

Course Proforma

- 1. Course code and Title** : CE 5XXX: Advanced Mechanics of Structures
2. Course category : ERC
3. Course credit : 3-0-1-4
4. Prerequisite course : Strength of Materials or equivalent
5. Consent of Teacher : Not required

6. Learning Objectives:

The aim of the course is to introduce students to advanced topics in mechanics of structures. This course builds upon the basic concepts that were introduced in the strength of materials and enables to understand generalised state of stresses and strains. This course also introduces students to failure theories.

7. Learning Outcomes: By the end of this course, the student will be able to:

- i. Analyse the stresses and strains at a point, on oblique planes, and transform them into arbitrary planes.
- ii. Evaluate the cause of failure using the various failure theories.
- iii. Compute torsional stresses non-circular sections.
- iv. Analyse symmetrical and unsymmetrical cross sections in bending.

8. Course Content:

Review of Elementary Mechanics: Members subjected to axial, torsional and flexural loads [3 lectures]

Stress: Stress at a point; Stress on Oblique plane; Transformation of stress; Mohr's circle in 3D; Principal stresses; Octahedral stresses; Hydrostatic and deviatoric stresses; Differential equations of motion in Cartesian and cylindrical co-ordinate system; stress-functions[10 lectures]

Strain: Strain at a point; Strain on Oblique plane; Transformation of strain; Mohr's circle in 3D; Principal strains; Strain-displacement relations in Cartesian and cylindrical coordinate system; Strain-compatibility relations [8 lectures]

Constitutive relations: Linear elasticity-Generalised Hooke's law; anisotropic, orthotropic and isotropic materials [3 lectures]

Yield Criteria: Maximum principal stress criterion, Maximum principal strain criterion, Strain energy density criterion, Maximum shear stress criterion, distortional energy density criterion-Effect of hydrostatic stress and π plane, Mohr-coulomb criterion, Dreyer-Pager criterion [5 lectures]

Torsion: St. Venant's semi-inverse method, Membrane analogy, Rectangular cross-section, Hollow thin-walled torsion members; multiply connected cross-section; Thin-walled members-warping; [4 lectures]

Bending: Symmetrical and unsymmetrical bending; [3 lectures]

Other topics: Thick and thin cylinder; Stress concentration; Shear centre [4 lectures]

Buckling: Buckling of columns with various end conditions, Columns with imperfections and eccentricity [2 lectures]

9. Text Books:

- A.P.Boresi and R.J.Schmidt (2004) *Advanced Mechanics of Materials*.Wiley. ISBN : 9788126522163
- Srinath (2004) *Advanced Mechanics of Solids*. Mcgraw Hill Higher Education. ISBN : 978-0070262126

10. Reference Books:

- S.Timoshenko and J.N.Goodier (2017) *Theory of Elasticity*. Mcgraw Hill Higher Education. ISBN : 978-0070701229

Proposing Faculty: Madhu Karthik and M.V.Anil Kumar

Department/Centre: Civil Engineering

Proposal Type: New

Programme: Research/PME (UG)