Course guides
330066 - RM - Strength of Materials

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.

Degree:
BACHELOR’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN ICT SYSTEMS ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2021 ECTS Credits: 6.0 Languages: Catalan

LECTURER

Coordinating lecturer: Dr. Fausto Arias Araluce i Prepedigno Martin Villanueva
Others: Dr. Fausto Arias Araluçe Prepedigno Martin Villanueva

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Knowledge and use of the principles of strength of materials.

Transversal:
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
3. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
4. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.
5. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

TEACHING METHODOLOGY

Combine lectures with group discussions and participations.

LEARNING OBJECTIVES OF THE SUBJECT

Distinguish the different types of structures based on their complexity and know the stresses present in structural elements and their graphic representation through diagrams.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>45,0</td>
<td>30.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
</tbody>
</table>
Total learning time: 150 h

CONTENTS

1. Types of structures

Description:
To be able to identify the different types of structures based on their complexity and know the stresses present in structural elements and their graphical representation through diagrams.

Specific objectives:
1. Know how to identify the different structures and simplifications appropriate for their analysis according to their difficulties.

Related activities:
1, 3 & 4.

Full-or-part-time: 13h 10m
Theory classes: 4h 15m
Laboratory classes: 1h 25m
Self study: 7h 30m

2. Efforts and Diagrams

Description:
Stresses on structural elements

Specific objectives:
2. To understand and be able to use the stresses that appear in the internal sections which are part of the structures and their graphic representations. Analysis will focus on two-dimensional structures.

Related activities:
1, 2, 3 & 4

Full-or-part-time: 38h 10m
Theory classes: 11h 25m
Laboratory classes: 4h 15m
Self study: 22h 30m

3. Pure traction and compression

Description:
Tensile and compressive stress as the simplest and most basic that appear in structural elements.

Specific objectives:
1. Know the tensile and compressive effort, the stresses and deformations created by them and know how to calculate the lengthening and shortening of bars subjected to this stress

Related activities:
1, 2, 3 & 4.

Full-or-part-time: 38h 10m
Theory classes: 11h 25m
Laboratory classes: 4h 15m
Self study: 22h 30m
4. Pure bending

Description:
The bending effort is the most important of those that appear in structural elements, especially in construction.

Specific objectives:
To understand the bending force, how to calculate the stresses and deformations it causes in the most dangerous sections of the structure.

Related activities:
1, 2, 3 & 4

Full-or-part-time: 38h 10m
Theory classes: 11h 25m
Laboratory classes: 4h 15m
Self study: 22h 30m

5. Cutting and twisting

Description:
Cutting as a secondary effort in construction and more important in some machine elements. Torque as a very important stress mainly on rotating machine shafts.

Specific objectives:
To understand how the cutting effort acts on very simple cross section bars and what stresses it causes. Know the torque on circular cross-section bars, the stresses it causes and the rotations of the cross-sections.

Related activities:
1, 2, 3 & 4.

Full-or-part-time: 25h
Theory classes: 7h 30m
Laboratory classes: 2h 30m
Self study: 15h
# ACTIVITIES

## 1. LABORATORY PRACTICE: TYPES OF STRUCTURES (CONTENT 1).

**Description:**
Laboratory practice, in pairs, lasting two hours. The student does a previous reading of the script and draws up a sheet where he/she will write down the experimental data.

**Specific objectives:**
At the end of the activity, the student must be able to:
- Use effectively the devices used in practice.
- Interpret the concepts of resistance of materials involved in the laboratory.

**Material:**
- Internship book (available at the Atenea digital campus)
- Website: http://www.epsem.upc.edu/~practiceresistencematerials
- All the necessary material for the realization of the practice.

**Delivery:**
The student will draw up a report (in pairs), according to the marked guidelines, which will be delivered to the teacher. The reports are returned corrected and with corresponding teacher feedback in the next session. It represents 1/4 of the lab note.

