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 CIVIL ENGINEERING AND ARCHITECTURE
Course	CIVIL AND ENVIRONMENTAL ENGINEERING
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	2nd semester (08/03/2021 - 14/06/2021)
ECTS	6
Lesson hours	60 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	BISI FULVIO (titolare) - 6 ECTS
Prerequisites	Notions given in basic courses in Calculus Analisi Matematica), Linear Algebra, Geometry (Geometria e Algebra), and Physics (Fisica).
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. 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.

	General kinematics Center of mass of a system of material 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's equations of motion Stability of motion Stability of motion according to Ljapunov. Dirichlet-Lagrange theorem. First Ljapunov's instability criterion. Normal modes Linearization of Lagrange's equations; normal co-ordinates. Oscillating, linear, and hyperbolic normal modes. One-dimensional Continuum mechanics Basic properties of curves. Unit tangent and unit normal vector to a plane curve; curvature of a curve. Intrinsic trihedron. Equilibrium equations for one-dimensional continuum bodies. Constitutive hypothesis: flexible and inextensible threads. Conservative active forces. Equilibriun profile of a homogeneous catenary. Suspended bridges.
Teaching methods	Lectures (hours/year in lecture theatre): 22.5 Practical class (hours/year in lecture theatre): 37.5 Practicals / Workshops (hours/year in lecture theatre): 0
Reccomended or required readings	F. Bisi, R. Rosso: Introduzione alla meccanica teorica (La Dotta, Bologna). P. Biscari, C. Poggi, E.G. Virga, Mechanics Notebook (Liguori, Napoli).
Assessment methods	Written test and oral exam (this latter is optional, and can be requested by the student or by the examiner). The student has to pass the test with 18/30 at least, and then, a few days later, he may take an oral test on theoretical topics. The final grade (including non-pass grade) depends on the outcome of both tests.
Further information	Written test and oral exam (this latter is optional, and can be requested by the student or by the examiner). The student has to pass the test with 18/30 at least, and then, a few days later, he may take an oral test on theoretical topics. The final grade (including non-pass grade) depends on the outcome of both tests.
Sustainable development	

goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile