# . – Rational Mechanics

## Prof.Alfredo Marzocchi

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

Rational Mechanics is a discipline that represents one of the most elegant and lasting constructions of Applied Mathematics. Throughout its historical development, it has added new mathematical concepts, and today constitutes a modern mathematical theory that underlies more in-depth and general physical theories such as Relativity and Quantum Mechanics. The first aim of the course, therefore, is to teach students the importance and conceptual value of the course, as well as the rational approach of classical mechanics.

At the end of the course, students will know the formulation of mechanical problems in a hypothetical-deductive theory and be able to apply them to example situations, both ideal and real. In particular, they will know the main outcomes of Mechanics, with related postulates, definitions and demonstrations, and the mathematical techniques used. The hypothetical-deductive structure of the course should, in conclusion, help develop learning skills enabling students to recognise the purposes of specific mathematical techniques in mechanical problems.

***COURSE CONTENT***

Introduction. Kinematics: motion of points and rigid bodies. Mass, Force, power, constraints. Dynamics: Principle of virtual power, dynamics, and equations of motion. Examples. Work, potential. Conservation theorems. Reduction to the one-dimensional case: Weierstrass’ problem. Applications: simple and spherical pendulum. Oscillations. Mechanics of systems: center of mass, momentum, angular momentum. Free and constrained rigid body. Moments of inertia. Dynamics of a free and constrained rigid body.

***READING LIST***

Lecture notes on the course topics and videolessons of support to didactics will be provided.

***TEACHING METHOD***

Frontal lectures with ample opportunity for interaction with students.

***ASSESSMENT METHOD AND CRITERIA***

Oral exam at the blackboard designed to ascertain the extent to which students have assimilated the concepts, results and procedures illustrated during the course, not excluding references to prerequisites or relationships between the parts of the programme.

Generally, at least two topics will be addressed, one usually drawn from the Kinematics part and one from the Dynamics part, with possible frequent references to other concepts illustrated in the course.

The marking of the interview will take into account accuracy of the procedures illustrated, logical and methodological rigour, and effectiveness and accuracy in explanation; assimilation of concepts and reworking thereof in a critical manner, knowing how to motivate the individual steps rather than learning them in an uncritical rote manner, will be appreciated.

**NOTES AND PREREQUISITES**

Students will have to know the most important results of Differential Calculus in one variable, Linear Algebra and Geometry; an anonymous assessment of acquired knowledge may be carried out in order to evaluate any necessary revision.

*Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG or on the Faculty notice board.*