**Full-or-part-time: 7h 36m**
- Laboratory classes: 2h
- Self study: 5h 36m

## 2. LABORATORY PRACTICE: PURE COMPRESSION TRACTION (CONTENT 3).

**Description:**
Laboratory practice, in pairs, lasting 3 hours. The student does a previous reading of the script and draws up a sheet where he/she will write down the experimental data.

**Specific objectives:**
At the end of the activity, the student must be able to:
- Use effectively the devices used in practice.
- Interpret the concepts of resistance of materials involved in the laboratory.

**Material:**
- Internship book (available at the Atenea digital campus)
- Website: http://www.epsem.upc.edu/~practiceresistencematerials
- All the necessary material for the realization of the practice.

**Delivery:**
The student will draw up a report (in pairs), according to the marked guidelines, which will be delivered to the teacher. The reports are returned corrected and with corresponding teacher feedback in the next session. It represents 3/8 of the lab note.

**Full-or-part-time: 11h 24m**
- Laboratory classes: 3h
- Self study: 8h 24m
3. LABORATORY PRACTICE: BENDING (CONTINGUT 4)

Description:
Laboratory practice, in pairs, lasting two hours. The student does a previous reading of the script and draws up a sheet where he/she will write down the experimental data.

Specific objectives:
At the end of the activity, the student must be able to:
Use effectively the devices used in practice.
Interpret the concepts of resistance of materials involved in the laboratory.

Material:
Internship book (available at the Atenea digital campus)
Website: http://www.epsem.upc.edu/~practiceresistencematerials
All the necessary material for the realization of the practice.

Delivery:
The student will draw up a report (in pairs), according to the marked guidelines, which will be delivered to the teacher. The reports are returned corrected and with corresponding teacher feedback in the next session. It represents 3/8 of the lab note.

Full-or-part-time: 11h 24m
Laboratory classes: 3h
Self study: 8h 24m

4. INDIVIDUAL CONTINUOUS EVALUATION TEST: TYPES OF STRUCTURES, SECTION ANALYSIS, PURE COMPRESSION TRACTION (CONTENTS 1-3).

Description:
Individual test in the classroom with a part of the theoretical concepts of the subject, and resolution of exercises and problems related to learning objectives.

Specific objectives:
At the end of the activity, the student must be able to:
Know, understand and use the basic principles of stresses in structural elements and of traction and pure compression.

Material:
Statements and calculator.

Delivery:
Resolution of the test.
It represents 45% of the final grade of the subject.

Full-or-part-time: 7h
Theory classes: 2h
Self study: 5h
5. INDIVIDUAL CONTINUOUS EVALUATION TEST: BENDING, CUTTING AND TWISTING (CONTENTS 4, 5).

**Description:**
Individual test in the classroom with a part of the theoretical concepts of the subject, and resolution of exercises and problems related to learning objectives.

**Specific objectives:**
At the end of the activity, the student must be able to:
Know, understand and use the basic principles of bending, cutting and twisting.

**Material:**
Statements and calculator.

**Delivery:**
Resolution of the test.
It represents 45% of the final grade of the subject.

**Full-or-part-time:** 7h
Theory classes: 2h
Self study: 5h

6. FINAL TEST: (CONTENTS 1-5).

**Description:**
Individual test in the classroom with a part of the theoretical concepts of the subject, and resolution of exercises and problems related to learning objectives.

**Specific objectives:**
At the end of the activity, the student must be able to:
To know, understand and use the bases of the different contents of the subject.

**Material:**
Statements and calculator.

**Delivery:**
Resolution of the test.
It represents 90% of the final grade of the subject.

**Full-or-part-time:** 13h
Theory classes: 3h
Self study: 10h

**GRADING SYSTEM**
Laboratory (Activities, 1, 2, 3) 10% of the grade for the course.
Assessment test (Activity 4) 45% of the grade for the subject.
Assessment test (Activity 5) 45% of the grade for the subject.
The student who has passed the practices and has not passed any of the two continuous assessment tests, must make up the pending part in the final test.
Final test 90% of the grade for the course.

**EXAMINATION RULES.**
It is an essential condition to pass the course to have done the practices with sufficiency.
BIBLIOGRAPHY

Basic: