UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

CONSIGLIO INTERCLASSE IN MATEMATICA

General information		
Academic subject	Mathematical Physics 2	
Degree course	*Mathematics*	
Academic Year	*2021-2022*	
European Credit Transfer and Accumulation System (ECTS)	(7 ECTS lessons :5; ECTS exe:2)	
Language	*italian*	
Academic calendar (starting and ending date)	*February 28 -May 27*	
Attendance	*Not compulsory attendance*	

Professor/ Lecturer	
Name and Surname	Lidia Rosaria Rita Palese
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Department and address	Department of Mathematics *Via E. Orabona 4, 70125 Bari*
Virtual headquarters	**jt79efz**
Tutoring (time and day)	In department (by e-mail appointment): Monday, Wednesday, and Friday from 10 to 12. On line with Microsoft Teams, code: awa1at0

Syllabus	
Learning Objectives	Mathematical formulation, understanding and resolution of physical problems concerning the motion of olonomic systems.
Course prerequisites	**Prerequisites:** Mathematical knowledge which usually is acquired during the first two year of the degree course.
Contents	Dynamics of a material point: General, and particular integrals. First integrals of the motion. Kinetic energy theorem. The first energy integral. Motion of a point subject to a central force. Motion of a point subject to an elastic force. Dynamics of a constraint material point. Motion of a point on a surface without friction. Motion of a point on a curve without friction Mathematical pendulum. (0.50 ECTS) Dynamics of a rigid body. Motion of a free rigid body. Rigid body with a fixed point; the Euler equations. Rigid body with a fixed axis., with a sliding axis on a fixed line. Principle of the gyroscopic effect. The gyroscope in presence of gravity. Poinsot motions. (0.50 ECTS) Hamilton equations. Legendre transformation and Hamiltonian. General and particolar integral in Hamiltonian formalism. Cyclic coordinates. Poisson brackets and their properties. Routh function: a mixed formulation of the motion problem.. (1.25 ECTS) Stability and small oscillations: Lyapunov criteria. Asymptotic stability. Equilibrium stability. Dirichlet theorem. Small oscillations near a stable equilibrium. Linearized equations. Normal coordinates. (0.75ECTS) Variational principles: elements of variational calculus. Continuous functionals. Maxima and minima of a functional. Euler equations. Hamilton

	variational principle. Maupertuis principle. (1 ECTS) Canonical transformations. Canonical transformations and generating function. Canonical invariants and Poisson brackets. Lagrange brackets. Infinitesimal contact transformations and their applications. (1 ECTS) Hamilton-Jacobi equation. The Hamilton Jacobi function. Separation of variables in Hamilton Jacobi equation. Cyclic coordinates. (0.25 ECTS) Dynamical systems and Cauchy problems. Examples. (0.75 ECTS) Qualitative analysys of the motion: autonomous systems. Phase space. Systems with one degree of freedom: Plane phase. Phase velocity. Linearization near a singular point. Classification of the singular points. Examples. (1 ECTS)
Books and bibliography	Alberto Strumia: MECCANICA RAZIONALE I, II. Edizioni Nautilus Bologna. Mauro Fabrizio: Introduzione alla Meccanica Razionale e ai suoi metodi matematici. Zanichelli, 1997.
Additional materials	Didactic material provided by the teacher

Work schedule			
Total 160	Lectures 40	Hands on (Laboratory, working groups, seminars, field trips) 30	Out-of-class study hours/ Self-study hours 90
Hours			
ECTS			
7	*5*	*2*	
Teaching strategy			
	Lectures and supplementary distance learning		
Expected learning outcomes			
Knowledge and understanding on:	Acquiring fundamental concepts of the classical mechanics, understanding physical, mathematical, and geometrical aspects of a given problem		
Applying knowledge and understanding on:	Ability to use theoretical knowledge in various dynamics problems		
Soft skills	• *Making informed judgments and choices* Ability to identify mathematical tools and techniques to study physical problems written as mathematical models. • *Communicating knowledge and understanding* Students should acquire the mathematical language and formalism necessary to read and comprehend textbooks, to explain the acquired knowledge. • *Capacities to continue learning*		

	Acquiring suitable learning methods, supported by text consultation and by solving the suggested questions.

Assessment and feedback	
Methods of assessment	
Evaluation criteria	• *Knowledge and understanding* Oral exam including an application exercise • *Applying knowledge and understanding* Oral exam including an application exercise • *Autonomy of judgment* Oral exam including an application exercise • *Communicating knowledge and understanding* Oral exam including an application exercise • *Communication skills* Oral exam including an application exercise • *Capacities to continue learning* Oral exam including an application exercise
Criteria for assessment and attribution of the final mark	*The final grade is awarded out of thirty, the exam is passed when the grade is greater than or equal to 18.* *The final evaluation is formulated considering the knowledge acquired by the student, the ability to understand and use it for the purpose of formulating and solving a physical problem.*
Additional information	