Universitat Autònoma de Barcelona

2019/2020

Industrial and Heritage Rocks

Code: 101050
ECTS Credits: 4

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

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

Isaac Corral Calleja

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

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

- Group work 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.

-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

Master Classes using Power Point support.

Practices: In class with some exercises on various aspects related to the related practical issues

Work: Preparation throughout the semester, with a follow-up by teachers on demand from students (1 tutorial). The teacher may indicate the obligation to make his presentation 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 (CA): 2 exams

There will be 2 exams. The weighting is 40% of the total grade, in each case. Each test may include theoretical

and / or practical aspects and will score about 10 pt:

1st Exam: industrial rocks ± Heritage rocks. Theoretical and practical contents. Weight: 40% total CA score

2nd Exam: Industrial Minerals ± Heritage rocks. Theoretical and practical contents. Weight 40% total CA score

The student who submit one of the exams will not be able to get the "not presented" final qualification, since each of the exams weight for an amount ≥ 35%.

If applicable, the presentation of the work in Power Point or Poster will be held in public sessions (for enrolled students plus teachers) during the last sessions of theoretical and / or practical classroom. At the end of the presentation, the teacher / s will be able to ask about the development or other aspects of the work. Each group will have to choose from 1 to 3 representatives (maximum) to do the exhibition. 20% of the total grade of the subject assigned to the Work in Group is composed of (50% exposition score (all members of the group will get the same score) and 50% score of written work (in case of no exposition 100%). The exhibition will assess the degree of organization, mastery of the subject, rigor, clarity and precision, adaptation of language and communicative effectiveness. For written work: effort in the search for quality information, degree of elaboration of the content, spelling correction, presentation care, degree of group coordination and explicitation of all credits of the materials used (any work that does not contain ALL the duly accredited figures - author name / year of publication + citation in the bibliography and all the citations in the bibliography section duly insertedin the text, may be considered not passed and scored with 0 points). Alternatively, the possibility is that the presentation is assigned in relation to a topic different from the chosen one for the written work (for example on a UNE regulation and the associated tests).

-Score of continuous evaluation (CA score) = (score in 1st exam x 0.4) + (score in 2nd exam x 0.4) + (score on Working contents x 0,1 or 0,2 -If there is no exhibition -) + (score on exposition work x 0,1 or be 0 if there is no exposition)

To pass the subject by continuous evaluation the CA score must be equal or greater thaan 5 and the scores on each partial will have to be greater than 3. Scores less than 3 in any exam prevent to calculate the AC score (non evaluable) and the student must submit to the corresponding part of the final exam in order to recovery. Final Exam:

The final exam will consist of two parts: Recovery of 1st exam: INDUSTRIAL ROCKS ± HERITAGE ROCKS and Recovery of 2nd exam: INDUSTRIAL MINERALS ± HERITAGE ROCKS. Students can do either of the two parts (or both) to improve the final grade of the subject. In the event that a score lower than that obtained in the corresponding part is obtained, the greatest of them will be maintained. If in any of the scores is less than 3, the final exam can not be passed (in case of an average higher than 5, the numerical score will be reduced to 4.9 - non passed).

It will be necessary to notify in advance the part or parts of the final exam that will be attended. The teacher will implementa list with a registration deadline for this exam. Students who have not passed the CA have the obligation to submit to the final exam and do not need to notifiy attendance. The students who attend in order to improve scoe and do not notify before deadline may be excluded from the exam.

In no case will there be a second final test, except for students who due to major impediments (properly documented and justified) have not been able to attend any of the exams.

All exams will consist of a multioption test type part and a short answer questions part. For the multichoice test part: Answered option valid: 1pt, option not answered: 0pt, option answered incorrectly: (- 0.25pt).

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 classes):

-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.