

## 60442 - Characterization of geological materials: techniques and applications

### Información del Plan Docente

<b>Academic Year</b>	2016/17
<b>Academic center</b>	100 - Facultad de Ciencias
<b>Degree</b>	541 - Master's in Geology: Techniques and Applications
<b>ECTS</b>	5.0
<b>Course</b>	1
<b>Period</b>	Second semester
<b>Subject Type</b>	Optional
<b>Module</b>	---

### **1.Basic info**

#### **1.1.Recommendations to take this course**

#### **1.2.Activities and key dates for the course**

### **2.Initiation**

#### **2.1.Learning outcomes that define the subject**

#### **2.2.Introduction**

### **3.Context and competences**

#### **3.1.Goals**

#### **3.2.Context and meaning of the subject in the degree**

#### **3.3.Competences**

#### **3.4.Importance of learning outcomes**

### **4.Evaluation**

### **5.Activities and resources**

#### **5.1.General methodological presentation**

The learning process designed for this course is based on:

The course has a theoretical and applied character. Thus, the proposed activities are focused on the understanding of the main techniques of characterization, their fundamentals and requirements, as well as their applicability to specific problems. The different activities proposed to achieve the intended learning results are:

- Participatory master classes: 2,4 ECTS

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- Laboratory sessions: 0,8 ECTS

- Case studies: 1,2 ECTS

- Special practices: 0,6 ECTS

The monitoring of the learning process will be favoured through conventional tutoring and more specific tutoring related to case studies. In addition, resource material will be uploaded on the Internet ( <https://moodle2.unizar.es/add/> ).

### 5.2.Learning activities

The program which is offered to the student to help him to achieve the intended results include the next activities...

**Participatory master classes:** 24 hours.

The precise program is specified in the next section (5.3)

**Laboratory sessions:** 8 hours.

Two laboratory sessions will be held where the students will carry out observations and analysis on real samples by means of electronic microscopy

**Case studies:** 12 hours.

In the different sessions the students will review and analyze the results and conclusions obtained from the application of different techniques in selected research papers. Furthermore, they will solve real problems and cases of data treatment provided by several analytical techniques. One part of the sessions will be dedicated to the proposal by the students of potential applications of several techniques to their Master Thesis, by consulting and reviewing research papers. At least one session will be reserved for the oral presentation of their works.

**Special practices:** 6 hours.

A visit to an analytical center, from the University of Zaragoza or from other research center, will be made

**Preparation of the written tests:** at least 36 hours of student's autonomous work.

**Lab sessions reports:** at least 39 hours of student's autonomous work.

### 5.3.Program

Contents are divided into two blocks:

**Block I)**

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- Scanning and transmission electron microscopy (SEM and TEM)
- Spectroscopic techniques (infrared, Raman, X-ray absorption, nuclear magnetic resonance, Mössbauer)
- Thermal analysis (differential thermal analysis, thermal gravimetric analysis, dilatometry)
- Image techniques (atomic force microscopy, tunnel effect microscopy, confocal microscopy)
- Synchrotron: basis and applications

### Block II)

- Electron microprobe
- Ion microprobe
- X-ray fluorescence
- ICP-MS
- Neutron activation
- Laser ablation

### 5.4.Planning and scheduling

#### Calendar

Timetable of master classes and practical sessions will be adjusted to the official calendar provided by the Facultad de Ciencias. The visit to an analytical center, from the University of Zaragoza or from other research center, will be scheduled by the Comisión de Garantía de Calidad del Máster and will be announced sufficiently in advance.

The precise dates of the different evaluation activities will be published by the Facultad de Ciencias and will be announced sufficiently in advance ( <https://moodle2.unizar.es/add/> and bulletin boards).

### 5.5.Bibliography and recommended resources

- Haines, P.J.. Thermal Methods of Analysis: Principles, Applications and Problems. Blackie Academic & Professional. 1995.
- Potts, P.J.. A Handbook of Silicate Rock Analysis. Blackie Academic & Professional. 1987.
- Riddle, C.. Analysis of Geological Materials. Ed. Dekker (New York). 1993.
- Skoog, Douglas A.. Análisis instrumental / Douglas A. Skoog, James J. Leary ; traducción Cristina Ariño Blasco ... [et.al.] ; revisión técnica M<sup>a</sup> Teresa Galcerán Huguet . - 4<sup>a</sup> ed. Madrid [etc.] : McGraw-Hill, D.L.1993