

28816 - Elasticity and Resistance of Materials

Syllabus Information

Academic Year: 2019/20

Subject: 28816 - Elasticity and Resistance of Materials

Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia

Degree: 424 - Bachelor's Degree in Mechatronic Engineering

ECTS: 6.0

Year: 2

Semester: Second semester

Subject Type: Compulsory

Module: ---

1.General information

1.1.Aims of the course

Elasticity is a basic theory, essential to be able to understand the resistance of materials from which it is, therefore, essential foundation. The first four topics refer to the theory of elasticity where the concepts of deformations and tensions are exposed, and later to address, in general, the solution of the elastic problem: To obtain the deformations and tensions in the points of An elastic solid, subject to a set of external loads.

The resistance of materials is a discipline of compulsory study for all the students of technical careers, because their theory has an object to establish the criteria that will allow them to determine the material, the form and the dimensions to be given to Any structural element that they must design in a particular project in their future professional activity.

Another fundamental objective is that these graduates acquire a series of technical, systemic, participatory and personal transversal competencies that will be listed in the following section.

1.2.Context and importance of this course in the degree

The subject of "elasticity and material resistance " is obligatory and belongs to the Mechanics module within the degree of "Mechatronics Engineering ". It has in the current curriculum a workload load of 6 ECTS credits and is imparted in the second semester of the second year.

Brief presentation of the subject

The theory of rigid solids was studied in the subject of "mechanical Engineering" based on the hypothesis that when a solid is subjected to a system of loads, it remains perfectly rigid, ie the distances between its points do not vary, the solid does not Experience any kind of deformation.

In this subject "elasticity and resistance of materials" The mechanics of the deformable solids will be studied since all the structures and real machines are deformed under the loads to which they are subjected.

The theory of elasticity is considered as that part of the mechanics that studies the elastically deformable solids of engineering interest; That is, those solids that recover their primitive form when they stop acting on them the mechanical or thermal actions that deformed them. Its field is very extensive being the resistance of materials apart, more applied, of this theory.

Thus, the resistance of materials can be defined as the whole of those techniques that allow studying the mechanical behaviour of elastic solids formed by a small number of prismatic pieces, interconnected with each other, and supporting actions Mechanical and thermal.

1.3.Recommendations to take this course

This subject requires to have studied the subjects related to fundamentals of physics I and mathematics of the first year of the qualification.

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

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

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

Strong interaction between the teacher/student. This interaction is brought into being through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

The current subject (Elasticity and Strength of Materials) is conceived as a stand-alone combination of contents, yet organized into three fundamental and complementary forms, which are: the theoretical concepts of each teaching unit, the solving of problems or resolution of questions and laboratory work, at the same time supported by other activities

The organization of teaching will be carried out using the following steps:

? **Lectures:** Theoretical activities carried out mainly through exposition by the teacher, where the theoretical supports of the subject are displayed, highlighting the fundamental, structuring them in topics and or sections, interrelating them.

? **Practice Sessions:** The teacher resolves practical problems or cases for demonstrative purposes. This type of teaching complements the theory shown in the lectures with practical aspects.

? **Laboratory Workshop:** Practical activities will be implemented in the computer room 1.1 simulation software structures (Wineva 7.0 and Abaqus.cae) with the presence and teacher mentoring.

? **Individual Tutorials:** Those carried out giving individual, personalized attention with a teacher from the department. Said tutorials may be in person or online.

4.2. Learning tasks

Programmed learning activities	<p>The programme offered to the student to help them achieve their target results is made following activities...</p> <p>Involves the active participation of the student, in a way that the results achieved in the learning are developed, not taking away from those already set out, the activities are the following:</p> <p>? Face-to-face generic activities:</p> <p>? Lectures: The theoretical concepts of the subject are explained and illustrative examples developed as a support to the theory when necessary.</p> <p>? Practice Sessions: Problems and practical cases are carried out, complementary to the concepts studied.</p> <p>? Laboratory Workshop: This work is tutored by a teacher, in groups of no more than 20 students</p> <p>? Generic non-class activities:</p> <p>? Study and understanding of the theory taught in the lectures.</p> <p>? Understanding and assimilation of the problems and practical cases solved in the practical classes</p> <p>? Preparation of seminars, solutions to proposed problems, etc.</p> <p>? Preparation of laboratory workshops, preparation of summaries and reports.</p> <p>? Preparation of the written tests for continuous assessment and final exams.</p> <p>The subject has 6 ECTS credits, which represents 150 hours of student work in the subject during the trimester, in other words, 10 hours per week for 15 weeks of class.</p> <p>A summary of a weekly timetable guide can be seen in the following table. These figures are obtained from the subject file in the Accreditation Report of the degree, taking into account the level of experimentation considered for the said subject is moderate.</p>
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Activity	Weekly school hours
Lectures	3
Laboratory Workshop	1
Other Activities	6

4.3. Syllabus

The course will address the following topics:

- **Topic 1: Introduction to Strength of Materials**
 - Types of Structures, links and loads
 - Balance and GDH a Structure

- Definition and types of internal efforts
- Calculation and Representation Efforts diagrams
- **Topic 2: Structure Design Rigid Knots**
 - Laminating criteria: voltage Von- Mises.
 - Normal stress distribution in a section
 - Distribution of shear stress one section
 - Bending and Twisting problems in structures
- **Topic 3: Structure Design Articulated Knots**
 - Method for calculating knots structures
 - PTV method to calculate displacements
 - Buckling phenomenon
 - Calculation of the truss structure
- **Topic 4: Calculation of displacements in structures**
 - Theorems Mohr (Gyre y Displacements)
 - Virtual work (Gyre y Displacements)
 - Flexibility Method for Structural Analysis Hyperstatic
- **Topic 5: Deformable Solid Mechanics: Stress-Strain**
 - Deformable Solid Mechanics
 - Kinematics of Solid Deformable
 - Dynamics of Deformable Solid
 - Ratio behaviour
 - Thermoelastic behaviour

4.4.Course planning and calendar

weeks	WEEKLY PLANNING SEMESTER	
1 ^a 2 ^a	Topic 1	Exercise No. 1 Continuous Assessment
3 ^a 4 ^a 5 ^a 6 ^a	Topic 2	Exercise No. 2 Continuous Assessment 1st Practice with Wineva software (Topic 1 and 2) 1st Written Test (Topic 1 and 2)
7 ^a 8 ^a 9 ^a	Topic 3	Exercise No. 3 Continuous Assessment 2nd Practice with software Wineva (Topic 3) 2nd Written Test (Topic 3)
10 ^a 11 ^a 12 ^a	Topic 4	Exercise No. 4 Continuous Assessment 3rd practice with software Wineva (Topic 4) 3rd Written Test (Topic 4)
13 ^a		Exercise No. 5 Continuous Assessment

14 ^a	Topic 5	4th Practice with Abaqus software (Topic 5)
15 ^a		4th Written Test (Topic 5)

The weekly schedule of the subject will be published at <http://www.eupla.unizar.es/asuntos-academicos/calendario-y-horarios>

The dates of the global evaluation test (**official calls**) will be published at <http://www.eupla.unizar.es/asuntos-academicos/examenes>

4.5. Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=28816&year=2019

Recommended Resources:

Material	Format
Topic theory notes Topic problems	Paper/repository
Topic theory notes Topic presentations Topic problems Related links	Digital/Moodle E-Mail
Educational software Wineva.7.0	Web page: wineva.upc.edu/esp/Download.php