ANEXO I

Escuela Técnica Superior de Ingeniería

GENERAL SPECIFICATIONS

Bachelor's Degree in Mechanical Engineering

Subject Data

Name:	
ESTRUCTURAS DE HORMIGÓN	
English name:	
Estructures of concrete	
Code:	**Type:**
606410223	

Hours:

	Total	**In class**	**Out class**
Time distribution	150	60	90

ECTS:

Standard group	**Small groups**			
	Classroom	**Lab**	**Practices**	**Computer classroom**
4	0	2	0	0

Departments:	**Knowledge areas:**
ING.MINERA, MECANICA, ENERGETICA Y DE LA CONSTRUCCION	MECANICA DE MEDIOS CONTINUOS Y T. DE ESTRUCTURAS
Year:	**Semester**
4° - Fourth	Second semester

ANEXO I

TEACHING STAFF

Name:	E-mail:	Telephone
* Sergio Jesus Gomez Melgar	sergio.gomez@dimme.uhu.es	959 217 455
Victoria Patricica Lopez Cabeza	victoria.lopez@pi.uhu.es	

Others Data (Tutoring, schedule...)

Sergio Gomez Melgar, sergomel@uhu.es, 959217455, office B33/ETS Ingeniería/Campus de El Carmen

Victoria Patricia Lopez Cabeza, victoria.lopez@pi.uhu.es, office to be assigned /ETS Ingeniería/Campus de El Carmen

ANEXO I

SPECIFIC INFORMATION OF THE COURSE

1. Contents description:

1.1 In English:

- Introduction.
- Components and technology of concrete.
- Mechanical properties. Stress response.
- Bending.
- Compression.
- Shear.
- Torsion.
- Calculation of reinforced concrete in structural elements.

1.2 In Spanish:

- Introducción
- Componentes y tecnología del hormigón
- Características mecánicas. Respuesta tensional
- Flexión simple o compuesta. Flexión esviada
- Compresión.
- Cortante y punzonamiento.
- Torsión.
- Cálculo de elementos estructurales de hormigón armado.

2. Background:

2.1 Situation within the Degree:

Concrete Structures is the last compulsory subject in the Bachelor's Degree in Mechanical Engineering.

It is taught in the last semester (2nd) of the final year (4th) of the degree program.

It is eminently practical in nature, drawing on the knowledge developed in previous subjects in the same degree program (see recommendations) to develop in detail the design, calculation, project, and implementation procedures for reinforced concrete structures.

It provides an overview of reinforced concrete structures, which is essential for the development of the final degree project and the professional practice of future engineers.

2.2 Recommendations

It is recommended that students have taken and passed the courses Foundation Calculus, Materials Science and Materials Technology.

It is essential to have taken and passed the courses Continuum Mechanics and Elasticity, Strength of Materials, and Structural Calculus and Design I.

This course complements and is complemented by the course Structural Calculus and Design II (which is taught simultaneously in the same semester, although it is optional), and it is highly recommended that both be taken together.

ANEXO I

3. Objectives (as result of teaching):

Use logical thinking to formulate and test hypotheses, make deductions, organize and relate diverse information related to engineering and the resolution of structural calculation problems applied to concrete.

Develop personal strategies for analyzing and solving problems, verifying, through the results, the suitability or otherwise of these strategies.

Incorporate knowledge, habits, and attitudes specific to the professional activity. Know and apply simple computer tools in learning.

4. Skills to be acquired

4.1 Specific Skills:

-

4.2 General, Basic or Transversal Skills:

CB2: Students should be able to apply their knowledge to their work or vocation in a professional manner and possess the skills that are usually demonstrated through the development and defense of arguments and problem solving within their area of study.
CB3: Students should have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific, or ethical issues.
G01: Problem-solving skills.
G04: Ability to apply knowledge in practice.
G05: Ability to work in a team.
G07: Ability to analyze and synthesize.
G08: Ability to adapt to new situations.
G12: Ability to learn independently and in depth.
G17: Ability to think critically.
G02: Ability to make decisions
TC2: Development of a critical attitude in relation to the ability to analyze and synthesize.
TC4: Ability to use Computer and Information Skills (CI2) in professional practice.
TC3: Development of an inquiring attitude that allows for the continuous review and advancement of knowledge.

