CE2010: Strength of Materials

Evaluation: Test-1 (20 Marks); Test-2(20 Marks); End Sem. (40 Marks); Tutorial (20 Marks)
Faculty: M.V Anil Kumar (131, Transit Campus) & Dr. Sanjukta Chakraborty(122, Temporary Campus)
Class Room: **18**; Timings: Monday (10-10.50), Tuesday (11-11.50), Thursday (8-8.50) and Friday (9-9.50)

Course content:

Stress: Equilibrium of deformable body, Normal stress, shear stress, General state of stress at a point, shear stress equilibrium, Allowable stress design. Plane stress transformation, Principal stresses and max. shear stresses, Mohr circle for plane stress.

Strain: Deformation, normal and shear strains, strain-displacement relation, Plane strain transformation, Principal strain and max. Shear strain Mohr circle for plane strain, Strain measure technique – Strain gauge.

Properties of Materials: Stress-stain diagram, Stress-strain behavior of ductile and brittle materials, Hooke's Law, Generalized 3-D constitute behavior.

Axial member: Saint- Venant's principle, elastic deformation of an axial loaded member, Principle of superposition, Force method of analysis for axial loaded member, Thermal stress.

Torsional member: Torsional deformation of circular shaft, Torsion formula, Max. torsional stress, Power transmission, Angle of twist,

Theories of failure: Max. Principal stress theory, Max. Principal strain theory, Max. shear stress theory, Max.strain energy theory, Max. distortion energy theory,

Linear beam theory: Bending moment and shear force diagrams, Euler Bernauli beam theory, understanding of neutral axis, development of flexure equation; concepts of bending stress and strain in transversely loaded symmetric beams.

Transverse shear: Concept of transverse shear in symmetric beams, shear center and shear flow for symmetric compound beams.

Composite beams: Neutral axis for composite beams, development of flexure formula for composite beams, bending stress and strain diagrams for composite beams.

Deflection in beams: Derivation of load-deflection formula for beams; direct integration approach, Macaulays bracket for discontinuous loading, Moment-area approach for deflection and slope of beams.

Energy based approaches: calculation of strain energy for axial, torsional and bending members; unit load method; Caltigliano's theorem; Maxwell-Betti's theorem; deflection based on Castigliano's theorem; indeterminate structures.

Buckling: Buckling of columns with various end conditions, Columns with imperfections and eccentricity

Indeterminate beams: Degrees of freedom, understanding of deflection boundary conditions for propped cantilever and fixed-fixed beam, understanding of force and deflection based methods.

Text books:

i. Russell C. Hibbeler, Mechanics of Materials, 9th Edition, Pearson, ISBN:978-93-325-1860-5.
ii. Gere and Timoshenko, Mechanics of Materials, CBS, 2 edition, ISBN-13: 978-8123908946.

Reference books:

i. E. G. Popov, Engineering Mechanics Of Solids, Second Edition, Phi Learning, ISBN: 978-81-203-2107-6.
ii. Beer, Johnston, Dewolf, Mazurek and Sanghi, Mechanics of Materials, McGraw Hill Education India Private Limited; Seventh edition, ISBN-13: 978-9339217624