UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Matematica e Informatica		
ACADEMIC YEAR	2020/2021		
BACHELOR'S DEGREE (BSC)	COMPUTER SCIENCE		
INTEGRATED COURSE	PHYSICS		
CODE	03245		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	FIS/07		
HEAD PROFESSOR(S)	MANTEGNA ROSARIO NUNZIO	Professore Ordinario	Univ. di PALERMO
OTHER PROFESSOR(S)	MANTEGNA ROSARIO NUNZIO	Professore Ordinario	Univ. di PALERMO
	MICCICHE' SALVATORE	Professore Ordinario	Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	1		
TERM (SEMESTER)	Annual		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**MANTEGNA ROSARIO NUNZIO** Tuesday 15:00 17:00 Studio del docente presso l'Edificio 18 di Viale delle Scienze previa comunicazione email all'indirizzo rosario.mantegna@unipa.it Professor's office located at Building 18 in Viale delle Scienze upon previous email agreement to rosario.mantegna@unipa.it **MICCICHE' SALVATORE** Tuesday 15:00 17:00 Dipartimento di Fisica e Chimica, Viale delle Scienze, Ed. 18, Studio del docente. Gli studenti sono pregati di iscriversi tramite portale UNIPA. \\ Department of Physics and Chemistry, Viale delle Scienze, Ed. 18, Lecturer's office. Students are requested to register through the UNIPA portal.		

DOCENTE: Prof. ROSARIO NUNZIO MANTEGNA

PREREQUISITES	Mathematical concepts typically acquired in high schools, including trigonometry and logarithms. Knowledge of basic concepts of mathematical analysis such as derivatives and integrals is not necessary although useful.
LEARNING OUTCOMES	Knowledge and ability to understand - Acquisition of concepts and laws of classical physics. Ability to apply physics laws to the solution of physics problems. Ability to apply knowledge and understanding - Ability to solve problems of physics and also to extend the scientific analysis to wider contexts and to apply the scientific method to the solutions of the different problems. Autonomy of judgment - A critical approach is stimulated in the learning of the various concepts and in the resolution of physics problems, comparing, where possible, different approaches or methodologies to a solving procedure, possibly discarding the less suitable ones or, where applicable, the inappropriate ones. Communicative skills - Students are invited to interact during the lesson, exposing their evaluation and their solution to the discussed topic. Learning skills - The autonomous approach to the written text, its analysis and use is stimulated. All skills are carefully evaluated during the exam.
ASSESSMENT METHODS	The final assessment consists of a written test and an oral test. The written test concerns the resolution, without the aid of textbooks or notes, of some problems concerning some of the main laws of classical physics. The written examination allows to verify the degree of knowledge of the physical laws object of the teaching. In particular, we highlight the ability to analyze a physical phenomenon and its mathematical systematization, as well as the ability to obtain quantitative results. The oral examination consists of an interview concerning the enunciation and discussion of the studied physical laws and their use in solving problems proposed to the candidate. This test makes it possible to evaluate not only the candidate's knowledge and his ability to apply them, but also the possession of properties of scientific language and of clear and direct exposure skills. The final evaluation will be obtained by averaging the assessments of the written and oral tests, also taking into account any ongoing tests. It, appropriately graded, will be formulated on the basis of the following conditions: a) Basic knowledge of the studied physical laws and limited ability to apply them autonomously, sufficient capacity to analyze the presented phenomena and to show the procedures followed (grade interval 18-21); b) Good knowledge of the studied physical laws and ability to apply them autonomously to situations similar to those studied, discrete ability to analyze the presented phenomena and to show the procedures followed (grade interval 22-25); c) In-depth knowledge of the studied physical laws and ability to apply them to each physical phenomenon proposed, even with some hesitation, good ability to analyze the presented phenomena and to show the procedures followed (grade interval 26-28); d) In-depth and widespread knowledge of the studied physical laws and the ability to apply them promptly and correctly to each proposed physical phenomenon, excellent ability to analyze the presented phenomena and excellent communication skills (grade interval 29-30L). At the end of each of the two units in which the course is divided, two tests will be carried out. The "in itinere" tests are held in the periods provided by the educational calendar or during the examination periods. The procedures for conducting and evaluating the tests are the same as those of the final examination, with the only difference that they will only deal with the part of the program carried out in the unit. The passing of both tests with a minimum grade of 15/30 allows direct access to the oral examination. The students failing to pass the tests will take the written and oral exam scheduled according to the academic calendar.
TEACHING METHODS	The teaching activity is developed through lessons including sessions of problem solving. This approach aims to test skills of students when applying physical concepts and constitute a useful training to the intermediate test and to the final exam.

MODULE
POINT MECHANICS

Prof. ROSARIO NUNZIO MANTEGNA

SUGGESTED BIBLIOGRAPHY

Testo di riferimento:
R. A. Serway Jewett – Fisica per scienze ed Ingegneria - Volume primo V edizione - ISBN 978-88-7959-834-7 EdiSES

AMBIT	10701-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48

EDUCATIONAL OBJECTIVES OF THE MODULE

The aim of the teaching unit is to introduce the student to the knowledge of the variables, concepts and laws of classical mechanics and thermodynamics.

