Universidad Zaragoza

Academic Year/course: 2022/23

29711 - Mechanics

Syllabus Information

Academic Year: 2022/23
Subject: 29711 - Mechanics
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 330 - Complementos de formación Máster/Doctorado
434 - Bachelor's Degree in Mechanical Engineering
ECTS: 6.0
Year: 434 - Bachelor's Degree in Mechanical Engineering: 2
330 - Complementos de formación Máster/Doctorado: XX

Semester: First semester
Subject Type: 434 - Compulsory
330 - ENG/Complementos de Formación
Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. It is based on participation and the active role of the student favours the development of communication and decision-making skills. A wide range of teaching and learning tasks are implemented, such as lectures, guided assignments, laboratory sessions, autonomous work, and tutorials.

Students are expected to participate actively in the class throughout the semester.

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

Further information regarding the course will be provided on the first day of class.

4.2. Learning tasks

The course includes 6 ECTS organized according to:

- Lectures (1.8 ECTS): 45 hours.
- Laboratory sessions (0.6 ECTS): 15 hours.
- Guided assignments (0.6 ECTS): 15 hours.
- Autonomous work (3 ECTS): 75 hours.
- Tutorials.

Lectures: the professor will explain the theoretical contents of the course and solve illustrative applied problems. These problems and exercises can be found in the problem set provided at the beginning of the semester. Lectures run for 3 weekly hours. Although it is not a mandatory activity, regular attendance is highly recommended.

Laboratory sessions: 5 sessions of 3 hours each. Students will work together in groups actively doing tasks such as practical demonstrations, measurements, calculations, and the use of graphical and analytical methods.

Guided assignments: students will complete assignments, problems and exercises related to concepts seen in laboratory sessions and lectures. They will be submitted at the beginning of every laboratory sessions to be discussed and analyzed. If assignments are submitted later, students will not be able to take the assessment test.

Autonomous work: students are expected to spend about 75 hours to study theory, solve problems, prepare lab sessions, and take exams.

Tutorials: the professor's office hours will be posted on Moodle and the degree website to assist students with questions and doubts. It is beneficial for the student to come with clear and specific questions.

4.3. Syllabus

The course will address the following topics:

Theoretical and practical contents

1) Introduction to mechanics

Mechanics of rigid body. Particle, rigid body and mechanical system

Frames of reference and vector bases

The orientation of a vector basis. Eulerian angles

Motion parameters of a mechanical system in three-dimensional space

The time derivative of a vector on a basis of projection

2) Kinematics of particles in three-dimensional motion

Cartesian components. Intrinsic components.

Curvilinear components: cylindrical and spherical.

Circular motion

Composition of motions. The absolute and relative motion of a particle.

3) Kinematics of rigid bodies

Kinematic relationships between points of a rigid body.

Translation. Rotation about a fixed axis. General plane motion

Rotation about a fixed point

General three-dimensional motion

Rolling without slipping

Kinematics of plane mechanisms

4) Motion and equilibrium. Statics

Newton?s law

Forces

Moment of a force about a point. Moment of couples

Force-couple systems. Resultant of a force system

Free body diagram. Equilibrium

Supports and Connections

Mechanical systems in static equilibrium

Dry friction

5) Geometry of masses

Center of gravity

Moments of inertia of a body

Steiner?s theorem

Principal axes of inertia of a body.

Inertia tensor of a solid

6) Dynamics of particles

Introduction

Newton?s second law in inertial frames of reference

Newton?s second law in non-inertial frames of reference

The theorem of linear momentum of a particle

Theorem of angular momentum of a particle

Work and power of a force

The kinetic energy of a particle. Potential energy

General work-energy theorem

Systems of particles

Impact

7) Dynamics of rigid bodies

Angular momentum of a rigid body

Equations of three-dimensional motion of a rigid. Linear momentum and angular momentum theorems

Equations of plane motion of a rigid body

Rotation about a fixed axis. Dynamic balancing of shafts

Gyroscopic motion

Work?energy theorem for a rigid body

4.4. Course planning and calendar

For further details concerning the timetable, classroom and further information regarding this course please refer to the "Escuela de Ingeniería y Arquitectura " website (https://eina.unizar.es/)