

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI
COURSE PLAN June - November 2024

Department : Physics
Name/s of the Faculty : Dr. K. Sownthari
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 24 – 26, 2024 (Day Order 4 - 6)	1	Numerical analysis Finite differences – Newton Gregory formula – Interpolation and extrapolation	K1-K6	2	1-5	Lecture, problem Solving	Problem solving and Quiz
Jun 27 – July 4, 2024 (Day Order 1 - 6)	1	Numerical differentiation - Numerical integration – Simpson’s one third rule - Solution of ordinary differential equations: Euler method	K1-K6	5	1-5	Lecture, problem Solving	Problem solving and Quiz
July 5 – 12, 2024 (Day Order 1 - 6)	1	Euler modified method – Runge – Kutta method (2nd order) – Newton Raphson method Method of iterations (forward and backward iterations) – method of Least squares.	K1-K6	5	1-5	Lecture, problem Solving	problem solving
July 15 – 23, 2024 (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	Presentation	Third component Seminar
July 24 – 31, 2024 (Day Order 1 - 6)	2	Singular points- Cauchy’s theorem - multiply connected regions - Cauchy integral formula - Derivatives of analytic function	K1-K6	5	1-5	Presentation	Third component Seminar

Aug 1 – 5, 2024 (Day Order 1 - 3)	2	Taylor and Laurent series – Residue theorem	K1-K6	2	1-5	Presentation	Third component Seminar
Aug 6 – 10, 2024	C.A. Test - I						
Aug 12 – 14, 2024 (Day Order 4-6)	3	Linear vector Space Dual space: ket and bra notation – basis – orthogonal basis	K1-K6	2	1-5	Lecture, problem Solving	Third Component problem solving
Aug 16 – 23, 2024 (Day Order 1-6)	3	change of basis – Isomorphism of vector spaces – projection operator – Eigen values and eigen functions – orthogonal transformations and rotations	K1-K6	5	1-5	Lecture, problem Solving	Third Component problem solving
Aug 27 – Sep 3, 2024 (Day Order 1-6)	3	Expansion theorem – Inner product and unitary spaces – Orthonormal sets – Schmidt orthogonalization procedure – Completeness Applications to Hydrodynamics , Heat flow in solids, Gravitation and Electromagnetic field	K1-K6	5	1-5	Lecture, problem Solving	Third Component problem solving
Sep 4 – 11, 2024 (Day Order 1-6)	4	Tensor Analysis Tensors in Physics - Notation and conventions - Contra and covariant tensors of rank one and two	K1-K6	5	1-5	Lecture, problem Solving	Third component snap test

Sep 12 - 20, 2024 (Day Order 1-6)	4	Algebra of tensors - outer and inner products - Contraction - Symmetric and anti symmetric tensors- Quotient law - Conjugate tensors - Metric tensor	K1-K6	5	1-5	Lecture, problem Solving	Third component snap test
Sep 23 - 26, 2024 (Day Order 1-4)	4	Raising and lowering of indices-Stress, strain and Hooke's law – Tensors in dynamics, in elasticity and in rigid bodies - Moment of inertia tensor	K1-K6	4	1-5	Lecture, problem Solving	Third component snap test
Sep 27 – Oct 3, 2024	C.A. Test - II						
Oct 4 – 5, 2024 (Day 5 & 6)	5	Special Functions – I Gamma and Beta functions	K1-K6	1	1-5	Group Discussion	problem solving
Oct 7 - 15, 2024 (Day Order 1 to 6)	5	Properties - Legendre polynomial and function - Generating function - Rodrigue formula –	K1-K6	5	1-5	Group Discussion	problem solving
Oct 16 - 22, 2024 (Day Order 1 to 6)	5	Orthogonality property - Associated Legendre function - Recurrence relations	K1-K6	5	1-5	Group Discussion	problem solving
Oct 23 - 24, 2024 (Day Order 1 to 2)	REVISION						