Course guide
330066 - RM - Strength of Materials

Last modified: 25/04/2024

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).
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2016). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2016). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2016). (Compulsory subject).
BACHELOR'S DEGREE IN MINERAL RESOURCE ENGINEERING AND MINERAL RECYCLING (Syllabus 2021). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Martin Villanueva, Prepedigno

Others: Prepedigno Martin Villanueva
Planells Torres, Mariano

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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

Transversal:
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 INFORMATI0N 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

Type	Hours	Percentage
Hours small group	15,0	10.00
Hours large group	45,0	30.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

1. Types of structures

Description:
Identification and classification of the types of structures that appear in construction and machinery in general.

Specific objectives:
1. Identify different structures and the simplifications that are appropriate for analysing them according to their difficulty

Related activities:
1, 3 and 4.

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

2. Efforts and Diagrams

Description:
Forces in structural elements.

Specific objectives:
2. Identify and use forces that appear in the internal sections of bars that form part of structures and their graphic representation. The analysis focuses on two-dimensional structures.

Related activities:
1, 2, 3 and 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:
Tension and compression forces as the most simple and basic forces of those that appear in structural elements.

Specific objectives:
1. Identify tension and compression, and the stress and deformation they cause, and calculate the lengthening and shortening of bars submitted to these forces.

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:
Bending as the most important of the forces that appear in structural elements, particularly in the field of construction.

Specific objectives:
Identify the bending force and calculate the stress and deformation it causes in the most dangerous sections of bars.

Related activities:
1, 2, 3 and 4

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

5. Cutting and twisting

Description:
Shearing as a secondary force in construction that is more important in some machine elements. Torsion as a very important force, particularly in the rotating axes of machines.

Specific objectives:
Identify how shearing acts on bars with very simple cross sections and the stress it causes. Identify torsion in circular section bars, and the stress it causes, and the rotations of cross sections.

Related activities:
1, 2, 3 and 4.

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

ACTIVITIES

1. LABORATORY PRACTICE: TYPES OF STRUCTURES (TOPIC 1).

Description:
Laboratory practical in pairs lasting two hours.
Students read the script beforehand and then draw up a sheet in which they record the experimental data.

Specific objectives:
On completion of the activity, students must be able to:
Use the apparatus for the practical effectively.
Interpret the strength of materials concepts involved in the practical.

Material:
Practicals book (available on the ATENEA virtual campus)
Web page: http://www.epsem.upc.edu/~practiquesresistenciamaterials
All of the materials needed for the practical.

Delivery:
Students draw up a report in pairs following the instructions given and hand it in to the professor.
The report is corrected and returned. Feedback is given in the next lesson. It makes up 1/4 of the laboratory mark.

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

2. LABORATORY PRACTICAL: TENSION AND PURE COMPRESSION (TOPIC 3)

Description:
Laboratory practical in pairs lasting three hours.
Students read the script beforehand and then draw up a sheet in which they record the experimental data.

Specific objectives:
On completion of the activity, students must be able to:
Use the apparatus for the practical effectively.
Interpret the strength of materials concepts involved in the practical.

Material:
Practicals book (available on the ATENEA virtual campus)
Web page: http://www.epsem.upc.edu/~practiquesresistenciamaterials
All of the materials needed for the practical.

Delivery:
Students draw up a report in pairs following the instructions given and hand it in to the professor.
The report is corrected and returned. Feedback is given in the next lesson. It makes up 3/8 of the laboratory mark.

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

3. LABORATORY PRACTICE: BENDING (TOPIC 4)

Description:
Laboratory practical in pairs lasting three hours.
Students read the script beforehand and then draw up a sheet in which they record the experimental data.

Specific objectives:
On completion of the activity, students must be able to:
Use the apparatus for the practical effectively.
Interpret the strength of materials concepts involved in the practical.

Material:
Practicals book (available on the ATENEA virtual campus)
Web page: http://www.epsem.upc.edu/~practiquesresistenciamaterials
All of the materials needed for the practical.

Delivery:
Students draw up a report in pairs following the instructions given and hand it in to the professor.
The report is corrected and returned. Feedback is given in the next lesson.
It makes up 3/8 of the laboratory mark.

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

4.4. INDIVIDUAL CONTINUOUS ASSESSMENT TEST: TYPES OF STRUCTURES, SECTIONAL ANALYSIS, TENSION AND PURE COMPRESSION (TOPICS 1-3)

Description:
Individual test in the classroom covering part of the theory of the subject and exercises and problems related to the learning objectives.

Specific objectives:
On completion of the activity, students must be able to:
Identify, understand and use the basic principles of forces in structural elements, particularly tension and pure compression.

Material:
Test paper 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 ASSESSMENT TEST: BENDING, SHEARING AND TORSION (TOPICS 4, 5)

Description:
Individual test in the classroom covering part of the theory of the subject and exercises and problems related to the learning objectives.

Specific objectives:
On completion of the activity, students must be able to:
Identify, understand and use the basic principles of bending, shearing and torsion.

Material:
Test paper and calculator.

Delivery:
The completed exam. It represents 45% of the final mark.

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

6. 6. FINAL EXAM (TOPICS 1-5)

Description:
Individual exam in the classroom covering all of the theory of the subject and exercises and problems related to the learning objectives.

Specific objectives:
On completion of the activity, students must be able to:
Identify, understand and use the basic principles of the topics covered in the subject.

Material:
Test paper and calculator.

Delivery:
The completed exam. It represents 90% of the final mark.

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

GRADING SYSTEM

Laboratory (activities 1, 2, 3): 10% of the final mark
Continuous assessment test (Activity 4): 45% of the final mark
Continuous assessment test (Activity 5): 45% of the final mark

Students who have passed the practicals but have not passed one of the three continuous assessment tests must take the part that is pending in the final exam.

Final exam: 90% of the final mark

EXAMINATION RULES.

Students must have carried out the practicals competently to pass the subject.

BIBLIOGRAPHY

Basic:
- Rivera Amores, Juanjo. Anàlisi d'estructures: teoria i problemes [on line]. Barcelona: Edicions UPC, 2005 [Consultation: 06/11/2020]. Available on: http://hdl.handle.net/2099.3/36638. ISBN 8483018179.
- Rivera Amores, Juanjo. Mecànica de materials: problemes [on line]. Barcelona: Edicions UPC, 2008 [Consultation: 06/11/2020]. Available on: http://hdl.handle.net/2099.3/36772. ISBN 9788483017616.
- Beer, Ferdinand Pierre, i altres. Mecánica de materiales [on line]. 7ª ed. México: McGraw-Hill, 2017 [Consultation: 08/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8071. ISBN 9781456260866.
- Gere, James M. Resistencia de materiales. 5ª ed. Madrid: International Thomson Editores, 2002. ISBN 9788497320658.