

Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	296 - Degree in Geology
ECTS	8.5
Year	2
Semester	Annual
Subject Type	Compulsory
Module	---

1.General information**1.1.Introduction****1.2.Recommendations to take this course****1.3.Context and importance of this course in the degree****1.4.Activities and key dates****2.Learning goals****2.1.Learning goals****2.2.Importance of learning goals****3.Aims of the course and competences****3.1.Aims of the course****3.2.Competences****4.Assessment (1st and 2nd call)****4.1.Assessment tasks (description of tasks, marking system and assessment criteria)****5.Methodology, learning tasks, syllabus and resources****5.1.Methodological overview**

The course has a basic character, thus the proposed activities focus on the comprehension of the basic principles of Mineralogy to use them as a tool to characterize and identify the most important rock-forming minerals. Also, the student will manage to deduce the structural and textural features of different mineral associations together with the context and genetic conditions under they formed.

For this reason, the knowledge acquired through participatory master classes will be enhanced by practical sessions,

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where the students should demonstrate their knowledge about different methods and analysis and their application in order to identify and characterize the rock-forming minerals. Also, the students have to prove their team work ability as well as their capacity to expose and to defend a report about different mineralogical aspects related to the course contents.

The monitoring of the learning process will be favoured through conventional tutoring and more specific tutoring related to the report that the students have to expose. In addition, resource material will be uploaded on the Internet (<https://moodle.unizar.es>).

5.2.Learning tasks

1: P articipatory master classes: 40 hours

Contents include 27 Units and are divided into three blocks: I) Physicochemical principles of mineral genesis and geological environments of formation; II) Systematics of silicate minerals; and III) Systematics of non-silicate minerals.

2: Development of a bibliographic work (5 hours)

3: Practical sessions (laboratory sessions: 32 hours)

4: Field trips (8 hours)

Two field trips are scheduled. The first term field trip is related to genesis environments of silicate minerals and the second term field trip to non-silicate minerals.

5: Study and preparation of written tests (at least 60 hours of student's autonomous work)

6: Performance of written tests (8 hours)

5.3.Syllabus

THEORETICAL PROGRAM

INTRODUCTION

1. Mineralogy: definition and relationships with other sciences. Importance among the Geologic Sciences. Concept of mineral. Industrial mineral, ore, gangue and gem.

I) MINERAL GENESIS ENVIRONMENTS

2. Structure and chemical composition of the Earth. Distinctive features of the Crust, the Mantle and the Core. The Earth Crust, the Lithosphere and the Asthenosphere. Chemical composition of the Earth Crust. Geochemical classification of the elements.

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3. Mineral genesis and geologic processes. Mineral formation and the phases rule: statement and terms explanation. Phase equilibrium diagrams. One-, two- and three-phases systems.

4. Magmatic environment. Equilibrium and fractionated crystallization. The Bowen Series. Mineralogy of the igneous rocks. The pegmatitic and pneumatolitic stages. The hydrothermal stage. Metasomatic processes.

5. Sedimentary environment. Weathering and types. Edaphic profiles and types. Physic-chemical factors controlling the sedimentary processes. Mineralogy of the sedimentary rocks.

6. Metamorphic environment. Physic-chemical factors controlling the metamorphic processes. Types of metamorphism and features. Metamorphic facies. Mineralogy of the metamorphic rocks.

II) SYSTEMATICS OF SILICATE MINERALS

7. Mineral classification: used criteria. Strunz classification. Silicates: generalities, crystal chemistry, classification, physical properties and types of rocks where they are present.

8. Nesosilicates. Main features. Olivine group. Aluminum silicates group. Garnet group.

9. Sorosilicates. Main features. Epidote group.

10. Ciclosilicates. Main features. Tourmaline group. Cordierite.

11. Inosilicates. Main features. Classification: pyroxenes, pyroxenoids y amphiboles.

12. Pyroxenes. Chemical composition and classification. Physical properties. Types of rocks where they are present.

13. Pyroxenoids. Main features. Wollastonite.

14. Amphiboles. Chemical composition and classification. Physical properties. Types of rocks where they are present.

15. Phyllosilicates. Main features crystal chemistry and classification. 1:1 phyllosilicates. 2:1 phyllosilicates.

16. Clay phyllosilicates. Chlorite group. Fibrous clay minerals.

17. Tectosilicates. Main features. SiO₂ group. Alkali feldspar group. Physical properties. Types of rocks where they are present.

18. Plagioclases. Chemical composition and structure. Physical properties. Types of rocks where they are present.

19. Feldspathoids. Scapolite group. Zeolite group.

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III) SYSTEMATICS OF NON-SILICATE MINERALS

20. Introduction to non-silicate minerals: scientific, technical and economic interest of non-silicate minerals, main applications, exploration and exploitation of mineral deposits, mineral and energy resources, Plate tectonics and metallogeny.

21. Native elements. General characteristics. Crystal chemistry and physical properties. Classification. Description of the main groups: metals, semimetals and nonmetals.

