Universidad Zaragoza

Year : 2019/20

28712 - Materials: Science and Technology

Syllabus Information

Academic Year: 2019/20
Subject: 28712 - Materials: Science and Technology
Faculty / School: 175 -

Degree: 423 - Bachelor's Degree in Civil Engineering

ECTS: 6.0
Year: 2
Semester: Second semester
Subject Type: Compulsory
Module: ---

1.General information

1.1.Aims of the course

The main goal of the course is to teah the basic concepts of materials engineering and to study the different types of materials in the construction sector. The content aims to provide an adequate response to the necessities that the future engineer will have afther finalising his/her degree (by the acquisition of knowledge and skills that meets the needs required by today's engineering companies)

Taking into account the students to whom the subject is addressed, the focus, as well as the content, should be directed, fundamentally, to the student knowing of the basics of the science of materials, the classification of the various families of materials , their properties, applications and behaviour in service, and the technology developed to improve the properties of the materials, in such a way that allows to any student to be able to choose the most suitable material for each application.

1.2.Context and importance of this course in the degree

The subject of Materials: Science and Technology is part of the degree in Civil Engineering taught by EUPLA, framed within the group of subjects that make up the module called Technical and Technological Building Education. It is a subject of the second year and compulsory in the second semester (OB), with a teaching load of 6 ECTS credits. Its contents must provide the basic knowledge necessary for the follow-up of the later subjects of the Curriculum.

Each subject of which the race is composed tries to cover a field in the Technological and Scientific formation of the student, in this case the selection of the material the first step to build. The viability of the project will depend not only on the chosen material, but also on the design and aesthetics of the project. In addition, it should be a basic subject for the development of the subsequent "Building Works, Construction of railway infrastructures, Construction of transport infrastructure: roads and structures", which will expand and deepen in some concepts already discussed.

To be able to choose a material one must know its mechanical, chemical, optical characteristics, the behavior with other materials and the durability that it may present depending on the environments in which it is located.

1.3.Recommendations to take this course

Officially, the current curriculum does not lay down any prerequisite to take this subject. However, the content to be taken will require skills and abilities, mainly in the subjects Physics, Mathematics and Chemistry (from previous academic years).

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The learning process designed for this subject is based on the following

The teaching methodology is based on a strong interaction between the teacher/student. This interaction is made a reality through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

The current subject SCIENCE AND TECHNOLOGY OF MATERIALS is conceived as a stand-alone combination of contents, yet organized into three fundamental and complementary ways, which are: the theoretical concepts of each teaching unit, the solving of problems or resolution of questions and laboratory work, supported in turn by other activities.

1. Classroom activities:
    1. **Theory Classes**: the theoretical concepts of the subject will be explained.
    2. **Practical Classes**: Students will develop examples and conduct problems or case studies concerning the theoretical concepts studied.
    3. **Laboratory Workshop**: Students will develop tests to reinforce the theoretical concepts studied.
2. Reinforcement activities: Through a virtual education portal (Moodle) several activities which strengthen and expand the basic contents of the subject will be addressed. These activities will be personalized and controlled its realization.

Teaching organization:

? **Theory Classes**: Master theoretical and / or practical lessons given mostly by the teacher.

? **Practical Classes** / seminars / workshops: Theoretical or practical activities carried out in the classroom and requiring high student participation.

? Lab / Working site / computer room: Practical activities in laboratories, in the working site, in the computer rooms.

? Group tutorials: Learning tracking scheduled activities in which the teacher meets with a group of students to guide their autonomous learning work that requiring a very high degree of counselling from the teacher.

? **Individual Tutorials**: Face-to-face or online.

4.2.Learning tasks

The programme offered to the student to help them achieve their target results is made up of the following activities:

Involves the active participation of the student, in a way that the results achieved in the learning process are developed, not taking away from those already set out, the activities are the following:

Face-to-face generic activities:

Theory Classes: The theoretical concepts of the subject are explained and illustrative examples are developed as support to the theory when necessary.

Practical Classes: Problems and practical cases are carried out, complementary to the theoretical concepts studied.

Laboratory Workshop: This work is tutored by a teacher, in groups of no more than 20 students.

Generic non-class activities:

- Study and understanding of the theory taught in the lectures.
- Understanding and assimilation of the problems and practical cases solved in the practical classes.
- Preparation of seminars, solutions to proposed problems, etc.
- Preparation of laboratory workshops, preparation of summaries and reports.
- Preparation of the written tests for continuous assessment and final exams.

Assisted Autonomous activities: Although they will have a strong face-to-face character, they will be focused mainly on seminars and tutorials under the supervision of the teacher.

Reinforcement activities: With a strong non-class character, through a virtual learning portal (Moodle) several activities that reinforce the basic contents of the subject will be conducted. These activities might be customized or not, but always under control.

The subject has 6 ECTS, which represents 150 hours of student work in the subject during the semester, in other words, 10 hours per week for 15 teaching weeks.

A summary of a weekly timetable guide can be seen in the following table. These figures are obtained from the subject file in the Accreditation Report of the degree, taking into account that the level of experimentation considered for the subject is moderate.

Activity	Weekly school hours
Lectures	3
Laboratory Workshop	1
Other Activities	6

Nevertheless, the previous table can be shown in greater detail, taking into account the following overall distribution:

? 45 hours of lectures, with 70% theoretical demonstration and 30% solving type problems.

? 9 hours of laboratory workshop, in 2 hours per sessions.

? 4 hours of written assessment tests, 2 hours per test.

? 2 hours of PPT presentations.

? 90 hours of personal study, over the 15 weeks of the 2nd semester.

There is a tutorial calendar timetable set by the teacher that can be requested by the students who want a tutorial.

4.3.Syllabus

Contents of the subjects essential to achieve learning outcomes

The guidelines followed to develop the contents were as follows:

- The contents proposed in the verification report were respected.

- A syllabus whose chapters are generally consistent with the titles of the specified program was developed. When this was not done it was because, due to its size and / or correlation, it was included in another.

- A large bibliography of current technical, classical and issues was selected

- The best suited units from the bibliography were selected and turned into a single text, with our own design and layout and innovative teaching resources. The teacher didn't mean to be creative in its preparation, but he based his work on renowned prestige texts. Only the goals, organization and presentation of the material and drafting of some sections of the issues are original. The full text is available in the reprographic service of the school, as well as on digital media published in Moodle.

- The main features of the text layout can be summarized as having nine units, which coincide with the content, completely developed, avoiding summaries.

- The specific goals achieved in the making of the text itself can be summarized as follows:

- Highlight the relationship between conceptual analysis and problem solving, using the number of examples needed to show approaches for their solution, stressing that solving is a process in which the conceptual knowledge is applied, and it is not merely a mechanized solving model. Therefore, in the text and the solved examples, the mind processes for problem solving based on the concepts are stressed, instead of highlighting the mechanical procedures.
- Provide students with practice in the use of analytical techniques presented in the text.
- Show students that the analytical techniques are tools, not goals, allowing in different situations to practice in choosing the analytical method they will use to obtain the solution.
- Encourage student interest in engineering activities, including real application problems.
- Develop problems and exercises using realistic values ??representing feasible situations.
- Encourage students to evaluate the solution, either with a different method of resolution or by testing to see if it makes sense in terms of the known behavior of the circuit, machine or system.
- Show students how the results of a solution are used to find additional information about the behavior of a circuit, machine or system.
- The resolution of most problems will require the type of analysis to be performed by an engineer to solve real-world problems. Developed examples, where the particular way of thinking of engineering is emphasized, can also be used as a basis for solving real problems.

The course syllabus is divided into two complementary content components:

- Theoretical.

- Practical.

Theoretical Contents

The choice of the content of the different teaching units was made seeking the express clarification of the final goal so that with the addition of incidental knowledge, the student can achieve a structured and understandable knowledge to reach the competences of a Civil Engineering.

The theoretical contents are classified according to five teaching units, attached table, indivisible treatment blocks, taken into

account the configuration of the subject under programming. These topics collect the contents needed for the acquisition of predetermined learning outcomes.

Unit 1: Aggregates and Roadbeds

1. Origin of aggregates
2. Physical and mechanical properties
3. Classification of aggregates
4. Setting of aggregates
5. Embankment, Grading & Roadbeds
6. Applications

Unit 2: Bitumen (-)

1. Origin of bitumen
2. Rheological test of bitumens
3. Classification of bitumens
4. NFU (out of use tyres in bitumens)
5. Bitiminous Emulsions
6. Bitumen applications

Unit 3: Bituminous Mixtures (Asphalt concrete)

1. Production
2. Transport
3. On-site positioning
4. Mix Typologies
5. Mix Classification
6. Mix Rheology
7. Regulations
8. Pathologies

Unit 4: Metals

1. Introduction
2. Crystal structura
3. Formation and nature of alloys
4. Mechanical properties
5. Concepts
6. Physical Properties
7. Chemical properties
8. Unions
9. Forming
10. Iron and its alloys
11. Copper and its alloys
12. Aluminium and its alloys

Unit 5: Cements (-)

1. Nature of cements
2. Raw materials of cements
3. Cement production
4. Cement constituents
5. Cement hydration
6. Classification of cements
7. Properties of cements
8. Test of cements
9. Uses of cement

Unit 6: Concretes

1. History

2. Manufacturing
3. Transport
4. On-site positioning
5. Fresh Concrete
6. Water
7. Aggregates
8. Durability
9. Additives
10. Concrete curing
11. Creep and shrinkage of concrete
12. Hardened concrete
13. Mechanical testing
14. Regulations
15. Pathologies

Practical Contents
The theoretical knowledge of the previous section, has associated practice tasks. The Laboratory practice tasks in Science and Technology of Materials are an important complement to the comprehensive training of the student in the Civil Engineering degree.

It is impossible to even try to give a minimal description of the different types of gadgets and commercial devices used for measuring different magnitudes. This is not the purpose of the subject. It is to cover the learning outcomes through a comprehensive program of laboratory practice activities, including aspects related to the following issues:

- Generically, a clear idea of ??the importance of the field of material testing as well as the implementation time and their application.
- Students must, at least, acquire knowledge about the most common techniques for measuring magnitudes such as: mechanical resistance, chemical resistance, environmental resistance, etc. of the materials used in construction.

4.4.Course planning and calendar

Assessment schedule

It will be fixed depending on the development of the lectures. The written assessment tests will have a connection with the aboved listed topics. On Moodle learning platform will be shown an schedule.

The dates of the final exams will be published at http://www.eupla.unizar.es/asuntos-academicos/examenes.

Next, the practice tasks to be developed in the laboratory that will be carried out by the students in sessions of two hours (Moodle for more information).

4.5.Bibliography and recommended resources

Materials

Materials	**Soporte**
Topic theory notes Topic problems	Paper/repository
Topic theory notes Topic presentations Topic problems Related links	Digital/Moodle E-Mail
Material de ensayos	Pc's laboratorio
Guión de prácticas	Paper/repository
Maquinas multiensayos Tamices Moldes de probetas Bandejas Etc.	

Bibliography

http://biblos.unizar.es/br/br_citas.php?codigo=28712&year=2019

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- PG-3 - [http://www.carreteros.org/normativa/pg3/apartados/indice.htm]