BACHELOR'S DEGREE IN INDUSTRIAL DESIGN ENGINEERING

SYLLABUS
STRUCTURAL CALCULATIONS

ACADEMIC YEAR: 2026-27
YEAR: 2nd
SUBJECT TYPW: Basic Training
SEMESTER: 3rd
ECTS: 6
TEACHING HOURS: 49
HOURS OF AUTONOMOUS WORK: 101
TOTAL HOURS: 150
LANGUAGE/S: Spanish/Catalan
CODE: 17039

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PRESENTATION OF SUBJECT / GOALS

The objective of this subject is for students to be able to size structural elements subjected to combined stresses. The starting point is the observation and analysis of the different mechanical systems existing in the products, evaluating the loads they support and the type of stresses they cause in each element. Students will learn how to calculate the stresses and deformations in the elastic regime and how to size each part with the appropriate safety factor, applying the failure criteria corresponding to the material.

SUSTAINABLE DEVELOPMENT GOALS (SDGS)

This subject does not specifically incorporate any SDGs.

CONTENTS

Block I: Axial and shear stresses
1.1. Types of efforts. Definitions.
1.2. Axial and shear stress diagrams.
1.3. Dimensioning of structural elements subjected to axial and shear stresses.

Block II: Calculation of joints
2.1. Dimensioning of riveted or bolted joints.
2.2. Analysis of failure in joints: tensile, shear or crushing.

Block III: Bending and torsional stress
3.1. Bending and torsion moment diagrams.
3.2. Dimensioning of structural elements subject to bending and torsion.

Block IV: Calculation of combined stresses
4.1. Free solid diagram of 2D and 3D mechanical systems.
4.2. Stress analysis for parts subjected to combined stresses in 2D and 3D.
4.3. Combined flexion.
4.4. Mohr's circle and maximum principal stresses.

4.5. Material failure criteria. Von Mises Tension.

Block V: Product Resizing
5.1. Detection of the most critical section.
5.2. Calculation of the safety coefficient of a part and a product.
5.3. Optimisation and resizing of the critical element.

Block VI: Structural Simulation
6.1. Introduction to structural simulation software.
6.2. Approach to the simulation model (constraints and loads).
6.3. Visualisation and interpretation of the results obtained.

TEACHING METHODOLOGIES

- Work sessions with the whole group, class with the teacher. (PA)

COMPETENCIES

- Developing a creative attitude of experimentation, under scientific and humanistic criteria, which favours the exploration of relevant and innovative contributions. (G1)
- Students must have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific or ethical issues. (CB3)
- Acting with a spirit and critical reflection in the face of knowledge in all its dimensions, showing intellectual, cultural and scientific concern and commitment to rigour and quality in professional demand. (T1)
- Showing skills for professional practice in multidisciplinary and complex environments, in coordination with networking teams, either in face-to-face or virtual environments, through the computer and informational use of ICTs. (T4)
- Becoming the main actor in the training process itself with a view to personal and professional improvement and the acquisition of a comprehensive training that allows learning and coexist in a context that respects linguistic diversity, with diverse social, cultural, gender and economic realities. (T7)
- Solving the mathematical problems that may arise in the modelling and simulation of industrial design engineering for the appropriate selection of processes and decision-making in the development of the project. (E2)

LEARNING OUTCOMES

- Acquiring and demonstrating advanced knowledge of the theoretical and practical aspects and work methodology in the field of calculation and modelling.
- Collecting and interpreting data and information on which to base their conclusions, including reflections on social, scientific or ethical issues in the field of simulation.
- Globally evaluating the learning processes carried out according to the plans and objectives set, and establishing individual improvement measures.
- Developing in contexts of virtual interaction through the use of ICTs.
- Defining their own learning objectives, and designing coherent and realistic development processes with the same objectives and time available.
- Evaluating product requirements through technical calculations.
- Sizing the product under mechanical stresses.

TRAINING ACTIVITIES

Each subject will present at the beginning of the course its WORK PLAN where the didactic activities per week / session / autonomous work are recorded.

EXAMINATION

EXAMINATION SYSTEMS

The evaluation of the subject will be based on continuous monitoring of the student's academic work throughout the course.

EXAMINATION SYSTEM	FINAL WEIGHTING
P1-Observation of participation	0
P2-Follow-up of the work done	10
P4-Specific assessment tests: exams	60
P5-Completion of required work or projects	30

EXAMINATION CRITERIA

The final grade of the subject will be the weighted average of the grades of the assessable activities according to the following table

EXAMINATION ACTIVITY	WEIGHT	RECOVERABLE (up to 50%)	EXAMINATION SYSTEM
Activity-1 Carrying out exercises and contribution in class	10%	NO	P-2
Activity-2 Technical projects	30%	YES*	P-5
Activity-3 Midterm exam	20%	NO	P-4**
Activity-4 Final exam	40%	YES*	P-4**

Students will have the option of retaking the retake tests. The retake tests will be carried out in the period of the semester allocated to this function, not being able to recover more than 50% of the subject.

* In the event that the Recoverable Assessable Activities exceed 50%, the student body may choose, up to a limit of 50%.

The unjustified non-submission of any assessable activity implies a grade of 0, even if the activity has been classified as Recoverable.

Recoverable Activities can only be recovered when they have been submitted by the student body on the indicated date and with a grade equal to or greater than 3.

** In order to calculate the final grade of the subject, it will be necessary to obtain a minimum grade of 4 in the weighted average of the exams (P-4 evaluation system).

If access to the retake test is waived, the grade achieved in the first instance will be maintained.

In case of taking the recovery, the grade obtained will be the last, even if it is lower than the first.

Plagiarism or copying of other people's work is penalised in all universities and, according to the Rules of Coexistence of the University of Vic-Central University of Catalonia, they constitute serious or very serious offences. That is why in the course of this subject any indication of plagiarism or misappropriation of texts or ideas other people (What is considered plagiarism?) as well as the improper or undeclared use of Artificial Intelligence in an activity, automatically translates into a

suspension and/or other disciplinary measures (Normes de Convivencia de la Universitat de Vic-Universitat Central de Catalunya).
For any questions or queries, see the (Academic Regulations of the Bachelor's Degree of the Faculty of Design and Engineering Elisava UVic-UCC).

BIBLIOGRAPHY AND TEACHING RESOURCES

Basic

- Beer & Johnston. 2017. *Mecánica vectorial para ingenieros. Estática*. Ed. McGraw-Hill.
- Gere, J. M. & Timoshenko, S. P. 2002. *Mecánica de Materiales.* Thomson Paraninfo.
- Mott. 2020. *Resistencia de materiales aplicada.* Ed. Prentice Hall
- Hibbeler, R. C. 2011. *Mecánica de materiales.* Pearson. Prentice Hall.

Complementary

- Gordon, J.E. 1978. *Estructuras o por qué las cosas no se caen.* Celeste Ed.
- Meriam & Kraige, 1998. *Mecánica para ingenieros: volumen 1: Estática, volumen 2: Dinámica*, Reverté.
- Riley. 1995. *Ingeniería mecánica: volumen 1: Estática, volumen 2: Dinámica*. Ed. Reverté.
- WinEva: http://wineva.upc.edu/

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