SYLLABUS

Hrs	Frontal teaching
2	Introduction - - Measure and measurement error - Significant digits - Dimensional analysis. Units of measurement and international measurement system.
2	One-dimensional motion - Coordinate reference system - Displacement - Average speed and instantaneous velocity - Motion with constant acceleration.
2	Vectors and scalars - Vector operations - Scalar product - Vector product.
2	Two dimensional motion - Projectile motion - Problem solving.
2	Newton's laws.
2	Forces observed in mechanical systems - Tension and friction- Problem solving.
2	Circular motion - Netwon's law of universal gravitation - Fundamental forces and derived forces.
2	Work - Kinetic energy - Potential energy - Conservative force and non-conservative force -
2	Mechanical energy and its conservation - Problem solving
2	Momentum - Impact and impulse - Conservation of energy and momentum in collisions - Elastic collisions in one dimension - Inelastic collisions - Center of mass.
2	Conservation of momentum. Problem solving.
2	Harmonic motion - Spring-mass system - Simple pendulum - Damped harmonic oscillator - Forced damped harmonic oscillator - Resonance.
2	Harmonic motion - Problem solving.
2	Waves - Transverse and longitudinal waves - Energy carried by waves - Wave equation in one dimension.
2	Wave reflection and wave interference - Stationary wave.
2	Waves - Problem solving.
2	Temperature and thermometers - Thermal equilibrium and zero principle of thermodynamics - Ideal gas law and absolute temperature - Kinetic theory of gases.
2	Heat as energy transfer - Specific heat - Latent heat - Thermal expansion - Heat transmission: conduction, convection and radiation.
2	Temperature and heat - Problem solving.
2	First law of thermodynamics - Internal energy - Thermodynamic processes: isothermal, isentropic, isobaric and isochoric.
2	First law of thermodynamics - Problem solving.
2	Heat engines -Second law of thermodynamics - Entropy - Statistical interpretation of entropy.
2	Second law of thermodynamics - Problem solving.
2	Special lecture: The kicked pendulum.

MODULE
ELECTROMAGNETISM AND OPTICS

Prof. SALVATORE MICCICHE'

SUGGESTED BIBLIOGRAPHY	
P. Mazzoldi, M. Nigro, C. Voci. Elementi di Fisica - Elettromagnetismo ed Onde. Edises. ISBN: 978 88 7959 478 3.	
AMBIT	10701-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48
EDUCATIONAL OBJECTIVES OF THE MODULE	
The aim of the module is to introduce the study of electric and magnetic phenomena and the study of electromagnetic waves.	

SYLLABUS

Hrs	Frontal teaching
2	Introduction to the Course. Coulomb force. Electric field. Electric field of a point charge.
2	Electrical potential of a point charge. Work and electrical potential. Classroom exercises on electric charges and Coulomb force.
2	Circulation theorem. Conservative character of electric forces. Gauss theorem. Field flow generated by a point electric charge exiting a sphere concentric to the charge. Field of an infinitely extended plane. Field of an infinitely long thin wire.
2	Proof of Gauss' theorem. Electric field generated by a conductive spherical shell. Electric field generated by a full sphere.
2	Electric field generated by a charged ring and electric field generated by a charged disc. Force exerted between two loaded rings. Classroom exercises on: electric fields generated by charge distributions.
2	Electric current. Ohm's law. Resistors in series and in parallel. Dissipated power and Joule effect.
2	Capacitors. Charge and discharge of the capacitor. Capacitors in series and in parallel. Energy stored in the capacitor.
2	Magnetic phenomena and the Biot-Savart Law. The magnetic field. Laplace's law for the magnetic field. Field of an infinitely long thin wire with current. Field of a circular loop crossed by current.
2	The circulation theorem for the magnetic field. The flow theorem for the magnetic field. Field of a thick wire infinitely long current path. Field of a hollow wire infinitely long traversed by current. Classroom exercises on magnetic fields.
2	Solenoid. Classroom exercises on magnetic fields.
2	The Lorentz force. The work done by the Lorentz Force. Classroom exercises on the Lorentz force and the Biot-Savart force.
2	Faraday's Law. Lenz's Law. The inductance. Calculation of the auto-inductance for a solenoid and for a toroid. Classroom exercises on Faraday's law.
2	RL circuits. Extra-opening current in RL circuits. Energy density of the magnetic field. Classroom exercises on Faraday's law and inductances.
2	RLC circuits. Resonance Frequency. Classroom exercises on RLC circuits and magnetic fields.
2	Classroom exercises on magnetic fields.
2	Electromotive force and electromotor field. Displacement current and Ampere-Maxwell's law. Maxwell's equations in integrated form. Maxwell's equations in the absence of sources in integral form. Maxwell's equations in the absence of sources in differential form. D'Alembert equation.
2	Electromagnetic field relations. Energy carried by electromagnetic fields. Poynting vector. Orthogonality of electromagnetic fields. Transversality of electromagnetic fields.
2	Elements of wave physics. Plane waves. Intensity of a plane wave.
2	Huygens-Fresnel principle. Construction of the Huygens-Fresnel wave fronts. Diffraction. Wave overlap, Constructive and destructive interference, Beats.
2	Interference of two coherent sources. Interference of two non coherent sources. Interference from a rectangular slit. Classroom exercises on waves.
2	Refraction and reflection of electromagnetic waves. Derivation of Snell's Law. Physical interpretation of the refraction coefficient. Transmission coefficients and reflection in small-angle approximation: continuity of the wave function. Transmission and reflection coefficients in approximation of small angles: transmitted and reflected energy.
2	Doppler effect. Classroom exercises on waves.
2	Polarization of light. Plane wave linearly polarized, Plane wave circularly polarized. Intensity of plane and spherical electromagnetic waves.
2	Classroom exercises on waves.