Solid mechanics ME-331 / 4 credits: topics and timing (estimated): Prof. John Botsis

Index Notation and Cartesian Tensors (Support Material 1)   **(week 1)**

Kinematics (Support Material 1)   **(week 2)**

- o   Deformation Gradient and Strain Tensors
- o   Linearized strains
- o   Transformation of strains
- o   Objectivity

Dynamics (Support Material 1)   **(week 3)**

- o   Stress Tensors, Linearization
- o   Transformation of stresses, Stress invariants
- o   Stress Deviator, Octahedral stress

Energetics (Support Material 1, 2)   **(week 4)**
- o   Thermodynamics
- o   Potential Energy, Strain energy
- o   Work and energy in solid mechanics
- o   Virtual Work principle

Isotropic elasticity (Support Material 1, 2)   **(weeks 5-9)**
- o   Problem definition and equations in Linear elasticity
- o   Navier equations; Beltrami-Michell equations
- o   Superposition, St. Venant's principle
- o   Boundary value problem, Uniqueness of the solution
- o   Plane strain, Plane stress
  Solution Methods
- o   Potentials (Sphere and Hollow cylinder, Kelvin problem …)
- o   Stress functions in plane problems (beams, Stress concentrations)
- o   Axisymmetric problems (cylinder, disc, …)
- o   Virtual work and Energy

Anisotropic elasticity (Support Material 1, 2**)**   **(week 10)**
- o   Definitions
- o   Applications to composite materials

Introduction to Non-Linear Elasticity (Support Material 1)   **(week 11)**
- o   Hyperelastic materials, theory and 2D problems

Introduction to Linear Viscoelasticity (Support Material 2)   **(week 12)**

Introduction to Plasticity Theory (Support Material 2)   **(week 13)**

Support Material
1. Mechanics of Continuous Media: an Introduction (J Botsis and M Deville, PPUR)
2. Course/Class notes given during the course (J Botsis)
3. Applied Mechanics of Solids (A Bower CRC Press)