UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2022/2023
BACHELOR'S DEGREE (BSC)	MECHANICAL ENGINEERING
SUBJECT	PHYSICS I
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50293-Fisica e chimica
CODE	15540
SCIENTIFIC SECTOR(S)	FIS/03
HEAD PROFESSOR(S)	PERSANO ADORNO DOMINIQUE Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**PERSANO ADORNO DOMINIQUE** Monday 12:00 14:00 Stanza 112 (primo piano) Dipartimento di Fisica e Chimica Viale delle Scienze, Ed. 18

DOCENTE: Prof.ssa DOMINIQUE PERSANO ADORNO

PREREQUISITES	In order to understand the content and the course learning objectives, the student should possess good knowledge of the more relevant concepts of Algebra, Geometry in the plane and in space, Analytic geometry, Goniometry, and Trigonometry.
LEARNING OUTCOMES	Knowledge and Comprehension: At the end of the course, the student will have acquired an organic knowledge of the fundamental laws of mechanics Newtonian, of fluid dynamics and oscillations (logical and mathematical structure, experimental support, physical phenomena described by it) and their applications for engineering. To this end, during the lessons, we will focus on the basilar concepts and the fundamental principles presented from time to time, also through the functional use of targeted exercises. Ability to apply knowledge and comprehension: At the end of the course, the student will be able to describe mechanical phenomena of the macroscopic world through classical mechanics, he will be able to schematize them in terms of simple systems and apply the physical laws to the model used for their description. Particular attention will be paid, where possible, to the recall of daily natural phenomena. In solving problems, the student must be able to clearly evaluate the orders of magnitude in situations that are physically different, but that show similarity, thus allowing the use of known solutions to new problems. In particular, it will be able to identify the essential elements of a process/situation and to create a model of the same, evaluating the approximations required.. Making judgments: At the end of the course, the student will be able to recognize and classify physical processes, will be able to choose in an autonomous and effective way the methods of solving problems and the laws to be applied. In particular, it will understand how the laws of Mechanics are applicable to many fields, and in particular to Engineering. The student will also be able to critically evaluate the results obtained, being frequently stimulated during the lessons through direct student/teacher interaction, especially through the classroom exercises. Communicative skills: The student will acquire the ability to communicate and express problems concerning the subject of the course using appropriate terminology. He will be able to discuss the meaning of the fundamental laws of Newtonian mechanics in a clear and concise way, knowing how to grasp the connections with the arguments treated in courses attended in the same semester. Learning ability: The learner, at the end of the course, will have acquired a method for the study of physical processes that can also be useful in subsequent applications. In particular, the student will be able to critically and autonomously describe phenomena observed in quantitative terms using the appropriate physical quantities; he will also be able to break down complex phenomena into elementary phenomena and be able to interpret them using the laws of classical physics. The student will have learned how to consult books and journals and to find concrete applications of the laws and principles studied. This will allow to the student to continue his engineering studies with greater intellectual independence and increased capability in operating assessments and making decisions.
ASSESSMENT METHODS	Written and Oral examination. The written test requires the resolution of 3/4 exercises on all parties covered by the program, and aims to verify the possession of skills and abilities provided by the course; the evaluation is expressed in thirtieths. The questions, well-defined, clear and interpretable, allow to independently formulate the response, and are structured so as to ensure comparability. Their structure provides open answers that meet constraints such as to make them comparable with predetermined correction criteria. The oral test consists of an interview, in order to check student skills and disciplinary knowledge provided by the course; the evaluation is expressed in thirtieths. The candidate must answer at least three / four oral questions/problems on all parties covered by the program. Both written and oral examinations aim to assess whether the student holds mastery and understanding of the topics, has acquired interpretative competence and independence of judgment in real cases. The sufficiency will be reached if the student knows and understands the

