ROMA TRE UNIVERSITÀ DEGLI STUDI — Ingegneria — 3TE

ROMA EMCN 202: Engineering Mechanics

Instructor
Prof. Umberto Iemma

Duration/Credits
60 hours, 4 hours/week, 15 weeks; 4 credits

Content
Mathematical background. Fundamentals of vector calculus. Spectral analysis of symmetric matrices and applications to classical mechanics problems. Vector spaces: conservative, irrotational, and potential vector fields. Solution of linear ODE of order two, homogeneous and non-homogeneous.
Mechanics of Systems of particles. Conservation laws of momentum and angular momentum. Motion of the center of mass, and around the c.o.m. Energy principles.
Rigid bodies mechanics. Rigid body motion. Conservation laws of momentum and angular momentum. Statics: equivalent system of forces, equilibrium condiditions. – Energy principles. Moments of Inertia, inertia tensor, principal axes. Euler equations;
Lagrangean Mechanics. Generalized coordinates. Lagrange equations and linearization.
Chaotic mechanical systems. Phase space. Sensitiivity to initial conditions, dense orbits, deterministic chaos.

Texts
No official textbook is required for the course. Lecture notes will be made available through the *e-learning* website of the course. The following texts can be used for reference.

- F.P. Beer and E. R. Johnston. *Vector Mechanics for Engineers – Statics and Dynamics*, McGraw-Hill Science/Engineering/Math; 7 edition.
- Russell C. Hibbeler. *Engineering Mechanics - Statics and Dynamics.* Prentice Hall.
- J.L. Meriam and L.G. Kraige, *Engineering Mechanics - Statics and Dynamics,* Wiley.

Prerequisites
Calculus: limits, derivatives of functions of n variables, maxima and minima of functions of one, two and three variables, Taylor series, indefinite integrals, definite integrals in one, two, and three dimensions.
Fundamentals of matrix algebra: operations with matrices, matrix form of linear systems of equations, determinants.

Exam
One mid-term exam: written test (1 hour); Final exam: written test (2 hours) + oral exam

Grades
Mid-term exam: 25%, final exam: written test 45%, oral exam 30%.