UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Matematica e Informatica
ACADEMIC YEAR	2016/2017
BACHELOR'S DEGREE (BSC)	MATHEMATICS
SUBJECT	THEORETICAL MECHANICS
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50195-Formazione Modellistico-Applicativa
CODE	16162
SCIENTIFIC SECTOR(S)	MAT/07
HEAD PROFESSOR(S)	SCIACCA VINCENZO Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	90
COURSE ACTIVITY (Hrs)	60
PROPAEDEUTICAL SUBJECTS	11081 - DYNAMIC SYSTEMS WITH LABORATORY
MUTUALIZATION	
YEAR	3
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**SCIACCA VINCENZO** Thursday 15:00 18:00 Dipartimento di Matematica e Informatica, via Archirafi 34, Ufficio n° 216 (2° piano)

DOCENTE: Prof. VINCENZO SCIACCA

PREREQUISITES	Differential calculus. Linear algebra. Elementary ODE's.
LEARNING OUTCOMES	Knowledge and Understanding capabilities The axioms of Mechanics. Equations of motions. Equilibrium and stability. Variational formulations. Conservation laws and conserved quantities. Hamiltonian formulation of Mechanics. Capability of applying knowledges Capability of writing the equations for the dynamics of a mechanical systems, also in presence of constraints. Capability of linearizing Lagrange equations close to equilibrium and of computing the frequency of small oscillations. Capability of writing the hamilton equations. Making judgments The student is able to find the conserved quantities for a mechanical system in presence of symmetries. The student is able to guess the equilibria of a system and make conjectures about their stability. Communication skills The student is able to elucidate, to a high school class, the properties of the most elementary mechanical systems, the concept of conserved quantity, and the idea behind the equation of motion. Learning skills The student, should be able to understand the most advanced texts of classical mechanics, for example those about the symplectic formulation of hamiltonian mechanics, those about transition to chaos and KAM theory.
ASSESSMENT METHODS	The final exam consists in a written test and of a viva voce exam. In the written test it will be asked 1) to give the qualitative properties of the motion in a central field; 2) to solve a problem with the methods of the Lagrangian Mechanics; 3) to write the Hamilton equation and to analyze them through the methods of the hamiltonian mechanics, possibly giving the solution in terms of conserved quantities. The above problems are give the weight of 20%, 60% 20% respectively. The viva voce exam will test the depth of the knowledge acquired by the student, his capability of expressing correctly. The student will be asked also to discuss the solutions he/she gave in the written test. Both oral and written test will be part of the evaluation of the student, with equal weight. The evaluation will be give according to the following criteria: a) The student does not have an acceptable knowledge of the most important topics of the course (failed) b) acceptable knowledge of the most important topics of the course, basic capability of applying the knowledge, primitive knowledge of the language of Mechanics(18-21); c) satisfactory knowledge of the main topics of the course, good skills in the use of the technical language, and satisfactory capability of solving only the most simple problems of Mechanics(22-24); d) good knowledge of the main topics of the course, very good skills in the use of the technical language, and fully satisfactory capability of solving all the proposed problems (25-27); e) excellent knowledge of the main topics of the course, capability to analyze and communicate all the subtleties of Mechanics, excellent capability of solving all the proposed problems (29-30 cum laude);
EDUCATIONAL OBJECTIVES	After introducing the principles of classical mechanics, the first goal of the course is the elucidation of the different formulations of the equations of motion, i.e. Newtonian, Lagrangian and Hamiltonian. The second goal is the introduction of techniques for the analysis of a constrained mechanical system and for the derivation of the characteristic of the motion close to equilibrium.
TEACHING METHODS	The course consists in theoretical lessons and exercise sessions. The topics of the course are addressed and discussed during theoretical lessons. Exercise sessions are used to solve exercises where students learn on the application of theoretical mechanics and on its subtleties. Written tests, mirroring the final written exam, will be administered .
SUGGESTED BIBLIOGRAPHY	L.Landau, E.Lifshitz, Meccanica Editori Riuniti, 1979. H.Goldstein Meccanica Classica Zanichelli, 2004. Gantmacher Lezioni di Meccanica Analitica Editori riuniti 1980. F.Scheck Mechanics, Springer, 2010.

SYLLABUS

Hrs	Frontal teaching
6	The principles of Mechanics.

SYLLABUS

Hrs	Frontal teaching
6	Energy, momentum, angular momentum. The two body problem, Kepler's problem.
6	Balance laws for momentum and angular momentum. The rigid body.
6	Analytical mechanics. Lagrange equations.
4	Equilibria, stability and small oscillations.
4	Introduction to Hamiltonian mechanics.

Hrs	Practice
6	Exercises on the qualitative properties of motion in a central field.
4	Exercises and examples on the rigid motion.
8	Problems on the equations of motion in the Lagrangian formalism.
6	Exercises on the determination of equilibria, on their stability and on small oscillations.
4	Exercises on hamiltonian mechanics