

Academic Year: ( 2024 / 2025 )

Review date: 03-09-2024

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

Coordinating teacher: RODRIGUEZ MARTINEZ, JOSE ANTONIO

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

**REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)**

Calculus I  
 Calculus II  
 Linear Algebra

**LEARNING OUTCOMES**

RA3: Be able to carry out conceptual designs for bioengineering applications according to their level of knowledge and understanding, working in a team. Design encompasses devices, processes, protocols, strategies, objects and specifications broader than strictly technical, including social awareness, health and safety, environmental and commercial considerations.

RA4: Be able to use appropriate methods to carry out studies and solve problems in the biomedical field, commensurate with their level of knowledge. Research involves conducting literature searches, designing and carrying out experimental practices, interpreting data, selecting the best approach and communicating knowledge, ideas and solutions within their field of study. May require consultation of databases, safety standards and procedures.

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.

CB3: Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.

CB4: Students should be able to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.

CG2: Ability to design, draft and develop scientific-technical projects in the field of biomedical engineering.

CG4: Ability to solve problems with initiative, decision-making, creativity, and to communicate and transmit knowledge, skills and abilities, understanding the ethical, social and professional responsibility of the biomedical engineer's activity. Capacity for leadership, innovation and entrepreneurial spirit.

CG7: Drafting, representing and interpreting scientific-technical documentation.

CG11: Ability to solve problems characteristic of the theory of continuous media that may arise in engineering and biomedical sciences.

ECRT13: Ability to solve the characteristic problems of the theory of continuous media that may arise in engineering and biomedicine. Ability to apply knowledge of: solid mechanics, fluid mechanics and transport theory in continuous media of a biological nature.

CT1: Ability to communicate knowledge orally and in writing to both specialised and non-specialised audiences.

CT2: Ability to establish good interpersonal communication and to work in multidisciplinary and international teams.

CT3: Ability to organise and plan their work, making the right decisions based on the information available, gathering and interpreting relevant data in order to make judgements within their area of study.

**OBJECTIVES**

Introduction of the basic concepts of continuum mechanics for the analysis of elastic and viscoelastic solids.  
Ability to formulate fundamental problems of solids mechanics, assessing the hypothesis and interpreting their results

#### DESCRIPTION OF CONTENTS: PROGRAMME

Chapter 1. Introduction to continuum mechanics applied to living and inert solids

Chapter 2. Stress, strain and compatibility conditions

Chapter 3. Derivation of the field equations and boundary conditions

Chapter 4. Properties of most common solids

Chapter 5. Constitutive equations of continuum mechanics: elasticity

Chapter 6. Constitutive equations of continuum mechanics: viscoelasticity

#### LEARNING ACTIVITIES AND METHODOLOGY

Every week a keynote lecture (large group) and a practical session (small group) will be delivered. The former is aimed at the acquisition of theoretical knowledge and the latter is aimed at the acquisition of practical skills related to theoretical concepts. Additionally, two lab sessions will be delivered in specific time in small groups (maximum 20 students).

The students will have the possibility of personal tutorials on the corresponding schedule. There will be a collective mentoring session at the 15th week of the calendar at the time scheduled for the keynote lecture.

#### ASSESSMENT SYSTEM

<b>% end-of-term-examination:</b>	60
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	40

End of term examination (mandatory): 60%

- The minimum mark on the final examination for taking into account the mark obtained during the continuous assessment is 4.5 over 10

Continuous assessment: 40% split up into:

- Lab sessions: 15%
- 2 Mid-term exams: 25%

It is mandatory attendance and completion of the laboratory classes provided in the weekly planning to pass the course. The weight of the mark of the lab sessions in the continuous assessment corresponds to what is established in the course, in accordance with the university regulations. In the course "Biomechanics of Continuum Media I", the weight of the laboratory classes takes the value of 37.5% of the continuous assessment mark.

In addition, 3 extra-exercises will be proposed to be carried out voluntarily, which will be graded by the teacher, whose grade will be 0.5 points each to be added to the final grade of the course **ONLY** in case the subject has been passed.

#### BASIC BIBLIOGRAPHY

- Federico Paris Carballo Teoría de la elasticidad, Universidad de Sevilla, 1998
- Flügge Wilhelm Viscoelasticity, Springer-Verlag .
- Oliver, X.; Agelet, C. Mecánica de medios continuos para ingenieros, UPC.

- Ortiz Berrocal, L Elasticidad, Ed. McGraw Hill.
- SAMARTIN, A Curso de Elasticidad, Bellisco, 1990

#### BASIC ELECTRONIC RESOURCES

- Bob McGinty . Continuum Mechanics: <http://https://www.continuummechanics.org/>
- XAVIER OLIVER . CONTINUUM MECHANICS FOR ENGINEERS:  
<http://http://oliver.rmee.upc.edu/xo/vpage/1/0/Teaching/Continuum-Mechanics>
- Allan F. Bower . Applied Mechanics of Solids: <http://http://solidmechanics.org/>