Course Outline: Mechanics of Solids (APL 104)

Chapter 1: Introduction – Concept of Stress
Stress Under Axial Loading; Components of Stress; Factor of Safety.

Chapter 2: Stress and Strain – Axial Loading
Stress-Strain Diagrams; Deformations Under Axial Loading; Statically Indeterminate Problems; Poisson's Ratio; Generalized Hooke's Law; Dilatation; Bulk Modulus; Shearing Strain; Stress Concentrations; Plastic Deformations; Residual Stresses.

Chapter 3: Torsion
Stresses in Elastic Range; Angle of Twist; Statically Indeterminate Shafts; Design of Transmission Shafts; Stress Concentrations; Thin-Walled Hollow Shafts.

Chapter 4: Pure Bending
Stresses in Elastic Range; Members Made of Several Materials; Stress Concentrations; Eccentric Axial Loading; Unsymmetric Bending; General Eccentric Axial Loading.

Chapter 5: Analysis and Design of Beams for Bending
Shear and Bending-Moment Diagrams; Using Relations among *w, V,* and *M;* Design of Prismatic Beams in Bending; Use of Singularity Functions to Determine *V* and *M*.

Chapter 6: Shearing Stresses in Beams and
Thin-Walled Members; Shearing Stresses in Beams; Shearing Stresses in Narrow Rectangular Beam; Shearing Stresses in Thin-Walled Members; Unsymmetric Loading; Shear Center.

Chapter 7: Transformation of Stress and Strain
Transformation of Plane Stress; Mohr's Circle for Plane Stress; Three-Dimensional Analysis of Stress; Yield and Fracture Criteria; Thin-Walled Pressure Vessels; Analysis of Strain; Mohr's Circle; Strain Rosette.

Chapter 8: Principal Stresses under a Given Loading
Principal Stresses in a Beam; Design of Transmission Shafts; Stresses under Combined Loadings.

Chapter 9: Deflection of Beams
Equation of Elastic Curve; Direct Determination of Elastic Curve from Load Distribution; Statically Indeterminate Beams; Use of Singularity Functions; Method of Superposition.

Chapter 10: Columns
Euler's Column Formula; Eccentric Loading; Secant Formula; Design of Columns under a Centric Load; Design of Columns under an Eccentric Load.

Chapter 11: Energy Methods
Strain Energy; Strain Energy for General State of Stress; Impact Loading; Deflections by Work-Energy Method; Castigliano's Theorem.

Grading: 35 Minor, 40 Major, 20 marks tutorial (attendance and quizzes), 5 marks lecture attendance

Attendance Lecture class: > 95% 5 marks, 90 to 95 4 marks, 85 to 90 3 marks, 80 to 85 2 marks,
75 to 80, 1 mark. Less than 75% attendance – no marks

Text Book:
Mechanics of Materials, 8th Edition by Ferdinand P. Beer, E. Russell Johnston Jr., John T. DeWolf, David F. Mazurek, Sanjeev Sanghi

Reference Books:
1. An Introduction to the Mechanics of Solids by Stephen Crandall, Norman Dahl, et al.
2. Mechanics Of Materials by R.C. Hibbeler
3. Solid Mechanics for Undergraduates by Ajeet Kumar
4. Mechanics of Solids by Dumir, Patel and Sanghi

Homework problems: A problem sheet for each chapter will be provided to you. Some of these problems will be discussed in the tutorial class. You must try all these problems.

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