Course Name:
Nonlinear Modeling of Structures and Materials

Course Number:
20898

Credit:
3

Course Content (outline):

- An overview on matrix structural analysis (direct stiffness method, PVD, PVF)
- Nonlinear behavior of truss element
- Numerical procedures
  - o Implicit procedures
  - o Explicit procedures
  - o Forced-controlled loading
  - o Displacement-controlled loading
- Nonlinear behavior of beam element (fiber- hinge)
  - o Steel brace
  - o Steel beam (monotonic - cyclic)
  - o Concrete beam (monotonic - cyclic)
- Dynamic nonlinear analysis of beam elements
- Geometric nonlinearity in truss and beam elements
  - o Buckling
  - o Large displacements (corotational – P-D)
- An overview on finite element method (accompanied with coding)
  - o Axisymmetric, plane stress and plain strain problems
- An overview on plasticity in solid elements with finite element implementation
- Constitutive material models
  - o Steel (Von Mises)
  - o Saturated and unsaturated soil (Cam-Clay)
  - o Concrete
  - o Masonry

References:

- Bathe, K.J. (1996), Finite Element Procedures, Prentice Hall, Englewood Cliffs, NJ.
- McGuire, W. (1999), Matric structural analysis, Wiley
- Crisfield M. A. (1996), Non-linear finite element analysis of solids and structures, Wiley
- Chen W. F. (1985), Soil Plasticity: Theory and Implementation, Elsevier Science
- Chen W. F. (1981), Plasticity for structural engineers, Springer
- Owen D. R. and Hinton E. (1981), Finite elements in plasticity, McGraw hill
- Simo J.C. and Hughes TJ.R. (1997), Computational Inelasticity, Springer