ADVANCED MECHANICS OF MATERIALS

Course Code: 15ME2202

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Pre requisites: Engineering Mechanics and Mechanics of solids

Course Outcomes: At the end of the course, a student will be able to

CO1: relate loading and deformation states to the proper components of stress and strain, determine the principal stresses and principal strains.

CO2: analyze and design the columns.

CO3: determine the stresses due to asymmetric bending; locate the shear centre of thin-walled sections.

CO4: determine the stresses in curved beams; apply Castigliano's theorems for deflection of statically determinate and indeterminate structures.

CO5: calculate the residual stresses in members under torsion / bending; analyze the torsion of noncircular cross-sections.

UNIT-I (10-Lectures)

Analysis of stress and strain: Introduction, the state of stress at a point, stress components on an inclined plane, principal stresses, stress invariants, octahedral stress, the plane state of stress, rectangular strain components, the state of strain at a point, principal strains, plane state of strain, stress-strain relations for isotropic materials.

UNIT- II (10-Lectures)

Columns: Euler's buckling load, effective length of a column, Rankine formula, columns subjected to eccentric loading, columns having initial curvature, beam column with a concentrated load.

UNIT –III (10-Lectures)

Unsymmetrical bending: Euler-Bernoulli hypothesis, shear centre, shear stresses in thin-walled open sections.

UNIT –IV (10-Lectures)

Bending of curved beams: Winkler-Bach formula - shift of neutral axis for various sections, stresses in curved beams, stresses in crane hook, stresses in circular rings.

UNIT –V (10-Lectures)

Energy methods: Strain energy principles, Castigliano's first and second theorems, applications to members subjected to axial, transverse and torsional loads, applications to statically indeterminate problems

Elasticity: IsotropicElastic Bodies, Anisotropic hyperelastic solids

Plasticity: Rate – independent functional, Representation by means of internal variables, Elastoplasticity**.**

TEXT BOOKS:

1. L. S. Srinadh, "*Advanced Mechanics of Solids*", 2nd Edition, Tata McGraw Hill, 2004
2. F. P. Beer, E. R. Johnston, J. T. Dewolf, and D. F. Mazurek, "*Mechanics of Materials*" , 6th Edition, McGraw Hill, 2012

REFERENCES:

1. S. S. Rattan, " Strength of Materials" , 2nd Edition, Tata McGraw Hill, 2008, 3rd Reprint, 2012
2. H. J. Shah, S. B. Junnarkar, "Mechanics of Structures: Strength of Materials (Volume-1)", 29th Edition, Charotar Publishing House, Anand, Gujarat, 2011
3. James M. Gere and Barry J. Goodno, "Mechanics of Materials" , 8th Edition, Cengage Learning, 2012
4. R. C. Hibbeler, "Mechanics of Materials", 8th Edition, Prentice Hall Inc., 2011
5. P. Haupt, "Continuum mechanics and theory of materials", 2ndedition, springer, 2002