

* 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

The course addresses the fundamental concepts to consider in the design and engineering of a modern mining mining project from the perspective of guaranteeing its technical, economic and environmental viability, all of which are pillars of sustainable mining development.

5.2. Syllabus

1. CHARACTERISTICS AND OBJECTIVES OF A MINING PROJECT
   1.1. CONCEPTION OF THE DESIGN AND THE ENGINEERING IN THE MINING SECTOR
   1.2. THE SUPPLY OF RAW MATERIALS IN THE 21ST CENTURY
2. MINE PLANNING
   2.1. CHARACTERISTICS, OBJECTIVES AND PURPOSE OF MINING PLANNING
   2.2. COMPONENTS OF THE MINE PLANNING MODEL
   2.3. PRODUCTION PLANNING
3. MINE REVENUES AND COSTS
   3.1. MINE COSTS DETERMINATION
   3.2. PRODUCTION CONTROL. GRADE CONTROL
   3.3. MARKETING OF MINERAL PRODUCTS AND SALES REVENUES
4. MINE DESIGN

4.1. OREBODY DESCRIPTION

4.2. REPORTING OF MINERAL RESOURCES AND ORE RESERVES

4.3. GEOMETRICAL CONSIDERATIONS, PIT LIMITS

4.4. OPEN PIT DESIGNS

4.5. UNDERGROUND MINE DESIGNS

5. MINE EQUIPMENT SELECTION

6. MINE INFRASCTRUCTURE DESIGN AND CONSTRUCTION

6.1. MINE RAMPS DESIGN AND CONSTRUCTION

6.2. DESIGN AND CONSTRUCTION OF MINE WASTE INFRASTRUCTURE

6.3. DESIGN AND CONSTRUCTION OF TAILINGS MANAGEMENT INFRASTRUCTURE

6.4. WATER SUPPLY INFRASTRUCTURE

6.5. MINE VENTILATION INFRASTRUCTURE

6.6. MINING EQUIPMENT MAINTENANCE

6.7. LIGHTING INFRASTRUCTURE AND COMMUNICATIONS

7. COMPUTER AIDED ENGINEERING TOOLS

7.1. COMPUTER SOLUTIONS

7.2. GEMCOM FUNDAMENTALS

8. MINE PROJECT FINANCING

8.1. MINE PROJECT FINANCING PRACTICES

8.2. TAX MECHANISMS TO PROMOTE MINING PROJECTS

6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	**B0T0. GENERAL INTRODUCTION TO THE SUBJECT** Duration: 01:00 Lecture **B1T1. CONCEPTION OF THE DESIGN AND THE ENGINEERING IN THE MINING SECTOR** Duration: 01:00 Lecture **B1T2. THE SUPPLY OF RAW MATERIALS IN THE 21ST CENTURY** Duration: 01:00 Lecture **B2T1. CHARACTERISTICS, OBJECTIVES AND PURPOSE OF MINING PLANNING** Duration: 01:00 Lecture			
2	**B2T2. COMPONENTS OF THE MINE PLANNING MODEL** Duration: 01:00 Lecture **B2T3. PRODUCTION PLANNING** Duration: 01:00 Lecture **B3T1. MINE COSTS DETERMINATION** Duration: 01:00 Lecture **B3T1. MINE COSTS DETERMINATION** Duration: 01:00 Lecture			
3	**B3T2. PRODUCTION CONTROL. GRADE CONTROL** Duration: 01:00 Lecture **B3T3. MARKETING OF MINERAL PRODUCTS AND SALES REVENUES** Duration: 01:00 Lecture **B4T1. OREBODY DESCRIPTION** Duration: 01:00 Lecture **B4T2. REPORTING OF MINERAL**			**Evaluation of Blocks 1 & 2** Online test Progressive assessment Presential Duration: 00:30

