UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Medicina di Precisione in area Medica, Chirurgica e Critica
ACADEMIC YEAR	2021/2022
MASTER'S DEGREE (MSC)	DENTISTRY
SUBJECT	APPLIED PHYSICS
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50443-Discipline generali per la formazione dell'odontoiatra
CODE	17186
SCIENTIFIC SECTOR(S)	FIS/07
HEAD PROFESSOR(S)	MILITELLO VALERIA Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	7
INDIVIDUAL STUDY (Hrs)	105
COURSE ACTIVITY (Hrs)	70
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**MILITELLO VALERIA** Monday 15:00 17:00 Ufficio personale al primo piano dell'Edificio 18 Viale delle Scienze. Si prega di contattarmi preventivamente via email per conferma.

DOCENTE: Prof.ssa VALERIA MILITELLO

PREREQUISITES	basic knowledge in Mathematics and Physics learned at high level school
LEARNING OUTCOMES	LEARNING OUTCOMES Knowledge and ability to understand: developing the knowledge and the application of physical quantities, their derivation and measurement. The students must know and understand the fundamental laws of classical physics related to mechanics, fluid mechanics, thermodynamics up to electromagnetisms; they must explain some phenomena related to the medicine and learn the basic concepts of molecular and nuclear physics useful in dental practice, optics and the new biomaterials used. Capacity to apply knowledge and understanding: the students must know how to apply the studied concepts to practical examples and problem-solving, but must also acquire a capacity of reasoning for demonstration of the laws and to the solution of the exercises; in addition, through concrete examples, exercises and simulations, they have to know how to apply the basic concepts to ordinary phenomenons and to basic processes in medicine and dentistry. Independent judgment: the students must get known independent judgment in solving exercises and problems and find the right solution even with different way. Communicative competences: the students have to acquire skills and tools to build, explain and present graphs and bibliographical data. Learning capacity: development and deepening of the acquired knowledges by consulting specialized literature and physics basic theory of some diagnostic and therapeutic applications.
ASSESSMENT METHODS	Test Type: written exercises and tests (oral discussion is optional). The test is intended to assess whether the student possesses knowledge and understanding of the teaching program topics, ability to apply the acquired knowledges through calculations and theorical proof, discipline-specific language, independent judgment. Minimum number of exercises: the student will have to solve a minimum of 3/4 whole exercises to obtain the minimum grade, i.e.18. The exercises will cover all the topics of the teaching program, with reference to the recommended texts. Evaluation and its criteria: the evaluation is shown in the diagram below. A – A+ Excellent30-30 cum laude Eccellente Excellent knowledge of teaching contents; students should show high analytical and synthetic capabilities and should be able to apply their knowledge to solve highly complex problems. B Very good 27-29 Ottimo Very good knowledge of the teaching contents and excellent language control; students should show analytical and synthetic skills and be able to apply their knowledge to solve problems of medium and, in some cases, even higher complexity. C Good 24- 26 BuonoGood knowledge of teaching contents and good language control; the students should be able to apply their knowledge to solve problems of medium complexity D Satisfactory 21-23 Discreto Average knowledge of the teaching contents, in some cases limited to the main topic; acceptable ability to use the specific discipline language and independently apply the acquired knowledge. E Sufficient18-20 Sufficiente Minimum teaching content knowledge, often limited to the main topic; modest ability to use the subject specific language and independently apply the acquired knowledge. F Fail Insufficiente Lack of an acceptable knowledge of the main teaching content knowledge; very little or no ability to use the specific subject language and apply independently the acquired knowledge.
EDUCATIONAL OBJECTIVES	At the end of the course the students should be able to: - know the of physics methods and some basic concepts of mechanics, thermodynamics and electromagnetism; - acquire general physical concepts and specific concepts of some particular areas of physics such as biomechanics and physics of fluids to have the tools to understand some phenomena investigated in the field of medical physics as the biomechanics of the jaw and the physics of cardiovascular system. - solve simple problems by using basic physics concepts to appreciate the quantitative nature of the discipline. - understand the latest biomedical applications based on physics, on optics and new materials used in medicine.

TEACHING METHODS	lessons and practice exercises
SUGGESTED BIBLIOGRAPHY	Giancoli DC "Fisica con Fisica moderna" Casa Ed Ambrosiana, Terza Edizione, ISBN: 9788808186102 Domenico Scannicchio, Fisica Biomedica, Terza Edizione, ISBN: 9788879597814

SYLLABUS

Hrs	Frontal teaching
8	FUNDAMENTALS OF MECHANICAL Physical quantities. Fundamental and derived quantities. Measurement units systems. Vectors and scalars. Operations with vectors. Kinematic of motion. Speed. Acceleration. Trajectories. Motion in one and in two dimensions. Rectilinear uniform motion, accelerated motion. Uniform circular motion. Periodic and armonic motion. Exercises.
8	Dynamic. Forces. Mass. Newton's laws. Force-Weight. Friction force. Elastic forces. Dynamics of circular motion. Excercises
8	Work and Energy. Work of a force. Kinetic energy. Potential energy. Conservation of mechanical energy. Power and performance. Exercises.
10	Momentum. Internal and external forces to a mechanical system. Principle of conservation of momentum. Collisions in one dimension. Elastic and inelastic collisions. Biomechanics. Center of mass of a rigid body. Elements of rotational dynamics. Moment of force. Angular momentum. Equilibrium of a rigid body. The constraints and levers. The joints equilibrium. Levers of the human body. Elasticity and Hooke's law. Stress and strain. Fractures. Exercises.
8	Mechanics of fluids. Gas and liquid. Density of a fluid. Statics of fluids. Stevin’s law. Pascal's Law. Archimedes' principle. ideal stationary fluids. Dynamics of fluids. Flow in a duct. Bernoulli’s equation. Viscous liquids. Newtonian liquids. Poiseuille’s law. Physical description of the cardiovascular system. The blood as a Newtonian fluid. Mechanical resistance of a duct. Resistance and blood flow. The heart and blood pressure. Diffusion and osmosis. Exercises.
8	THERMODYNAMICS. Heat. zero principle of thermodynamics. temperature scales. Thermometer Gas and absolute temperature. Thermal and specific heat capacity. Latent heat present in the phase transitions. First law of thermodynamics. Reversible and irreversible transformations termodinamice. Transformations isothermal, isochoric, isobaric and adiabatic. thermal machines. Efficiency of a thermal machine. The Carnot machine. Entropy. The second law of thermodynamics. Exercises.
8	ELECTROMAGNETISM. Electric charges. Forces and electric fields. Magnets. Forces and magnetic fields.Electromagnetic field. Maxwell's laws. Transverse and longitudinal waves. Wavelength and propagation velocity. General form of the wave function. Light-matter interaction: electromagnetic radiation and photons. Energy, frequency and wavelength. Electromagnetic spectrum and spectral regions. Ionizing and non ionizing radiations. X-ray. Photoelectric effect and Compton effect. Radiation damage. Exercises and examples.
8	OPTCS and BIOMATERIALS. UV-Visible light. Light absorption and emission. Reflection, refraction and dispersion of light. Interference. Spectroscopies and biomedical techniques. Nuclear physics and radioactivity. Structure and properties of the nucleus. Energy and nuclear forces. Radioactivity. Alpha, beta and gamma decay. Biomaterials: physical properties and uses. Spectroscopic methods for characterizations. Examples.

Hrs	Practice
2	Test in Mechanics: solving exercises.
2	Test on the second part studied: exercises and questions.