UNIVERSITÀ DI PAVIA

Anno Accademico 2018/2019

FOUNDATIONS OF MECHANICS

Enrollment year	2017/2018
Academic year	2018/2019
Regulations	DM270
Academic discipline	MAT/07 (MATHEMATICAL PHYSICS)
Department	DEPARTMENT OF MATHEMATICS "FELICE CASORATI"
Course	MATHEMATICS
Curriculum	PERCORSO COMUNE
Year of study	2°
Period	2nd semester (04/03/2019 - 14/06/2019)
ECTS	9
Lesson hours	84 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	PULVIRENTI ADA (titolare) - 9 ECTS
Prerequisites	Analysis 1, Analysis 2, Geometry 1 and Linear Algebra.
Learning outcomes	The aim of the course is to present the basic mathematical models of classical mechanics, in their theoretical aspects and in their applications.
Course contents	Kinematics of a point. Dynamics: fundamental principles. The motion of a free particle. Constraints. Multi particles systems. Rigid systems. Cardinal equations of dynamics. Lagrange's equations. Some classical problems: the problem of two bodies. Equilibrium and stability. Hamilton's principle.

	Hamilton's equations. Canonical tranformations. Poisson brackets. Extended summary Kinematics of a point. Frenet's frame. Constraints and their classification. The motion of a free particle. Lagrangian coordinates. Dynamics: the fundamental principles of mechanics. Work and energy. Conervatives forces. The motion of a point under constraint. Discrete systems. Cardinal equations of dynamics. Non dissipative constraints. Lagrange's equations. Lagrange's equations for conservative systems. Conservations laws. One-dimensional motions. Qualitative analysis. Some classical problems: the problem of two bodies. Keplero's equations. Rigid body: Euler's angles. Angular velocity. Relative motions. Rigid body dynamics: inertia ellipsoid. Euler's equations. Lagrange's gyroscope. Equilibrium and stability: Lagrange-Dirichlet theorem. Instability criteria. Small oscillations. Variational principles of mechanics: Hamilton's principle. The Hamiltonian function (via Legendre transformation). Hamilton's equations. Canonical tranformations. Poisson brackets.
Teaching methods	Lectures and exercises.
Reccomended or required readings	1.Fasano A., Marmi S.,: "Meccanica Analitica", Bollati Boringhieri. 2.Goldstein H., Poole C., Safko J.: "Meccanica Classica", Zanichelli. 3.Gantmacher F.R.: "Lezioni di Meccanica Analitica", Editori Riuniti. 4.Lanczos C., : "The variational principles of Mechanics, Dover.
Assessment methods	Written and oral examination.
Further information	Written and oral examination.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile