Design extension and machines test

Academic Year: (2023 / 2024) **Review date: 27/04/2023 13:57:31**

Department assigned to the subject: Mechanical Engineering Department

Coordinating teacher: GUTIERREZ MOIZANT, RAMON ALBERTO

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Subjects that provide the common skill to the industrial branch mentioned in the Order CIN/351/2009, of February 9, establishing the requirements for the verification of the official university degrees that qualify for the profession of Industrial Technical Engineer. In particular, those that provide " Knowledge of the fundamentals of mechanism and machine theory", "Knowledge and use of the principles of materials resistance" and "Basic knowledge of production and manufacturing systems".

OBJECTIVES

Ability for machine desing.
Synthesis of mechanisms.
Multibody System Dynamics.
Machine simulation to solve kinematic and dynamic problems and modal analysis.
Evaluation and control of effects of rigidity, play, crack and deformation in machines.
Ability to predict, analyze and control the vibrational response of machines.
Advanced test and diagnostic of machine functionality.
Ability to analyze and correct measurements of surface strains.
Ability to select the most appropriate strain gauge for the object of study.
Ability to analyze and correct surface deformation measurements.
Acquire the necessary tools for the measurement of deformations and analysis of movements through optical methods.
Analysis and propagation of uncertainties in strain gauges.
Ability to perform and validate finite element models.

DESCRIPTION OF CONTENTS: PROGRAMME

Synthesis of mechanisms.
Function generating.
Path generating.
Generalization of spatial mechanism.
Non-lineal dynamics of machines.
Non-lineal vibrations. Autoexcited vibrations and parametric resonance.
Stochastic and stationary vibrations.
Modal Analysis.
Metrology concepts in mechanical engineering.
Experimental measurement of deformations.
Modelling using Finite Element Method.

LEARNING ACTIVITIES AND METHODOLOGY

Teaching activities will include:
* Theoretical lectures. Master presentations (2.3 ECTS).
* Practical classes. Theoretical and practical classes in computer labs (2.1 ECTS).
* Laboratory exercises (0.4 ECTS).
* Tutorials (1.2 ECTS).

The methodology to be used will be:
* Lectures. Presentations by the teacher, supported by computer and audiovisual media, in which the main concepts of the subject are developed and the materials and basic bibliography are provided to complement the learning.
* Practical sessions. Solving problems, etc. posed by the teacher, individually or in groups.
* Presentations and class discussions.
* Preparation of practical projects.

ASSESSMENT SYSTEM

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

The work done by the student will be evaluated by following the Bologna criteria. The work carried out by each student during the term will be evaluated separately as well as the final exam.
Labs are also part of the evaluation of the subjetc and its execuation is obligaded to pass the subject.
In the extraordinary exam there will be an evaluation with all the contents of the course. In case of failing the practicals, a practical exam must be taken.

BASIC BIBLIOGRAPHY

- Carstensen, Carsten; Wriggers, P The finite element analysis of shells: fundamentals, Springer, 2009

- Erdman, Arthur; Sandor, George; Kota, Sridhar Mechanism Design: Analysis and Synthesis, Pearson, 2001

- International Academy for Production Engineering, The Metrology, Springer, 2014

- Jonathan Whiteley Finite Element Methods, Springer, 2017

- Norton, Robert L. Machine Design: An Integrated Approach, Pearson, 2020

- Zienkiewicz, O.C. The Finite Element Method: Its Basis and Fundamentals, Butterworth-Heinemann, 2005

ADDITIONAL BIBLIOGRAPHY

- William M. Murray The Bonded Electrical Resistance Strain Gage: An Introduction , Oxford University Press, 1992