

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI

COURSE PLAN (June - November 2026)

Department : PHYSICS
Name/s of the Faculty : DR. D. SUKANYA
Course Title : MATHEMATICAL PHYSICS - I
Course Code : 23PH/PC/MP14
Shift : II

COURSE OUTCOMES (COs)

COs	Description	CL
CO1	recall the main mathematical methods used in physics.	K1
CO2	explain the fundamentals of Vector and Tensor analysis, Complex Analysis and special functions	K2
CO3	apply the concepts of mathematical physics in real life problems	K3
CO4	demonstrate the tools of mathematical physics that are important prerequisites for other theoretical physics courses	K4
CO5	evaluate accurate and efficient use of specific mathematical physics techniques	K5, K6

Week	Unit No.	Content	Cognitive Level	Teaching Hours	COs	Teaching Learning Methodology	Assessment Methods
Jun 22, 2026 (Day Order 6)	5	Introduction to special functions	K1- K6	1	1-5	Discussion	Group discussion
Jun 23 – July 1, 2026 (Day Order 1- 6)	5	Legendre polynomial and function - Generating function - Rodrigue formula –	K1- K6	5	1-5	Lecture derivation on the topic	Quiz on special functions
July 2 – July 8, 2026 (Day Order 1- 6)	5	Orthogonality property - Associated Legendre function - Recurrence relations - Gamma functions	K1- K6	5	1-5	Lecture derivation on the topic and PPT presentation on applications	Exploring the other recurrence relations of Legendre polynomials
July 9 – 16, 2026 (Day Order 1- 6)	5,4	Beta functions - Tensors in Physics - Notation and conventions - Contra and covariant tensors of rank one and two - Algebra of tensors - outer and inner products - Contraction	K1- K6	5	1-5	Lecture with PPT presentation on real time applications of tensors in physics	Peer group discussion and problem-solving assignments
July 17 – 24, 2026 (Day Order 1- 6)	4	Symmetric and antisymmetric tensors - Quotient law - Conjugate tensors - Metric tensor - Raising and lowering of indices- Stress, strain and Hooke's law –	K1- K6	5	1-5	Lecture and Problem-solving tasks	Assignment on the Applications of tensors
July 25 – 28, 2026 (Day Order 1- 3)	4	Tensors in dynamics, in elasticity and in rigid bodies - Moment of inertia tensor	K1- K6	3	1-5	Lecture and demonstration of	Third component Problem sheet assignment on

						practical relevance	special functions and tensors (K4, K5) – 15 marks
July 29 – Aug 3, 2026	C.A. Test – I						
Aug 4 - 6, 2026 (Day Order 4 - 6)	1	Numerical analysis Finite differences – Newton Gregory formula – Interpolation and extrapolation – Numerical differentiation - Numerical integration	K1- K6	2	1-5	Theory explanation and problem solving tasks	Hands on activity using simulations
Aug 7 – 14, 2026 (Day Order 1- 6)	1	Simpson’s one third rule - Solution of ordinary differential equations: Euler method - Euler modified method – Runge – Kutta method (2nd order)	K1- K6	5	1-5	Lecture derivation and Problem solving	Problem solving and Visual learning assignments
Aug 17 - 24, 2026 (Day Order 1- 6)	1	Newton Raphson method – method of iterations (forward and backward iterations) – method of Least squares.	K1- K6	5	1-5	Lecture with real world examples	Solving problems by students on board
Aug 25 – Sep 2, 2026 (Day Order 1- 6)	2	Complex Analysis Functions of a complex variable - Analytic function - Cauchy - Riemann equations -Laplace equation and harmonic function - Line integral in complex plane	K1- K6	5	1-5	Theorem explanations and problem solving discussion	Homework problem solving activity and discussion
Sep 3 – 11, 2026 (Day Order 1- 6)	2	– Singular points- Cauchy’s theorem - multiply connected regions - Cauchy	K1- K6	5	1-5	Theorem explanations and problem solving	Third component test on formulas

		integral formula - Derivatives of analytic function-Taylor and Laurent series – Residue theorem				discussion	and simple problems (K1, K2, K3) – 20 marks
Sep 15-17, 2026 (Day Order 1 - 3)	3	Linear vector Space Dual space: ket and bra notation – basis – orthogonal basis – change of basis –	K1- K6	3	1-5	Lecture discussion on introductory concepts	Quiz and peer group discussion
Sep 18 –23, 2026	C.A. Test – II						
Sep 24 - 28, 2026 (Day 4 – 6)	3	Isomorphism of vector spaces – projection operator – Eigen values and eigen functions –orthogonal transformations and rotations– Expansion theorem – Inner product and unitary spaces	K1- K6	2	1-5	Lecture and demonstration of practical relevance	Third Component Seminar presentation on theorem-based problems (K6) – 15 marks
Sep 29 – Oct 7, 2026 (Day Order 1 - 6)	3	Orthonormal sets – Schmidt orthogonalization procedure – Completeness – Applications to Hydrodynamics	K1- K6	5	1-5	Theorem discussion through lecture and applications	Group problem solving tasks
Oct 8 - 14, 2026 (Day Order 1 - 6)	3	Heat flow in solids, Gravitation and Electromagnetic field	K1- K6	5	1-5	Lecture and Problem-solving tasks	Discussion
Oct 15 - 21, 2026 (Day Order 1- 4)	REVISION						

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