

Department of Applied Mechanics, Indian Institute of Technology Madras

Course title	Geometry & mechanics of materials									Cours e No	AM6XXX			
Department	Applied Mechanics	New Credit s	L	T	E	P	O	C	T H	Old Credit s	L	T	P	C
			3				6	9			3			3
Offered for	B.Tech (Honours), DD, M. Tech., M.S. and Ph.D									Status	New			
Faculty	S Ganga Prasath									Type	Theory			
Pre-requisite skills	Introductory level courses in Solid Mechanics									To take effect from	01-08-2023			
Submission date	Date of approval by DCC		Date of approval by BAC						Date of approval by Senate					

Objectives:

- Gain insights and develop intuitions as to how the geometry interplays with the material properties to determine its mechanical response
- Get introduced to the analytical & numerical techniques used to solve non-linear problems in elastic systems

Course Contents:

- Revision of bulk elasticity concepts, Classification of materials based on their geometry: filaments, ribbons, sheets and shells
- Geometric properties of curves in 3D using Serret-Frenet and Darboux frames
- Introduction to the Kirchhoff rod theory, Solution to the Euler-Bernoulli beam equation, Euler's solution to the 'Elastica' problem and Mechanics of hair curls
- Instabilities in filaments, Using numerical continuation to identify solution branches and bifurcation points
- Representation of surfaces: first and second fundamental form, Gauss' Theorema Egregium
- Derivation of Foppl-von Karman plate equations, Lamé problem in thin-sheets and mechanism of wrinkling
- Summary of instabilities in sheets: wrinkles, folds and cusps
- Geometry of origami, designing materials using kirigami and overview of differential growth problems in biological systems

Text Books:

- Bassile Audoly and Yves Pomeau, Elasticity and Geometry: From hair curls to the non-linear response of shells, Oxford University Press, 2010.

Reference Books:

- Landau and Lifshitz, Theory of Elasticity, Elsevier, 1970.
- Howell, Kozyreff and Ockenden, Applied Solid Mechanics, Cambridge University Press, 2009.

Pre-requisite Course:

No Pre-requisite Courses

	CourseNo	Course Name		CourseNo	CourseName
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Course 1			or		
			or		
Course 2			or		
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Course 3			or		
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