

Course guide 310727 - 310727 - Structural Systems

 Last modified: 28/06/2023

 Unit in charge:
 Barcelona School of Building Construction

 Teaching unit:
 Barcelona School of Architectural Technology.

 Degree:
 BACHELOR'S DEGREE IN ARCHITECTURAL TECHNOLOGY AND BUILDING CONSTRUCTION (Syllabus 2019).

 Academic year: 2023
 ECTS Credits: 6.0
 Languages: Catalan, Spanish

LECTURER	
Coordinating lecturer:	SANDOKAN LORENTE MONLEÓN
Others:	SANDOKÁN LORENTE MONLEÓN EDUARDO GALEOTE

PRIOR SKILLS

The students should be able to:

Calculate the sectional stresses of isostatic rod structures.

Measure and check rods depending on the stresses acting, both in steel and reinforced concrete.

Calculate beam deformations, for steel and reinforced concrete beams.

Use appropiately the momentum formulas of fixed end momentums.

Know the physical properties of the soils.

REQUIREMENTS

Is recommended to have passed the subjects Introduction to structures and Steel and concrete structures

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. FE-15 Aptitude for the pre-measuring, design, calculation and verification of structures and manage its materials execution.

Transversal:

2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.



TEACHING METHODOLOGY

The directed learning hours consist on:

- Exposition-participative classes (big group):

The faculty does a brief exposition for introducing the general learning objectives related with the basic concepts of the subject and explains the theoretical contents. By means of practical exercises tries to motivate and involve the students so that they can participate in their learning.

It is used support material in detailed teaching plan by ATENEA: learning objectives by contents, concepts, examples, evaluation activities and directed learning schedules and bibliography.

Generally, at the end of each session there will be proposed exercises to solve out of class which can be worked individually or in groups and are part of the directed and autonomous learning.

- Practical classes - Workshop (medium group):

A practical exercise is proposed, which is related with the weekly contents and the students solve it during the class. The professor directs the students in the resolution, answers their doubts and start a debate for analyzing the results obtained.

The autonomous learning hours consist on:

- Bibliography readings.
- Study of the theoretical concepts.
- Resolution of the application exercises which complement the study of the theoretical concepts.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, students should be able to:

- Determine the actions that take part in a structure; to establish the loads state and the combinations of actions in order to verify the fulfilment of the limit states.

- Define the analysis model of a structure and determine the loads that are applied on it.
- Apply design criteria to solve the resistant diagram of a building structure and justify the adopted solution.
- Calculate the different elements that compose the building structure.

STUDY LOAD

Туре	Hours	Percentage
Hours large group	30,0	20.00
Hours medium group	9,0	6.00
Hours small group	21,0	14.00
Self study	90,0	60.00

Total learning time: 150 h



CONTENTS

C1 DESIGN AND STRUCTURAL SECURITY. ROOF STRUCTURES AND SLABS UNIDIRECTIONAL AND BIDIRECTIONAL. ELEMENTS OF FOUNDATION AND CONTENTION

Description:

- In this content the students work:
- Clasification and values of the actions (construction).
- Limit state method: Effect of the actions.
- Situations of calculus. Combination of actions.
- Analysis and Design of:
- Lightweight roof structures: truss, straps.
- Slabs: unidirectional and bidirectional.
- Criteria for choose the foundation type.
- Design, analysis and measuring of foundation components (shallow foundation, piles, pile caps and walls).

Specific objectives:

- Identify, classify and determine the value of the actions which act in a particular building.
- Define the concepts of favourable and non-favourable actions.
- Define the concepts of eigenvalue, representative value and calculation value of an action.
- Identify the different components of the structure of a lightweight roof.
- Define the suitable model of analysis for each component which form the resistance structure of a lightweight roof.
- Establish the simple hypothesis and the combination of actions for checking both the Ultimate Limit States and the Serviceability Limit States in each one of the components which form a lightweight roof.
- Solve the structural analysis of the components which form a lightweight roof.
- Apply the knowledge acquired in the previous subjects to pre-measure and check the different components which form a
- lightweight roof structure.
- Measure the edge of a slab and justify the taken value.
- Test and justify the analysis model suitable depending on the slab type.

- Establish the simple hypothesis and the combination of actions for checking both the Ultimate Limit States and the Serviceability Limit States of an unidirectional slab.

- Solve the structural analysis of an unidirectional slab (linear analysis, analysis with limited redistribution).
- Define the components which configure a reticulated slab (abacus, rebars, perimeter beams).
- Apply the virtual arcades method to determine the calculation stresses of the different components which form a reticular slab.
- Apply the acquired knowledge in the previous subjects to calculate the necessary reinforced of the different components which form a reticular slab.
- Identify the different components which form the foundations of a building, depending on the foundation type.
- Deduce the features and mechanical properties of the land based on the geotechnical report.
- Deduce the actions which serve in a foundation element, based on the results of the analysis of the structure.
- Measure the foundation element and check its Ultimate Limit State of equilibrium.

- Apply the connecting rod method or the acquired knowledge in the previous subjects for measuring the reinforcement of the element.

Related activities:

There will be done resolution of workshop exercises and the exam.

