Universidad Zaragoza

Academic Year/course: 2022/23

28618 - Materials III

Syllabus Information

Academic Year: 2022/23
Subject: 28618 - Materials III
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
Degree: 422 - Bachelor's Degree in Building Engineering
ECTS: 6.0
Year: 2
Semester: Second semester
Subject Type: Compulsory
Module:

1. General information

1.1. Aims of the course

The subject and its expected results respond to the following approaches and objectives:

Show the basic concepts of materials engineering and study the different types of materials in construction.

Materials III is compulsory and is taught during the second semester of the second year of the Study Plan.

Its contents must provide the basic knowledge necessary for monitoring the subsequent subjects of the Study Plan.

These contents aim to provide an adequate response to questions as fundamental for the graduate as the acquisition of knowledge that meets the needs of today's society, and to train him with the necessary skills to practice his profession in a convenient and competitive way. .

Taking into account the students to whom the subject is addressed, the approach, as well as the contents, must be aimed, fundamentally, at the student knowing the basic foundations of materials science, the classification of the various families of materials , its properties, applications and behavior in service, and the technology developed to improve the properties of materials, in such a way that it allows any student to choose, in a first approximation, the most suitable material for each application

These approaches and objectives are in line with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (https://www.un.org/sustainabledevelopment/es/), in such a way that the acquisition of the course learning outcomes provides training and competence to contribute to their achievement to some degree.

- Goal 4: Quality Education
- Goal 6: Ensure access to water and sanitation for all
- Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation
- Goal 12: Ensure sustainable consumption and production patterns

1.2. Context and importance of this course in the degree

Materials III, is part of the Degree in Technical Architecture taught by the EUPLA, within the group of subjects that make up the module called Technical and Technological Building Training. It is a second-year subject located in the fourth semester and is compulsory (OB), with a teaching load of 6 ECTS credits.

Said subject implies a more than discreet impact in the acquisition of the competences of the degree, in addition to providing useful additional training in the performance of the functions of the Technical Architect related to the field of materials.

The Materials III subject teaches concepts that will be used in other compulsory subjects of the degree. Materials III will be a basic pillar for optional subjects of different intensifications. In addition, it must be a basic subject for the development of the later one: Structures, which will expand and deepen some concepts already exposed.

The student must have a base of all the concepts developed in the subject, for a better understanding of the materials that can be used in each case, as well as their conformation techniques and, as a consequence, the modification of their properties with each type of processing, to be able to pass the subjects of subsequent courses.

1.3. Recommendations to take this course

The current study plan does not establish any prerequisite for taking this subject. However, it would be advisable to have a basic knowledge of mathematics, physics and chemistry.

In relation to the above, in the first course of the degree and in advance of the subject in question, the subjects of Fundaments of Construction Materials, Applied Mathematics to Building I and Physics I: General Mechanics, Materials I and Materials are studied. II, providing the basic knowledge to be able to follow the evolution of the subject without any type of problem.

2. Learning goals

2.1. Competences

The student will acquire generic and specific competences that the verification memory of the degree marks.

Upon passing the subject, the student will be more competent to ...

- CE4 Knowledge of the traditional or prefabricated materials and construction systems used in buildings, their varieties and the physical and mechanical characteristics that define them.
- CE5 Ability to adapt the construction materials to the type and use of the building, manage and direct the reception and quality control of the materials, their commissioning, the execution control of the work units and the carrying out of tests and final tests.
- G01 Organizational and planning capacity
- G02 Ability to solve problems
- G03 Ability to make decisions
- G04 Aptitude for oral and written communication of the native language
- G05 Analysis and synthesis capacity
- G06 Information management capacity
- G07 Ability to work in a team
- G08 Capacity for critical reasoning
- G09 Ability to work in an interdisciplinary team
- G10 Ability to work in an international context
- G11 Improvisation and adaptation capacity to face new situations
- G12 Leadership aptitude
- G13 Positive social attitude towards social and technological innovations
- G14 Capacity for reasoning, discussion and presentation of own ideas
- G15 Ability to communicate through words and images
- G16 Ability to search, analyze and select information
- G17 Capacity for autonomous learning
- G18 Possess and understand knowledge in a study area that starts from the general secondary education base, and is usually found at a level, which, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study
- G19 Apply their knowledge to their job or vocation in a professional way and possess the competencies that are usually demonstrated by preparing and defending arguments and solving problems within their area of ??study.
- G20 Ability to collect and interpret relevant data (usually within their study area) to make judgments that include reflection on relevant issues of a social, scientific or ethical nature.
- G21 Transmit information, ideas, problems and solutions to a specialized and non-specialized audience
- G22 Develop those learning skills necessary to undertake further studies with a high degree of autonomy.

2.2. Learning goals

The student, to pass this subject, must demonstrate the following results ...

1.To Know the behavior and technology of materials.

2. To Explain the manufacturing technologies and the implementation technologies of the different materials.

3. To Explain the differentiating criteria for the ?classification? of the different families of construction materials (concretes, bituminous mixtures, aggregates, firm, composite materials) according to the structure and properties they present.

4. It is able to relate the properties of the materials with the structure and / or microstructure.

5. It is able to relate the properties of the materials, obtained from the tests, with the applications and their behavior in service.

6. It is able to choose the materials based on the applications and their behavior in service.

7. Has a sufficient knowledge base to broaden and deepen the study and development of the materials used in construction.

8. To Know the importance of innovation in the development of manufacturing, commissioning and application of materials.

9. Has the ability to critically analyze the results obtained in an experimental work and extract correct conclusions, as well as propose future work that, in light of these conclusions.

10. Is capable of carrying out, individually and / or in teams, a research experiment in the field of Materials Engineering in a correct way and observing the necessary standards of safety, hygiene, economy of means, etc.

2.3. Importance of learning goals

This subject is highly technical, that is, it offers training with application content and immediate development in the labor and professional market. For this, Materials III constitutes one of the pillars on which their training must be based, since the structures, components, devices ... that the Graduate will design, manufacture, use and supervise, are made of materials, and are the properties of these, which ultimately define both the limits of use and the capacities of the structure or device, as well as the techniques that can be used for its manufacture.

For all these reasons, the acquisition of basic knowledge about the most relevant properties of materials, and the relationship between them and their composition and structure, should be a fundamental aspect of Graduate training.

At the end of the subject, the student will have knowledge of the materials used in the building, their varieties, and the physical and mechanical characteristics that define them. Ability to adapt construction materials to the type and use of the building, manage and direct the reception and quality control of the materials, their placement, control of the execution of the work units and the conduct of tests and trials endings. Likewise, it will be able to manage and direct the reception and quality control of the materials in the works.

3. Assessment (1st and 2nd call)

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

Continuous Assessment System

To opt for the Continuous Assessment system, you must attend the 100% of the face-to-face activities/visits/seminars and complete the laboratory practices on the days indicated in Moodle for this purpose.

The student must demonstrate that they have achieved the expected learning outcomes by evaluating the following activities:

- Written assessment tests: They will consist of a classic written exam scored from 0 to 10 points.
- Exercises, theoretical questions and proposed works: The teacher will propose exercises, problems, practical cases, theoretical questions, etc. to be solved individually.
- Individual activities in class: This activity will materialize in the presentation, exposition and discussion of a work in PPT, in class and directed to their classmates.
- Laboratory sessions: They will not count in the final grade, but will be compulsory to be eligible for this type of evaluation. For its development the student will have scripts or will have to do them according to the indications of the person in charge of practices.

As a summary of the above, the following weighting table of the grading process of the different activities has been designed, in which the final evaluation process of the subject has been structured:

Evaluation / weighting activity:

- Individual activities in class, exercises, theoretical questions and proposed works (PPT presentations). 10%
- Theory written exams: 45%.
- Written exam of practice problems: 45%
- Laboratory practices: 0%

The course will have been passed based on the sum of the scores obtained in the different activities carried out (as indicated above), obtaining a minimum of 50% of the total. Each one of the tests (theoretical / problem) will contribute to the grade and it is essential to obtain a minimum of 40% in the part of problems. The written tests must all be passed (> = 50%).

There will be a presentation of the subject on the first day of class where the parts that make up the continuous assessment, the assessment criteria and the teaching method followed will be indicated.

Global Assessment System

Following the regulations of the University of Zaragoza in this regard, in subjects that have continuous or gradual evaluation systems, a global evaluation test will be scheduled for those students who decide to opt for this second system or do not meet the evaluation requirements. keep going.

As a summary of the above, the following weighting table of the grading process of the different activities has been designed, in which the final evaluation process of the subject has been structured:

Evaluation / weighting activity:

- Theory written exam: 50%
- Written exam of practice problems: 50%

The course will have been passed based on the sum of the scores obtained in the different activities carried out, each contributing a minimum of 50%. Each of the tests (theoretical / problems) will contribute 50% of the grade, and it is essential to obtain at least 40% in each of them.

The theory or practice part may be saved between assessment calls of the same course. In addition, the part passed in the continuous evaluation will also be saved in the global evaluation.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as theory sessions, practice sessions, workshops, and autonomous work and study.

The teaching methodology is based on a strong interaction between the teacher and 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 approach, methodology and assessment of this guide are intended to be the same for any teaching scenarios. They will be adapted to the social-health situation at any particular time, as well as to the instructions given by the authorities concerned.

4.2. Learning tasks

This course is organized as follows:

- **Theory sessions**: The theoretical concepts of the subject are explained and illustrative examples are developed as support to the theory when necessary.
- **Practical sessions**: Problems and practical cases are carried out, complementary to the theoretical concepts studied.
- **Workshop**: This work is tutored by a teacher, in groups of no more than 20 students.
- **Tutorials**
    - **Group tutorials:** Learning tracking scheduled activities in which the teacher meets with a group of students to guide their autonomous work and study that requires a very high degree of counselling from the teacher.
    - **Individual tutorials**: On-site or online
- **Autonomous work and study.**
    - 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 on-site 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.

4.3. Syllabus

This course will address the following topics:

Theoretical Contents

Topic 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

Topic 2: Bitumen

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

Topic 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

Topic 4: Metals

1. Introduction
2. Crystal structure
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

Topic 5: Concrete

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

P r a c t i c a l C o n t e n t s

The theoretical knowledge of the previous section, has associated practice tasks. The Laboratory practice tasks in Materials I 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.

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 behaviour of the circuit, machine or system.
    - Show students how the results of a solution are used to find additional information about the behaviour 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.

4.4. Course planning and calendar

This course 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. This includes 3 hours of lectures, 1 of workshop and 6 of other activities every week.

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

- 32 hours of lectures, with 70% theoretical demonstration and 30% solving type problems.
- 2 hours of laboratory workshop, in 2 hours per sessions.
- 8 hours of written assessment tests, 2 hours per test.
- 8 hours of PPT presentations, 1 hour per PPT
- 90 hours of personal study, over the 15 weeks of the 2nd term.

Tasks to be developed in the laboratory will be carried out by the students in sessions of two hours.

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the EUPLA website:

- https://eupla.unizar.es/
- https://eupla.unizar.es/asuntos-academicos/calendario-y-horarios
- https://eupla.unizar.es/asuntos-academicos/examenes

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28618