

CONTINUUM MECHANICS & TENSOR ANALYSIS

Course Code	22MEMD1T5B	Year	I	Semester	I
Course Category	Programme elective	Branch	ME	Course Type	Theory
Credits	4	L-T-P	4-0-0	Prerequisites	Nil
Continuous Internal Evaluation:	40	Semester End Evaluation:	60	Total Marks:	100

Course outcomes: At the end of the course, the student will be able to:

CO	Statement	BTL	Units
CO1	Understand the stress tensor and derive it for ideal, Newtonian and viscous fluids	L2	1
CO2	Explain the models of linear elasticity and, linear viscoelasticity	L2	2
CO3	Explain central terms as material volume, particle and deformation tensor	L2	3
CO4	Distinguish Eulerian and Lagrangian definition of the equations of motion	L3	4
CO5	Derive conservation laws for mass, momentum and energy on local and global form	L3	4

Contribution of Course outcomes towards achievement of programme outcomes & Strength of correlations (High:3, Medium: 2, Low:1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2			1							3	1
CO 2	3	3	2			1							3	1
CO 3	3	3	2			1							3	1
CO 4	3	3	2			1							3	1
CO5	3	3	2			1							3	1

Syllabus		
Unit	Contents	Mapped CO
1	TENSOR ANALYSIS - I:	CO1

	Multi linear forms, Definition of Tensor over including vector spaces, Alternating tensors, determinants, orientation, tensor products.	
2	<p>TENSOR ANALYSIS – II:</p> <p>Rotation of tensors, calculations of tensors, internal calculations of tensors and Integral identities,</p> <p>TENSOR CALCULUS: Tensor calculus.</p>	CO2
3	<p>CONTINUUM MECHANICS</p> <p>Eulerian and Lagrangian description of a continuous, discrete systems, continua, physical quantities and their derivatives. Rigid body motion, Relation between continuum models and real materials</p> <p>CONSERVATION LAWS IN A CONTINUUM:</p> <p>Mass conservation in Lagrangian and Eulerian frames, Conservation of momentum in Lagrangian and Eulerian frames.</p>	CO3
4	<p>CONSERVATION LAWS OF ENERGY:</p> <p>Conservation in angular momentum in Lagrangian form. Conservation of energy in Lagrangian and Eulerian frames. Strain and decomposition. Finite deformation, infinitesimal displacements</p> <p>CONSTITUTIVE RELATIONS - I:</p> <p>Material frame indifference, Elastic Materials</p> <p>CONSTITUTIVE RELATIONS - II:</p> <p>Viscous fluids, linear viscoelasticity</p>	CO4, CO5

Learning Resources	
Text Book(s):	
1. Continuous mechanics by George Backus, Samizdat Press, 1997	
References:	
1. Mechanics of Continua by A.C. Eringen, 1962	
2. Continuous Physics by A.C. Eringen Vol. 1, Academic press 17, 1967,	
3. Introduction to Continuous Mechanics by B.L.N. Kennett	
4. Quick introduction to Tensor analysis by R.Sharipov, 2004, Samizdat Press.	
5. Non-linear continuum mech-win, SEACAS theory manuals part II by T.A. Laursen, S.W.Attaway and R.I.Zadoks	