UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Biomedicina, Neuroscienze e Diagnostica avanzata
ACADEMIC YEAR	2017/2018
MASTER'S DEGREE (MSC)	MEDICINE AND SURGERY
SUBJECT	PHYSICS
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50400-Discipline generali per la formazione del medico
CODE	90402
SCIENTIFIC SECTOR(S)	FIS/07
HEAD PROFESSOR(S)	MICCICHE' SALVATORE Professore Ordinario Univ. di PALERMO MANTEGNA ROSARIO NUNZIO Professore Ordinario Univ. di PALERMO CASCIO DONATO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	90
COURSE ACTIVITY (Hrs)	60
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**CASCIO DONATO** Tuesday 16:00 18:00 -- Il ricevimento viene effettuato su teams. Si prega di richiedere appuntamento almeno due giorni prima via email (donato.cascio@unipa.it), indicando il Corso di Laurea di appartenenza. **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. DONATO CASCIO- *Sede HYPATIA*

PREREQUISITES	The prerequisites are those required at national level in order to access to the Degree Courses in Medicine and Surgery. In fact, to be admitted to the degree course, perspective students must pass a mandatory access competition based on tests that also include questions related to physics.
LEARNING OUTCOMES	KNOWLEDGE AND UNDERSTANDING: Knowing the general principles of physics. Knowing the basic laws of mechanics, fluids, thermodynamics and electromagnetism and their main applications to the biomedical sciences. In order to verify the achievement of this goal , in the written exam there are a number of exercises aiming at verifying what is the methodological approach of the student. APPLYING KNOWLEDGE and UNDERSTANDING: Knowing how to do an energy balance. Know how to choose the instrumental techniques more suitable for measuring a physiological parameter. Knowing how to evaluate the accuracy of the measurement of a physiological parameter. Ability to assess the physical principles that underlie certain physiological mechanisms and their relevance for diagnostic purposes. In order to verify the achievement of this goal, in the written test there are a number of applicationoriented exercises. In addition the modality of multiple choice tests allows to assess whether the student is able to discern reasonable results from results evidently not reliable. MAKING JUDGEMENTS: Developing the capacity of being autonomous through the continuos application of concepts and techniques of physics to biological and biomedical problems. COMMUNICATION SKILLS: Ability to correctly describe the physical principles underlying a biomedical and biological phenomenon , presenting in a clear and rigorous way the hypothesized model, the mathematical procedure used and the results obtained. LEARNING SKILLS: Capacity to deepen, not in a notional shape but rather with a critical and quantitatively founded approach, the concepts presented during the course, even through the study of different texts. Ability to take into account the approximations on which a physical model is based, and therefore of its limitations in effectively describe the biological and biomedical processes.
ASSESSMENT METHODS	Written exam with multiple choice test followed by an optional oral examination. The written exam is passed with a minimum score of 15/30. The oral examinations mandatory when a score of 15/30 , 16/30 , 17/30 is achieved in the written exam. The oral exam is at the discretion of the Commission in case of score greater than or equal to 18/30. Where possible/necessary, the access to the written exam might be preceded by a pre-test to be held in a computer room. The final evaluation will be graded based on the following scale: A) Excellent knowledge of teaching content; the student demonstrates high analytic-synthetic capacity and is able to apply the knowledge to solve highly complex problems (score 30, 30L; Excellent) B) Excellent knowledge of teaching content and excellent properties of language; students demonstrate analytical and synthetic skills and able to apply their knowledge to solve problems of medium complexity and, in some cases, even higher (score 27-19; Very Good) C) Good knowledge of teaching content and good properties of language; the student is able to apply knowledge to solve problems of medium complexity (score 24-26; Good) D) Satisfactory knowledge of teaching content, in some cases limited to the main topic; acceptable ability to use the specific language of the discipline and independently apply the knowledge gained (score 21-23; Satisfactory) E) Minimum knowledge of teaching content, often limited to the main topics; modest ability to use the specific language of the discipline and independently apply the knowledge acquired (score 18-20; Sufficient) F) Do not have an acceptable knowledge of the main teaching content; very little or no ability to use the specific language of the discipline and independently apply the acquired knowledge (score 1-17; Fail)
EDUCATIONAL OBJECTIVES	- To have a good basic knowledge on different physical phenomena at the base of a biomedical and biological nature phenomenon. - Acquire a certain familiarity with the scientific method of investigation and, in particular, with the modeling of biomedical and biological real problems. - Acquiring skills to critically evaluate the physical models used, identifying their operational benefits and limitations. - Have adequate understanding of mathematical tools as well as the capacity to use them.
TEACHING METHODS	Lectures in classroom. During the lectures basic concepts of physics and their simple applications in biological and biomedical systems are taught. Part of the lectures are reserved for classroom exercises aiming at teaching the student to

	have a quantitative approach to the analysis of a given problem.
SUGGESTED BIBLIOGRAPHY	R. C. Davidson, Metodi matematici per un corso introduttivo di fisica, EdiSES, Napoli, ISBN 8879591363. D. C. Giancoli, Fisica. Pricipi ed Appllicazioni, CEA, ISBN:8808087735 D. Scannicchio, Fisica biomedica, Edises, Napoli, ISBN: 9788879595582.

SYLLABUS

Hrs	Frontal teaching
2	Introduction to the course. Primitive and derived physical quantities. Unit systems. Dimensional equations. Scalar and Vectorial physical quantities. Vectors. Sum and difference of vectors, scalar and vector product. Brief notes on the Theory of errors. Significant digits.
2	Kinematics: space, speed and acceleration. Uniform rectilinear motion and uniformly accelerated motion. Time Law and time diagrams. Brief notes on the uniform circular motion.
2	EXERCISES in CLASSROOM on topics related to kinematics
2	Newton's laws. Mass definition. Types of forces: weight force, tension, elastic force. Projectile motion. Harmonic oscillator motion.
2	Strength of static and dynamic friction. Work of a force. Kinetic energy theorem. Power. Conservative forces. Conservation of energy theorem.
2	Momentum. Conservation of Momentum. Collisions in one dimension. Center of mass.
2	EXERCISES in CLASSROOM on topics related to the dynamics of the material point
2	Physical quantities of Fluids: pressure and density. Fluids at equilibrium: Stevin's law, Archimedes' principle, Principle of Communicating Vessels.
2	Fluid Dynamics: mass and volume flow. Ideal fluids: Equation of Continuity. Bernoulli's theorem. Newtonian fluids: Viscosity, Poiseuille Law, hydrodynamic resistance. Notes on laminar and turbulent motion.
2	Real Newtonian fluids: Viscosity, Poiseuille Law, hydrodynamic resistance. Notes on laminar and turbulent motion.
2	EXERCISES in CLASSROOM on topics related to fluid dynamics
2	Transport in viscous regime: Stokes's Law, the erythrocyte sedimentation speed, centrifuges.
2	Forces of Cohesion and Surface Tension. Capillarity phenomena. Elastic membranes. Laplace law.
2	EXERCISES in CLASSROOM on topics related to viscosity, capillarity and elastic membranes
2	Physical quantities of Thermodynamics: Temperature and Heat. Brief notes on specific heats. Thermal expansion of solids and liquids. Calorimetry. Thermodynamic systems. Mechanical equivalent of the calorie. Internal Energy and the First law of Thermodynamics.
2	Ideal gases and their thermodynamic transformations. Cyclic transformations.
2	EXERCISES in CLASSROOM on topics related to thermodynamics and ideal gases
2	Kinetic theory of ideal gases. Statistical foundations of the concept of entropy. Entropy and the second law of thermodynamics: Clausius statement.
2	EXERCISES in CLASSROOM on topics related to ideal gases and entropy
2	Physical characterization of semipermeable membranes in biological systems. Diffusion of solutes in solution. Fick's laws of diffusion.
2	Semipermeable membranes and osmotic balance. Van't Hoof Law. Osmotic work and chemical potentials. Osmotic equilibrium in biological systems. Electrochemical potentials. Nernst equation. Donnan-Gibbs equilibrium.
2	EXERCISES in CLASSROOM on topics related to semipermeable membranes
2	Waves and their characteristics: amplitude, velocity, wavelength and period. Wave equation.Plane waves. Waves superposition. Riflection and Rifraction. Doppler Effect.
2	Recall of concepts related to electrical and magnetic phenomena.
2	Electromagnetic waves. Electromagnetic spectrum. Energy of Electromagnetic waves. Photons. Transverse and longitudinal mechanical waves. Energy of mechanical waves.
2	EXERCISES in CLASSROOM on topics related to waves
2	Structure and properties of the nucleus. Binding energy and nuclear forces. Ionizing radiation sources and receivers. Law of radioactive decay. Alpha decay. Beta decay. Gamma Decay. Conservation of nucleon number and other conservation laws. Decay series.Decay law.
2	Basic examples of interaction between radiation and matter: Compton effect and photoelectric effect. Attenuation of electromagnetic radiation in the presence of targets: exponential law. Absorption of radiation in human tissues. Bragg peak. Dosimetric quantities.
2	Concept of resonance. Magnetic resonance.
2	EXERCISES in CLASSROOM on topics related to radioactivity and decays

