Teaching guide

IDENTIFICATION DETAILS

Degree:	Architecture
Scope	Architecture, construction, building and urban planning, and civil engineering
Faculty/School:	Higher Polytechnic School
Course:	STRUCTURES II
Type:	Compulsory
ECTS credits:	6
Year:	4
Code:	3741
Teaching period:	Seventh semester
Subject:	Structures
Module:	Technician
Teaching type:	Classroom-based
Language:	Spanish
Total number of student study hours:	150

SUBJECT DESCRIPTION

In the subject of STRUCTURES II

It is intended that the student:

- Understand the behavior of hyperstatic structures.

- Acquire basic structural design criteria so that you are able to design “credible” structures compatible with the planned architecture, encouraging your structural “intuition” so that you can predict the consequences of structural decisions.

- Evaluate the concept of structural safety.

- Learn about the behavior of structural materials so that, knowing what you can expect from them, you can use them properly.

- Analyze the differences between manual calculation and calculation with computer programs and learn the correlation between “structural model and real structure”.

We want the student to:
-Understand that in hyperstatic structures the behavior of each element influences and is influenced by and by the rest of the elements that make up the structure.
-Internalize a structural design methodology by setting aside random decisions.
-Understand that structural materials influence and condition the design of the structure,
-Keep in mind that both the evaluation of actions and structural safety are governed by mandatory regulations.
-Know that computer programs do not solve structures by themselves and that their results must be analyzed to verify that they provide credible results.
-Assume that the premises adopted in the design and testing of a structure must be transferred to the work by designing details consistent with them.
-Establish magnitude relationships between the loads applied, the structural dimensions, the values of the loads and the required sections

GOAL

Know the behavior of hyperstatic structures and the criteria and possibilities of global structural design.

This course, especially in its second part, deals with major structural design decisions regarding the use of typologies, materials and sections and constitutes the conceptual framework of the set of subjects in the area of structures.

PRIOR KNOWLEDGE

To study this subject it is advisable

In general, having passed the subjects of mathematics, physics and structures of previous career courses

In particular, the following aspects must be handled with ease:

Knowledge of the basic requirements to which a structural element may be subject
Obtaining requests and diagrams of isostatic structures
Concept of inertia of a section
Concept of bar stiffness

This course transmits to the student a global vision of the discipline

COURSE SYLLABUS

THEME 0. Introduction. Architecture and structure
The supporting or architectural concept of the structure. Structural architecture and architectural structure

TOPIC 1. Hyperstatic structures
The interdependent structural elements agree, depending on their rigidity, how to deform and withstand the acting actions.

TOPIC 2. The design and testing of structures. Calculation bases.
The actions, the materials, the security, the calculation methods.

TOPIC 3. The design and testing of structures. Design and methodology bases.
The structural solution is not unique. Adequate structural design criteria lead to predictable and solvent structures. The calculation as confirmation of design assumptions. The Structural Design Methodology.

TOPIC 1.
1.01.- The hyperstatic structure.
1.02.- Principle of superposition of effects. Compatibility equations
1.03.- Method of forces. Concept. Degree of hyperstaticity. Fundamental isostatic system and equivalent system.
1.04.- Solution using the method of stiffness or deformation of continuous beams. Clapeyron's theorem.
1.05.- Solution using the Gantry Cross method. Translationality and intraslationality.
1.06.- Advantages and disadvantages of each method.

TOPIC 2.
2.01.- Building actions. Concept. Types. Regulations.
2.02.- Structural materials. Features. Benefits. Regulations.
2.03.- The safety of structures. Concept. Criteria. Regulations.
2.04.- Limit state method.
2.05.- Ultimate boundary states.
2.06.- Service limit states.

