

CE 429: CONTINUUM MECHANICS (3-0-0: 3)

Essential Mathematics

Scalars, vectors and cartesian tensors, tensor algebra, Kronecker delta, Levi-Civita symbol, covariant and contravariant tensor, quotient law of tensors, elementary tensor calculus, Green's theorem, integral theorems of Gauss and Stokes.

Kinematics of Deformation

Continuum hypothesis, properties of a continuous medium, spatial (Eulerian) and material (Lagrangian) description of motion of deformable bodies, measure of strain deformation, infinitesimal strain tensor, change in volume due to strain deformation, strain quadric, principle strain, strain invariant.

Theory of Motion

Material derivative, stream line and path line, strain rate tensor, time rate of change of volume element, time rate of change of volume and line integrals, Reynold's transport theorem, velocity potential, rotation and vorticity.

Stress Principles

Body and surface forces, stress tensor, continuity equations, Cauchy's first and second equation of motion, energy equation, principle stress, principal stress direction.

Elastics Solid

Constitutive equation for linearly elastic solid- generalized Hooke's law, elastic constants

Fluid

Behaviour of the fluid, derivation of equation of continuity and momentum from Reynold's transport theorem and its application in engineering problems, constitutive equations, derivation of Navier-Stoke's equation, introduction to laminar flow, Bernoulli's equation and its applications, energy equation for viscous fluid

Text Books:

1. R. Chatterjee, "Mathematical Theory of Continuum Mechanics", Narosa Publishing House.
2. G. T. Mase and G. E. Mase, "Continuum Mechanics for Engineers", CRC Press.
3. V. L. Streeter, E. B. Wylie and K. W. Bedford, "Fluid Mechanics", McGraw Hill Education India Private Limited.

References:

1. T. J. Chung, "Continuum Mechanics", Prentice Hall