Universidad Zaragoza

Academic Year/course: 2022/23

28824 - Calculation and Design of Machines

Syllabus Information

Academic Year: 2022/23
Subject: 28824 - Calculation and Design of Machines
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
Degree: 424 - Bachelor's Degree in Mechatronic Engineering
ECTS: 6.0
Year: 3
Semester: First semester
Subject Type: Compulsory
Module:

1. General information

1.1. Aims of the course

The aim is to enable the student to design machine elements following the fault criteria, focusing on fatigue fault criteria. In addition, it enables the student to select the ideal materials for element design.

These approaches and objectives are in line with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (https://www.un.org/sustainabledevelopment/es/), in such a way that the acquisition of the course learning outcomes provides training and competence to contribute to their achievement to some degree:

- Target 8.2. Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors.
- Target 9.4. By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.

1.2. Context and importance of this course in the degree

The course on Machine Calculation and Design is part of the Degree in Mechatronic Engineering, belonging to the group of subjects that make up the module called Mechanics.

Each course of the degree aims at covering a field in the Technological and Scientific training of the student, in this case, Design and Calculation. Success in this goal means obtaining efficient and safe machines.

1.3. Recommendations to take this course

The progress of the subject requires previous knowledge of Mathematics, Physics Mechanics and Materials Resistance, but having passed other previous subjects is not a compulsory requirement.

2. Learning goals

2.1. Competences

General competences:

- GI06: Ability to manage specifications, regulations and mandatory standards.
- GC01: Ability to integrate and apply mechanical, electronic and control knowledge in the design, development and maintenance of products, equipment or industrial facilities.
- GC03: Ability for abstraction and logical reasoning.
- GC04: Ability to learn continuously, self-directed and autonomously.
- GC05: Ability to evaluate alternatives.
- GC14: Ability to understand the operation and develop the maintenance of mechanical, electrical and electronic equipment and installations.

- GC15: Ability to analyze and apply simplified models to technological equipment and applications that allow forecasting of their behavior.

Specific competences:

- EM01: Knowledge and capabilities for the calculation, design and testing of machines.
- EM02: Knowledge and ability to model and simulate mechanical systems.
- EM05: Knowledge and skills for the design and maintenance of mechatronic systems.

2.2. Learning goals

The student, to pass this subject, must demonstrate the following results ...

- Select the most suitable material or treatment for the application.
- Model or solve the mechanisms of actuation of subsets or mechanical machines, from plans or specification books.
- Dimension mechanical elements based on specifications.
- Design or analyze, using computer tools; the behavior of parts, subassemblies or systems, in the face of stresses or established operating requirements.
- Perform kinematic and kinetic analysis of mechanical assemblies, machines and mechanisms analytically or by numerical simulation, analyzing the results obtained.
- Calculate and design structural elements subjected to loads.
- Preparation and interpretation of plans and diagrams based on the appropriate regulations and symbols.

2.3. Importance of learning goals

Solving a Design problem, selecting materials and their treatments, sizing a mechanical element, is a task and a responsibility that requires a qualification that is intended to be achieved after passing this subject.

Showing a critical and constructive attitude towards established solutions motivates the student to deepen their analysis, study, creativity and innovation when designing new products. Also to recognize the work of current designers and their Designs, to learn, understand and value their contribution in the development of machines and installations.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The assessment process will include two types of action:

- A continuous assessment system, to be carried out throughout the learning period.
- A global assessment test that reflects the achievement of learning results at the end of the teaching period.

1. CONTINUOUS ASSESSMENT SYSTEM

Remember the obligation to attend at least 80% of the classes to opt for this evaluation modality. The continuous assessment system will have the following group of qualifying activities:

- Exercises, theoretical questions and proposed works: The teacher will propose exercises, problems, practical cases, theoretical questions, etc. to be solved individually or in groups of two or three students maximum. This activity will contribute 10% to the final grade for the course.
- Written tests: The tests will collect theoretical and / or practical questions, of the different subjects to evaluate, their total number will be three, distributed throughout the whole semester with a minimum duration of one class. This activity will contribute 90% to the final grade for the course. The final score will be the arithmetic mean of the three tests, with the minimum mark for each of them being 4 out of 10 to pass.

As a summary of the aforementioned, the following weighting table of the grading process of the different activities has been designed, in which the starting evaluation system of the subject has been structured.

Activity	Weighting
Weighting Exercises, theoretical questions and proposed works	10%
Written tests	90%

Prior to the first call, the teacher of the subject will notify each student whether or not they have passed the subject based on the use of the continuous assessment system, based on the sum of the scores obtained in the different activities carried out throughout thereof, each contributing a minimum of 50%. In case of not passing in this way, the student will have two additional calls to do so (global assessment test), on the other hand, the student who has passed the course through this dynamic, may also choose the global assessment test, in first call, to upload the grade but never to download.

2. GLOBAL ASSESSMENT TESTS

The students must opt ??for this modality when, due to their personal situation, they cannot adapt to the rhythm of work required in the continuous assessment system, have suspended or want to upload a grade having participated in said assessment methodology.

As in the previous assessment methodology, the global evaluation test must be aimed at verifying if the learning results have been achieved, as well as contributing to the acquisition of the various competences, and should be carried out through more objective activities if possible.

The global assessment test will have the following group of qualifying activities:

- Written exam: Due to the type of subject, with problems of medium complexity and reasonable resolution times, the most appropriate type of test is the one consisting of solving exercises of theoretical and / or practical application with similar characteristics to those solved during the conventional development of the subject, carried out over a period of three hours. This test will be unique with representative exercises on the topics, contributing 100% to the final grade for the course.

The course will have been passed based on the sum of the scores obtained in the different activities carried out, each contributing a minimum of 50%.

For those students who have suspended the continuous assessment system, but some of their activities, with the exception of the written assessment tests, have been carried out may promote them to the global assessment test in January, and it may be the case that they only have to take the written exam.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process designed for this subject is based on the following:

- **Lectures**: Theoretical activities carried out mainly through exposition by the teacher, where the theoretical supports of the subject are displayed, highlighting the fundamentals, structuring them in topics and or sections, interrelating them.
- **Practice Sessions**: The teacher resolves practical problems or cases for demonstrative purposes. This type of teaching complements the theory shown in the lectures with practical aspects.
- **Individual Tutorials**: Those carried out giving individual, personalized attention with a teacher from the department. The tutorials may be in person or online.

The approach, methodology and assessment of this guide are intended to be the same for any teaching scenarios. They will be adapted to the social-health situation at any particular time, as well as to the instructions given by the authorities concerned.

4.2. Learning tasks

The subject will have the following overall distribution:

- 54 hours of lectures, with 20% theoretical demonstration and 80% solving type problems.
- 6 hours of written assessment tests, one hour per test.
- 90 hours of personal study, divided up over the 15 weeks of the 2nd semester.

There is a tutorial calendar timetable set by the teacher that can be requested by the students who want a tutorial.

4.3. Syllabus

The course will address the following topics:

- **Topic 1. Design by Static Resistance**
  - 1.0. Review of straight beams and element design
  - 1.1. Curved Beams
  - 1.2. Beams of variable section
  - 1.3. Contact stress
  - 1.4. Stress Concentrators
  - 1.5. Failure Theories for Static Load
- **Topic 2. Dynamic Resistance Design**
  - 2.1. Dynamic loads
  - 2.2. Design to impact loads

    - 2.3. Fatigue Resistance Design
- **Topic 3. Securing and transmitting elements**
    - 3.1. Gears
    - 3.2. Shafts and trees
    - 3.3. Screws and bolts

4.4. Course planning and calendar

The dates of the final exams will be those that are officially published at

https://eupla.unizar.es/asuntos-academicos/examenes

The written assessment tests will be related to the following topics:

? **Test 1**: Topic 1.

? **Test 2**: Topic 2.

? **Test 3**: Topic 3.

The topics on which the work will be developed will be proposed during the course depending on the teaching activity, and will be delivered on the established day. In the course of the signature the dates will be specified.

The dates and hours of classes will be found on the EUPLA website http://www.eupla.unizar.es

In addition, students will have, at the beginning of the course, the dates and places of the exams necessary to pass this subject.

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28824