DOCENTE: Prof. ROSARIO NUNZIO MANTEGNA- *Sede IPPOCRATE*

PREREQUISITES	The prerequisites are those required at national level in order to access to the Degree Courses in Medicine and Surgery. In fact, to be admitted to the degree course , perspective students must pass a mandatory access competition based on tests that also include questions related to physics.
LEARNING OUTCOMES	KNOWLEDGE AND UNDERSTANDING: Knowing the general principles of physics. Knowing the basic laws of mechanics, fluids, thermodynamics and electromagnetism and their main applications to the biomedical sciences. In order to verify the achievement of this goal , in the written exam there are a number of exercises aiming at verifying what is the methodological approach of the student. APPLYING KNOWLEDGE and UNDERSTANDING: Knowing how to do an energy balance. Know how to choose the instrumental techniques more suitable for measuring a physiological parameter. Knowing how to evaluate the accuracy of the measurement of a physiological parameter. Ability to assess the physical principles that underlie certain physiological mechanisms and their relevance for diagnostic purposes. In order to verify the achievement of this goal, in the written test there are a number of application-oriented exercises. In addition the modality of multiple choice tests allows to assess whether the student is able to discern reasonable results from results evidently not reliable . MAKING JUDGEMENTS: Developing the capacity of being autonomous through the continuos application of concepts and techniques of physics to biological and biomedical problems. COMMUNICATION SKILLS: Ability to correctly describe the physical principles underlying a biomedical and biological phenomenon , presenting in a clear and rigorous way the hypothesized model, the mathematical procedure used and the results obtained. LEARNING SKILLS: Capacity to deepen, not in a notional shape but rather with a critical and quantitatively founded approach, the concepts presented during the course, even through the study of different texts. Ability to take into account the approximations on which a physical model is based, and therefore of its limitations in effectively describe the biological and biomedical processes.
ASSESSMENT METHODS	Written exam with multiple choice test followed by an optional oral examination. The written exam is passed with a minimum score of 15/30. The oral examinations mandatory when a score of 15/30 , 16/30 , 17/30 is achieved in the written exam. The oral exam is at the discretion of the Commission in case of score greater than or equal to 18/30 . Tests are planned during the course for specific parts of the program. They are reserved to students who have attended at least 2/3 of the lessons on topics to be tested. Where possible/necessary, the access to the written exam might be preceded by a pre-test to be held in a computer room. The final evaluation will be graded based on the following scale: A) Excellent knowledge of teaching content; the student demonstrates high analytic-synthetic capacity and is able to apply the knowledge to solve highly complex problems (score 30, 30L; Excellent) B) Excellent knowledge of teaching content and excellent properties of language; students demonstrate analytical and synthetic skills and able to apply their knowledge to solve problems of medium complexity and, in some cases, even higher (score 27-19; Very Good) C) Good knowledge of teaching content and good properties of language; the student is able to apply knowledge to solve problems of medium complexity (score 24-26; Good) D) Satisfactory knowledge of teaching content, in some cases limited to the main topic; acceptable ability to use the specific language of the discipline and independently apply the knowledge gained (score 21-23; Satisfactory) E) Minimum knowledge of teaching content, often limited to the main topics; modest ability to use the specific language of the discipline and independently apply the knowledge acquired (score 18-20; Sufficient) F) Do not have an acceptable knowledge of the main teaching content; very little or no ability to use the specific language of the discipline and independently apply the acquired knowledge (score 1-17; Fail)
EDUCATIONAL OBJECTIVES	- To have a good basic knowledge on different physical phenomena at the base of a biomedical and biological nature phenomenon. - Acquire a certain familiarity with the scientific method of investigation and, in particular, with the modeling of biomedical and biological real problems. - Acquiring skills to critically evaluate the physical models used, identifying their operational benefits and limitations. - Have adequate understanding of mathematical tools as well as the capacity to use them.
TEACHING METHODS	Lectures in classroom. During the lectures basic concepts of physics and their simple applications in biological and biomedical systems are taught. Part of the

	lectures are reserved for classroom exercises aiming at teaching the student to have a quantitative approach to the analysis of a given problem.
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SYLLABUS