THEME 3
3.01.- Requirements of the supporting structure.
3.02.- Structural design methodology.
3.03.- Basic structural typologies. Bar and surface structures. Usual applications and parameters.
3.04.- Types of linear and surface forgings. Calculation of requests. Simplified methods. Limits of use
3.05.- Bar structures. The porch. Loads, knots, lights, materials.
3.06.- Surface structures. Simplified calculation. The virtual porch. Loads, knots, lights, materials.
3.07.- The 'big numbers'
3.08.- Structural discretization. Calculation models.
3.09.- The manual calculation and the computer program.

EDUCATION ACTIVITIES

1. In-person activities. Online support is not included.
1.1. Exhibition classes. In each topic, the teacher will address the theoretical concepts that it is necessary to know. The students will participate in the debate on the issues discussed and the teacher will clarify any questions they may raise.
1.2. Performing exercises. Practical exercises will be proposed to help understand the application of each concept. The class exercises will be carried out, as the case may be, by the teacher with an explanation for all the students, by a student or a group of students supported by the teacher and with simultaneous explanation for the group of students or by each student individually with permanent monitoring and resolution of individual doubts by the teacher.
1.3. Evaluation controls. During the course, at least two evaluation checks will be carried out to verify students' assimilation of the concepts discussed. These controls can be replaced, for all students or for those students who request it with a sufficiently accredited previous work, in the teacher's opinion, by development work and conclusions of the exercises carried out. The purpose, process and temporal development will be set by the teacher or proposed by the student and accepted by the teacher. The development of the work will be monitored and supported continuously by the teacher. Students interested in following this alternative process should report it to the teacher within the first two weeks from the start of the course.
1.4. Tutorials
1.4.1. Personalized. Individualized attention to the student in order to clarify doubts that the student does not understand during their personal study.
1.4.2. From a group. Attention to groups of students who need additional help on specific issues for the monitoring of the subject.
Tutoring will take place only during the teaching period outside of which the student works autonomously while the teaching staff performs organizational tasks, faculty meetings, subject preparation, etc.
2. Non-face-to-face activities
2.1. Resolution, individually or in groups, of exercises proposed by the teacher to be carried out outside the classroom, based on the theoretical knowledge acquired and the experience of similar exercises carried out in class. The teacher, after reviewing the exercises, will inform the students of the individual errors committed and will make group corrections highlighting the most common errors.
2.2. Preparation, by groups of students, on topics or exercises for presentation in class. Attention to and assimilation of what has been explained in class will be encouraged by -The preparation by groups of brief summaries of partial topics of the subject. Special attention will be paid to the initiation of a structural design

methodology that will be expanded, with dimensioning criteria, in the following structural courses. -The preparation of models in Excel for solving exercises so that once the solution of a case has been completed, the results of similar cases can be obtained, avoiding the repetition of operations and promoting a faster acquisition of experience. -The preparation of simple models, with the 'MOLA' structural kit or with the help of a laser printer, that materialize structural concepts and typologies.
2.3. If it is possible to access a work in progress appropriate to the level of the course, a visit to it will be proposed, as a complementary activity, to be able to see in the field what the physical reality of structural analysis models is like. Otherwise, the structural analysis of a simple work that has already been built will be carried out in class. In class, the conceptual resolution of the structure of various buildings will be discussed to strengthen the design criteria and will serve as an introduction to the exercises to be carried out. The buildings to be analyzed will be proposed by the teacher or, preferably, by the students and may be existing buildings or projects under development in the subjects of architectural design. In the first part of the course, the exercises to be performed outside the classroom will focus on the resolution of hyperstatic structures. The second part will address the design of the structure of a building in the preliminary draft phase so that, according to a rational methodology, architectural, structural and constructive design proceed together until a viable structural proposal is reached. The generic loads will be evaluated and the projected unidirectional slabs will be calculated. A gantry will be selected from the same subject to the loads transmitted by the slabs. The combinatorics of actions and the corresponding safety coefficients will be established. It will be modeled in a computer calculation program and your requests will be obtained, which will be duly analyzed.

DISTRIBUTION OF WORK TIME

TEACHER-LED TRAINING ACTIVITIES	INDIVIDUAL WORK
60 Horas	90 Horas

SKILLS

Basic Skills

Students must have demonstrated knowledge and understanding in an area of study that is founded on general secondary education. Moreover, the area of study is typically at a level that includes certain aspects implying knowledge at the forefront of its field of study, albeit supported by advanced textbooks

Students must be able to apply their knowledge to their work or vocation in a professional manner and possess skills that can typically be demonstrated by coming up with and sustaining arguments and solving problems within their field of study.

Students must have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgments that include reflections on pertinent social, scientific or ethical issues

Students must be able to convey information, ideas, problems and solutions to both an expert and non-expert audience

Students must have developed the learning skills needed to undertake further study with a high degree of independence

Capacity for analytical, synthetic, reflective, critical, theoretical and practical thought.

Ability to solve problems and to take decisions.

Ability to apply procedures.

An understanding of the problems involved in structural design, construction and engineering associated with building projects.

General Skills

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Specific skills

Ability to: Conceive, calculate, design, integrate into buildings and urban complexes and execute building structures. (T)

Adequate knowledge of the mechanics of solids, continuous media and soil, as well as of the plastic, elastic and resistance qualities of heavy-duty materials.

LEARNING RESULTS

-Know how to evaluate the actions acting on a structure in accordance with the provisions of the regulations and distribute them to the structural elements

Know how to apply the corresponding safety coefficients to materials and combination of actions, as determined by the regulations.

Know how to obtain requests and diagrams of hyperstatic structures

Know how to determine the turns and displacements of knots.

Demonstrate structural design criteria.

Know how to design the bar structure of a simple building.

Know how to project the surface structure of a simple building.

LEARNING APPRAISAL SYSTEM

The course can be approved:
BY COURSE (Continuous Assessment):
-Proving regular attendance: It is essential to attend at least 80% of classes.
-Demonstrating sufficient knowledge of the subject throughout the course.
This sufficiency will be accredited by obtaining a grade equal to or greater than 5 as a weighted average of the result of the partial grades obtained from:
-The 2 control exams that will be taken during the semester (65% of the overall score). The first one will be on topics 1 and 2 and the second on topics 3 and 4.
-The exercises to be performed at home, individually or in groups, (25% of the overall score) A minimum of four exercises will be performed. The delivery of 75% of the proposed exercises is mandatory. If you do not submit an exercise, your score will be 0 and will be averaged with the rest. An exercise will be considered delivered when it is delivered in a timely and timely manner in accordance with what is established in each statement. With a view to the evaluation, late deliveries or improvements to the exercises delivered will not be accepted. However, if they are carried out, they can be analyzed in individual or group tutorial spaces. The score of the exercises performed at home will only be considered if it serves to increase the score of the control exams. The grade of the exercises carried out in a group will be the same for all the components of the group, unless the tests that the teacher can carry out show a significantly unequal participation of one or more of its components.
-Active and relevant participation in theoretical and practical classes. (10% of the overall grade)
The subject, for the purpose of continuous evaluation, will be divided into two parts defined by each of the evaluation controls. One or both parts may be approved per course. However, approval by one of the parties is not possible if the global conditions for assistance and delivery of exercises are not met. If one of the parts is not passed per course, the student must take the exam of the ordinary call or, where appropriate, of the extraordinary call. To pass a single pending part in any of the official calls, a minimum score of 6 points will be required. This grade will be averaged with the accredited grade for the part passed per course to obtain your overall grade. If you do not pass these exams, the pending part must be taken again.
EVALUATION IN ORDINARY CALL Students who do not pass the course or do not take it may be eligible for an exam in the ordinary call. As indicated in the previous section, you must submit yourself to one or both parts into which the subject is divided. The grade of the students who take the whole subject will be that obtained in the exam. You cannot pass the course in parts in the official exams if you do not already have one approved part per course. Students who pass the course in both parts may take the official exam in the first call to improve their grade. Your exam will focus on the totality of the subject. As a result of this exam, you can also lower your grade, not fail, if the exam score is 20% lower than the accredited score per course.
EVALUATION IN AN EXTRAORDINARY CALL. The conditions for passing the subject in the extraordinary call as well as the qualification criteria are the same as in the ordinary call. In this subject, students are allowed to use books, notes, exercises and spreadsheets like Excel during the exams, since the intention is to be able to answer the questions posed under the same conditions as they will do in the future in the professional field without the memory to remember formulation or operational repetitiveness acquiring a fundamental character in the result of the test. However, the use of applications that automatically provide the conceptual and/or quantitative result of some question (s) requested in the statements, as well as any form of plagiarism, is prohibited. Plagiarism, as well as the use of illegitimate means in evaluation tests, will be sanctioned in accordance with the University's Evaluation Regulations and Coexistence Regulations. In the case of remote tests, any violation of the general

