UNIVERSITÀ DEGLI STUDI DI PALERMO

SCHOOL	POLYTECHNIC SCHOOL
ACADEMIC YEAR	2016/2017
FIRST CYCLE COURSE	BIOMEDICAL ENGINEERING
SUBJECT	PHYSICS 1
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50293-Fisica e chimica
CODE	03295
SCIENTIFIC SECTOR(S)	FIS/03
HEAD PROFESSOR(S)	LO FRANCO ROSARIO Ricercatore a tempo determinato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**LO FRANCO ROSARIO** Thursday 15:00 17:00 Ufficio del docente. Viale delle Scienze, Edificio 6 (ex DIN), secondo piano, stanza 214.

DOCENTE: Prof. ROSARIO LO FRANCO

TEACHING METHODS	The course is annual (first semester and part of second semester), organized into three main topics. - The first one is intended to provide the mathematical and physical foundations of kinematics and mechanics of the material point. - The second one provides the physical and mathematical basis for the discussion of the mechanics of material points and rigid body systems. - The third one treats the statics and dynamics of ideal and real fluids and also provides elements of the physics of oscillations and mechanical waves. The teaching consists of lectures and classroom exercises. Part of the exercises is dedicated to the resolution of the exam problems. The exercises are designed to test the skills attained by students in the application of acquired knowledge and are a useful training to the ultimate test exam.
ASSESSMENT METHODS	The assessment will be done through an ongoing evaluation, a final written test and an oral test. The written tests are intended to check the degree of knowledge of the object of teaching topics that capacity 'of the candidate to use the knowledge acquired to analyze unassigned physical situations. Also the written tests (ongoing and final) have the aim to investigate the ability of the candidate to develop a computational strategy adoption of the appropriate mathematical tools in order to solve the assigned problem. At the end of the first semester is expected an ongoing evaluation to assess the level of learning acquired on the topics covered up to that point. The ongoing evaluation consists of a written test lasting two hours, with three problems (kinematics and dynamics of particle systems). The ongoing evaluation test will be judged as passed if it shows that the candidate has at least a sufficient level of both basic knowledge about the topics of the course treated in the first semester and capacity to apply them for the resolution of given problems. The final written test, lasting four hours, provides for the resolution of six problems: three problems on kinematics and dynamics of material points and three problems on rigid body dynamics and fluid dynamics. Students who have passed the test in progress at the end of the first semester will only carry out the three problems of rigid body dynamics and fluid dynamics of the final written test. The final written test will be judged as passed if the candidate will show at least an acceptable level of knowledge of the topics of the course and of their application to solving specific problems of interest. The oral test consists instead of an examination-interview concerning discussion of the topics covered during the course. The oral test, in addition to verify the acquired knowledge, allows to assess whether the candidate has adequate property 'scientific capacity and a' clear and comprehensive presentation language. The overall assessment, which will take into account all the tests of the candidate, will be made on the basis of the following criteria. - Inadequate: if the candidate does not have an acceptable knowledge of the topics covered in the teaching; - Sufficient (rating 18-21): If you have a basic understanding of the object of teaching subjects but an insufficient ability to use independently the acquired knowledge; - Satisfactory (rating 22-25): if it has not fully mastered the topics covered but has sufficient capacity of independent use of the knowledge gained; - Good (score 26-28): if you have a good command of the object of teaching topics, has a discrete property of language and demonstrates a sufficient ability 'to independently apply the knowledge acquired; - Excellent (score 29- 30 cum laude): if it demonstrates excellent knowledge and mastery of the topics of the course, excellent property of language and if it is able to apply autonomously the acquired knowledge to solve problems.
LEARNING OUTCOMES	Knowledge and understanding The student at the end of the course will have knowledge of the basic laws of classical mechanics and of the models that describe it. In particular will have understood and will know the problems regarding the mechanics of the material point, systems of material points, rigid bodies and fluids. Applying knowledge and understanding The student will know how to use the laws of physics and the mathematical equations that describe them to solve simple problems of mechanics, fluidostatics and fluidodynamics. The student will be able to outline a physical phenomenon by identifying the evolution and estimating the values of the