Hrs	Frontal teaching
2	Introduction to the course. Primitive and derived physical quantities. Unit systems. Dimensional equations. Scalar and Vectorial physical quantities. Vectors. Sum and difference of vectors, scalar and vector product. Brief notes on the Theory of errors. Significant digits.
2	Kinematics: space, speed and acceleration. Uniform rectilinear motion and uniformly accelerated motion. Time Law and time diagrams. Brief notes on the uniform circular motion.
2	Tutorial on kinematics
2	Newton's laws. Mass definition. Types of forces: weight force, tension, elastic force. Projectile motion. Harmonic oscillator motion.
2	Strength of static and dynamic friction. Work of a force. Kinetic energy theorem. Power. Conservative forces. Conservation of energy theorem.
2	Momentum. Conservation of Momentum. Collisions in one dimension. Center of mass.
2	Tutorial on the dynamics of the material point
2	Physical quantities of Fluids: pressure and density. Fluids at equilibrium: Stevin's law, Archimedes' principle, Principle of Communicating Vessels.
2	Fluid Dynamics: mass and volume flow. Ideal fluids: Equation of Continuity. Bernoulli's theorem. Newtonian fluids: Viscosity, Poiseuille Law, hydrodynamic resistance. Notes on laminar and turbulent motion.
2	Real Newtonian fluids: Viscosity, Poiseuille Law, hydrodynamic resistance. Notes on laminar and turbulent motion.
2	Tutorial on fluids
2	Transport in viscous regime: Stokes's Law, the erythrocyte sedimentation speed, centrifuges.
2	Forces of Cohesion and Surface Tension. Capillarity phenomena. Elastic membranes. Laplace law.
2	Tutorial on viscous fluids, capillarity phenomena, and elastic membranes
2	Physical quantities of Thermodynamics: Temperature and Heat. Brief notes on specific heats. Thermal expansion of solids and liquids. Calorimetry. Thermodynamic systems. Mechanical equivalent of the calorie. Internal Energy and the First law of Thermodynamics.
2	Ideal gases and their thermodynamic transformations. Cyclic transformations.
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2	Electromagnetic waves. Electromagnetic spectrum. Energy of Electromagnetic waves. Photons. Transverse and longitudinal mechanical waves. Energy of mechanical waves. 2
2	Tutorial on wave phenomena
2	Structure and properties of the nucleus. Binding energy and nuclear forces. Ionizing radiation sources and receivers. Law of radioactive decay. Alpha decay. Beta decay. Gamma Decay. Conservation of nucleon number and other conservation laws. Decay series.Decay law.
2	Basic examples of interaction between radiation and matter: Compton effect and photoelectric effect. Attenuation of electromagnetic radiation in the presence of targets: exponential law. Absorption of radiation in human tissues. Bragg peak. Dosimetric quantities.
2	Concept of resonance. Magnetic resonance.
2	Tutorial on radioactivity and radioactive decays

DOCENTE: Prof. SALVATORE MICCICHE'- *Sede CHIRONE*

PREREQUISITES	The prerequisites are those required at national level in order to access to the Degree Courses in Medicine and Surgery. In fact, to be admitted to the degree course, perspective students must pass a mandatory access competition based on tests that also include questions related to physics.
LEARNING OUTCOMES	KNOWLEDGE AND UNDERSTANDING: Knowing the general principles of physics. Knowing the basic laws of mechanics, fluids, thermodynamics and electromagnetism and their main applications to the biomedical sciences. In order to verify the achievement of this goal , in the written exam there are a number of exercises aiming at verifying what is the methodological approach of the student. APPLYING KNOWLEDGE and UNDERSTANDING: Knowing how to do an energy balance. Know how to choose the instrumental techniques more suitable for measuring a physiological parameter. Knowing how to evaluate the accuracy of the measurement of a physiological parameter. Ability to assess the physical principles that underlie certain physiological mechanisms and their relevance for diagnostic purposes. In order to verify the achievement of this goal, in the written test there are a number of application-oriented exercises. In addition the modality of multiple choice tests allows to assess whether the student is able to discern reasonable results from results evidently not reliable. MAKING JUDGEMENTS: Developing the capacity of being autonomous through the continuos application of concepts and techniques of physics to biological and biomedical problems. COMMUNICATION SKILLS: Ability to correctly describe the physical principles underlying a biomedical and biological phenomenon , presenting in a clear and rigorous way the hypothesized model, the mathematical procedure used and the results obtained. LEARNING SKILLS: Capacity to deepen, not in a notional shape but rather with a critical and quantitatively founded approach, the concepts presented during the course, even through the study of different texts. Ability to take into account the approximations on which a physical model is based, and therefore of its limitations in effectively describe the biological and biomedical processes.
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2	EXERCISES in CLASSROOM on topics related to waves
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2	Basic examples of interaction between radiation and matter: Compton effect and photoelectric effect. Attenuation of electromagnetic radiation in the presence of targets: exponential law. Absorption of radiation in human tissues. Bragg peak. Dosimetric quantities.
2	Concept of resonance. Magnetic resonance.

SYLLABUS

Hrs	Frontal teaching
2	EXERCISES in CLASSROOM on topics related to radioactivity and decays