Universitat Autònoma de Barcelona

2020/2021

Industrial and Heritage Rocks

Code: 101050
ECTS Credits: 4

Degree	Type	Year	Semester
2500254 Geology	OT	3	0
2500254 Geology	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Lluís Casas Duocastella

Prerequisites

A good knowledge of Mineralogy and Petrology (sedimentary, igneous and metamorphic) is strongly recommended.

Objectives and Contextualisation

It is an Optional Subject of 4 ECTS credits, framed within the subject matter "Economic Geology", to be chosen by students of third or fourth course level who choose a general education mention path or for students who want to obtain the Geotechnical and Geological Resources Mention .

It deals with various applied aspects of geological materials such as:

- The Industrial Rocks, such as: Dimension stone, aggregates, clays or binder materials (cement, lime or plaster)

- The Industrial Minerals, such as: Borates, Barite, Fluorite, Micas, Talc or Zeolites

- The Heritage rocks: Rocks of the sculptural and architectural heritage and their identification techniques

Each material studies the geological context, mineralogical aspects, methods of exploration and evaluation of deposits, methods of extraction and processing, main uses, control of the quality of products that are derived from them, some socioeconomic aspects and the environmental and sustainability issues that affect them.

Competences

Geology
- Evaluate and carry out the selection and collection of suitable geological samples.
- Identify and characterise minerals and rocks through instrumental techniques, determine their formation environments and know their industrial applications.
- Identify and tackle environmental problems, plan land-use and know the principles of prevention and mitigation of geological risks.
- Learn and apply the knowledge acquired, and use it to solve problems.
- Plan the exploration and sustainable development of geological resources.
- Process, interpret and present laboratory data using qualitative and quantitative techniques, and suitable computer programmes.
- Recognise theories, paradigms, concepts and principles in the field of geology and use them in different areas of application, whether scientific or technical.
- Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
- Work independently.

Learning Outcomes

1. Draw up subsoil interpretation tables and graphs in relation to geological engineering.
2. Evaluate the environmental problems related to mining, industrial rock and hydrocarbon exploitations.
3. Identify metal ores using a reflected light microscope.
4. Identify the environmental problems related to exploitations of hydrocarbons, mineral deposits and industrial rocks.
5. Learn and apply the knowledge acquired, and use it to solve problems.
6. Reconstruct hydrocarbon reserves based on the appropriate data.
7. Relate the theories and principles of geology to the exploration of reserves and mineral deposits, and to problem solving in geological engineering.
8. Solve problems in reserves, mineral deposits and geological engineering based on field and laboratory observations and the concepts studied.
9. Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
10. Work independently.

Content

Theory

1. Introduction

1.1. Definition

1.2. Classification

1.3. Economic context

1.4. Multiple Uses of Rocks and Industrial Minerals

1.5. Economic considerations

1.6. Environmental considerations

1.7. Industrial Rocks and Minerals in the Iberian Peninsula

2. Industrial Rocks

2.1. Natural and dimension stone

2.2. Aggregates

2.3. Clays

2.4 Binders: cement, lime and plaster

3. Industrial minerals

3.1. Introduction: definitions, classification, economic importance and aspects of the market

3.2. Exploration and Evaluation of Industrial Minerals

3.3. Borates

3.4. Feldspat

3.5. Mica

3.6. Fluorite

3.7. Barita

3.8. Talc

3.9. Zeolites

** Depending on the context of teaching development, a subset of these minerals may be taught. Each covers aspects of: Introduction, History, Production, Geology and Mineralogy, Specific Exploration Methods, Extraction and Processing Technologies, Industrial Uses, Specific Environmental Regulations and Considerations, and Specific Market Predictions and Trends.

4. Heritage Rocks

4.1. Classic sculptural and architectural heritage

4.2. Rocks from Catalan Archytectural Heritage

4.3. White marbles Identification techniques

4.4. Problems related to degradation of heritage rocks

Practices

- As a possibility, a course work done in group of students can be set on some aspect of industrial rocks or minerals according to a list that will be proposed by teachers. It is established as a possibility that the work be presented in class in Power-Point format or as Poster (the decided format will be communicated at the beggining of the semester) or only in written format. In any case, it must be presented in written form (in paper copy plus pdf file). The work must contain the parts: index, Introduction, historical summary of the use of the material, Exploration methods, Main present uses and applications, instrumental techniques related to the study and / or identification and / or evaluation of quality in the material , methods of exploitation, processes of manufacture of their industrial applications, environmental aspects and of sustainability, economic and market aspects and Bibliography and references or web links. There is logically flexibility to add or cancel some of the items to be treated, to adapt to the type of material studied at work. The list of specific topics to choose from will be communicated in the first weeks of the course. A deadline will be established for the working groups to be formed and communicated to the teacher (members of the group and chosen subject). The topics worked

during the previous year can not be chosen during the current course.

Practical sessions / exercises on spetial cases will be heldin the classroom or computer room. The contents will be considered among the following:

-Prospection and exploration (data interpretation of remote sensors, geophysical, geochemical or sounding testimonies)

-Geostatistics

-Operative methods (rock quarries, agregate quarries, open pit or underground mining operations)

-Environmental impact and restoration of land after open pit or underground mining operations.

-Manufacture of an Industrial Rock or examples of treatment plants.

- Techniques for characterization of industrial minerals and rocks (RX difraction, particle size and shape, thermal analysis, vivrational spectroscopy, Electron microprobe analysis, Image analysis).

-Visual identification of heritage rocks, for example exercises on the identification of marbles using C and O isotopes of or by X-ray diffraction.

-methods for testing of properties of industrial rocks . UNE Normative quality standarts.

Methodology

Theory:

Magistral lectures.

In any case, the contents will be provided in advance through the Moodle Virtual Campus. The contents will be expanded as far as possible through web links. The contents will be provided prior to theoretical explanation sessions on essential aspects and resolution of doubts that will be carried out in person or virtually in the scheduled theoretical classes of the subject. A prior study by students is a must in order that the theoretical or doubt sessions to be fruitful. In addition, Question and Answer Forums will be established on theoretical topics.

Practicals:

In class with some exercises on various aspects related to the related practical issues. Practical exercises on the various aspects of the theoretical topics taught will be encouraged. In addition, forums will be also set up on practical topics.

Course work (in group of students):

Preparation throughout the semester, with a follow-up by teachers on demand from students (1 tutorial). The teacher may indicate the obligation or not to do this work and / or to make his presentation either with Power Point or Poster (will be communicated) in addition to written format. In this case both presentations will be evaluated.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practices	14	0.56	4, 3, 7, 6, 1, 9, 10, 2

Theory	20	0.8	4, 3, 7, 6, 9, 2
Type: Supervised			
Supervision of individual / grup work	7	0.28	4, 3, 7, 6, 9, 10, 2
Type: Autonomous			
Study, search for bibliographic information	50	2	4, 3, 7, 6, 9, 10, 2

Assessment

Continuous assessment (AC): 2 partial exams

There will be 2 partial exams. The assessment is 40% of the total grade,
1st part: Industrial Rocks ± Heritage Rocks. Theoretical and practical cor
2nd part: Industrial Minerals ± Heritage Rocks. Theoretical and practical
The student who presents to one of the partial ones will not be able to op
1st Partial Exam: consists of 3 parts: 1: Industrial Rocks_1 (test), 2: Indus

Rating on 10 points. The weighting of the parts is: 1: 25% -2: 25% -3: 50%. 40% of the continuous assessment n
2nd Partial Exam: with 2 parts: 1. Industrial Minerals + Practices 3 and 4

Rating on 10 points. The weighting of the parts is 1: 50%, 2: 50%. 40%
of the continuous assessment mark.

