Structural Dynamics

Academic Year: (2023 / 2024) **Review date: 25-04-2023**

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 :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Structural mechanics, elasticity and strength of materials

SKILLS AND LEARNING OUTCOMES

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.
CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.
CG1. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG3. Ability to design a system, component or process in the field of Industrial Technologies to meet the required specifications
CG4. Knowledge and ability to apply current legislation as well as the specifications, regulations and mandatory standards in the field of Industrial Engineering.
CG5. Adequate knowledge of the concept of company, institutional and legal framework of the company. Organisation and management of companies.
CG6. Applied knowledge of company organisation.
CG8. Knowledge and ability to apply quality principles and methods.
CG9. Knowledge and ability to apply computational and experimental tools for the analysis and quantification of Industrial Engineering problems.
RA1. Knowledge and understanding: Have basic knowledge and understanding of science, mathematics and engineering within the industrial field, as well as knowledge and understanding of Mechanics, Solid and Structural Mechanics, Thermal Engineering, Fluid Mechanics, Production Systems, Electronics and Automation, Industrial Organisation and Electrical Engineering.
RA2. Engineering Analysis: To be able to identify engineering problems within the industrial field, recognise specifications, establish different resolution methods and select the most appropriate one for their solution
RA3. Engineering Design: To be able to design industrial products that comply with the required specifications, collaborating with professionals in related technologies within multidisciplinary teams.
RA4. Research and Innovation: To be able to use appropriate methods to carry out research and make innovative contributions in the field of Industrial Engineering.
RA5. Engineering Applications: To be able to apply their knowledge and understanding to solve problems and design devices or processes in the field of industrial engineering in accordance with criteria of cost, quality, safety, efficiency and respect for the environment.
RA6. Transversal Skills: To have the necessary skills for the practice of engineering in today's society.

OBJECTIVES

The design of structures requires always the dynamic analysis. Civil structures, this analysis is essential to prevent the serious effect of earthquakes and wind actions. Structures of transport dynamic analysis is essential since they always have rotary systems that xindex some sort of vibration. Aircraft and space vehicles are subjected to modal analysis to ensure their integrity.

In this course, you will enable the student to use the General techniques for the analysis of vibration

and the dynamic behavior of structures. Learn how to analyze and control vibrations experienced by lightweight structures. Analyze the vibrations and dynamic actions produced by the effect of wind and earthquakes on structures.

This course will allow students to analyze the dynamic response of simple structures such as structures of bars of chassis of cars, robotic arms etc.

DESCRIPTION OF CONTENTS: PROGRAMME

The contents are:

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