	topics, at least in general terms, and holds minimal skills of problem-solving. Below this threshold, the examination will result insufficient. Evaluation methods: Excellent: 30-30 cum laude: the student shows a good knowledge of the topics, excellent properties of language, good analytical skills, and is able to apply knowledge to solve the proposed problems. Very good: 26-29: the student owns good mastery of the subjects, language skills, and is able to apply knowledge to solve the proposed problems. Good: 24-25: the student shows a good knowledge of the main topics, good language skills, but limited ability to independently apply knowledge to solve the proposed problems. Satisfactory: 21-23: the student possesses a basic mastery of the main topics of the course and owns satisfactory language skills. The student is not able to independently apply knowledge to solve the proposed problems. Sufficient: 18-20: the student owns basic knowledge of the main topics and minimum language skills, very little ability to independently apply the knowledge gained. Insufficient: the student does not have an acceptable knowledge of the topics of the course.
EDUCATIONAL OBJECTIVES	The adequate knowledge of the methodological-operational aspects related to the topics covered by the course and the ability to use this knowledge to interpret and describe the problems of Engineering. In particular, the student will become familiar with the kinematics of the point, the dynamics of point bodies and rigid bodies, with the concepts of the momentum, angular momentum, and mechanical energy as well as with the laws of statics; a part of the course will also be dedicated to fluids and oscillations. The comparison between the physical aspect of the problem qualitatively discussed, and the description obtained mathematically, will allow to the student to have a complete understanding of the studied phenomenon.
TEACHING METHODS	Lectures, classroom exercises, laboratory experiments (simulations and remote).
SUGGESTED BIBLIOGRAPHY	1. P. Mazzoldi, M. Nigro, C. Voci, "Fisica, vol. I", Ed. II/2000, EdiSES, ISBN 9788879591379 2. P. Mazzoldi, M. Nigro, C. Voci, Elementi di Fisica – Meccanica e termodinamica, III edizione, Edises, ISBN 9788836230365 3. R.A. Serway, J.W. Jewett, "Fisica per Scienze ed Ingegneria, Volume 1", Ed. V/2015, EdiSES, ISBN 9788879598347. 4. C. Mencuccini, V. Silvestrini, "Fisica - Meccanica e termodinamica", Casa Editrice Ambrosiana, ISBN 9788808186492 Libri di esercizi e problemi. - C. Del Papa, M. P. Giordani, G. Giugliarelli, "Problemi di fisica con soluzione. Meccanica - Termodinamica - Gravitazione", 2014 CEA. ISBN 978-8808-18738-3. - P. Mazzoldi, A. Saggion, C. Voci, "Problemi di fisica generale. Meccanica - Termodinamica", 1999 Libreria Cortina. ISBN 9788877841278. - M. Zani, L. Duò, P. Taroni, "Esercizi di Fisica", I Ed./2021, ISBN 9788836230297.

SYLLABUS

Hrs	Frontal teaching
6	PHYSICS, MEASUREMENT AND VECTORS: Standard of Length, Mass and Time. Matter and Model Building. Dimensional Analysis. Conversion of Units. Estimates and Order of magnitude calculations. Coordinate systems. Vector and Scalar quantities. Some properties of vectors. Components of a vector and unit vectors.
8	MOTION IN ONE AND TWO DIMENSIONS: Position, velocity and speed. Instantaneous velocity and speed. Acceleration. Motion diagrams. One-dimensional motion with constant acceleration. Freely falling objects. Kinematic Equations derived from calculus. General Problem-solving strategy. Simple harmonic motion. Two-dimensional motion with constant acceleration. Projectile motion. Uniform circular motion. Tangential and radial acceleration. Relative velocity and relative acceleration.
8	THE LAWS OF MOTION: The concept of Force. Newton's first law and inertial frames. Mass. Newton's second law. The gravitational force and weight. Newton's third law. Forces of friction. Circular motion and other applications of Newton's laws. Motion in accelerated frames. Motion in the presence of resistive forces. Linear momentum and its conservation. Impulse and momentum.
7	ENERGY AND ENERGY TRANSFER: Work done by a force. Kinetic energy and the work-kinetic energy theorem. The non-isolated system. Conservation of energy. Situations involving kinetic friction. Power. Potential energy of a system. Conservation of Mechanical energy. Conservative and nonconservative forces. Relationship between conservative forces and potential energy. Energy diagrams and equilibrium of a system.
7	MOTION OF A SYSTEM OF PARTICLES: The center of mass. Motion of a system of particles. Angular position, velocity and acceleration. Angular and linear quantities. Angular momentum. Conservation of angular momentum. Collisions in one dimension. Two-dimensional collisions. Rocket propulsion.

SYLLABUS

Hrs	Frontal teaching
8	ROTATION OF A RIGID OBJECT: Rotational kinematics: rotational motion with constant angular acceleration. Rotational kinetic energy. Calculation of moments of inertia. Torque. Relationship between torque and angular acceleration. Work, power and energy in rotational motion. Rolling motion of a rigid object. The motion of gyroscopes and tops. Angular momentum as a fundamental quantity. The conditions for static equilibrium.
4	FLUID MECHANICS: Pressure. Variation of pressure with depth. Pressure measurements. Buoyant forces and Archimede's principle. Fluid dynamics. Bernoulli's equation. Other applications of fluid dynamics.
4	WAVE MOTION: Propagation of a disturbance. Sinusoidal waves. The speed of waves on strings. The linear wave equation. Speed of sound waves. The Doppler effect. Superposition and standing waves.

Hrs	Practice
3	Motion in one and two dimensions.
6	The laws of motion.
4	Work and energy.
6	Motion of a system of particles.
6	Rigid object dynamics.
4	Fluid mechanics.