Universidad Zaragoza

Academic Year/course: 2021/22

29821 - Strenght of Materials

Syllabus Information

Academic Year: 2021/22
Subject: 29821 - Strenght of Materials
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
326 - Escuela Universitaria Politécnica de Teruel
Degree: 440 - Bachelor's Degree in Electronic and Automatic Engineering
444 - Bachelor's Degree in Electronic and Automatic Engineering
ECTS: 6.0
Year: 3
Semester: First semester
Subject Type: Compulsory
Module:

1. General information

1.1. Aims of the course

The aim of this course is to provide basic knowledge in mechanics of materials so that the students can solve real engineering problems and design engineering systems. This is achieved through the following objectives:

Course Objectives:

1. To provide the basic concepts and principles of strength of materials.
2. To give an ability to calculate stresses and deformations of objects under external loadings.
3. To give an ability to apply the knowledge of strength of materials on engineering applications and design problems.

Sustainable Development Goals (SDGs)
Students will be able to design systems, components or processes that meet desired needs, such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability

1.2. Context and importance of this course in the degree

The course builds upon previous courses in mathematics, physics and mechanics to assist the student in understanding the

stresses and forces involved in materials used in engineering designs.

This required course constitutes a transition from fundamental math and science topics to specific applications within the context of structural mechanics and engineering. It provides the foundation for advanced design and structural analysis courses.

1.3. Recommendations to take this course

A basic understanding of mathematics, solid rigid mechanics and thermodinamics is required. Specifically:

- Calculus: Concept of derivative and integration. Their calculations.
- Algebra: Matrix calculation.
- Solid rigid mechanics: Specifically, static mechanics. Equilibrium equations.
- Thermodinamics: Concepts of temperature, heat and conduction.

2. Learning goals

2.1. Competences

Students who successfully complete this course will have demonstrated an ability in the field of structural design to identify, formulate and solve engineering problems and to use the techniques, skills and modern engineering tools necessary for engineering practice.

2.2. Learning goals

In order to succesfully complete this course, students have to demonstrate an ability to:

1. Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials.

2. Calculate the stresses and strains in axially-loaded members, circular torsion members, and members subject to flexural loadings.

3. Determine the stresses and strains in members subjected to combined loading and apply the theories of failure for static loading.

4. Determine and illustrate principal stresses, maximum shearing stress, and the stresses acting on a structural member.

5. Determine the deflections and rotations produced by the three fundamental types of loads: axial, torsional, and flexural.

6. Analyse slender, long columns subjected to axial loads.

2.3. Importance of learning goals

The knowledge here gained is necessary to solve structural mechanics problems in Robotics.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

Students can choose between a continuous and a global assessment.

CONTINUOUS ASSESSMENT (weigh of the final score for Zaragoza and Teruel Polytechnics, respectively):

- Practical task (15%, 15%)
- Partial exam (20%, 15%)
- Computer lab sessions (15%, 10%)
- Final exam (50%, 60%)

GLOBAL ASSESSMENT (same percentages for all):

- Global exam (85%)
- Lab sessions exam (15%)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The teaching methodology is structured in four levels:

- Theory sessions where the main subject contents are presented and discussed
- Practice sessions where practical applications of the theoretical concepts are developed and solved
- Computer lab sessions where the theoretical concepts are applied
- Development of a practical task based on a real application

4.2. Learning tasks

There will be the following activities

ON-SITE WORK: 2,4 ECTS (60 hours)

- Theory sessions (T1). They constitute the central teaching core. In them, the scientific body contained in the syllabus is developed and examples of applications are presented.
- Practice sessions (T2). Practice sessions complement the theory ones by allowing the student to apply the theoretical concepts to the resolution of practical problems. These sessions can also be used to develop skills such

as the application of empirical formulas of specific use, the use of tables, etc.

- Computer lab sessions (T3). The aim is to familiarise students with another of the basic tools of the subject, such as calculus and numerical simulation. The fundamental objective of these sessions is for the student to be able to interpret the results obtained by means of the computer, being able to discern if these are suitable or not.

INDIVIDUAL WORK: 3,6 ECTS (90 hours)

- Development of a practical task (T6). It aims to develop the formula of project-based learning to reinforce the rest of the teaching activities and, together with laboratory and computation sessions, allow the student to acquire teamwork skills.
- Autonomous work and study (T7). The student's autonomous work of the theoretical part and problem solving. The student's continuous work will be encouraged by the homogeneous distribution of the various learning activities throughout the course. Tutorials are included here, such as direct attention to the student, identification of learning problems, orientation in the subject, support to exercises and work.
- Assessments (T8). In addition to the grading function, assessment is also a learning tool with which the student checks the degree of understanding and assimilation achieved.

4.3. Syllabus

The course will address different topics, including concepts such as:

- Introduction to Elasticity. Stresses and strains.
- Introduction to Strength of Materials.
- Shear and Bending-Moment Diagrams.
- Stress and strain under axial loading.
- Shear and bending of beams.
- Compound bending.
- Torsion.
- Determinate and indeterminate structural problems.
- Buckling of struts

4.4. Course planning and calendar

The course calendar is defined by the University of Zaragoza. Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the EINA website (http://eina.unizar.es) and EUPT website (https://eupt.unizar.es/).

In addition, a detailed schedule of activities (computer lab sesión, deadlines, ?) will be available on the website of this course (http://moodle.unizar.es/).

The practical task should be presented before the exam. The deadline is fixed by the corresponding professor.

Every professor fixes their office hours.