

Programme Name	M. Tech. (Civil Engineering with Specialization in Structural Engineering)
Course Code	CESE5061S
Course Title	Continuum Solid Mechanics

COURSE OUTCOME:

After completion of this course students shall be able to

CO1: define basic definitions of modern continuum mechanics, such as deformations, strains, stress, constitutive equations of linear and non-linear materials.

CO2: apply basic elasticity formulation in 2-D and 3-D domains for rectangular and polar coordinate systems.

CO3: apply energy theorems for the elasticity solutions.

Introduction

Stress transformation and strain transformation at a point in an elastic body, 3D problems, rigid body translation and rotation of an element in space, formulation of generalized Hooke's law, derivation of displacement for a general displacement field u, v, w , evaluation of principal stresses and strains at a point. Tensor notations for stresses and strains at a point.

2-D Problems in Continuum Mechanics

Study of plane stress and plain strain idealizations of problems. Application of equilibrium and compatibility conditions to solve a problem of continuum mechanics. Application of boundary conditions and stress functions approach for solution of problems. 2-D problem formulation in rectangular coordinates, polynomial solutions and cantilever loaded at the end, simply supported beam under uniformly distributed load and linear loading. 2-D problem in polar coordinates, stress distribution about an axis, pure bending of curved bars, displacement for symmetrically loaded cases, bending of a curved bar by forces at end. Stress analysis of plates with circular hole due to in plane loading. Stress analysis in structures due to a concentrated load at a point of a straight boundary. Stress analysis of circular disks and wedges. 2-D formulation for stress analysis of prismatic bars of elliptical, rectangular, triangular and other sections subjected to torsion by Membrane Analogy.


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3-D Problems in Continuum Mechanics

Application of equilibrium and compatibility conditions to 3-D problems in continuum mechanics. Problems of rods under axial stress, bar under its own weight and pure bending of prismatic rods. Bending of prismatic bars as a problem of continuum mechanics in 3-D. Bending of a cantilever, stress function for circular and rectangular sections of bars.

Energy Theorems

Applications of complementary energy theorems to the problems of continuum mechanics
Case studies: Related to structural engineering problems.

Recommended Reading

1. Wang C. T., Applied Elasticity, McGraw Hill Book Co., 1953.
2. Timoshenko S. P. and Krieger S. W., Theory of Plates and Shells, McGraw Hill International Ed., 1959.
3. Timoshenko S. P. and Goodier J. N., Theory of Elasticity, McGraw Hill Book Company, International Ed., 1970.
4. Shames H. and Cozzarellie F. A., Elastic and Inelastic Stress Analysis, Prentice Hall New Jersey, 1992.
5. Chandrasekharaiah D. S. and Debnath L., Continuum Mechanics, Prism Books Pvt. Ltd., Bangalore, 1994.
6. Srinath L. S., Advanced Mechanics of Solids, Tata McGraw-Hill Education, 2009.
7. Boresi Arthur P., Chong K., Lee J. D., Elasticity in Engineering Mechanics, Wiley and Sons, 2011.
8. Budynas R. G., Advanced Strength and Applied Stress Analysis, WCB/McGraw-Hill, 1999.


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