

**Course Number: 28033****Course Name: Continuum Mechanics**

Course Type: Theoretical
Prerequisite: -
Level: PhD
Group: Energy conversion

Type & Max Unit: 3
Corequisite:-
First Presentation:
Last Edition: November, 2017

**Objectives:**

The purpose of the course is to expose the students to the basic elements of continuum mechanics in a sufficiently rigorous manner. After attending this course, the students should be able to appreciate a wide variety of advanced courses in solid and fluid mechanics.

**Topics:**

- 1- **Vector and tensor algebra**, Index notation, Tensor algebra, Transformation of tensors, Calculus of tensors, Eigen values and eigen vectors.
- 2- **Kinematics of a continuum**, Eukerian and Lagrangian description, displacement and deformation, strain tensor, rotation, small deformation versus large deformation, rate of deformation tensor, compatibility condition, material derivative of line, area and volume.
- 3- **Stress**: Body and surfaces forces, Cauchy stress relation, symmetry in stress tensor, maximum and minimum of stress tensor, equation of motion, angular momentum equation, Piola-Kirichhoff stress tensor, stress power and energy conservation equation, Entropy inequality.
- 4- **The elastic solid**, Linear, isotrop and elastic solid, constitutive equation, Hook's law, Navier equation for Hookian solids, Application of Navier equation such as wave propagation in solids, bending, torsion. Anisotropic solids, introduction to large deformation.
- 5- **Newtonian Fluids**, constitutive equation of Newtonian fluids, Navier-Stokes equations, Energy equation in fluids, Vorticity equation and physical meanings.
- 6- **Viscoelastic fluids, linear vистоelastic fluids, Maxwell fluid, Kelvin fluids, creep, relaxation and dynamical tests in viscoelastic fluids.**
- 7- **References:**

1-W.M. Lai; D. Rubin & E. Krempel, Introductin to Continuum Mechanics; 4rd Ed., Pergamon Press, 2010.

2-Chung, Continuum Mechanics, Prentice-Hall, 1983.

3-F. Irgens, Continuum Mechanics, Springer, 2008.

4-T. Mase, G. Mase, Continuum Mechanics for Engineers, CRC Press, 1999.