Universitat Autònoma de Barcelona

2019/2020

Structural Geology I

Code: 101047
ECTS Credits: 6

Degree	Type	Year	Semester
2500254 Geology	OB	3	1

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Teachers

Albert Griera Artigas

Prerequisites

It is recommended to have passed the subject "Fonaments de Geologia" and taken the course "Geological Carto

Objectives and Contextualisation

This subject deals with basic aspects of Structural Geology, including the study of stress, stress-strain relationshi

It is dedicated to the study of the structures originated by brittle deformation of rocks: faults and joints, and to sal

Competences

- Display understanding of the size of the space and time dimensions of Earth processes, on different scales.
- Draw up and interpret geological maps and other means of depicting geological information (columns, correlation frames, geological cross-sections, etc.)
- Learn and apply the knowledge acquired, and use it to solve problems.
- Obtain information from texts written in other languages.
- Process, interpret and present field data using qualitative and quantitative techniques, and suitable computer programmes.
- 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.
- Use concepts from physics when solving problems in geology.
- Work independently.

Learning Outcomes

1. Discern the deformation processes on different scales.
2. Draw up structural subsoil models, based on geological cross-sections and three-dimensional block diagrams.
3. Formulate and verify hypotheses of a structural and tectonic nature.
4. Interpret the mechanical behaviour of geological materials in accordance with physical parameters.
5. Learn and apply the knowledge acquired, and use it to solve problems.
6. Obtain information from texts written in other languages.
7. Process, interpret and present structural data.
8. Recognise and depict the principal tectonic structures.
9. Relate deformation structures to tectonic stress.
10. Relate the principal tectonic structures to structural and petrogenetic processes.
11. Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
12. Synthesise and analyse information critically.
13. Work independently.

Content

PROGRAM

Unit 1. STRUCTURAL GEOLOGY. Structural
geology
and tectonic : concepts and scales of study. Typology of structural data and structural analysis. Experimentation a

Unit 2. STRESS. Concepts of force and stress. State of stress at a point. The stress tensor. The Mohr circle for s

Unit 3. DEFORMATION. Concepts of deformation and strain, its components. Homogeneous and heterogeneous

Unit 4. RHEOLOGY. Relationships between stress and deformation. Elasticity, plasticity and viscosity: rheologica

Unit 5. BRITTLE DEFORMATION. Typology of the fractures developed in rocks subjected to stress. Shear fractu

Unit 6. JOINTS. Growth and morphology of joints. The origin of joints. Propagation of joints into the regional stres

Unit 7. FAULTS. Geometry of faults,displacement distribution. Formation and propagation of faults. Kinematic crit

Unit 8. SEISMICITY. The global distribution of earthquakes. Seismicity at plate and intraplate edges. Theoretical

Unit 9. THRUSTS. Terminology. Geometry of thrusts. Folds related to thrusts.Thrust systems and their evolution.

Unit 10. NORMAL FAULTS. Extensional faults: theyr geometry. Normal faults systems. Rift formation and metam

Unit 11. STRIKE SLIP FAULTS. Geometry of strike slip faults. Terminations of strike slip faults. Transfer and tran

Unit 12. SALT TECTONICS. Properties and rheology of salt. Salt flow and parameters of control. Geometry of sa

PRACTICE PROGRAM

- LABORATORY

I. Force and stress. Concept of stress tensor and Mohr circle.

II. Stress Mohr circle. Calculation of the state of stress from "in-situ" measurements.

III. Experimental deformation. Obtention of the stress-deformation curve from experimental data: material properties.

IV. Interpretation of graphs on the rheology of materials. The role of pressure, temperature, fluids and deformation rate in the rheology of rocks.

V. The fracture envelope. The use of Mohr circles to study the formation of faults and fractures.Physical parameters in the formation of fractures. Influence of the anisotropy in fracture development.

VI. Structures related to the displacement of thrusts and normal faults.

VII- VIII. Interpretation of geological maps and drowing of geological cross-sections.

IX. Analysis and interpretation of field data. Obtention of the stress field orientation from faults.

- FIELD WORK

Fault system of the Vallès-Penedès (1 day)

Fault recognition in the field and data collection. Kinematic criteria. Fault rocks. Interpretation of the structures and their representation in skectches and stereographic projections. Interpretation of the geodynamic context. Elaboration of a field report.

Methodology

This subject consists of a theoretical part (23 hours), in which the topics will be explained and some study guideli

The laboratory practices (21 hours) will be taught in sessions of 2 hours and their content will be closely related t

This work will be done by the student under supervision The work not completed during the practice session, wi

The field work will consist of a day trip to study the Vallès-Penedès
fault system. Attendance at the field trip is mandatory to pass the subject. Before the practice, the students will el autonomously a summary based on bibliography, on the location and main structural elements of the zone.

The practice will consist in the observation and explanation of the outcrops, followed by the data collection by the

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Field work	7	0.28	12, 5, 2, 3, 7, 8, 9, 11, 13
Laboratory Practices	21	0.84	12, 5, 2, 3, 4, 6, 7, 9, 11, 13
Theory	23	0.92	12, 5, 1, 3, 4, 9, 10

Type: Autonomous			
Study, reading of bibliography and use of the Virtual Campus	32.5	1.3	1, 3, 4, 6, 9, 10, 13
Treatment and interpretation of structural data and interpretation of geological maps	44.5	1.78	12, 5, 2, 7, 8, 11

Assessment

Degree of compulsory nature of face-to-face teaching

In order for a student to be evaluated, the following minimum requirements must be met:

- Attend to the 80% of the theoretical sessions

- Attend to the 80% of the laboratory practices.

- To attend the field trip.

Evaluation

Two partial exams of theoretical and practical content will be carried out. The evaluation will be completed with the evaluation of the other activities in the manner indicated below.

Assessment system for the acquisition of skills and qualifications system:

- Evaluation of laboratory practices by presenting a dossier (10%)

- Correction of practical exercises (10%)

- Evaluation of a fieldwork report (20%)

- Partial and final exams based on the theoretical and practical contents (60%)

Only the activities evaluated through partial exams are recoverable. Students must take the exam for all those activities not passed during the course. The recovery will be made through an examination.

If a student has carried out evaluation activities that exceed 35% of the total of the subject, he / she could not be graded as NOT PRESENTED.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Correction of practical exercises	10%	1	0.04	12, 5, 1, 2, 4, 7, 8, 10, 11
Dossier of laboratory practices	10%	1	0.04	12, 2, 3, 4, 7, 8, 10, 11, 13
Examination to recover the first and/or second exams	máx. 60%	3	0.12	12, 5, 1, 2, 3, 4, 7, 8, 9, 10, 11
Field Work Memory	20%	11	0.44	12, 5, 3, 6, 7, 8, 11, 13
First partial exam of theoretical and practical contents	30%	3	0.12	1, 3, 4, 6, 8, 9, 10, 11
Second partial exam of theoretical and practical contents	30%	3	0.12	12, 5, 1, 2, 3, 4, 8, 9, 10, 11

Bibliography

Bastida, F. 2005. *Geología. Una visión moderna de las Ciencias de la Tierra (vol.2).*Edic. Trea. Gijón.

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Hobbs, B.E., Means, W.D. & Williams P.F. 1981. *Geología Estructural*. Omega. Barcelona. 518 pp.

Mattauer, M. 1976. *Las deformaciones de los materiales de la corteza terrestre*. Omega. Barcelona.

Means, W. D. 1976. *Stress and strain*. Springer-Verlag. New York. 338 pp.

Twiss, R.J. & Moores, E. M. 1992. *Structural Geology.* W.H. Freeman and Co. New York. 532 pp.

Van der Pluijm, B.A. & Marshak, S. 1997. *Earth Structure, An introduction to Structural Geology and Tectonics* .WCB/McGraw-Hill. 495 pp.