# COMPUTATIONAL MECHANICS
## ES 536
## ENERGY METHODS IN ENGINEERING

A review of the equations of mechanics, kinetics, kinematics, constitutive equations, boundary value problems of mechanics, equations of bars, beams, torsion and plane elasticity. Energy and variational principles: preliminary concepts, calculus of variations, virtual work and energy principles, energy theorems in structural mechanics. Stationary variational principles, Hamilton's principle, applications. Variational methods of approximation: Ritz, weighted residual methods: Galerkin, Least squares, Collocation, Subdomain, Kantorovich, Trefftz methods, Finite Elements method and meshless methods (applications to elastic roads, structural systems, elastic plates and shells). Stability: columns, beam-columns, frames, plates.

**References:** 1. Energy and Variational Methods in Applied Mechanics, J. N. Reddy, 1984
2. Energy Methods in Applied Mechanics, H. L. Langhaar, 1962
3. Solid Mechanics: A Variational Approach, Clive L. Dym, Irving H. Shames, 1973 McGraw-Hill
4. Variational Methods in Elasticity and Plasticity, Washizu, K., 1982, 3rd edition, Pergamon Press, New York.
5. Methods of Applied Mathematics, F. B. Hildebrand, 2nd edition, 1965 Prentice-Hall, Inc.

**This course is a fundamental course for the numerical methods in computational mechanics, such as Finite Element Method.**

## FIRST MEETING: 24.09.2019, 10:40 on Tuesday, AE026.

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