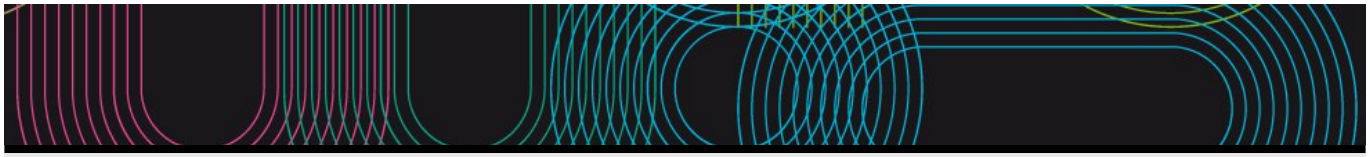

IDENTIFYING DATA				
Soil mechanics				
Subject	Soil mechanics			
Code	V09G311V01301			
Study programme	Grado en Ingeniería de los Recursos Mineros y Energéticos			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Giráldez Pérez, Eduardo			
Lecturers	Araújo Fernández, María Giráldez Pérez, Eduardo			
E-mail	egiraldez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	In this subject it is intended that the student knows the technological principles in the field of soil mechanics. The knowledge about this area will focus on understanding the basic aspects of elasticity, elasto-plasticity, water flow in continuous media, consolidation and resistance behavior of soils. Another target will be to know the different experimental process for characterization, classification, resistance and consolidation in soils. To know how to design and calculate retaining walls and foundations. These theoretical and practical notions should allow the student to solve real problems and understand the singularity of the technology developed in this field. The principles of rock and soil mechanics are based on scientific knowledge, but the technical works are projected in a natural environmental where the variability of the input parameters is very relevant and has a very significant influence on the results. The knowledge of the peculiarities of this discipline will enable to solve and make good decisions into this geological context. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
A1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
A2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
A3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
A4	That the students can transmit information, ideas, problems and solutions to a specialized and non-specialized audience
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
B1	Scientific and technical training and qualification as a Mining Engineer and knowledge of the functions of consultancy, analysis, design, calculus, project, construction, maintenance, preservation and exploitation.
B3	Ability to design, write and plan partial or specific projects within the units specified in the previous section, such as mechanical and electric plants and their maintenance, networks of energy transportation, facilities for transportation and storage of solid, liquid and gaseous materials, waste sites, tailing dams, foundation and support, demolition, restoration, controlled explosions and explosives logistics.
B7	Ability to do, within the field of mining engineering, with the knowledge acquired in accordance with section 5 of order CIN/306/2009, measurements, stakeouts, planes and maps, calculations, assessments, risk analyses, expert reports and studies, work plans, environmental and social impact studies, restoration plans, quality control systems, prevention systems, analysis and assessment of the properties of metal, ceramic, refractory, synthetic and other materials, soil and rock mass classification and other works of a similar kind.
C12	Knowledge of geotechnics and soil and rock mechanics.

D1	Ability to draw links between the different elements of all the knowledge they acquired, understanding them as components of a body of knowledge with a clear structure and strong internal cohesion.
D2	Ability to develop a project to completion in any field of this branch of engineering, combining appropriately the knowledge acquired, consulting the relevant sources of information, carrying out any required inquiries, and joining interdisciplinary work teams.
D3	To suggest and develop practical solutions, using the relevant theoretical knowledge, to phenomena and problems-situations of ordinary reality that are specific to engineering, developing appropriate strategies.
D4	To foster collaborative working, communication, organization and planning skills, along with the ability to take responsibilities in a multilingual, multidisciplinary work environment that promotes education for equality, peace and respect for fundamental rights.
D5	To be familiar with the relevant sources of information, including constant updating, in order to practice one's profession competently, accessing all the present and future tools of information search, constantly adapting to technological and social changes.

Expected results from this subject

Expected results from this subject		Training and Learning Results		
To comprise the basic principles of the laws of the elasticity, elasto-plasticity, water flow in continuous media, consolidation and resistance behavior of soils.		B1 B3 B7	C12	D3
To know how characterise, classify and interpret experimental tests of resistance and consolidation in soils.		B1 B3 B7	C12	D3
To know how to design and calculate retaining walls and foundations.		B1 B3 B7	C12	D1 D3
Realize that technology, although based on scientific knowledge, has as its primary objective to make design decisions and solve problems (quoting Von Karman: Scientists discover the world that exists; engineers create the world that never was).	A1 A2 A3 A4 A5	B1 B3 B7	C12	D1 D2 D3 D4 D5
To integrate the basic principle of rock and soil mechanics: the geotechnical engineer does not select the materials because it works into a natural context, and the influence of the variability of the input parameters is very relevant and has a very significant influence on the final results.	A1 A2 A3 A4 A5	B1 B3 B7	C12	D1 D2 D3 D4 D5

Contents

Topic	
GEOTECHNICS	The natural ground and its relationship with engineering. Geotechnical characterization. Behavior of rock masses. Behavior of soils.
DEFINITION, CLASSIFICATION AND INDEX PROPERTIES OF SOIL	Definition of soil and description of its geological origin. Granulometry. Plasticity of soils. Atterberg limits. Soil classification systems (Casagrande, H.R.B.). Index properties.
STRESS AND DEFORMATION IN A MASS OF SOIL	Effective and total stress in a soil. Tensional states in the soil mass. Elastic settlements.
THEORY OF GROUNDWATER FLOW IN A MASS OF SOIL	Steady state flow. Ascending flow under structures of containment. Water flow through small earth dams.
THEORY OF CONSOLIDATION AND SETTLEMENT ANALYSIS.	Theory of vertical consolidation (Terzaghi). The oedometer test. Settlement analysis. Shear strength of a soil.
LATERAL EARTH PRESSURE AND RETAINING WALLS	Rankine's lateral earth pressure. Active and passive soil states. Gravity Retaining walls. Reinforced soil wall. Anchored walls. Diaphragm walls.
FOUNDATIONS	Bearing capacity of shallow foundations. Cone and standard penetration tests (CPT and SPT). Design of shallow foundations (introduction). Bearing capacity of deep foundations.
GEOTECHNICAL SITE INVESTIGATION	Trial pits. Penetrometers. Borehole drilling. Geotechnnical reports. Site improvements and site preparation.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	22	40	62
Problem solving	12	40	52
Laboratory practical	10	17.5	27.5
Seminars	3	0	3
Workshops	3	0	3

Objective questions exam	0.5	0	0.5
Problem and/or exercise solving	2	0	2

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Exhibition of the basic contents of the matter.
Problem solving	Formulation, analysis and resolution of a problem or exercise related with the subject.
Laboratory practical	Activities developed in laboratory for the application of basic skills related with the matter. A practices report will be evaluated.
Seminars	Activity focused on the work on a specific topic, which allows to deepen or complement the contents of the subject.
Workshops	Activities focus on the acquisition of knowledge and manipulative skills and instrumental on a specific theme, with specific assistance from the teacher to the individual activities and / or group to develop students.

Personalized assistance

Methodologies	Description
Lecturing	Any doubt can be solved, individually or in groups, during tutorship. Likewise, the students will be able to do queries through telematic means (email, videoconference, Moovi forums, ...) after a previous request to the lecturer
Problem solving	Any doubt can be solved, individually or in groups, during tutorship. Likewise, the students will be able to do queries through telematic means (email, videoconference, Moovi forums, ...) after a previous request to the lecturer
Laboratory practical	Any doubt can be solved, individually or in groups, during tutorship. Likewise, the students will be able to do queries through telematic means (email, videoconference, Moovi forums, ...) after a previous request to the lecturer
Seminars	Any doubt can be solved, individually or in groups, during tutorship. Likewise, the students will be able to do queries through telematic means (email, videoconference, Moovi forums, ...) after a previous request to the lecturer
Workshops	Any doubt can be solved, individually or in groups, during tutorship. Likewise, the students will be able to do queries through telematic means (email, videoconference, Moovi forums, ...) after a previous request to the lecturer

Assessment

	Description	Qualification	Training and Learning Results
Lecturing	It will be evaluated with 3 objective response tests or test type having a weight of 10%, the first two, and a weight of 5%, the third. Through this methodology, all the expected results in the subject are evaluated.	25	A1 B1 C12 D1 A3 B3 D2 A5 B7 D3 D5
Problem solving	It will be evaluated with 3 problem solving tests having a weight of 15%, the first two, and a weight of 20%, the third. Expected results: To comprise the basic principles of the laws of the elasticity, elasto-plasticity, water flow in continuous media, consolidation and resistance behavior of soils. To know how characterise, classify and interpret experimental tests of resistance and consolidation in soils. To know how to design and calculate retaining walls and foundations. To integrate the basic principle of rock and soil mechanics: the geotechnical engineer does not select the materials because it works into a natural context, and the influence of the variability of the input parameters is very relevant and has a very significant influence on the final results.	50	A1 B1 C12 D1 A2 B3 D3 A5 B7

Laboratory practical	It will be evaluated with 2 practical reports having a weight of 10% each one of them. Expected results: To comprise the basic principles of the laws of the elasticity, elasto-plasticity, water flow in continuous media, consolidation and resistance behavior of soils. To know how characterise, classify and interpret experimental tests of resistance and consolidation in soils. To integrate the basic principle of rock and soil mechanics: the geotechnical engineer does not select the materials because it works into a natural context, and the influence of the variability of the input parameters is very relevant and has a very significant influence on the final results.	20	A1 A2 A3 A4 A5	B1 B3 B7	C12	D1 D2 D3 D4 D5
Seminars	Evaluation based on systematic observation, monitoring and degree of autonomy shown in the resolution of the proposed activity. Teamwork. Through this methodology, all the expected results in the subject are evaluated.	5	A1 A2 A3 A4 A5	B1 B3 B7	C12	D1 D2 D3 D4 D5

Other comments on the Evaluation

Continuous evaluation first opportunity:

Each one of the partials, will consist of a part of theory and another part of problems, they will be carried out jointly on date. That is, there will be a total of three partials throughout the semester:

- Partial 1 Theory and Problems (25%).

- Partial 2 Theory Problems (25%).

- Partial 3 Theory and Problems (25%).

In this way, each of these partials add up to 25% of the overall mark. A minimum grade of 4 out of 10 will be required in each partial for it to add to the continuous assessment grade.

Partials 1 and 2 will take place during the academic year and part 3 will take place on the date of the official exam calendar.

The completion of the practices will be assessed with the delivery of 2 reports, with a weight each of 10% of the final grade. A minimum score of 4 out of 10 points will be required in each of them.

The assessment of the work carried out in the seminars will be carried out with the assistance to them.

Continuous evaluation second chance:

The exam will have a weight of 75% of the final mark and the marks of the practical reports and the seminar will be kept.

Global evaluation, the exam of this modality will consist of two parts:

- An exam of theoretical concepts and problem solving, with a weight of 75% of the overall grade.

- An exam on the concepts worked on in the practices and in the seminar, with a weight of 25% of the overall grade. In this second part, a minimum score of 3 out of 10 will be required to be scored.

Exam Timetable: Exam dates and rooms must be verified in the official webpage of the school:

http://minaseenerxia.uvigo.es/es/docencia/examenes

Sources of information

Basic Bibliography

Berry, P.L. y Reid, D., **Mecánica de Suelos**, McGraw-Hill, 1993

González de Vallejo, L.; Ferrer, M.; Ortuño L. y Oteo, C., **Ingeniería Geológica**, Prentice Hall, 2002

Jiménez Salas, J.; de Justo Alpañes, J.L., **Geotecnia y Cimientos**, 2ª ed., Editorial Rueda, 1981

Verruijt, A., **An Introduction to Soil Mechanics**, Springer, 2017

Complementary Bibliography

Das, Braja M., **Fundamentos de Ingeniería de Cimentaciones**, 7ª ed., Cengage Learning, 2012

Calavera, J, **Cálculo de estructuras de cimentación**, 5ª ed., INTEMAC, D.L., 2015

Craig, R. F., **Craig's soil mechanics. Solutions manual**, 7th ed., Taylor & Francis e-Library, 2004

Recommendations

Subjects that are recommended to be taken simultaneously

Rock mechanics/V09G311V01304

Subjects that it is recommended to have taken before

Physics: Physics I/V09G311V01102
Geology: Geology/V09G311V01206
Fluid mechanics/V09G311V01204
Materials resistance/V09G311V01203