

**Información del Plan Docente**

<b>Academic Year</b>	2016/17
<b>Academic center</b>	100 - Facultad de Ciencias
<b>Degree</b>	447 - Degree in Physics
<b>ECTS</b>	6.0
<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**

This course aims to provide a planet-wide perspective on the energy and matter flows in the Earth. These global flows have a large impact on the Earth surface, thus affecting life in a fundamental way by conditioning the value of most environmental variables (atmosphere composition, surface temperature, presence or absence of a liquid hydrosphere, ocean chemistry, climate, etc.). They are also the drivers of geological processes in the crust and the mantle underneath. From this point of view, it can be said that global energy and matter flows are the first order "predictors" of the type and characteristics of terrestrial superficial environments.

## 5.2.Learning activities

Learning activity 1: Lecture (2.4 ECTS).

Learning activity 2: Problem-solving classes (1.8 ECTS)

Learning activity 3: Seminars (0.8 ECTS)

## 5.3.Program

LECTURES (24 hours)

**Unit 1** . Earth's global energy budget (8 hours) : principles of heat transfer; thermal properties of solids and liquids; heat flow and geotherm; sources and sinks of thermal energy; Earth's thermal history and current thermal budget; thermal anomalies; geothermics and geothermal exploration.

**Unit 2.** Chemical geodynamics and global geochemical cycles (8 hours) : basics of cycles, reservoirs, stationary states and residence times; the water cycle and its role in Earth's dynamics; global bio-geochemical cycles of carbon, sulphur and nitrogen.

**Unit 3.** External effects of Earth's internal large-scale processes (8 hours) : magmatism, metamorphism and their effect on atmosphere, hydrosphere and biosphere; mountain building and its interaction with climate; consequences of changes in the distribution of land masses; applied geothermics; distribution of key chemical elements in the Earth's surface; natural and anthropogenic geochemical anomalies.

PRACTICALS AND SEMINARS (26 hours)

There are 9 two-hour practical sessions and 4 two-hour seminars on topics covered during the lectures.

## 5.4.Planning and scheduling

Title: Earth - processes and interactions at large scales

UZ Code: 60435

Coordinator: Javier Gómez-Jiménez

Other contributors: Juan Mandado-Collado, Enrique Arranz-Yagüe, Marceliano Lago-Sanjosé

Term: 2

Credits: 5 ECTS

Written Exam: 30% (three written exams, one at the end of each thematic unit; 10% each)

## 26910 - Geology

Coursework: 70% (Practical session reports, 50%; Seminars, 20%)

Pre-requisites: None

Total Number of Hours of Student Work: 75

Hour of Lectures/Seminars: 24

Hours of Practicals/Problem Classes: 26

Days of Fieldwork: 0

Moodle Page: <https://moodle2.unizar.es/add/>

### 5.5. Bibliography and recommended resources

Course materials will consist of lecture notes, lecture Powerpoint presentations and practical class handouts. Recommended textbooks are:

- Jaupart, C. Heat generation and transport in the Earth. Cambridge University Press. 2010.
- Stober, I. Geothermal Energy: From Theoretical Models to Exploration and Development. Springer. 2013.
- Treatise on geochemistry. Volumes 2, 3, 5, 7; executive editors H.D. Holland and K.K. Turekian Amsterdam: Elsevier, 2005.
- Turcotte, D.L. Geodynamics / Donald Turcotte, G. Schubert, Cambridge: Cambridge University Press, 2002, Second edition.