The mark obtained in these partial exams will be complemented with the marks obtained in the exercises or theo

In the case of the first part, the mark will be modified according to thefollowing scale:1st Partial mark = 15% Prac

In the case of the second part, the mark will be modified according to the following scale: 15% Practica_3 deliver
For the written work, the effort in the search for quality information, the d

(any work that does not contain ALL the duly accredited figures -author / s name and year of publication + citatio

The evaluation of this work will be 20% of the continuous evaluation mark. In case of non- assignment of this wo

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Continuous assessment grade (grade AC) = (Grade 1 partial x 0.4) + (Grade 2 partial x 0.4) + (Grade Work conte

To pass the subject (passed) for continuous assessment, the AC mark m

and the student must appear in the corresponding part of the final recovery test.

Final test:

It will be necessary to recover any partial in which the qualification has b

It will be possible to do either of the two parts (or both) to improve the final note of the asignatura. In the event th

If in any of the parts the mark is still lower than 3, the final grade will be suspended (in case of an average higher

It will be necessary to notify in advance about the part or parts of the fina

Students who have not passed the CA have the obligation to take the final test (partials not passed) and do not n

Students who present themselves to improve their mark do have the obligation to notify and in the event that the

In no case will there be a second final test of recovery, except for studen

All exams will consist of a test-type part with multiple-choice questions a

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
1st Exam	40% of total EC grade	2	0.08	4, 3, 7, 6, 8, 9, 10, 2
2n Exam	40% of total EC grade	5	0.2	5, 4, 3, 7, 6, 1, 9, 10, 2
Final Exam	The same as each previous exams	2	0.08	4, 3, 7, 6, 8, 9, 10, 2
Oral (ppt or poster) presentation	20 %	0	0	4, 3, 7, 6, 9, 10, 2

Bibliography

Àlvarez A., Domènech A., Lapuente P., Pitarch A., Royo H., (2009) Marbles and Stones of Hispania. Exhibition catalogue. Edited by Institut Català d'Arqueologia Clàssica (ICAC)

Bustillo, M., Calvo, J.P. & Fueyo, L. (2001). *Rocas industriales. Tipología, aplicaciones en la construcción y empresas del sector*. Editorial Rocas y Minerales. Madrid.

Carr, Donald D. (editor) (1994). *Industrial Mineral and Rocks*. 6a edició. Society for mining, Metallurgy, and Exploration, Inc. Littlenton, Colorado (USA).

Elzea Kogel, J. et. al., (eds.) (2006). *Industrial Minerals and Rocks: Commodities, Markets, and Users*. 7a edició. Society for Mining, Metallurgy, and Rxploration, Inc. Nova York.

Gutiérrez, A., (2009) Quarries in the Northeast of Hispania. Documenta 10, ICAC.

Lopez Gimeno, C., (1995). Manual de Rocas Ornamentales. Prospección. Explotación. Elaboración. ETS de Ingenieros de Minas de Madrid. LOEMCO. Ed. Entorno Gràfico S.L.

Herz N., Waelkens M., (eds)., (1988). Classical marble : geochemistry, technology, trade. Kluwer Academic Publishers, 1988

Regueiro, M. & Lombardero, M. (1997). *Innovaciones y avances en el sector de las rocas y minerales industriales*. Ilustre Colegio Oficial de Geólogos de Espanya. Madrid.

Principal web links (others will be given and used during the semester):

-Industrial Mineral Association EUROPE

http://www.ima-europe.eu/

-Industrial Mineral Association of N. America

http://www.ima-na.org/index.asp

-New Zealand Mineral Industry Association

http://www.minerals.co.nz/html/index.html

-Seminarios de la SEM (Sociedad Española de Mineralogia)

http://www.ehu.es/sem/revista/seminarios.htm

-IGME-DIR.GRAL.POLITICA ENERGETICA Y MINAS: PANORAMA MINERO

http://www.igme.es/internet/PanoramaMinero/PMLin.htm

- http://www.oum.ox.ac.uk/corsi/catalogue/classi

Corsi Collection of Decorative Stones.