

**Course Name:**  
Continuum mechanics

**Course Number:**  
20136

**Credit:**  
3

**Course Content (outline):**

**1. Tensor**

Transformation law for components of a vector, tensor calculations, eigen value and eigen vectors, Cayley-Hamilton theorem

**2. Kinematic**

Material description, spatial description, relative description, material derivative, rate of deformation, rate of rotation

**3. Strain and small deformation**

Displacement gradient, Lagrangean description, Euler description, stretching, volume change, right stretch tensor and left stretch tensor, rotation and stretch tensor, rate of rotation and stretch tensor, strain compability.

**4. Conservation of mass and continuity equations**

continuity equations, material description of continuity, material derivative, volume integrals

**5. Stress and momentum**

Cauchy stress, couple stress, first and second Piola-Kirchhof, coupled stresses and strain and their relations, equation of motion and equilibrium

**6. Energy laws in continuum mechanics**

First law of thermodynamic, stress power, internal energy, entropy and second thermodynamic law, reversible and irreversible processes, variables and state functions, Helmholtz free energy, enthalpy, Gibbs energy

**7. Material Constitutions**

Isotropic tensors, changing coordinates, tensor and vectors, objectivity, Jaumann object derivation, elastic and inelastic strain decomposition