Course guide
310702 - 310702 - Mechanics

Unit in charge: Barcelona School of Building Construction
Teaching unit: 748 - FIS - Department of Physics.
Degree: BACHELOR’S DEGREE IN ARCHITECTURAL TECHNOLOGY AND BUILDING CONSTRUCTION (Syllabus 2019). (Compulsory subject).
Academic year: 2022  ECTS Credits: 6.0  Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: CARLOTA E. AUGUET SANGRÀ
Others: Sergio Alonso
         Eduardo Moreno
         Laureano Ramírez
         Inmaculada Rodríguez
         Oscar Lorente
         Mª Luisa Perea
         Julián Álvarez

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. FB-2 Applied knowledge of the general mechanics principles, the statics of structural systems, the mass geometry, the principles and methods of analysis of the elasticity of solids.

Transversal:
2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

TEACHING METHODOLOGY

The learning hours of the subject alternate theoretical classes with practical classes where different exercises and problems are solved. In the theoretical classes, the faculty does a brief exposure to introduce the general learning objectives related with the basic concepts of the subject. Subsequently the faculty tries to motivate and involve the students through practical exercises. These practical classes facilitate individual aspects (concepts understanding, understanding of the wordings, specific applications, calculus methods, confidence) and collective aspects (teamwork, oral and written comprehension, variety in problem solving, question proposal). The faculty also propose exercises which can be solved at home and later explained at class.
LEARNING OBJECTIVES OF THE SUBJECT

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

· Use vector methods in calculations of forces and calculations of moments in systems of forces.
· Determine, in static equilibrium conditions, reactions and internal forces in rigid solid systems and statically determinate structures.
· Define the characteristic concepts about geometry of masses (gravity centre, moment of inertia, product of inertia) and calculate and use them properly.
· Appropriately interpret the tables of moments of inertia.
· Determine the inertia tensors and the main axis of inertia.
· Explain the pressure concept, the behaviour of forces in a liquid in static equilibrium and the meaning of the pressure centre. Relate this concept with systems of forces.
· Define the elastic magnitudes and interpret the meaning of the elastic modules. Use analytic methods in order to determine elastic variables.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>90.0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30.0</td>
<td>20.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>9.0</td>
<td>6.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>21.0</td>
<td>14.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

C1 Systems of forces

Description:

Full-or-part-time: 30h 10m
Theory classes: 3h
Practical classes: 7h
Self study : 20h 10m

C2 Analytic statics and structures

Description:
2.2. Isostatic articulated structures. Reaction calculations. Node method. Ritter method or sections method.

Full-or-part-time: 46h 50m
Theory classes: 3h
Practical classes: 15h
Self study : 28h 50m
C3 Center of mass and moment of inertia

Description:
3.1. Mass center: concept and features. Center of gravity of volumes, flat figures and material lines. Center of gravity of flat homogeneous figures: static moment of first order. Pappus-Guldin theorem.
3.3. Applications: retaining wall, bending of beams.

Full-or-part-time: 37h 10m
Theory classes: 6h
Practical classes: 12h
Self study: 19h 10m

C5 Elasticity

Description:
Content:

Full-or-part-time: 35h 50m
Theory classes: 6h
Practical classes: 8h
Self study: 21h 50m

ACTIVITIES

PE2 PRACTICAL TEST 2

Description:
Continuous assessment individual written test. Exercises of contents of second half part of the subject. Done at the end of the period. 25% of the weighted average mark. (See qualification system).

Specific objectives:
Show the learning of contents of the second half part of the subject

Material:
Statement, blank paper, scientific calculator, drawing and writing material.

Delivery:
The test should be turned in on paper.

Full-or-part-time: 6h
Practical classes: 2h
Self study: 4h
## EXFIN FINAL EXAM

**Description:**
Continuous assessment individual written test. Exercises of all the contents.
50% of the weighted average mark. (See qualification system).

**Specific objectives:**
Students must be able to answer all the theoretical and practical questions, and to solve the exercises of the entire course.

**Material:**
Statement, blank paper, scientific calculator, drawing and writing material.

**Delivery:**
The test should be turned in on paper.

**Full-or-part-time:** 11h
- Practical classes: 2h
- Self study: 9h

## R REAPPRaisal

**Description:**
Individual written test. Exercises of all the contents.
See qualification system for details.

**Specific objectives:**
Students must be able to answer all the theoretical and practical questions, and to solve the exercises of the entire course.

**Material:**
Statement, blank paper, scientific calculator, drawing and writing material.

**Delivery:**
The test should be turned in on paper.

**Full-or-part-time:** 6h
- Practical classes: 2h
- Self study: 4h

## PE1 Practical test 1

**Full-or-part-time:** 2h
- Theory classes: 2h
GRADING SYSTEM

There will be two practices (PE1 and PE2) and a final exam (ExFin).

The first practice PE1 includes the first half part of the matter. The weight of the practice is a 30% of the final grade. This exercise will be done at the partial exams term.

The second practice PE2 includes the second half part of the matter, except the last subject. The weight of the practice is a 20% of the final grade. This exercise will be done at the end of the period.

The final exam ExFin includes all the contents. The weight of this exam is a 50% of the final grade.

According to Normativa Académica de Estudios de Grado y Máster de la UPC and EPSEB, the final evaluation of the subject will be done as it is described.

The final grade of the subject will be the larger between these two grades:

a) m: Arithmetic mean of the pertinent marks of PE1, PE2 and ExFin.

\[ m = 0.30p + 0.20s + 0.5f \]

where

\[ p = \text{PE1 practice mark.} \]
\[ s = \text{PE2 practice mark.} \]
\[ f = \text{ExFin final exam mark.} \]

b) f: Final exam mark.

Reappraisal

The student who has failed the subject with a numerical mark between 3.5 and 4.9 will have the opportunity to do an unique reappraisal exam, which will include all the contents of the subject and will be done in a settled term. If the student pass the exam, his final mark of the subject will be 5.0.

The student won't be able to do this reappraisal exam if:

i) The student has already passed the subject.
ii) The student's final mark is less than 3.5 (including NP).

EXAMINATION RULES.

- If a student has failed the subject and has not done the final exam, the final grade will be NP.
- Mobiles ara not allowder during the exam.
- The entry to the exam will be denied once started.

BIBLIOGRAPHY

Basic:

Complementary:
- Camí, Enric. Forces i moments : teoria i problemes. Barcelona: Universitat Politècnica de Catalunya. Departament de Física Aplicada,
2000.

**RESOURCES**

**Other resources:**
Audiovisual Material
- DVD Humitats per capil·laritat
  Rodríguez Cantalapiedra, I.; Lacasta, A; Sarró, P.