Course Title	Continuum Mechanics and Applications	Course Code	**ME5XXX**			
Dept./ Specialization	Mechanical Engineering	Structure (LTPC)	3	1	0	4
To be offered for	UG/PG	Status	Core ☐		Elective ▬	
Faculty Proposing the course	Dr. Siva Prasad AVS	Type	New ▬		Modification ▬	
Recommendation from the DAC		Date of DAC				
External Expert(s)						
Pre-requisite	Mechanics of Materials	Submitted for approval			xxth Senate	
Learning Objectives	The main objective of the course is to learn the principles of continuum mechanics with emphasis on developing constitutive laws for solid materials.					
Learning Outcomes	At the end of the course, students will be capable of applying continuum mechanics principles to investigate the deformation behavior of solid materials.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	**Tensor algebra and calculus:** Indicial notation, eigen value problems, co-ordinate transformation; derivatives of functions with respect to tensors; gradient, divergence, curl, divergence theorem, transport theorem (L6+ T2) **Kinematics of deformation:** Material (Lagrangian) and spatial (Eulerian) derivatives; Deformation gradient, rotation, stretch, strain, strain rate and spin tensors; Infinitesimal and finite strain formulations (L9+T3) **Concept of Stress:** Cauchy Stress Vector and Tensor; Cauchy's formula; Various measures of stress tensors (L4+T2) **Balance laws:** Governing equations for conservation of mass, momentum and energy in both material and spatial configurations; second law of thermodynamics – entropy inequality principle (L8+T2) **Constitutive equations**: Work conjugates for various stress measures; Objectivity and frame invariance; Material anisotropy and elastic constants for different crystal symmetries; Material and geometrical nonlinearities; Hyperelastic materials–strain-energy functions and stress-strain relations; Viscoelastic materials at large strains (L9+T3) **Applications & Case studies:** Formulation of boundary value problems in linear and nonlinear elasticity; Mechanics of hydrogels; Biomechanics of tissues (L6+T2)					
Text Book	1. M. H. Sadd, Continuum Mechanics Modeling of Material Behavior, Academic press (Elsevier), 2019. 2. G. A. Holzapfel, Nonlinear Solid Mechanics: A Continuum Approach for Engineering, Wiley & Sons, 2000.					
Reference Books	1 R. W. Ogden, Non-Linear Elastic Deformations, Wiley & Sons, 1997. 2 Hua Li and Vadim Silberschmidt, The Mechanics of Hydrogels – Mechanical Properties, Testing and Applications, Elsevier, 2022. 3 G. A. Holzapfel and R. W. Ogden, Mechanics of biological tissue, Springer, 2006. 4 G. A. Holzapfel and E. Kuhl, Computer Models in Biomechanics – From Nano to Macro, Springer, 2013.					