	RESOURCES AND ORE RESERVES Duration: 01:00 Lecture			
4	**B4T3. GEOMETRICAL CONSIDERATIONS, PIT LIMITS** Duration: 01:00 Lecture **B4T4. OPEN PIT DESIGNS** Duration: 01:00 Lecture **B4T4. OPEN PIT DESIGNS** Duration: 01:00 Lecture			
5	**B4T4. OPEN PIT DESIGNS** Duration: 01:00 Lecture			
6	**B4T5. UNDERGROUND MINE DESIGNS** Duration: 01:00 Lecture **B4T5. UNDERGROUND MINE DESIGNS** Duration: 01:00 Lecture			
7	**B4T5. UNDERGROUND MINE DESIGNS** Duration: 01:00 Lecture **B4T5. UNDERGROUND MINE DESIGNS** Duration: 01:00 Lecture **B5T0. MINE EQUIPMENT SELECTION** Duration: 01:00 Lecture			
8	**B5T0. MINE EQUIPMENT SELECTION** Duration: 01:00 Lecture **B5T0. MINE EQUIPMENT SELECTION** Duration: 01:00 Lecture **B5T0. MINE EQUIPMENT SELECTION** Duration: 01:00 Lecture			**Evaluation of Blocks 3 & 4** Online test Progressive assessment Presential Duration: 00:30
9	**B6T1_MINE RAMPS DESIGN AND CONSTRUCTION** Duration: 01:00 Lecture **B6T2_DESIGN AND CONSTRUCTION OF MINE WASTE INFRASTRUCTURE** Duration: 01:00 Lecture **B6T3_DESIGN AND CONSTRUCTION OF TAILINGS MANAGEMENT INFRASTRUCTURE** Duration: 01:00 Lecture			

10	**B6T4_WATER SUPPLY INFRASTRUCTURE** Duration: 01:00 Lecture **B6T5_MINE VENTILATION INFRASTRUCTURE** Duration: 01:00 Lecture **B6T5_MINE VENTILATION INFRASTRUCTURE** Duration: 01:00 Lecture			
11	**B6T6_MINING EQUIPMENT MAINTENANCE** Duration: 01:00 Lecture **B6T7_LIGHTING INFRASTRUCTURE AND COMMUNICATIONS** Duration: 01:00 Lecture **B7T1_COMPUTER SOLUTIONS** Duration: 01:00 Lecture			
12	**B7T1_COMPUTER SOLUTIONS** Duration: 01:00 Lecture **B7T2_GEMCOM FUNDAMENTALS** Duration: 01:00 Lecture **B7T2_GEMCOM FUNDAMENTALS** Duration: 01:00 Lecture			**Evaluation of Blocks 5 & 6** Online test Progressive assessment Presential Duration: 00:30
13	**B7T2_GEMCOM FUNDAMENTALS** Duration: 01:00 Lecture **B7T2_GEMCOM FUNDAMENTALS** Duration: 01:00 Lecture **B7T2_GEMCOM FUNDAMENTALS** Duration: 01:00 Lecture			
14	**B7T2_GEMCOM FUNDAMENTALS** Duration: 01:00 Lecture **B8T1. MINE PROJECT FINANCING PRACTICES** Duration: 01:00 Lecture **B8T2. TAX MECHANISMS TO PROMOTE MINING PROJECTS** Duration: 01:00 Lecture			

15				**Evaluation of Blocks 7 & 8** Online test Progressive assessment Presential Duration: 00:30
16				**Final Exam** Online test Global examination Presential Duration: 01:00
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
3	Evaluation of Blocks 1 & 2	Online test	Face-to-face	00:30	25%	5 / 10	C01 C02
8	Evaluation of Blocks 3 & 4	Online test	Face-to-face	00:30	25%	5 / 10	C01 C02
12	Evaluation of Blocks 5 & 6	Online test	Face-to-face	00:30	25%	5 / 10	C01 C02
15	Evaluation of Blocks 7 & 8	Online test	Face-to-face	00:30	25%	5 / 10	C01 C02

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
16	Final Exam	Online test	Face-to-face	01:00	100%	5 / 10	C01 C02

7.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

7.2. Assessment criteria

The course is structured in several conceptual blocks, which are complementary to each other and are grouped into didactic units. These didactic units are articulated according to criteria of content homogeneity and balance of lectures and personal effort required to the students.

EVALUATION AND SCORE CRITERIA:

The final grade for the course will be expressed in a numerical figure on a scale between 0 and 10. This global rating may be obtained:

- Per course, by submitting to four voluntary tests that will be convened in good time.
- Only by a final exam, on the published dates, and for those students who have not opted for the first option.

In both cases, before any of the exams, students must have previously successfully completed and submitted all the practical study cases, exercises or laboratory practices corresponding to each block of the subject, a requirement without which the student cannot be examined. The minimum grade in each case will be set depending on the degree of difficulty and its characteristics and published in the platform.

In no case roundings will be made in the ratings. Consequently, the minimum grade to pass an exam can never be less than 5.0 points (out of 10).

TYPOLOGY OF THE EXAMS:

In general, students who take any of the exams must complete and deliver in advance all the laboratory practices, questionnaires, and practical cases pending. Students are expressly warned that they will not be allowed to pass any exam without having successfully passed the practical part and without having answered the self-assessment questionnaires.

Unless the coordinator of the subject specifies otherwise, the exams will be test type, with questionnaires of questions related to the subject covered in the lectures and in the auxiliary documentation. The questionnaires will be answered through the moodle platform, within a certain period of time that will be set for each case. Both the number of questions and the time for their answer can be varied at the discretion of the teachers.

To pass these exams, students will require a deep study of the subject before proceeding to complete the exam questionnaires. Exam questionnaires are limited to a single attempt. This means that they can only be edited once and once the deadline for their completion and set in the call has ended, access will be closed. Given that the term will be restricted in time when the exams are not carried out from the School's computer rooms, it will be the student's responsibility to control their internet access speed. The questionnaires will consist of questions randomly selected from those existing in a bank and questions. Consequently, the exercises answered by the students may be different.

In these exams:

- Questions answered correctly will be valued with +1 point.
- Questions answered incorrectly or left blank will be penalized with -0.5 points.

Regarding the possibility of consulting documentation by students during the exam when teachers authorize it, the following general criteria are established:

- **Only the teaching material and the course documentation made available to the students at the lecture of the subject on the Moodle platform will be available during the exam. For reasons of space and operability, this consultation can only be done online and using the same computer equipment with which the evaluation questionnaire is being answered. The use of any other device or consultation in paper format is not allowed. The use of any other type of reference material, whatever its origin, is also not allowed. Violation of this condition will be grounds for expulsion from the exam and qualification of the exercise with 0 points.**

- Out of respect and consideration for the rest of the classmates that are being examined, the space that a student may occupy is strictly limited to its table and the computer that is being used and cannot be extended outside this space.

- Oral or written communication is not allowed (paper, Whatsapp, instant messaging, etc.), nor is it possible to consult the information in forums of any kind.

- Consultation with Google, Yahoo, Ask, or similar type of web browsers is not allowed.

- Copying of the statement and/or answers to the questions is not allowed.

- Foreign students may make use of online or paper dictionaries.
- The use of collections of questions will be grounds for expulsion from the exam and qualification of the exercise with 0 points.
- Notwithstanding the foregoing, in each particular situation that arises, the teacher's criteria will always prevail.
- Students must understand that failure to comply with this criterion will mean that their exercise will be graded with 4.5 points, or less as appropriate (EXAM NOT PASSED).

The final mark of each questionnaire will be expressed on a total of 10 points. As indicated above, in no case rounding will be performed on the ratings.

In general, the questionnaires will cover all the subject matter that is the subject of evaluation regardless of the teacher who explained that part or the duration of the lectures. Apart from the exposition in the teacher's class, all the notes, problem collections, auxiliary documentation, presentations, videos and any other material made available to the students through the lecture of the subject in the institutional platform. It is noted that the concepts and knowledge that the student must have acquired through practical cases, problems, and laboratory practices will also be part of the evaluated content.

It is expressly noted that while in the partial exams the questions may relate concepts evaluated in the block under evaluation and in the previous ones already evaluated, in the final exams the questions may be related to concepts of the entire subject matter, even if they are specific. of a block.

