Design extension and machines test

Academic Year: (2024 / 2025) **Review date: 26-04-2024**

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

1. Ability to design and test machines.
2. Synthesis of planar and spatial mechanisms.
3. Machine element simulation to solve kinematic, dynamic, structural and modal analysis problems by means of computer.
4. Advanced testing and diagnosis of the state of operation of machines.
5. Ability to predict, analyse and modify the vibratory response of machines.
6. Acquiring the necessary tools for the correct measurement of surface deformations in machine elements.
7. Ability to analyse and correct surface deformation measurements.
8. Analysis and propagation of uncertainties in strain gauges.
9. Ability to perform and validate finite element stress models.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Synthesis of mechanisms.
2. Non-lineal dynamics of machines.
3. Non-lineal vibrations.
4. Metrology concepts in mechanical engineering.
5. Experimental strain measurement.
6. FEM modelling and experimental validation.
7. Modal analysis.

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, using SPOC methodology.

ASSESSMENT SYSTEM

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

The evaluation system includes the continuous evaluation of the student's work through two partial evaluations, linked to the two parts of the subject. The partial evaluations will be released and the second evaluation will be based on a group work using the SPOC methodology and a final exam to check the assimilation of the concepts.
The ordinary assessment, if necessary, will be carried out with a final written exam in which the knowledge, skills and abilities acquired throughout the course will be assessed. The final exam will only cover the failed part of the subject (first part, second part or both).
The subject will be assessed according to the following criteria:
For the practicals:
- Continuous assessment of the first part of the subject (EP1), through compulsory practical work: Up to 2 points.
- Continuous assessment of the second part of the subject (EP2), through compulsory practical work: Up to 2 points.

Partial exams of continuous assessment, consisting of two parts:
- Final exam of the first part of the subject (EC1): Up to 3 points.
- Final exam of the second part of the subject (EC2): Up to 3 points.
Total: Up to 10 points.

Ordinary Final call:
If any part of the continuous evaluation is passed, the attendance to the ordinary exam of the part of the subject passed will be released. So that:
- If the student does not pass any of the compulsory practicals (EP1<5 and EP2<5 out of 10) the student must take a practical exam in the ordinary or extraordinary call. The laboratory practicals are compulsory (attendance and paper submission). Failing the practicals means failing the course.
- To pass the course by mid-term exams, it is necessary to obtain a minimum of 2.5 points out of 5 in each of the parts of the course. The final mark will therefore be: EP1+EC1+EP2+EC2
- If one of the parts has been failed, the student will have to sit the failed part(s). Since EO1 and EO2 are the examination of each of the parts in the ordinary final call, there are three possibilities:
- EP1+EO1+EP2+EC2
- EP1+EC1+EP2+EO2
- EP1+EO1+EP2+EO2
Likewise, the condition of practice and exam equal to or higher than 2.5 points must be fulfilled in the ordinary exam.

Extraordinary Call:
If the student followed the continuous evaluation process, the EXT exam will have a value of 6 points out of 10. The extraordinary exam will be of the whole theory of the subject. In order to pass the course, the final mark, taking into account the practical marks of the continuous assessment, must comply with the following: EXT+EP1+EP2 must be greater or equal to 5

In case of not having followed the continuous evaluation process, the student has the right to take an exam of the whole course EXT and also a practical exam EP.
In this case, in order to pass the subject it is necessary that:
EXT+EP must be greater or equal to 5. Conditional on obtaining at least 2.5 points in each of the parts.

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