

15 MAMC 205 Continuum Mechanics (3-1-0)

Module-I (14 Hours)

Vector calculus: Derivative of a Scalar Function of a Vector, The del Operator, Divergence and Curl of a Vector, Cylindrical and Spherical Coordinate Systems, Gradient, Divergence, and Curl Theorems, Tensor calculus, Eigen values & Eigen vectors of Tensors. Kinematics of Continua: Descriptions of Motion: Configurations of a Continuous Medium, Material Description, Spatial Description, Displacement Field, Analysis of Deformation: Deformation Gradient Tensor, Isochoric, Homogeneous, and Inhomogeneous Deformations, Change of Volume and Surface, Strain Measures: Cauchy–Green Strain Tensors

Module-II (14 Hours)

Conservation of Mass, Momenta, and Energy: Conservation of Mass: Material Time Derivative, Continuity Equation in Spatial and Material Description, Conservation of Momenta: Principle of Conservation of Linear Momentum, Equation of Motion in Cylindrical and Spherical Coordinates, Principle of Conservation of Angular Momentum, Thermodynamic Principles: The First Law of Thermodynamics: Energy Equation, Energy Equation for One-Dimensional Flows, The Second Law of Thermodynamics

Module-III (12 Hours)

Constitutive Equations: Elastic Solids: Generalized Hooke's Law, Material Symmetry, Monoclinic, Orthotropic and Isotropic Materials, Transformation of Stress and Strain Components, Constitutive Equations for Fluids: Ideal Fluids, Non-Newtonian Fluids, Heat Transfer: Fourier's Heat Conduction Law, Newton's Law of Cooling,

TEXT BOOKS

J. N. Reddy, An Introduction to Continuum Mechanics with Applications, Cambridge University Press, 2008.

Chapters 2(2.4,2.5.4,2.5.5),3(3.2,3.3,3.4.1),5(5.2.2-5.2.4,5.3.1-5.3.3,5.4.2,5.4.4,5.4.5),6(6.2.2-6.2.7,6.3.2-6.3.4,6.4.2-6.4.3)

M. Gurtin, An Introduction to Continuum Mechanics, Academic press, 1981.

REFERENCES

O. Gonzalez and A. M. Stuart, A First Course in Continuum mechanics, Cambridge University Press, 2008.

J. N. Reddy, Principles of Continuum Mechanics: A Study of Conservation Principles with Applications, Cambridge University Press, 2010.

Y. R. Talpaert, Tensor analysis and Continuum Mechanics, Springer, 2003.

R. Temam and A. Miranville, Mathematical Modelling in Continuum Mechanics, Cambridge University Press, 2005.