protocol established by the university or specific to the subject is prohibited and, if this occurs, the official regulations of the UFV existing for this purpose will apply to the student.

ETHICAL AND RESPONSIBLE USE OF ARTIFICIAL INTELLIGENCE

1.- The use of any Artificial Intelligence (AI) system or service shall be determined by the lecturer, and may only be used in the manner and under the conditions indicated by them. In all cases, its use must comply with the following principles:
a) The use of AI systems or services must be accompanied by critical reflection on the part of the student regarding their impact and/or limitations in the development of the assigned task or project.
b) The selection of AI systems or services must be justified, explaining their advantages over other tools or methods of obtaining information. The chosen model and the version of AI used must be described in as much detail as possible.
c) The student must appropriately cite the use of AI systems or services, specifying the parts of the work where they were used and describing the creative process followed. The use of citation formats and usage examples may be consulted on the Library website(https://www.ufv.es/gestion-de-la-informacion_biblioteca/).
d) The results obtained through AI systems or services must always be verified. As the author, the student is responsible for their work and for the legitimacy of the sources used.
2.- In all cases, the use of AI systems or services must always respect the principles of responsible and ethical use upheld by the university, as outlined in the Guide for the Responsible Use of Artificial Intelligence in Studies at UFV. Additionally, the lecturer may request other types of individual commitments from the student when deemed necessary.
3.- Without prejudice to the above, in cases of doubt regarding the ethical and responsible use of any AI system or service, the lecturer may require an oral presentation of any assignment or partial submission. This oral evaluation shall take precedence over any other form of assessment outlined in the Teaching Guide. In this oral defense, the student must demonstrate knowledge of the subject, justify their decisions, and explain the development of their work.

BIBLIOGRAPHY AND OTHER RESOURCES

Basic

Andres Rubio Moran. Professor of the subject -Theoretical-practical course notes written and provided by Professor Andrés Rubio Morán

Ortiz, J and Hernando, J.I. Building Structures. Sourcebook for topic 1 Editorial Ariel. ISBN: 978-84-344-8057-5

Timoshenko, S.P./Young D.H Theory of Structures. Sourcebook for topic 1 Editorial Urmo. ISBN: 978-84-314-0241-9

José Calavera Design and calculation of concrete structures. Volumes I and II. Reference book for topic 2 INTEMAC. ISBN: 9788488764058

Montoya, Meseguer, Morán Reinforced concrete. Sourcebook for topic 2 Ed. Gustavo Gili. ISBN: 9788425207587

Juan Carlos Arroyo Fat Numbers. Sourcebook for topic 3 CINTER. ISBN: 97884932270-4-3

Group of experts in collaboration with the Ministry of Development Technical Code for Building Structural Safety (DB-SE). Applicable to topic 2 Ministry of Housing

Group of experts in collaboration with the Ministry of Development Technical Building Code Structural Security

(DB-SE AE) Ministry of Housing

Additional

Salvadori and Heller Structures for Nobuko architects. ISBN: 978-987-584-005-8