UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

PHYSICS	
Enrollment year	2021/2022
Academic year	2021/2022
Regulations	DM270
Academic discipline	FIS/03 (MATERIAL PHYSICS)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	INDUSTRIAL ENGINEERING
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	2nd semester (07/03/2022 - 17/06/2022)
ECTS	9
Lesson hours	83 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	GRANDO DANIELA (titolare) - 9 ECTS
Prerequisites	Elementary algebra, Euclidean and analytical geometry, trigonometry, derivatives and integrals. It is well recommended to take 'Fisica I' after ‘Geometry and Algebra’ and ‘Mathematical Analysis I’. Students with a curricular debt in Maths must first pass these two exams before attempting Fisica I.
Learning outcomes	This course provides grounding in classical physics, spanning from kinematics, dynamics, fluid dynamics and thermodynamics. The students are expected to achieve a better understanding of theories and concepts through practical classes. Beside developing problem solving ability, practical classes are of fundamental importance for mastering the acquired knowledge and discovering its links to everyday life.
Course contents	The course covers a range of topics in classical mechanics and thermodynamics. Topics are introduced by following a logic and

analytical framework. Sessions of exercises are proposed for every topic.

Mechanics

Physical quantities; international system of units for mass, time and length.
Vectors, vector addition, scalar and vector product
Kinematics: position and displacement vector, velocity and acceleration vectors, the inverse problem of kinematics; rotational motion, angular velocity and acceleration, normal and tangential acceleration; relative motion.
Definition of force; inertial reference systems and Newton's laws; weight, elastic force, contact force and friction; inertial forces.
Work of a force and kinetic energy; power due to a force; work-energy equation; conservative forces; potential energy; mechanical energy; principle of conservation of mechanical energy.
Impulse of a force; momentum; the impulse-momentum equation; moment of momentum or angular momentum; moment of force or torque; moment of force-moment of momentum equation; central forces.
Systems of particles; internal and external forces; center of mass; Newton's second law for a system of particles; conservation of momentum and of moment of momentum; plastic and elastc collisions.
The rigid body; center of mass and moment of inertia of a rigid body; the Huygens-Steiner or parallel axis theorem; the motion equations for a rigid body; moment of momentum for a rigid body; rotation about an axis and kinetic energy of a rigid body: Koenig theorems; the rolling motion; rigid body collisions; the gyroscopic effect.
Elements of statics.
Vibrations; kinematics of oscillatory motion; spring-mass harmonic oscillator, mathematical, physical and torque pendulum; damped vibrations; forced vibrations and resonance.

Fluid Dynamics

Pressure; density and specific weight.
Pascal's law, Archimedes' principle, and Stevino's law.
Definition of ideal fluid; volumetric flux and mass flux; Bernoulli's equation

Thermodynamics

Thermodynamic variables; thermal equilibrium and the zeroth law of thermodynamics; temperature, thermometers and temperature scales; thermal dilatation.
The ideal gas and the state equation; kinetic theory of the ideal gas; internal energy.
Heat and work in thermodynamic systems; heat transfer and calorimetry; the first law of thermodynamics; transmission of heat; thermodynamic transformations.
The second law of thermodynamics and thermal machines; Carnot theorem and Carnot cycle; Clausius theorem and entropy.

Teaching methods

Lectures (hours/year in lecture theatre): 68
Practical class (hours/year in lecture theatre): 0
Practicals / Workshops (hours/year in lecture theatre): 0

Reccomended or required readings

Serway, Beichner. FISICA Per Scienze e Ingegneria. EdiSES.

Halliday, Resnick, Krane. Fisica, vol. 1. Casa Editrice Ambrosiana.

P.A. Tipler, G. MoscaCORSO DI FISICA. Vol 1- Meccanica Onde Termodinamica. ZANICHELLI. . CORSO DI FISICA. Vol 1- Meccanica Onde Termodinamica. ZANICHELLI.

Assessment methods

Written and oral. During the written examination the students will be asked to solve simple problems on classical physics. The oral examination is a discussion on the written examination and the principles of classical physics.

Further information

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