Lightweight Structures

Academic Year: (2024 / 2025) **Review date: 24-01-2025**

Department assigned to the subject: Continuum Mechanics and Structural Analysis Department

Coordinating teacher: ARTERO GUERRERO, JOSE ALFONSO

Type: Electives ECTS Credits : 3.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Mechanics of Structures
Elasticity
Strength of Materials

SKILLS AND LEARNING OUTCOMES

RA1.2: An systematic understanding of the key aspects and concepts of their branch of engineering.
RA1.3: Coherent knowledge of their branch of engineering including some at the forefront of the branch.
RA2.1: The ability to apply their knowledge and understanding to identify, formulate and solve engineering problems using established methods.
RA2.3: The ability to select and apply relevant analytic and modelling methods.
RA3.2: An understanding of design methodologies, and an ability to use them.
RA4.2: Rhe ability to design and conduct appropriate experiments, interpret the data and draw conclusions.
RA5.2: The ability to combine theory and practice to solve engineering problems.
RA5.3: An understanding of applicable techniques and methods, and of their limitations.
RA5.4: An awareness of the non-technical implications of engineering practice.
RA6.3: Demonstrate awareness of the health, safety and legal issues and responsibilities of engineering practice, the impact of engineering solutions in a societal and environmental context, and commit to professional ethics, responsibilities and norms of engineering practice.
CB1: Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2: Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CG1: Ability to resolve problems with initiative, creativity decision-making and critical reasoning skills, and to communicate and transmit knowledge, skills and abilities in the Industrial Engineering area.
CG3: Capacity to design a system, component or process in the area of mechanical engineering in compliance with required specifications.
CG9: Knowledge and capacity to apply computational and experimental tools for analysis and quantification of mechanical engineering problems.
CE5: Knowledge and capacity to construct and design industrial structures and buildings.

OBJECTIVES

By the end of this course, students will be able to have:
1. A systematic understanding of the key concepts and aspects for the calculation and design of lightweight structures.
2. An adequate knowledge of calculation and design of lightweight structures that includes leading knowledge in this field in mechanical engineering, such as the design and calculation of composite structures.
3. The ability to apply their knowledge and understanding to identify, formulate and solve problems of lightweight structures using established methods.

4. The ability to choose and apply analytical and modeling methods to solve lightweight structure problems.
5. An understanding of the different calculation methods that are used for the analysis of lightweight structures.
6. The ability to combine theory and practice to solve lightweight structure problems.
7. An understanding of the different applicable methods and techniques and their limitations for the analysis of the lightweight structures.
8. An awareness of the implications of engineering practice in the design and calculation of lightweight structures.

DESCRIPTION OF CONTENTS: PROGRAMME

Chapter 1. Bending of thin-walled beams

Chapter 2. Torsion of thin-walled shafts

Chapter 3. Introduction to composites laminated beams and sandwich beams

Chapter 4. Introduction to the theory of elastic plates

Chapter 5. Introduction to the theory of elastic shells

LEARNING ACTIVITIES AND METHODOLOGY

Lecture sessions (master class) and practical sessions will be taught. The first is geared to the acquisition of theoretical knowledge, and the second to the acquisition of practical skills related to theoretical concepts. In addition to this sessions one laboratory practical session in reduced groups (maximum 20 students) will be impart.

Additionally, tutorial sessions in group may be taught.

ASSESSMENT SYSTEM

% end-of-term-examination:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

Final exam (mandatory): 40%
Continuum evaluation: 60%
- Laboratory: 30%
- Evaluation controls: 30%

In order to pass the course, attendance and successful completion of the laboratory practices foreseen in the weekly planning are mandatory. The weighting of the laboratory practice mark in the continuous assessment corresponds to what it is established in the course, in accordance with the regulations of the university. In the Lightweight Structures course, the weighting of the laboratory practices takes the value of 30% of the continuous assessment grade.

BASIC BIBLIOGRAPHY

- Megson, T.H.G. Aircraft structures for engineering students, Elsevier, 2007

- Timoshenko, S.P. Teoría de placas y láminas, Urmo, 1975

ADDITIONAL BIBLIOGRAPHY

- Ugural, A. C. Stresses in beams, plates, and shells, Taylor & Francis, 2009

- Vinson, J. R. The Behavior of thin walled structures: beams, plates, and shells, Kluwer Academic Publishers, 1989