5. Training Activities and Teaching Methods

5.1 Training Activities:

- Theory sessions on the program content.
- Problem-solving sessions.
- Practical sessions in specialized laboratories or computer rooms.
- Field sessions to gain an understanding of the industrial reality.
- Academically directed activities by teaching staff: seminars, conferences, project development, debates, group tutorials, assessment and self-assessment activities, etc.

ANEXO I

5.2 Teaching Methods::

- Participatory master class.
- Practical work in specialized laboratories or computer rooms in small groups.
- Practical field work in small groups.
- Problem solving and practical exercises.
- Individual or group tutorials. Direct interaction between teachers and students.
- Planning, tutoring, and presentation of assignments.
- Lectures and seminars.
- Assessments and exams.

5.3 Development and Justification:

The theory classes will present concepts in a clear and concise manner, using different techniques (whiteboard, transparencies, overhead projector, etc.). Simple examples will be used to clarify the different concepts. During the presentations, students will be encouraged to participate using techniques such as brainstorming, analysis, and debate on real-life problems in the profession, among others.

The sessions will last an average of 1.5 hours, for a total of 21 sessions, bearing in mind that the last topics will be linked to more than one session at the beginning. In the problem-solving sessions, the concepts learned will be applied, starting with problems of low difficulty and continuing in ascending order.

Starting with an initial approach to the topic in the theory and problem-solving sessions, students will be presented with situations close to professional reality, supported by bibliographic material, web links, projects, etc. The work will be carried out in small groups, which will also require independent work by the students. Throughout the process, the teacher will provide monitoring and tutoring.

Along with the theory and problem-solving sessions, laboratory sessions will be held to study different types of tests. Complementing the laboratory sessions, visits will be made to concrete structures under construction to reinforce the theoretical concepts learned.

Group tutorials will be held periodically, also taking into account the results of written tests, so that they can be used to resolve any problems and doubts that students may have encountered.

ANEXO I

6. Detailed Contents

TOPIC 1. COMPONENTS OF CONCRETE
Aggregates
Cement and water
Reinforcing steel
Additives and admixtures
Mechanical characteristics
TOPIC 2. EXECUTION AND PLACEMENT OF CONCRETE
Reinforcement
Concrete
TOPIC 3. STRESS RESPONSE OF REINFORCED CONCRETE ELEMENTS
Parabola-rectangle diagram
Deformation domains
TOPIC 4. SIMPLE BENDING, COMPOSITE BENDING, AND DEVIATED BENDING
Sections subjected to simple or composite bending.
Calculation of rectangular elements with equal reinforcement on all four sides
TOPIC 5. SHEAR AND PUNCHING CALCULATION
Concrete shear strength
Reinforcement and concrete under shear stress
Members without punching reinforcement
Members with punching reinforcement
TOPIC 6. TORSION CALCULATION
General information
Calculation of members subjected to torsion
Calculation of torsion combined with simple or composite bending
Arrangement of torsion reinforcement
TOPIC 7. CALCULATION OF REINFORCED CONCRETE STRUCTURAL ELEMENTS: COLUMNS
General information
Slenderness
Translationality or intraslationality of a structure
Isolated supports: real or first-order eccentricity
Eccentricity due to the lack of verticality of the structure
Fictitious eccentricity due to buckling effects
Approximate EHE method for checking isolated supports
Buckling in deflected bending for checking isolated supports
TOPIC 8. CALCULATION OF REINFORCED CONCRETE STRUCTURAL ELEMENTS: SLABS
Introduction
One-way slabs
Two-way slabs
Solid slabs

