# SUBJECT TEACHING GUIDE

## M1309 - High Pressure Techniques

## Master's Degree in New Materials

Academic year 2019-2020

| 1. IDENTIFYING DATA | | | | | |
|---|---|---|---|---|---|
| Degree | Master's Degree in New Materials | | | Type and Year | Optional. Year 1 |
| Faculty | Faculty of Sciences | | | | |
| Discipline | General Optional Module | | | | |
| Course unit title and code | M1309 - High Pressure Techniques | | | | |
| Number of ECTS credits allocated | 5 | Term | | Semester based (2) | |
| Web | | | | | |
| Language of instruction | Spanish | English Friendly | Yes | Mode of delivery | Face-to-face |

| | |
|---|---|
| Department | DPTO. CIENCIAS DE LA TIERRA Y FISICA DE LA MATERIA CONDENSADA |
| Name of lecturer | FERNANDO RODRIGUEZ GONZALEZ |
| E-mail | fernando.rodriguez@unican.es |
| Office | Facultad de Ciencias. Planta: + 2. DESPACHO PROFESORES (2008) |
| Other lecturers | JESUS MARIA RODRIGUEZ FERNANDEZ<br>RAFAEL VALIENTE BARROSO<br>FERNANDO AGUADO MENENDEZ<br>JESUS ANTONIO GONZALEZ GOMEZ |

| 3.1 LEARNING OUTCOMES |
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| - To get a background of theory of materials at microscopic level aiming to explain their properties under high pressure conditions. |
| - To know the capacity of high-pressure techniques and their potential in Materials Science. |
| - To know the basis of working, setup, handling, loading of pressure cells, as well as to do basic experiments employing different experimental techniques with distintc types of cell. |
| - To write a report similarly to a research paper on the performed experiments. |
| - Micro manipulation of materials and characterization of systems in micro environments under extreme conditions. |
| - To know the basis, experimental techniques and instrumentation for materials characterization, as well as physical phenomena of interest in materials induced at high pressure. |
| - To handle materials characterization techniques adapted to high pressure cells. |
| - To get and interpret high pressure experimental results on the basis of microscopic models of Materials Science |

| 4. OBJECTIVES |
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| Study of Matter at High Pressure. Introduction, Theoretical background and experiments. |
| Methods for producing high pressrue (diamond anvil cells, explosions, shock waves). |
| Materials characterization techniques under high pressure conditions (spectroscopy, diffraction, magnetization, conductivity, etc.) |
| Analysis and interpretation of high pressure results (equation of state, phase transitions, volume-pressrue dependances, etc.) |
| To write a report similar to a scientific paper. |

| 6. COURSE ORGANIZATION | |
|---|---|
| CONTENTS | |
| 1 | PRESSURE CELLS/BACKGROUND AND APPLICATIONS/<br>PREINDENTATION+HIDROSTIC CAVITY/<br>PRESSURE SENSORS; EQUATION OF STATE/<br>LUMINESCENCE OF RUBY UNDER PRESSURE |
| 2 | CHARACTERIZATION TECHNIQUES/<br>ELECTRONIC PROPERTIES /<br>OPTICAL ABSORPTION: SEMICONDUCTOR GAP UNDER PRESSURE |
| 3 | RAMAN - IR SPECTROSCOPIES/<br>MICROSCOPE AND IMAGING AT HIGH PRESSURE/<br>RAMAN OF DIAMOND AND SILICON UNDER PRESSURE |
| 4 | MAGNETIC AND TRANSPORT PROPERTIES/<br>MAGNETIZATION MEASUREMENTS AT HIGH PRESSURE |

## 7. ASSESSMENT METHODS AND CRITERIA

| Description | Type | Final Eval. | Reassessn | % |
|---|---|---|---|---|
| Continous evaluation through experimental reports and test-type exams. | Laboratory evaluation | No | No | 50,00 |
| Test-type exam | Written exam | Yes | Yes | 40,00 |
| Reading and comprehension of scientific paper. | Work | No | Yes | 10,00 |
| TOTAL | | | | 100,00 |

Observations

One report of all performed experiments.
Test-type final exam.
Report on a scientific paper.

Observations for part-time students

## 8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

An introduction to high pressure science and technology, J.M. Recio, J. M. Menéndez, A. Otero de la Roza, CRC Press, Taylor & Francis, 2015