	physical quantities involved. The student will be able fully to assess the validity and limits of the laws and of the models used. Making judgments The student will be able to observe natural phenomena and recognize the laws that govern them; the student will be able to schematize a process, to identify the dominant causes that determine its evolution and to estimate the values of the physical quantities involved. The student will be able to determine whether a given problem must use a "dynamic" approach (analysis of the system in terms of forces), or otherwise, an "energy" approach (analysis of the system through the application of the principle of conservation of 'energy). Communication skills The student will have acquired the ability to exhibit consistently and properties of language problems concerning the topics of the course, knowing grasp the connections with the topics covered in the courses taken previously or in the same year. Will support conversations about mechanics of bodies and fluids, referring to the principles and laws on which they are based and by qualitative considerations on specific issues. Learning ability The student will have learned the basic laws of classical mechanics of bodies and fluids, the typical methods of the physical sciences to be applied to engineering problems, critically and independently.
EDUCATIONAL OBJECTIVES	To acquire the basic principles of mechanics of material points, rigid bodies and fluids. Knowing how to apply the general theory to solve simple exercises of mechanics, fluid statics and fluid dynamics.
PREREQUISITES	The prerequisites for a profitable learning and for achieving the objectives of the course are as follows: - Knowledge and mastery of basic math: algebra, equations and inequalities, trigonometry, logarithms and exponentials; - Knowledge and ability to apply the calculation of derivatives and integrals
SUGGESTED BIBLIOGRAPHY	- P. Mazzoldi, M. Nigro, C. Voci, “Fisica, vol. I”, II/2000, EdiSES, ISBN 8879591371. - D. Kleppner, R. Kolenkow, “An Introduction to Mechanics”, II/2013, Cambridge University Press, ISBN 9780521198110. - S. Focardi, I. Massa, A. Uguzzoni, M. Villa, “Fisica Generale, Meccanica e Termodinamica”, II/2014, CEA, ISBN 9788808182159. - Hugh D. Young, Roger A. Freedman, A. Lewis Ford, "Principi di Fisica vol 1, Meccanica, onde e termodinamica con Mastering Physics e etext", Pearson, ISBN 9788865189016. - R.A. Serway, J.W. Jewett, “Fisica per Scienze ed Ingegneria”, Volume 1, V/ 2015, EdiSES, ISBN 9788879598347. Siti consigliati: http://www.compadre.org/osp/search/browse.cfm?browse=gsss

SYLLABUS

Hrs	Frontal teaching
4	Topic 1. Measurement and physical quantities. Physics and the scientific method. Measurement of a physical quantity. direct and indirect measurement. fundamental and derived quantities. Systems of measurement unities and dimensional equations. The International System. Vector algebra: scalars and vectors. Decomposition and sum of vectors: geometric and analytical method. Scalar product and vector product. Derivative of a vector. Momentum of an applied vector. Position vector and coordinate systems.
6	Topic 2. Kinematics of the material point. Reference system. The law of motion of a material point. Equation of the trajectory. Rectilinear motion. Speed and acceleration in rectilinear motion. Uniform rectilinear motion and uniformly accelerated motion. Free fall motion of bodies. unsteady flow. simple harmonic motion. Motion of a particle with trajectory lying in a plane. Speed 'and acceleration in plane motion. Projectile Motion. uniform circular motion and varied. angular sizes. Relations between the linear and angular sizes. Motion in space. Composition of motions. Kinematics of relative motions. Relation between the speed and the accelerations with respect to two reference systems in relative motion. Coriolis acceleration.
6	Topic 3. Dynamics of a material point. Interactions and forces. inertial reference systems. Newton's laws. support reactions. Mass and weight. Applications of Newton's laws. friction forces. elastic forces and Hooke's law. Forces dependent on speed. Classification of forces. Impulse and quantity of motion (linear momentum). Dynamics of circular motion. central forces. The simple harmonic oscillator. Simple pendulum. Moment of force and angular momentum. Theorem of the angular momentum and of the momentum of the impulse. Laws of dynamics in a non-inertial reference frame.
6	Topic 4. Work and energy. Work of a force. kinetic energy and theorem of the kinetic energy. Fields of conservative forces. Potential energy. non-conservative forces. Mechanical energy and its conservation. The law of energy conservation. Relationship between force and potential energy. The power. energy considerations on the simple harmonic motion.

SYLLABUS

Hrs	Frontal teaching
6	Topic 5. Dynamics of systems of many particles. center of mass. Theorem of motion of center of mass. Principle of conservation of the quantity of motion. Theorem of the angular momentum. Conservation of angular momentum. Theorem of kinetic energy. frame of center of mass. König's theorems. Systems of parallel forces and center of gravity. Cardinal equations of system dynamics. Collisions between material points. variable mass systems.
6	Topic 6. Dynamics of the rigid body. Degrees of freedom. Kinematics of rigid bodies: translational motions, rotational motions with fixed or variable axis. Moment of inertia. Parallel axis (Huygens-Stenier) theorem. Dynamics of a rigid body with a fixed axis. Kinetic energy of a rigid system. Work of the forces acting on a rigid body. Pure rolling motion. free rigid body. Compound pendulum. Conservation laws in the motion of a free rigid body. Collisions between material points and rigid bodies and between rigid bodies. static equilibrium of rigid body.
5	Topic 7. mechanical properties of fluids. General characteristics of fluids. Density. Pressure. static equilibrium of a fluid. Stevin's law and the law of Pascal. barometric equation. Archimedes' principle. Ideal and real fluids. Fluid dynamics. Bernoulli's theorem and its applications. laminar flow. Viscosity. Motion in a viscous medium. Capillarity and superficial tension.
3	Topic 8. Oscillations. Calls on the simple harmonic motion. Damped oscillations. forced oscillations. Resonance. mechanical waves. Gravitation. central forces. The gravitational force. Inertial mass and gravitational mass. Field and gravitational energy.

Hrs	Practice
3	Topic 1
4	Topic 2
4	Topic 3
4	Topic 4
6	Topic 5
8	Topic 6
7	Topic 7
3	Topic 8