Teaching guide

IDENTIFICATION DETAILS

Degree:	Architecture
Scope	Architecture, construction, building and urban planning, and civil engineering
Faculty/School:	Higher Polytechnic School
Course:	STRUCTURES I
Type:	Compulsory
ECTS credits:	6
Year:	3
Code:	3737
Teaching period:	Sixth semester
Subject:	Structures
Module:	Technician
Teaching type:	Classroom-based
Language:	Spanish
Total number of student study hours:	150

SUBJECT DESCRIPTION

This is the first subject in the area of structures.

It is intended to:

- That the student understands that the structure is an integral part of architecture and that, therefore, to design any type of building it is essential to simultaneously analyze and plan its structure, broadly speaking but in a believable way.

- Bring the student closer to understanding how buildings are supported, and how structural materials behave in the face of the different actions they support. All this based on the study of simple isostatic structures.

- Present a basic, simplified and manageable theory so that the student can understand structural concepts with simple and real examples.

Through a simple approach to structural models, it is intended that the student:
- Know and know how to evaluate the basic actions to which a structure is subject and how they are channeled and affect the elements that compose it.
- Establish the conditions of global stability of a structure.
- Know how to relate the acting loads to the demands they produce and their representation using diagrams.
- Learn the fundamental properties of the section, inertia, and of the bar, stiffness.
- Learn the basic properties of structural materials commonly used: Concrete and steel.
- Relate the concepts of action, stress and deformation.
- Keep in mind the concept of structural safety

GOAL

That the student knows and relates the basic structural concepts to each other, knows how to evaluate them in simple structures and understands that structure is architecture.

PRIOR KNOWLEDGE

To study this subject it is advisable
In general, having passed the mathematics and physics subjects corresponding to the previous courses of the career.
In particular, the following sections must be handled with ease
General Principles of Statics.
Basic concepts of trigonometry
Vector operations.
Moment of a force and a system.
Function resolution. Derivative.
Functional maximums and minimums.
Graphical representation.
Systems of equations Linear transformations (coordinate transformation)
Basic curves: parabola
Centers of mass and gravity. Moment of Inertia. Steiner's theorem.
The previous knowledge and those acquired in this subject will give the student a global vision of it within the general context of this area of knowledge.

COURSE SYLLABUS

THEME 0. Introduction. Architecture and structure. Or how architecture and structure are indissoluble concepts. The structure is architecture.

TOPIC 1. Overview of the supporting structure This topic aims to provide a general overview of the structural problem and a first approach to basic and operational concepts for understanding and solving it.
TOPIC 2. Articulated isostatic systems. This topic addresses a type of simple structures but with a wide field of use.
TOPIC 3. Flat isostatic lattice structures Most building structures are lattice structures. This topic limits the study to a small part of them, those that meet the conditions of isostatism and flatness.
TOPIC 4. Introduction to material strength. Structural materials have their own characteristics that determine the behavior of structures. What and/ how far can the material be required?
TOPIC 1
1.01.- The structural solution: Action-Requestation-Tension-Deformation-Safety-Durability-Cost
1.02.- Basic structural typologies. Bar structures. Surface structures.
1.03.- The structural model. Holders, bars and knots. Simplifications.
1.04.- Stability and balance. Isostatism and hyperstatism. Mechanism
1.05.- Actions. Types and their structural consideration. Introducing security.
1.06.- Basic requirements: Axle, Bending Moment, Shear Strength and Torsion Moment. Compound Requests.
1.06.- Materials. Basic introduction: Factory, wood, concrete and steel. The ground as a support.
1.07.- Request and material. Request and section. Request and form. Pandeo
1.08.- Tensions. Tension and section
1.09.- Deformations. Tension, section and inertia. Stiffness. The arrow.
THEME 2
2.01.- Definitions and concepts. Articulated framework. Holders, bars and knots. Simplifications.
2.02.- Stability and balance. Isostatism and hyperstatism. Mechanism
2.03.- Requests. Axil effort
2.04.- Analytical calculation. Reactions in the supports. Requests on the bars. Knot method Section method (Ritter)
2.05.- Introduction to section dimensioning. The section of the part. Static values (A, W, I, i)
THEME 3
3.01.- Definitions and concepts
3.02.- Forces acting on the bars. The charge function derived from the shear function.
3.03.- Stability. Mechanism, Isostatism, and Hyperstatism. Calculation of external reactions
3.04.- Internal requests Flexing moments. Equations and their graphic representation Moment function derived from the rotation function. Shear stresses. Equations and their graphic representation Shear function derived from the moment function.
3.05.- Introduction to section dimensioning
THEME 4
4.01.-General concepts. Stability, Rigidity, Strength, Isotropy, Homogeneity, Continuity.
4.02.-Rigid solid, elastic solid and true solid.
4.03.-Basic hypotheses of material resistance. Relating to material and actions. Simplifications.
4.04.-Deformation concept. Stress-strain ratio. Elasticity Hooke's Law. Deformation modules. Limit of proportionality. Elastic limit. Plasticity. Plastic limit. Decline step. Acrimony phase. Restriction zone. Rupture limit
4.05.-Second-order deformations. Bending 4.06.-Deformations in isostatic structures. Elastic equation.

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, two evaluation checks will be carried out to verify students' assimilation of the concepts discussed.
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, preparation of materials, etc.
2. Non-face-to-face activities
2.1. Resolution, individually or in groups, of exercises proposed by the teacher to be performed 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 made 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 through
-The preparation by groups of brief summaries of partial topics of the subject.
-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 the laser printer, that materialize structural concepts.
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.

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

- Define a simple structural model of building bars, distinguishing typologies of knots, relating them to the concepts

of isostatism, hyperstatism and mechanicism and establishing equilibrium conditions.

- Define, differentiate and evaluate the loads acting on a building, assigning them to the corresponding bars and introducing the concept of safety.

- Quantitatively and qualitatively obtain the requirements of a flat articulated triangulated system.

- Define the requirements of a simple isostatic system, relating the load, moment, shear and rotation functions and obtaining the diagrams of bending moments, shear and axial forces corresponding to different types of loads.

- Calculate the moment of inertia of simple and composite sections.

- Dimension the section of bars subjected to axial stress considering the effect of buckling.

- Obtain the isostatic bar arrow.

- Relate the concepts of action, stress and deformation.

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 in the semester (65% of the overall grade). 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

Federico Goded Echevarría ELASTICITY AND STRENGTH OF MATERIALS. Sourcebook for UNED topic 4. ISBN: 8436203798.

Luis Ortiz Berrocal MATERIAL RESISTANCE. Reference book for topics 1 and 4 Editorial MC GRAW HILL. (Luis Ortiz Berrocal MATERIAL RESISTANCE. Reference book for topics 1 and 4 Editorial MC GRAW HILL. , ||M.Vázquez/E. López ESTÁTICA. Sourcebook for topics 1, 2 and 3. NOELA Publishing House. ISBN: 8440034598.)

Manuel Vázquez MATERIAL RESISTANCE Reference book for topics 1 and 4 Editorial NOELA. ISBN: 978-8488012050.

Additional

Eduardo Torroja Miret Razón and being one of the structural types Higher Council for Scientific Research. ISBN: 978-8400086121

J. Gordon STRUCTURES OR WHY THINGS DON'T FALL Squid, edition and design. ISBN: 9788496235069