

**Global Tectonics**

Code: 101042  
ECTS Credits: 6

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**

Eduard Saura Parramon  
Albert Griera Artigas

**Prerequisites**

This course presupposes a basic knowledge of the various branches of the fundamental geology acquired in the previous courses. We recommend revising the concepts and methods of structural geology.

**Objectives and Contextualisation**

This optional course aims to make the student gain a knowledge of the dynamics of the Earth, with special emphasis on the interrelations between geologic processes of diverse nature and their integration in the frame of the plate tectonics. The course will incorporate concepts of diverse subjects acquired in the previous three years of the degree, and has the objective to enable the student to frame the terrestrial processes on a global scale.

**Competences**

- Geology
- Display knowledge of the applications and limitations of geophysical methods for learning about the Earth.
- Display understanding of the size of the space and time dimensions of Earth processes, on different scales.
- Obtain information from texts written in other languages.
- Recognise theories, paradigms, concepts and principles in the field of geology and use them in different areas of application, whether scientific or technical.
- Recognise, depict and reconstruct tectonic structures and the processes that generate them and relate types of rocks and structures to geodynamic environments.

- Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
- Synthesise and analyse information critically.
- Work independently.

## Learning Outcomes

1. Discern the interactions between the various layers or spheres of the planet.
2. Evaluate and critically apply the paradigms of plate tectonics and the different currents of thought regarding global change.
3. Integrate the different global-scale terrestrial processes in terms of planetary evolution.
4. Interpret the internal structure of the Earth through seismic profiles, seismic tomography, gravimetry, etc., and understand the degree of reliability of these techniques.
5. Obtain information from texts written in other languages.
6. Relate the geodynamic significance of structural, petrogenetic and surface processes to the framework of plate tectonics.
7. Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
8. Synthesise and analyse information critically.
9. Work independently.

## Content

### *Theory*

#### UNIT 1. EARTH CONSTITUTION AND DYNAMICS

- Internal structure of the Earth's globe. Sources of information (seismology).
- Continental and oceanic crust. Continental margins. The tectonic plates and their boundaries.
- Rheology of the lithosphere.
- Review of structural associations. Horizontal movements of the lithosphere: contractional, extensional and strike-slip systems. The tectonic inversion.
- Tectonics and topography: vertical movements of the lithosphere. Isostasy. Gravity anomalies. Flexure of the lithosphere. Dynamic topography. Uplift and exhumation.

#### UNIT 2. PLATE TECTONICS

- Historical perspective. Continental drift and sea floor spreading.
- Divergent boundaries I: Mid-ocean ridges. Structure of the oceanic crust and ophiolites.
- Divergent boundaries II: Continental Rifts. Passive continental margins
- Oceanic fracture zones and transform faults.
- Convergent boundaries: Subduction Zones. Accretionary prisms. Magmatic arcs and backarcs.
- Collision of plates.
- Plate kinematics. The main plates today.
- Mechanics of plate tectonics. Driving forces.

#### UNIT 3. MAIN TECTONIC ELEMENTS OF THE EARTH

- Distribution of the main tectonic elements in the continents. .
- Study methods I: seismic refraction and reflection. Reflectivity patterns. .
- Study methods II: balanced geological cross-sections. .
- Cratons and Precambrian tectonics. Beginning of plate tectonics. .
- Subduction orogens: the Andes. .
- Collision orogens: the Paleozoic orogenies (Caledonian and Variscan), the

Alpine-Himalayan system. .

- The Iberian plate and the western Mediterranean. .
- Intracontinental chains.
- Post-orogenic extension in mountain ranges. Gravitational collapse. .
- Tectonic subsidence and the different types of sedimentary basins.

### *Practical exercises*

#### 1- Exercises of plate tectonics

- Surface elevation and isostasy
- Rifting and tectonic subsidence
- Sea floor spreading
- Spherical rotation of plates

#### 2- Interpretation of maps and seismic lines

- Interpretation of seismic reflection profiles of deformed regions
- Construction of geological cross-sections of representative tectonic styles
- Restoration and balancing of geological cross-sections

### **Methodology**

This course consists of a theoretical part (35 hours, in sessions of 1 hour, 2-3 times per week), in which the subjects will be explained and guidelines will be given so that the student can complete learning autonomously. Apart from the recommended bibliography, students will have additional material (graphics, scientific articles) on the virtual campus of the subject.

The laboratory work (10 hours) will be structured in sessions of 1-2 hours. It will consist in exercises related to practical work on plates tectonics, interpretation of map and seismic reflection profiles, and balancing cross-sections.

The student, individually or in small groups, will have to carry out an original work or term paper that may consist of the synthesis of a tectonic plate or of a regional tectonic unit, based on the bibliography and on data available on internet. The responsibility for research and selection of bibliography or resources will correspond to the student. The work will be presented in a written report and exposed orally in class.

### **Activities**

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical sessions	25	1	4, 6
Theory sessions	26	1.04	1, 3, 6, 2
Type: Supervised			
Group tutorials	2	0.08	6, 2
Type: Autonomous			

Bibliographic study, use of virtual campus	45	1.8	8, 5, 9
Completion of practical exercises	15	0.6	4, 6, 7, 9
Term paper on a tectonic plate or element of the Earth	30	1.2	8, 5, 7, 9, 2

## Assessment

The assessment will be on a continuous basis, based on written tests, on the work to deliver, and on a practical exercises dossier.

There will be two partial, individual and written tests, one at the end of blocks 1-2 and one at the end of block 3. To attend to the second partial, a student must at least have scored 3 in the first partial. The students that have not passed the average of the partial tests, or that want to raise the note, they can attend to one final exam, during the regular period of examinations. This final exam is will not be necessary for those who have passed the partials. 65% of the overall grade of the course will result from these individual written tests.

25% of the grade will be from the original work or term paper. The written and oral presentation of the work, the quality of the work carried out (originality, method, clarity, organization, conclusions extracted) and relevance of the bibliography or internet resources will be evaluated. 10% of the note will result from the dossier of practical exercises, which must reflect personal work.

Attendance to classes is mandatory.

For a student to be assessed he must attend at least:

- 60% of the theory sessions
- 80% of the practical sessions

If a student has carried out evaluation activities that exceed 35% of the total, it will appear as presented to the course. The failure to deliver any of the two additional documents to the written tests (work and dossier of practical exercises) will result in failing the course.

## Evaluation activities

Presentation of a dossier of practical exercises

Presentation of original term paper

Individual written tests (continuous evaluation)

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Individual written tests (continuous evaluation)	65%	4	0.16	1, 3, 6, 7
Presentation of a dossier of practical exercises	10%	0	0	8, 4, 6, 9
Presentation of original term paper	25%	3	0.12	8, 5, 7, 9, 2

## **Bibliography**

Allen, P.A., Allen J.R. 2005. Basin analysis. Blackwell Scientific Publications, Oxford, 2nd ed.

Kearey, P., Vine, F.J. 2009. Global tectonics. Blackwell Science, Oxford, 3rd ed.

Lowrie, W. 2007. Fundamentals of Geophysics. Cambridge University Press, 2nd ed.

Moores, E.M., Twiss, R.J. 1995. Tectonics. W.H. Freeman and Company, New York.

Summerfield, M.A. 1991. Global Geomorphology: an introduction to the study of landforms. Longman Scientific and Technical, Harlow.

Turcotte, D.L., Schubert, G. 2002. Geodynamics. Cambridge University Press, 2nd ed.