DEGREE CURRICULUM

ELASTICITY AND STRENGTH OF MATERIALS II

Coordination: BRADINERAS ESCO, FRANCISCO JAVIER

Academic year 2023-24

ELASTICITY AND STRENGTH OF MATERIALS II 2023-24

Subject's general information

<table>
<tr><td>Subject name</td><td>ELASTICITY AND STRENGTH OF MATERIALS II</td></tr>
<tr><td>Code</td><td>102306</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Mechanical Engineering</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Double bachelor's degree: Degree in Mechanical Engineering and Degree in Energy and Sustainability Engineering</td><td>4</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><td>PRALAB</td><td>PRAULA</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>0.4</td><td>2.6</td><td>3</td></tr>
<tr><th>Number of groups</th><td>4</td><td>2</td><td>1</td></tr>
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</td></tr>
<tr><td>Coordination</td><td>BRADINERAS ESCO, FRANCISCO JAVIER</td></tr>
<tr><td>Department</td><td>AGRICULTURAL AND FOREST SCIENCES AND ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>60h attendance class + 90h personal work</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Spanish</td></tr>
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ELASTICITY AND STRENGTH OF MATERIALS II 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BRADINERAS ESCO, FRANCISCO JAVIER	javier.bradineras@udl.cat	9,8	

Subject's extra information

We recommend attendance and resolution of proposed problems.

Case studies should be solved as soon as possible, it is not advisable to leave them to the last minute.

Consulting bibliography is an essential requirement for the subject.

Students must achieve a level of knowledge that allows the calculation of structural and mechanical parts to achieve capacity enough to select the most appropriate design criteria for optimum performance of each piece.

It aims to establish a foundation of calculation knowledge that will be needed in other areas such as in the case of structural design, mechanical, etc.

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Laboratory gown from UdL (unisex)
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos
Centre the Cultures i Cooperació Transfronterera

http://www.publicacions.udl.cat/

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...

- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratoy gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: http://www.sprl.udl.cat/alumnes/index.html

Learning objectives

- Calculate static values of sections.

- Get stresses and deformations caused by axial forces.

- Calculate stresses and deflections caused by bending moments.

- Calculate stresses and deformations caused by shear forces.

- Learn to solve isostatic and statically indeterminated cases.

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Competences

Degree-specific competences

- Knowledge and ability to apply the principles of elasticity and resistance of materials to the behaviour of real solids.

  Goals

  - Students must be able to address real problems and propose simplifications to them, within the field of strength of materials

- Knowledge and ability for calculus, structural design and industrial constructions.

  Goals

  - Students must be able to calculate a structure and decide what kind of links are the best to the design system selected

Degree-transversal competences

- Ability to gather and interpret relevant data in their field of study, and to emit judgements that include a reflection on relevant themes of a social, scientific or ethical nature

  Goals

  - Students must be able to interpret data of problems and results

- Ability to resolve problems and elaborate and defend arguments inside their field of study

  Goals

  - The student must learn to propose and decide the order to follow for solving problems and real cases

- Ability to analyse and synthesize.

  Goals

  - Students must be able to organize the results of the calculations and choose the relevant ones

Subject contents

1. - Static values of areas
2. - The axial force
3. - Bending theory. Stress analysis. Pure bending.
4. - Bending theory. Stress analysis. Composite bending.
5. - Bending theory. Stress analysis. Simple bending.
6. - Bending theory. Deflection analysis
7. - Indeterminate beams. Continuous beams.
8. - Torque
9. - Buckling/instability

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Methodology

* Lectures: Before beginning with the problems a theoretical introduction to each chapter of the course will take place.

* Problems: The main focus of the course is to learn to solve problems of strength of materials and structural design. After the theoretical introduction will arise and solve different kind of problems. Problems are conducted in small groups.

* Exercises to deliver: Students also have to solve problems individually or in groups. The problems solved and delivered in class will be used in the calculation of the final mark for the subject. These exercises will be conducted in small groups.

* Case Studies: At the end of each chapter, a case studie will be required. Students will submit a final report with all of them. This case is different for each student as data depends on the student identification number. This report will also have an important weight in the mark of the subject.

Development plan

Week	Chapters	Classroom working hours	Freelance working hours
1-2	Chapter 1	8	12
3-5	Chapter 2	12	18
6-7	Chapter 3	8	12
8-10	Chapter 4	12	18
11-12	Chapter 5	8	12
13-14	Chapter 6-7	8	12
15	Chapter 8-9	4	6

Evaluation

Exams: 80% (2 partial 40%)

Case Studies: 10%

Teory and problems test: 10%

Máximum mark in second chance exam: 6

Alternative evaluation: 80% two partial exams + 20% one exercise from each chapter with the tool of the virtual campus.

Bibliography

* Luis Ortiz Berrocal. Resistencia de Materiales. Mc Graw Hill

* Luis Ortiz Berrocal. Elasticidad. McGraw Hill.

* Fernando Rodriguez-Avial. Resistencia de Materiales. ETSII Madrid.

* James M. Gere. Timoshenko. Resistencia de Materiales. Paraninfo

* Manuel Vázquez. Resistencia de Materiales. Ed. Noela.

* Manuel Romero, Pedro Museros, María D. Martínez, Ana Poy. Resistencia de Materiales. Ed. Universitat Jaume I

* Ramón Argüelles Álvarez. Cálculo de estructuras. E.T.S.I.M. Madrid.

* Enrique Nieto. Estructuras arquitectónicas e industriales, su cálculo. Tebar.

* Santiago Rico Fernando. Teoría y cálculo sobre estructuras resistentes de prismas rectos. Bellisco

* Jack C. McCormac. Análisis de estructuras, método clásico y matricial. ALFAOMEGA

* Miguel Cervera, Elena Blanco. Resistencia de Materiales. CIMNE-UPC