Universitat Autònoma de Barcelona

2020/2021

Geology of Petroleum

Code: 101052
ECTS Credits: 4

Degree	Type	Year	Semester
2500254 Geology	OT	3	0
2500254 Geology	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

Name: Eduard Remacha Grau
Email: Eduard.Remacha@uab.cat

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

Gumer Galán García

Prerequisites

The subject, largely involves integration of basic knowledge on geology, mainly stratigraphy, sedimentology and tectonics; but also interpretation of geological mapping, geochemistry and geochronology, as well as stratigraphic and structural interpretation of seismic reflection data and interpretation and correlation of well log (logs). It is highly recommended the student having already passed the subjects where the mentioned disciplines are dealt with.

The acquisition of knowledge on petroleum geology is much more effective and easier if the student has already completed the basin analysis subject, or is studying it in parallel within the same period of time.

Objectives and Contextualisation

The objective of this subject is to provide the most basic concepts of petroleum geology, essentially oriented to the hydrocarbon exploration and basic characterization mainly of conventional reservoirs, and less those nonconventional.

Starting with the analysis of the historical and socio-economic aspects, as well as the projection to the future within the energetic transition time and the final global "decarbonization", the subject follows with a detailed analysis of the essential elements forming a petroleum system, and geological characterization of reservoirs.

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.
- Draw up and interpret geological maps and other means of depicting geological information (columns, correlation frames, geological cross-sections, etc.)
- Identify and tackle environmental problems, plan land-use and know the principles of prevention and mitigation of geological risks.
- Obtain information from texts written in other languages.
- Plan the exploration and sustainable development of geological resources.
- Process, interpret and present laboratory data using qualitative and quantitative techniques, and suitable computer programmes.
- 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.
- Show initiative and adapt to problems and new situations.
- Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
- Synthesise and analyse information critically.
- Work in teams, developing the social skills needed for this.
- Work independently.

Learning Outcomes

1. Correctly interpret geological information with applications in the exploration of hydrocarbons and mineral deposits, and in geological engineering.
2. Correctly sample industrial mineral and rock deposits.
3. Draw up geological cross-sections or other types of presentation for geological data in order to characterise hydrocarbon reserves and mineral deposits.
4. Draw up subsoil interpretation tables and graphs in relation to geological engineering.
5. Evaluate the environmental problems related to mining, industrial rock and hydrocarbon exploitations.
6. Explain the genesis processes of the principal types of mineral deposits, and their evolution across time.
7. Obtain information from texts written in other languages.
8. Process, interpret and present analysis results.
9. Relate Earth processes to those of mineral and oil genesis.
10. Relate the theories and principles of geology to the exploration of reserves and mineral deposits, and to problem solving in geological engineering.
11. Show initiative and adapt to problems and new situations.
12. Solve problems in reserves, mineral deposits and geological engineering based on field and laboratory observations and the concepts studied.
13. Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
14. Synthesise and analyse information critically.
15. Use geochemical methods to detect and study mineral deposits.
16. Work in teams, developing the social skills needed for this.
17. Work independently.

Content

1. - Theoretical classes
1.- Petroleum, composition and geochemical characterization.
1.2.- The petroleum geologists in the past and nowadays. Socio-economic aspects. Development of the oil industry from the beginning to the current state-of-the-art. Sustainability, energy transition and future of the oil industry.
1.3.- Concept of petroleum system. Source rock, migration, reservoir rock and traps. Plays and prospects, basin, province and oil field.
1.4 - Classification of reservoirs.

1.5.- Tools and techniques for the characterization of reservoirs.
1.6.- Principles of characterization of reservoirs and geological controls.
1.7.- Exploration of non-conventional hydrocarbons and introduction to production techniques.

2.- Seminars and practical exercises
2.1.- In both cases the active participation of the students is required and they deal with real cases, to face the corresponding problems searching solutions. Both types of activities are intended to reinforce and apply different theoretical aspects. Individual results are discussed among students under the mentoring and control of the teacher, and conclusions must be reached involving more than one scenario. The different possibilities must be defended and properly argued by the students. The activities want favoring and increasing the critical capacity facing real problems of socio-economic interest. The student is required to have a critical vision for the future of the hydrocarbons problem as a non-renewable resource, as well as the role of hydrocarbons in the transition to other more sustainable energy resources.

2.2.- Different practical exercises are carried out in groups of 2-4 students on some types of reservoirs, conventional and non-conventional, formed in different times and sedimentary environments and types of traps. The differnt single works must be presented and discussed with the rest of the students, through debates obtaining conclusions as well as uploading the different synthesis works, in pdf documents, into the corresponding spaces created in the Moodle platform of this subject.

Methodology

In the theoretical part of this subject, the program already indicated will be followed according to lectures given by the teacher. This activity will contain a recommendation of the basic bibliography of each subject, and complementary recomendations for self-learning. The students will have the bibliographic material allowing the open digital distribution, or in other cases the links where specific information of interest may be downloaded. Material will be also provided from the examples, mainly of subsoil real cases, discussed in class. All the latter will be available in the Moodle of the subject, and the teacher reserves the decision to ask the students for its acceptance to upload their final works presented in class.

The teacher does not accept the obligation to provide additional notes than those provided in the Moodle, it is there where all the content for the exams will be available.

The seminars and practical exercises are based on real cases. In these activities different aspects are faced according to the theoretical content. Each practice can be complemented with a supplementary questionnaire that the student should answer if requiered, usually within a limited time at the end of a seminar session, or, by delivery within a period established in accordance with the group within the corresponding space enabled in the Moddle of the subject. It is necessary to keep in mind that some of the questions in the questionnaires may be also included in the exams.

Several seminars will be held, and their content will be determined based on the development of the theory, searching the practical application to real cases. The aim of seminars is to reinforce theoretical and practical aspects that the teacher selects as a need to go deeper and beyond the aspects dealt with in the theoretical classes.

It is necessary to emphasize that the subject, including exams, is in practice fully developed, taking advantage of the Moodle environment provided by the UAB. For that reason is considered essential that students bring their own laptop or tablet to follow the theoretical and practical exercises actitities. The use of smart phones for these activities is not recommended due to the limitations in the dimensions of the screens, particularly in the observation of the commonly large graphic format of different files.

The inappropriate use of hardware and applications during the fixed times of activities of this subject (theory, practical exercises and seminars), as for example the use of the devices attending social networks, could mean the final fail of this subject.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical exercises	14	0.56	14, 11, 1, 2, 6, 4, 8, 9, 3, 13, 17
Theory	20	0.8	1, 10, 2, 6, 7, 4, 8, 15, 9, 12, 3, 5
Type: Supervised			
Mentoring of works either being individual or in group	10	0.4	14, 11, 1, 2, 6, 15, 9, 3, 13
Type: Autonomous			
Study of the theory, completion of practical exercises, and preparation of synthesis works	41	1.64	14, 11, 1, 10, 2, 6, 7, 4, 8, 15, 9, 3, 13, 17, 16, 5

Assessment

1.- Assessment of theoretical content.
It will be according to the arithmetic average of scores obtained in a minimum of two exams. The examinations will be carried out by connecting to the Moodle platform of the subject, and each student has to bring their own laptop or tablet to take the exam in the corresponding UAB classroom. In the exceptional case an student do not have these facilities, is necessary to communicate in advance this fact to the professor to find a solution to the problem.

2.- Assessment of practices and seminars.
They will be according to the correction of a dossier with the set of the finished practical exercises that the student will deliver before the deadline, and according to the teacher, in the corresponding space enabled in the Moodle of the subject.
The contributions that will be made to the Moodle of the subject (to the forum, group discussions, wikis, glossary contributions, and other short activities) are also object of evaluation. The teacher will announce in advance the value of each activity.

Note about the evaluation
Low participation in activities proposed in the Moodle or seminar sessions may involve negative grades in the seminars and practical exercises as well as in the synthesis works. Each student has the responsibility to be sure that the digital information, which is delivered directly within the Moodle environment and the corresponding site, has been correctly uploaded and can be opened without difficulties. Corrupt files, infected by viruses or trojans, etc., or that can not be opened, will not be considered as not presented and consequently, will not be evaluated (mark 0).

It is necessary to keep in mind that all the different activities offered in the Moodle (forums, wikis, short exercises ...), in addition to essentially serving to improve learning, may increase or decrease the mark of the theoretical exams.

Recovery exam

Students who have not passed the subject from continuous evaluation may recover the subject by means a final exam, the day and time assigned for that. The content of the final test, in all cases, will consist of all the theoretical content, and also after uploading in the Moodle the complete set of practical exercises. After the recovery exam, the final mark of the subject would replace the marks previously obtained by continuous evaluation and the punctuation criteria will follow the same % as in the case of continuous evaluation.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exams of theory	80%	11	0.44	14, 11, 1, 10, 2, 6, 7, 4, 15, 9, 12, 3, 13, 17, 16, 5
Practical exercises and seminars	20%	4	0.16	14, 11, 1, 2, 6, 4, 8, 15, 9, 12, 5

Bibliography

Basic recomended bibliography:

Bronlow A.H. (1996) Geochemistry, Prentice Hall

Killops S.D., Killops, V.J. (1993). An introduction to organic geochemistry. Harlow, Essex, England : Longman Scientific & Technical ; New York : Wiley.

Bend. S. L. (2010). Petroleum Geology eTextbook (ver 1.1). AAPG Spetial Publication on CD-ROM

Slatt R. (2006). Stratigraphic Reservoir Characterization for Petroleum Geologists, Geophysicists and Engineers. Handbook of petroleum exploration and production. Vol. 6. John Cubit (Ed). Elsevier

Knut Bjorlykke (2010). Petroleum Geoscience: From Sedimentary Environments to Rock Physics