

**QE Topics List: *Structural Analysis***  
**August 2003**

<b>General</b>	<b>Trusses</b>
Structural idealizations Equations of static equilibrium in 2-D and 3-D Static determinacy (vs. indeterminacy) and stability (including eigenvalue methods) Reactions for statically determinate structures Moving loads; influence lines (Mueller-Breslau principle) Matrix algebra: Operations – multiplication, transposition, and use of submatrices Determinants; inverses; linear equations; Gauss elimination; Choleski decomposition	Method of sections; method of joints Stiffness method of analysis for 2-D and 3-D configurations Temperature loads; misfits; secondary stresses

<b>The Finite Element Method for Two-Dimensional Problems</b>
2-D elasticity (stress equilibrium; strain-displacement; Hooke's law; compatibility; Cauchy relations; plane stress and plane strain idealizations) Principle of virtual displacements for 2-D continuum Constant strain triangle (CST) element formulation (B matrix; stiffness matrix) Solution of simple plane stress and plane strain linear elasticity problems using CST elements Interpretation of computed strains and stresses from CST solutions

<b>Continuous Beams and Frames</b>	<b>Virtual Work and Energy Methods</b>
Shear and moment diagrams for beams Differential equation for beam bending Moment-area and conjugate beam methods for deflections Moment distribution method (beams and frames without sidesway) Stiffness method for 2-D and 3-D configurations: Applications to continuous beams and simple frames with sway Beam stiffness coefficients and fixed-end forces via flexibility method Plane frame element coordinate transformation Methods to impose displacement boundary conditions Modified frame stiffness for force-moment releases Imposition of non-global displacement constraints Methods to orient space frame elements Structural symmetry; load decomposition to symmetric and anti-symmetric parts Internal hinges; elastic supports; semi-rigid connections; curved members	Principle of virtual displacements for truss and beam-frame structures Interpolation concepts; beam interpolating (shape) functions Finite element for beams; internal and external virtual work for beams