22. Halides. Introduction. General characteristics. Classification. Description of the main groups. Types of rocks where they are found.

23. Sulfides, related minerals and sulfosalts. Introduction. Crystal chemistry and physical properties. Classifications, structures and characteristics of the main groups and associations.

24. Oxides and hydroxides. Introduction. Crystal chemistry and physical properties. Classification. Origin and types of deposits.

25. Carbonates, nitrates and borates. Introduction. Crystal chemistry and physical properties of carbonate minerals. Carbonates classification. Calcite, dolomite and aragonite series. Properties and forming environments.

26. Sulfates, chromates, molybdates and wolframates. Introduction. Gypsum and anhydrite. Types of rocks where they are found.

27. Phosphates, arsenates and vanadates. Introduction. General characteristics.

PRACTICAL SESSIONS (laboratory sessions)

Contents are divided in two hour sessions scheduled as follows:

- Session 1. Macroscopic observation and identification of silicate minerals
- Session 2. Optical microscopy: tectosilicates
- Session 3. Optical microscopy: phyllosilicates
- Session 4. Optical microscopy: inosilicates
- Session 5. Optical microscopy: nesosilicates

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- Session 6. Optical microscopy: silicates and cyclosilicates
- Session 7. Silicates review
- Session 8. Macroscopic observation and identification of non-silicate minerals: non-metallic minerals
- Session 9. Macroscopic observation and identification of non-silicate minerals: metallic minerals
- Session 10. Optical microscopy: carbonates, sulphates and halides
- Session 11. Optical microscopy: reference ore minerals (I)
- Session 12. Optical microscopy: reference ore minerals (II)
- Session 13. Optical microscopy: sulphides and related minerals
- Session 14. Optical microscopy: oxides
- Session 15. Optical microscopy: copper minerals
- Session 16. Non-silicates minerals review

Development of a bibliographic work (5 hours)

Students can choose a subject related to the course contents for the development and exposition of the work, following the indications of the teaching staff.

Field trips (8 hours)

Two field trips are scheduled. The first term field trip is related to genesis environments of silicate minerals and the second term field trip to non-silicate minerals.

5.4.Course planning and calendar

40 master classes and 16 practical sessions (2 hours/session) have been planned. Timetable of master classes and practical sessions will be adjusted to the official calendar provided by the Facultad de Ciencias. Field trips will be scheduled by the Comisión de Garantía de Calidad del Grado.

Evaluation dates will be published by the Facultad de Ciencias and will be announced sufficiently in advance.

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5.5. Bibliography and recommended resources

- BB** Dyar, Melinda Darby. Mineralogy and optical mineralogy / written by Melinda Darby Dyar and Mickey E. Gunter ; illustrated by Dennis Tasa Chantilly, VA : Mineralogical Society of America, cop. 2008
- BB** Hibbard, Malcolm J.. Mineralogy : a geologist's point of view / M.J. Hibbard.. - 1st ed. Boston : McGraw-Hill, c2002.
- BB** Klein, Cornelis. Manual de mineralogía : basado en la obra de J.D. Dana / Cornelis Klein, Cornelius S. Hurlbut, Jr. ; [versión española por J. Aguilar Peris] . - 4a. ed., 2. reimp. Barcelona [etc.] : Reverté, D.L. 2001
- BB** Nesse, William D.. Introduction to mineralogy / William D. Nesse New York ; Oxford : Oxford University Press, cop. 2000
- BB** Putnis, Andrew. Introduction to mineral sciences / Andrew Putnis . - [1st. publ.] [Cambridge] : Cambridge University Press, 1992
- BB** Putnis, Andrew. Introduction to mineral sciences / Andrew Putnis . - [1st. publ.] [Cambridge] : Cambridge University Press, 1992
- BB** Wenk, Hans-Rudolf.. Minerals : their constitution and origin / Hans-Rudolf Wenk and Andrei Bulakh. Cambridge : Cambridge University Press , 2004.
- BB** Wenk, Hans-Rudolf.. Minerals : their constitution and origin / Hans-Rudolf Wenk and Andrei Bulakh. Cambridge : Cambridge University Press , 2004.

LISTADO DE URLs:

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Amethyst Galleries. Mineral Gallery -
[<http://mineral.galleries.com>]

James Cook University (Silicate
Mineralogy -
[<http://tesla.jcu.edu.au/Schools/Earth/EA1001/Mineralogy/Silicates.html>]

Mineralogy Database -
[<http://www.webmineral.com/>]

Optica Mineral -
[<http://geologia.ujaen.es/opticamineral/paginas/default.htm>]

Tulane University. Department of Earth &
Environmental Sciences -
[<http://www.tulane.edu/~sanelson/>]

Universidad Nacional a Distancia - [:
<http://www.uned.es/cristamine/>]

University of Bristol (Minerals under the
microscope): -
[<http://www.gly.bris.ac.uk/www/teach/opmin/mins.html>]