29711 - Mechanics

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

5.2.Learning activities

5.3.Program

Theoretical and practical contents

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1) Introduction to mechanics

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

Frames of reference and vector bases

Orientation of a vector basis. Eulerian angles

Motion parameters of a mechanical system in three-dimensional space

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. 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

Newton's law

Forces

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Moment of a force about a point. Moment of couples

Force-couple systems. Resultant of a force system

Free body diagram

Supports and Connections

Dry friction

Air friction in the fall of bodies

5) Geometry of masses

Center of gravity

Theorems of Pappus - Guldin

Moments of inertia of a body

Steiner's theorem

Principal axes of inertia of a body. Ellipsoid of inertia

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

Theorem of linear momentum of a particle

Theorem of angular momentum of a particle

Work and power of a force

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

8) Statics

Equilibrium of a particle.

Equilibrium of a rigid body.

Mechanical systems in static equilibrium

5.4.Planning and scheduling

5.5.Bibliography and recomended resources