Incidents of any kind that may occur in conducting online tests (early termination of the connection due to involuntary student error, suspected fraud for completing the group test, etc.), as well as the necessary random control of The knowledge of the students will be resolved through the timely convening of an oral test intended for the student to defend their knowledge. This test will cover all the evaluated subjects. The call for an oral exam, whatever the reason, will be final and the grade obtained in the oral test will prevail over that of the online test.

POSITIVE EVALUATION OF THE SUBJECT BY CONTINUOUS EVALUATION:

For students who choose the continuous monitoring and evaluation option during the semester, 4 (four) evaluating tests will be called. As mentioned above, these exams will be test type.

Students must pass all assessment tests, both practical and knowledge and theory. Furthermore, it is established that:

1. Students who pass all the partial exams will not have to sit for the final exam and will have the result of the arithmetic mean of the partial grades as the final grade for the course.

2. Students who have failed a partial exam with a grade lower than 5.0 (out of 10), may continue to be examined in the following partial exams, but they must be examined in the ordinary official call in January or June, as appropriate, for the subject not passed. In this regard, it is noted that:

    a. If the grade achieved in the failed assessment is greater than 4.0 points, the student may be examined only from the subject of that didactic unit, being exempt from examining the subject blocks that they have passed.

    b. If the grade achieved is less than 4.0 points, the student must take the entire subject in the final exam.

3. Once all the evaluations of the different units have been approved (partial evaluations) with a grade equal to or greater than 5.0 points (out of 10), the final grade in the minutes of the ordinary call will be the arithmetic average of the different grades obtained in the evaluations of these units.

4. If in the ordinary call (January or June) the student does not succeed in having passed all the didactic units, his grade in the minutes will be 4.5 points (out of 10) regardless of the arithmetic mean that he could have achieved and must be examined in the extraordinary call of July of all the matter of the subject.

Only exceptionally, and exclusively in those cases in which, at the teachers' criteria, a student has demonstrated a favorable attitude and a remarkable performance in the study of the subject, maintains a respectful attitude towards teachers and peers, and accredits regular attendance at class, the compensation of the qualification of a failed partial exam with the marks of the other exams would be admitted. For these exceptional cases, it will be required that the grade of the failed exam is not less than 4.0 points (out of 10), the other exams are passed and the scores of at least two of them are higher than 6.0 points (out of 10).

Final grade improvement: Those students who, having passed the subject by course (necessarily having passed all the partial tests), wish to improve their final grade, may take the final exam of the ordinary call exclusively for this purpose. Only in this case the students will keep as a final grade the one that is higher than the two obtained (average grade for the partial exams and/or grade for the final exam). To do so, they must previously request it from the course coordinator, a requirement without which this condition will not apply to them.

POSITIVE EVALUATION OF THE SUBJECT EXCLUSIVELY BY FINAL EXAMS:

Those students who have declined to follow the subject by continuous assessment, stopping to sit the partial exams or who have chosen to go directly to this type of assessment, may sit directly in the final exams of the ordinary official calls (January or June, as appropriate)), or extraordinary (July). Students must complete and deliver all the laboratory practices, questionnaires, and practical cases that are pending. Without this requirement, they will not be able to take the exam.

The final exams will consist of a test-type test that will cover all the subject matter, with all the aforementioned being applicable. To pass the course, a grade equal to or greater than 5.0 points (out of 10) is required. It is expressly warned that a part of the subject cannot be partially released by passing a part of the blocks.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Open Pit Mine Planning and Design	Bibliography	William A. Hustrulid, Mark Kuchta, Randall K. Martin. ISBN-13: 978-1466575127

9. Other information

9.1. Other information about the subject

Those students who, having passed the subject by continuous evaluation (necessarily having passed all the exam tests), wish to improve their final grade, may take the final exam of the ordinary final exam call exclusively for this purpose. Only in this case, the students will keep as a final grade the higher one of the two grades achieved (average grade for the partial exams and/or the final exam grade). This must be previously requested to the course coordinator.