UNIVERSITÀ DI PAVIA

Anno Accademico 2020/2021

MATHEMATICAL PHYSICS	
Enrollment year	2020/2021
Academic year	2020/2021
Regulations	DM270
Academic discipline	MAT/07 (MATHEMATICAL PHYSICS)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	ELECTRICAL ENGINEERING
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	1st semester (28/09/2020 - 22/01/2021)
ECTS	6
Lesson hours	60 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	ROSSO RICCARDO (titolare) - 6 ECTS
Prerequisites	Notions given in standard courses in Calculus and Geometry.
Learning outcomes	The course aims at giving an overwiev of classical mechanics to show that an adequate mathematical formulation can give a deep insight into the problems of this discipline.
Course contents	Vector and tensor algebra Scalar and vector product; mixed product and repeated vector product; Diadics; symmetric tensors: spectral theorem. Skew-symmetric tensors: spin axis. Orthogonal tensors: Euler's angles. Systems of vectors Relative and rigid-body kinematics Poisson formulae; Time derivatives of vectors in different frames. Basic formulae in relative kinematics. Fundamental formula in rigid kinematics; Planar rigid motion: Chasles theorem.

General kinematics
Center of mass of a system of mateiral points; Momentum, moment of momentum, and kinetic energy. Transport theorem for moment of momentum. König's theorem.

Inertia tensor
Definition and main properties of the inertia tensor. Moments of inertia. Huygens-Steiner theorem. Theorem of perpendicular axes. Composition theorem. Material symmetry.

General dynamics
Balance equations. Kinetic energy theorem. Conservation laws. Power expanded in a rigid motion.

Lagrangian dynamics
Lagrange equations. Cyclic coordinates and conservation laws.

Rigid body dynamics
Euler's equations. Poinsot case. Lagrange's top.

Stability of motion
Stability of motion according to Ljapunov. Dirichlet-Lagrange theorem. First Ljapunov's instability criterion. Stability of steady rotations in Poinsot motions.

Normal modes
Linearization of Lagrange's equations; normal co-ordinates. Oscillating, linear, and hyperbolic normal modes.

Teaching methods	Lectures (hours/year in lecture theatre): 38 Practical class (hours/year in lecture theatre): 22 Practicals / Workshops (hours/year in lecture theatre): 0
Reccomended or required readings	F. Bisi, R. Rosso: Introduzione alla meccanica teorica.
Assessment methods	Written test and oral exam. The student has to pass the test with 18/30 at least, and then, a few days later, he will take an oral exam on theoretical topics. If a student passes the written test, he can decide to avoid the subsequent oral test. In that case, however, he will obtain his mark, whenever it does not exceed 21/30 while, if the written exam exceeds this threshold and the student does not take the oral exam, his mark will be 21/30.
Further information	
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile