STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI
COURSE PLAN (November 2024 – April 2025)

Department	: **MATHEMATICS**
Name/s of the Faculty	: **Dr. CHINTHAMANI. S**
Course Title	: **CONTINUUM AND FLUID MECHANICS**
Course Code	: **23MT/PC/CF44**
Shift	: **I**

COURSE OUTCOMES (COs)

COs	Description	CL
CO1	recall and summarize the key concepts related to tensors, stress, strain, and kinematics of fluid motion	K1
CO2	demonstrate an understanding of tensor algebra, stress principles, deformation, and the basics of fluid motion	K2
CO3	apply the principles of tensor algebra and fluid mechanics to solve complex problems	K3
CO4	analyse and solve problems in various fields, demonstrating the ability to adapt their skills to diverse applications	K4
CO5	analyse and solve problems in various fields, demonstrating the ability to adapt their skills to diverse applications	K5

Week	Unit No.	Content	Cognitive Level	Teaching Hours	COs	Teaching Learning Methodology	Assessment Methods

Nov 18 – 25, 2024 (Day Order 1-6)	I	**Unit 1: Cartesian Tensors and Algebra of Tensors** 1.1 Tensors and Continuum Mechanics 1.2 General Tensors - Cartesian Tensors - Tensor Rank 1.3 Dyads and Dyadics 1.4 Coordinate Systems- Base Vectors - Unit Vector Triads	K1-K5	6	CO1-5	Presentation, Lecture & Problem Solving using Mind map	Group Discussion
Nov 26- Dec 3, 2024 (Day Order 1 to 6)	I	**Unit 1: Cartesian Tensors and Algebra of Tensors** 1.5 Linear Vector Functions - Dyadics as Linear Vector Operators 1.6 Indicial Notation - Range and Summation Conventions - Kronecker Delta, Permutation Symbol 1.7 Transformation Laws for Cartesian Tensors – The Orthogonality Conditions	K1-K5	6	CO1-5	Lecture & Problem solving through technical forum LUMI etc	Short Q/A
Dec 4-11, 2024 (Day Order 1 to 6)	I	**Unit 1: Cartesian Tensors and Algebra of Tensors** 1.8 Operations on Cartesian Tensors	K1-K5	6	CO1-5	Lecture & Problem Solving	Quiz using software like Lumi

		1.9 Symmetry of Dyadics, Matrices and Tensors 1.10 Principal Values and Principal Directions of Symmetric Second-Order Tensors **Unit 2: Stress and Strain** 2.1 Continuum Concept 2.2 Homogeneity, Isotropy, Mass-Density					
Dec 12-19, 2024 (Day Order 1 to 6)		**Unit 2: Stress and Strain** 2.3 Body Forces, Surface Forces 2.4 Cauchy's Stress Principle, The Stress Vector 2.5 State of Stress at a Point, Stress Tensor 2.6 The Stress Tensor-Stress Vector Relationship 2.7 Force and Moment, Equilibrium, Stress Tensor Symmetry	K1-K5	6	CO1-5	Lecture & Problem Solving	Modelling
Dec 20-21, 2024 (Day Order 1&2)		**Unit 2: Stress and Strain** 2.8 Stress	K1-K5	2	CO1-5	Lecture & Problem Solving	Modelling

		Transformation Laws 2.9 Stress Quadric of Cauchy 2.12 Position Vector, Displacement Vector					
Jan 3 – 7, 2025 (Day Order 3 to 6)		**Unit 2: Stress and Strain** 2.10 Particles and Points 2.11 Continuum Configuration, Deformation and Flow Concepts 2.13 Lagrangian and Eulerian Descriptions	K1-K5	4	CO1-5	Lecture & Problem Solving	**III Component Test: Written Test – 25 marks Portion: Unit 1**
Jan 8 – 17, 2024 (Day Order 1 to 6)		**Unit 2: Stress and Strain** 2.14 Deformation Gradients, Displacement Gradients 2.15 Deformation Tensors, Finite Strain Tensors **Unit 3: Kinematics of Fluid Motion** 3.1 Real Fluids and Ideal Fluids – Velocity of a Fluid at a Point 3.2 Stream Lines and Path Lines – Velocity Potential – Vorticity	K1-K5	6	CO1-5	Lecture & Problem Solving	Mind map

		Vector					
Jan 18 - 23, 2025		**C.A. Test – I [Portion: Units 1 & 2]**					
Jan 24 -31, 2025 (Day Order 1 to 6)		**Unit 3: Kinematics of Fluid Motion** 3.2 Stream Lines and Path Lines – Velocity Potential – Vorticity Vector 3.3 Local and Particle Rates of Change	K1-K5	6	CO1-5	Lecture & Problem Solving	Experiment
Feb 3-8, 2025 (Day Order 1 to 6)		**Unit 3: Kinematics of Fluid Motion** 3.4 Equation of Continuity - Worked Examples 3.5 Acceleration of a Fluid – Conditions at a Rigid Boundary 3.6 Sources, Sinks and Doublets	K1-K5	6	CO1-5	Lecture & Problem Solving	Experiment
Feb 10– 18, 2025 (Day Order 1 to 4)		**Unit 4: Equations of Motion of a Fluid** 4.1 Pressure at a Point in a Fluid at Rest 4.2 Pressure at a Point in a Moving Fluid –	K1-K5	4	CO1-5	Lecture & Problem Solving	**III Component Test: Presentation - 10marks Portion: Unit 4**

		Conditions at a Boundary of two Inviscid Immiscible Fluids 4.3 Euler's Equation of Motion – Bernoulli's Equation						
Feb 19- 26, 2025 (Day Order 1-6)		**Unit 4: Equations of Motion of a Fluid** 4.4 Steady Motion Under Conservative Body Forces 4.5 Meaning of Two-Dimensional Flow 4.6 Use of Cylindrical Polar Coordinates	K1-K5	6	CO1-5	Lecture & Problem Solving	Presentation
Feb 27- Mar 6, 2025 (Day Order 1 to 6)		**Unit 4: Equations of Motion of a Fluid** 4.7 The Stream Function 4.8 The Complex Potential for Two-Dimensional, Irrotational, Incompressible Flow - Some Standard Two- Dimensional Flows	K1-K5	6	CO1-5	Lecture & Problem Solving	Presentation
Mar 7 – 11, 2025 (Day Order 1 to 3)		**Unit 5: Viscous Flow** 5.1 Newton's Law of Viscosity	K1-K5	3	CO1-5	Lecture & Problem Solving	Quiz by using ICT tool Kahoot

		5.2 The Rate of Strain Quadric					
Mar 12 –17, 2025	**C.A. Test – II [Portion: Units 3 & 4]**						
Mar 18 – 20, 2025 (Day 4 to 6)		**Unit 5: Viscous Flow** 5.3 Navier – Stokes Equation of Motion of a Viscous Fluid 5.4 Steady Motion between Parallel Planes	K1-K5	3	CO1-5	Lecture & Problem Solving	**III Component Test: Exhibition – 15 marks**
Mar 21 - 28, 2025 (Day Order 1 to 6)		**Unit 5: Viscous Flow** 5.5 Steady Viscous Flow in Tubes of Uniform Cross-Section	K1-K5	6	CO1-5	Lecture & Problem Solving	Group Discussion
Mar 29- April 2, 2025 (Day Order 1 to 3)	**REVISION**						

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