CE723A: Finite Element Methods for Civil Engineering Applications 3-0-0-0 [9]

Course Contents:

Problem formulation, numerical and closed form solutions, weak form, collocation, least square, Galerkin technique, derivation of finite element equations, stiffness matrices, global assembly, coordinate transformation, enforcing boundary conditions, solution of the systems of equations, Convergence, Stability and possible sources of errors; Formulation of one dimensional truss and beam elements, Application to 2D trusses and frames; Formulation of 2D problems involving plane stress, plane strain, and axis symmetry, Applications to pressure vessels, chimneys, dams, embankments, and pavements; Formulation of plate bending elements, Bending of plate, Von Karman nonlinear plate theory and formulation; Formulation of thin shell elements, Applications to dome, water tank etc; Formulation of three dimensional brick elements, Applications to stress analysis in dam, earthen embankment, tunnel, etc.; Nonlinear static and dynamic problems; geometric and material nonlinearity, P-delta effects in tall buildings, elasto-plastic analysis as encountered in structures and geotechnical mechanics, seismic soil-foundation-structure interaction problems; Formulation for contact elements, infinite elements and crack tip elements; CE applications such as 3-D elastic problems, consolidation, seepage, transport and propagation through heterogeneous media; Finite element formulation of fluid flow and transport problems. Applications to pipe, open channel flow, contaminant and species transport with emphasis to hydraulics and environmental flow modeling.