Structural Dynamics

Academic Year: (2022 / 2023) **Review date: 05-04-2022**

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

Coordinating teacher: PERNAS SANCHEZ, JESUS

Type: Electives ECTS Credits : 3.0

Year : 4 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Structural mechanics, elasticity and strength of materials

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 structures under dynamic loadings.
2. An adequate knowledge of calculation and design of lightweight structures that includes leading knowledge in this field in mechanical engineering in structures under dynamic loadings.
3. The ability to apply their knowledge and understanding to identify, formulate and solve problems of structures under dynamic loadings using established methods.
4. The ability to choose and apply analytical and modeling methods to solve structures under dynamic loadings problems.
5. An understanding of the different calculation methods that are used for the analysis of structures under dynamic loadings.
6. The ability to combine theory and practice to solve structures under dynamic loadings problems.
7. An understanding of the different applicable methods and techniques and their limitations for the analysis of the structures under dynamic loadings.
8. An awareness of the implications of engineering practice in the design and calculation of lightweight structures.
9. 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;

DESCRIPTION OF CONTENTS: PROGRAMME

Topic 1: Review of free and forced oscillations
1. Presentation of the dynamic phenomenon and its application to the dynamic calculation of structures
2. Physical models and degrees of freedom
3. Free and forced oscillation in systems 1 DOF
4. Free and forced oscillation in sets 2 DOF
5. Free and forced oscillation in N DOF systems

Topic 2: Dynamics of continuous systems
1. Partial Differential Equations of motion
2. Dynamics of beam subjected to bending
3. Simply supported beams
4. Cantilever beams
5. Bemas with distributed elastic supports

Topic 3: Seismic analysis of structures
1. Introduction to seismology
2. Legislation relating to the seismic analysis of structures: actions in seismic project
3. Modal spectral analysis
4. Application to the seismic analysis of structures examples of calculation)

Topic 4: Structures subject to the action of the wind
1. Characterization of the wind
2. Aeroelastic instability: gallop and flashover
3. Slender structures: cables, towers and poles

4. Cable-stayed and suspension bridges

Topic 5: Structures subjected to moving loads
1. Pedestrian walkways
2. Road bridges
3. Railway bridges

LEARNING ACTIVITIES AND METHODOLOGY

- Lectures, classes to resolve doubts in small groups, student presentations, tutorials and personal work, oriented to the acquisition of knowledge (1.5 ECTS).
- Lab and classes of problems in small groups, individual tutorials and personal work, oriented to the acquisition of practical skills related to the program of the course (1.5 ECTS).

Due to the uncertainty about the teaching format to which the health circumstances will lead us during the next course, it is expected to start in the semi-attendance mode, and may lead to training 100% classroom or 100% online depending on the evolution of the spread or control of the pandemic and the health and hygiene standards dictated by the authorities of the sector.

ASSESSMENT SYSTEM

Continuous assessment based on work, class participation, practics and assessment tests skills and knowledge.
In the extraordinary call, the final grade will be the maximum between the exam including continuous assessment and the exam only.

In order to pass the course, the attendance of the laboratory practices foreseen in the weekly planning are compulsory. The weighting of the practice mark in the continuous assessment corresponds to that established in the course, in accordance with the regulations of the university.

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- Mario Paz Dinámica Estructural, Reverté, 2002
- Ray W. Clough, Joseph Penzien Dynamics of structures, McGraw-Hill, 1993