Related competencies :

FE-15. FE-15 Aptitude for the pre-measuring, design, calculation and verification of structures and manage its materials execution.

Full-or-part-time: 76h

Theory classes: 35h Practical classes: 14h Self study : 27h



C2 WOOD AND BRICK STRUCTURES. STEEL JOINTS. SEISMIC ANALYSIS

Description:

- In this content the students work:
- Analysis and Design of wood structures
- Analysis and Design of brick structures
- Analysis and Design of steel joints
- Seismic analysis

Specific objectives:

- Identify, define and solve the different components of the woods structures.
- Identify, define and solve the different components of the bricks structures.
- Identify, define and solve the different components of the steel joints.
- Introduction of seismic analýsis

Related activities:

There will be done resolution of workshop exercises and the exam.

Related competencies :

FE-15. FE-15 Aptitude for the pre-measuring, design, calculation and verification of structures and manage its materials execution.

Full-or-part-time: 58h Theory classes: 17h Practical classes: 5h Self study : 36h



ACTIVITIES

A1 - EXAM (CONTENTS 1)

Description:

Individually and in-person exam. Theoretical-practical exercise which includes all the learning objectives of the content 1.

Specific objectives:

At the end of the activity the students should be able to:

- Identify, classify and determine the value of the actions which act in a particular building.
- Define the concepts of favourable and non-favourable actions.
- Define the concepts of eigenvalue, representative value and calculation value of an action.
- Identify the different components of the structure of a lightweight roof.
- Define the suitable model of analysis for each component which form the resistance structure of a lightweight roof.
- Establish the simple hypothesis and the combination of actions for checking both the Ultimate Limit States and the Serviceability Limit States in each one of the components which form a lightweight roof.
- Solve the structural analysis of the components which form a lightweight roof.

- Apply the knowledge acquired in the previous subjects to pre-measure and check the different components which form a lightweight roof structure.

- Measure the edge of a slab and justify the taken value.
- Test and justify the analysis model suitable depending on the slab type.

- Establish the simple hypothesis and the combination of actions for checking both the Ultimate Limit States and the Serviceability Limit States of an unidirectional slab.

- Solve the structural analysis of an unidirectional slab (linear analysis, analysis with limited redistribution).

- Apply the virtual arcades method to solve a bidirectional slab.

- Identify the different components which form the foundations of a building, depending on the foundation type.

- Deduce the features and mechanical properties of the land based on the geotechnical report.
- Deduce the actions which serve in a foundation element, based on the results of the analysis of the structure.
- Measure the foundation element and check its Ultimate Limit State of equilibrium.

- Apply the connecting rod method or the acquired knowledge in the previous subjects for measuring the reinforcement of the element.

Material:

Practice wording.

Calculator.

Summary of the topic available in ATENEA and basic bibliography corresponding to the contents 1. Wordings of the exercises to solve (autonomous work).

Delivery:

Resolution of the exam.

This activity has a worth of 42.5% in the final mark of the course.

Related competencies :

FE-15. FE-15 Aptitude for the pre-measuring, design, calculation and verification of structures and manage its materials execution.

07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

04 COE N3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

Full-or-part-time: 2h

Practical classes: 2h



A2 - EXAM (CONTENT 2)

Description:

Individually and in-person exam. Theoretical-practical exercise which includes all the learning objectives of the content 2.

Specific objectives:

Wooden structures and brick structures

Material:

Exam wording. Non-programmable calculator For preparing the exam: Summary of the topic available in ATENEA and basic bibliography corresponding to the content 2.

Delivery:

Resolution of the exam. This activity has a worth of 42.5% in the final mark of the course.

Related competencies :

FE-15. FE-15 Aptitude for the pre-measuring, design, calculation and verification of structures and manage its materials execution.

04 COE N3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means. 07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 2h

Practical classes: 2h

A3 - WORKSHOP RETICULAR WROUGHT

Material:

Work in group Application of the structural knowledge of design and construction of a model in scale.

Delivery:

Model. Delivery and exposition This activity is worth a 7.5% in the final mark of the course.

Full-or-part-time: 2h Practical classes: 2h



A4 - WORKSHOP CONTEST MODEL (CONTENT 1-3)

Description:

Workshop contest model. Carried out in group. Delivery and exposition

Specific objectives:

Work in group

Application of the structural knowledge of design and construction of a model in scale.

Material:

Bases contest model in ATENEA

Delivery:

Model. Delivery and exposition This activity is worth a 7.5% in the final mark of the course.

Related competencies :

FE-15. FE-15 Aptitude for the pre-measuring, design, calculation and verification of structures and manage its materials execution.

07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

04 COE N3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

Full-or-part-time: 2h Practical classes: 2h

GRADING SYSTEM

The final mark is the arithmetic mean of the partial marks, according to this expression:

Nfinal = 0,425 A1 + 0,425 A2 + 0,075 A3 + 0,075 A4

A1, A2: (Evaluation exam, individual and in-person) A3, A4: (work, in group and in-person)

EXAMINATION RULES.

If some of the evaluation activities is not done, it will be considered as non-marked.

BIBLIOGRAPHY

Basic:

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