

Course Name:

Nonlinear Modeling of Structures

Course Number:

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Credit:

3

Course Content (outline):

- An overview on matrix structural analysis (direct stiffness method, PVD, PVF)
- Nonlinear behavior of truss element
- Numerical procedures
 - Implicit procedures
 - Explicit procedures
 - Force-controlled loading
 - Displacement-controlled loading
 - Arc-length
- Nonlinear behavior of beam element (fiber- hinge)
 - Steel brace
 - Steel beam (monotonic - cyclic)
 - Concrete beam (monotonic - cyclic)
- Dynamic nonlinear analysis of beam elements
- Geometric nonlinearity in truss and beam elements
 - Buckling
 - Large displacements (corotational – P-D)
- An overview of finite element method (accompanied with coding)
 - Axisymmetric, plane stress and plane strain problems
- An overview on plasticity in solid elements with finite element implementation
- Constitutive material models
 - Steel (Von Mises)
 - Saturated and unsaturated soil (Cam-Clay)
 - Concrete
 - 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), Nonlinear 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 T.J.R. (1997), Computational Inelasticity, Springer