7. Bibliography

ANEXO I

7.1 Basic Bibliography:

1. Spanish Structural Code (2021)
2. Spanish Structural Concrete Instruction (EHE-08)
3. Rules of thumb in Structural Design. Juan Carlos Arroyo et al. Cinter technical dissemination
4. Structures or Why Things Don't Fall Down. J.E.Gordon. Calamar Ediciones
5. Reticular Slabs. Florentino Regalado Tesoro. Cype Ediciones

7.2 Additional Bibliography:

6. Montoya, Meseguer, Moran. REINFORCED CONCRETE. Gustavo Gili.
7. A. García Meseguer. Reinforced Concrete. UNED
8. J. Calavera. Design and Calculation of Reinforced Concrete Structures
9. Leonhardt, F. Reinforced Concrete Structures. Ed. Ateneo
10. Manuel López R. Muñiz. CONSTRUCTION AND CALCULATION OF REINFORCED CONCRETE. Official Association of Quantity Surveyors and Technical Architects of Madrid
11. Hornbostel. CONSTRUCTION MATERIALS (TYPES, USES, AND APPLICATIONS). Limusa Wicey
12. NBE Standards, Regulations, NTE, UNE and TECHNICAL BUILDING CODE, highlighting the following:
    a. CTE-DB-SE
    b. EFEHE-08
    c. Instructions for the Reception of Cements

8. Systems and Assessment Criteria

8.1 System for Assessment:

- Theory/problem exam.
- Practical defense.
- Defense of written assignments and reports.
- Individual student monitoring.

8.2 Assessment Criteria and Marks:

8.2.1 Examinations Convocatory I

The continuous assessment criteria for the course are as follows:
1. Compulsory laboratory practicals (10%) (CB3, G04, T01).
2. Reports/assignments on the course content - CB2, CB3, G1, G2, G4, G5, G7, G8, G12, G17 - (40%).
3. Individual student monitoring - G01, G05, G12, T02 - (15%)
4. Written tests and theoretical-practical exams (35%). To be assessed, students must obtain at least a 5 (out of 10) in the tests and/or exams (CB2, G1, G2, G12, G17).

8.2.2 Examinations Convocatory II

The continuous assessment criteria for the course are as follows:
1. Compulsory laboratory practicals (10%) (CB3, G04, T01).
2. Reports/assignments on the course content - CB2, CB3, G1, G2, G4, G5, G7, G8, G12, G17 - (40%).
3. Individual student monitoring - G01, G05, G12, T02 - (15%)
4. Written tests and theoretical-practical exams (35%). To be assessed, students must obtain at least a 5 (out of 10) in the tests and/or exams (CB2, G1, G2, G12, G17).

8.2.3 Examinations Convocatory III

The continuous assessment criteria for the course are as follows:
1. Compulsory laboratory practicals (10%) (CB3, G04, T01).
2. Reports/assignments on the course content - CB2, CB3, G1, G2, G4, G5, G7, G8, G12, G17 - (40%).
3. Individual student monitoring - G01, G05, G12, T02 - (15%)
4. Written tests and theoretical-practical exams (35%). To be assessed, students must obtain at least a 5 (out of 10) in the tests and/or exams (CB2, G1, G2, G12, G17).

8.2.4 Extraordinary Convocatory

The continuous assessment criteria for the course are as follows:
1. Compulsory laboratory practicals (10%) (CB3, G04, T01).
2. Reports/assignments on the course content - CB2, CB3, G1, G2, G4, G5, G7, G8, G12, G17 - (40%).
3. Individual student monitoring - G01, G05, G12, T02 - (15%)
4. Written tests and theoretical-practical exams (35%). To be assessed, students must obtain at least a 5 (out of 10) in the tests and/or exams (CB2, G1, G2, G12, G17).

8.3 Single Final Evaluation:

The criteria for the final assessment of the course are as follows:
5. Students will be assessed by means of a single final exam (worth 100% of the final grade), which may cover the different concepts developed in both theory and practice, even if the student has not attended the practical sessions for the course.
Assessment will preferably be continuous, meaning diversified assessment carried out at different times over a period of time and included in this teaching guide.
However, a single final assessment is also available for students who wish to take it.