CE204 August 3:0

Solid Mechanics

Instructor

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Teaching Assistant

Email:

Department: Civil Engineering

Course Time:

Lecture venue:

Detailed Course Page: http://civil.iisc.ac.in/~nsundaram/teaching.html

Announcements

Brief description of the course

CE 204 is a graduate-level core course in solid mechanics and is mandatory for all incoming CiE MTech students. The course has a blend of topics from traditional Continuum Mechanics, Theory of Elasticity and Advanced Structural Analysis. It is taken by about 40 students.

Prerequisites

No specific requisite course, but a good grasp of undergraduate multi-variable calculus, linear algebra and "strength of materials" is highly recommended.

Syllabus

Introduction to tensor algebra and calculus, indicial notation, matrices of tensor components, change of basis formulae, eigenvalues, Divergence theorem. Elementary measures of strain. Lagrangian and Eulerian description of deformation. Deformation gradient, Polar decomposition theorem, Cauchy-Green and Lagrangian strain tensors. Deformation of lines, areas and volumes. Infinitesimal strains. Infinitesimal strain-displacement relations in cylindrical and spherical coordinates. Compatibility.

Tractions, body forces, stress at a point, Cauchy's theorem. Piola-Kirchhoff stress tensors. Momentum

balance. Symmetry of the Cauchy stress tensor. St. Venant's Principle. Virtual Work. Green's solids, elastic strain energy, generalized Hooke's Law, material symmetry, isotropic linear elasticity in Cartesian, cylindrical and spherical coordinates, elastic moduli, plane stress, plane strain.

Navier's formulation. Airy stress functions. Selected problems in elasticity. Kirchhoff's uniqueness theorem, Betti-Maxwell reciprocal theorem, Principle of stationary potential energy. Torsion in circular and non-circular shafts and thin-walled tubes, warping.

Course outcomes

Rigorous introduction to the principles of solid mechanics, and the ability to apply these principles to solve problems in a wide variety of applications.

Grading policy

50% for midterms (2 exams), 50% for Final exam.

5 homework assignments

Assignments

Resources

Fung, Y. C. and Pin Tong, Classical and Computational Solid Mechanics, World Scientific, 2001
Boresi, A.P., Chong K., and Lee J., Elasticity in Engineering Mechanics, Wiley, 2010
Theoretical Elasticity, A.E. Green and W. Zerna, 1968, Dover Publications
Malvern L., Introduction to the Mechanics of a Continuous Medium, Prentice Hall, 1969