STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI

COURSE PLAN (June - November 2026)

Department : **PHYSICS**

Name/s of the Faculty : **Ms. J. Josfel Flora**

Course Title : **ELECTROMAGNETIC THEORY**

Course Code : **23PH/PC/ET34**

Shift : **II**

COURSE OUTCOMES (COs)

COs	Description	CL
CO1	Remember the basic concepts of divergence and curl, Biot-Savart law, Amperes law, Electric and magnetic potential, maxwell's equation, Poynting's theorem, Polarization, wave equation, Lorentz's transformation and energy-momentum correlation	K1
CO2	Understand the idea on electric dipole, magnetic dipole, multipole, gauge transformation, frequency dependence of permittivity, and covariance of electrodynamics	K2
CO3	Apply the concept of multipole to assess field at different distances, Poynting's theorem in linear dissipative media, wave propagation in a rectangular wave guide, Lorentz transformation to show invariance of Maxwell's equation.	K3
CO4	Analyse the effect of magnetic field on atomic orbits, electric field in a dielectric medium, reflection and transmission at normal incidence and oblique incidence, fields on the surface and inside rectangular wave guide, transformation of electromagnetic fields.	K4

CO5	Evaluate and develop boundary value problems in electrostatics and magnetostatics, deduct the field of a moving point charge, predict energy flow and attenuation in wave guides, evaluate Lagrangian and Hamiltonian for a relativistic charged particle.	K5

CL – Cognitive Level

K1 – Remember | K2 – Understand | K3 – Apply | K4 – Analyse | K5 – Evaluate

Week	Unit No.	Content	Cognitive Level	Teaching Hours	COs	Teaching Learning Methodology	Assessment Methods
Jun 15 – 22, 2026 (Day Order 1- 6)	1.1 1.2	Divergence and curl of E – Electric potential - Poisson's equations - Laplace's equations in 1D, 2D and 3D – Boundary's conditions and uniqueness theorems Potential of a localized charge distribution - Energy of a point and continuous charge distributions - Multipole expansion: approximate potentials at large distances – monopole and dipole	K1-K5	6	CO1 – CO5	Lecturing: Delivering structured spoken explanations and presentations (ppt) of the topics.	Quizzes: Tests recall
Jun 23 – July 1, 2026 (Day Order 1- 6)	1.2	Electric field of a dipole Dielectrics – Field of a	K1-K5	6	CO1 – CO5	Video: showing how these concepts work	Peer Evaluation

	1.3	polarized object – Boundary value problems with dielectrics - Field inside a dielectric – Energy in dielectric systems – Forces on dielectric.				Problem solving: Group activity	written test: Allows participants to assess and provide constructive feedback to one another
July 2 – July 8, 2026 (Day Order 1- 6)	2.1	Bio-Savart law - Divergence and curl of B – Ampere's law – Calculation of magnetic fields due to current carrying elements – Long straight wire, long solenoid - Magnetic vector potential – Magnetic potential at any point due to current carrying elements	K1-K5	6	CO1 – CO5	Collaborative Learning: Placing students in small groups to work together on assignments and group discussions.	Oral evaluation on the topics taught
July 9 – 16, 2026 (Day Order 1- 6)	2.2	Macroscopic equations, boundary conditions on B and H - Methods of solving boundary value problems in magnetostatics - Multipole expansion of	K1-K5	6	CO1 – CO5	Flipped Classroom: Having students consume lecture materials at home through multimedia, while dedicating class time to interactive	Problem solving: On board

	2.3	the vector potential. Magnetization – Torque and forces on magnetic dipole – Energy in the magnetic field				discussions on the unit.	
July 17 – 24, 2026 (Day Order 1- 6)	2.3 4.1	Effect of a magnetic field on atomic orbits. Wave equation – Boundary conditions: Reflection and Transmission – Polarization – Electromagnetic waves in vacuum	K1-K5	6	CO1 – CO5	Game based learning: The topics will be covered using games and flash cards	Self-Reflection: Home test encourages students to evaluate their own progress. Component – test I: 10 marks (MCQ: K1-K5 level; Units-1 and 2)
July 25 – 28, 2026 (Day Order 1- 3)	4.1	Wave equation for E and B - Monochromatic plane waves - Energy and momentum in electromagnetic waves - Propagation in linear media	K1-K5	3	CO1 – CO5	Chalk and board method	Oral evaluation

July 29 – Aug 3, 2026	**C.A. Test - I**						
Aug 4 - 6, 2026 (Day Order 4 - 6)	4.1	Reflection and transmission at normal incidence and oblique incidence	K1-K5	2	CO1 – CO5	Lecture: presentation Demonstration of the concept	Group activity: Poster making
Aug 7 – 14, 2026 (Day Order 1- 6)	4.2	Guided waves – Wave guides – TE and TM waves - TE waves in a rectangular wave guide - Cut-off frequency, wave velocity and wavelength – Group velocity - Coaxial transmission line - Cylindrical waveguides - Energy flow and attenuation in wave guides – Cavity resonators	K1-K5	6	CO1 – CO5	Lecture: presentation, chalk and board Problem solving: chalk and board	Group relay: Written tests in groups
Aug 17 - 24, 2026 (Day Order 1- 6)	5.1	Lorentz transformation – Structure of space time Relativistic mechanics - Relativistic energy and momentum – Relativistic kinematics – Relativistic dynamics Invariance of Maxwell's	K1-K5	6	CO1 – CO5	Lecture: presentation, chalk and board	Brain storming the topics after the lecture

	5.2	equations under Lorentz transformation – Invariance of electric charge; covariance of electrodynamics					
Aug 25 – Sep 2, 2026 (Day Order 1- 6)	5.2	Transformation of electromagnetic fields - Lagrangian for a relativistic free particle- Lagrangian and Hamiltonian for a relativistic charged particle in an external electromagnetic field	K1-K5	6	CO1 – CO5	Lecture: presentation, chart, flash cards	Peer Evaluation written test
Sep 3 – 11, 2026 (Day Order 1- 6)	3.1	Maxwell's equations – Maxwell's equation in matter – Polarization current – Displacement current - Boundary conditions – Vector and Scalar potentials – Gauge transformations – Lorentz and Coulomb Gauge	K1-K5	6	CO1 – CO5	Lecture: presentation and videos	Component – test II: 20 marks (Seminar: K1-K5 level; Units – 1 to 5)
Sep 15-17, 2026 (Day Order 1 - 3)	3.2	Poynting's theorem and conservation of energy and momentum for a	K1-K5	3	CO1 – CO5	Lecture: chalk and board	Oral evaluation

		system of charged particles and electromagnetic fields – Retarded scalar and vector potentials for continuous distributions - Jefimenko's equations - Point charges – Lienard-Wiechert potential					
Sep 18 –23, 2026	**C.A. Test - II**						
Sep 24 - 28, 2026 (Day 4 – 6)	3.2	Fields of a moving point charge - Electric and magnetic fields of a moving point charge Velocity and acceleration fields.	K1-K5	2	CO1 – CO5	Lecture: presentation (ppt)	Problem test: Group
Sep 29 – Oct 7, 2026 (Day Order 1 - 6)	3.2	Electric dipole radiation - Magnetic dipole radiation- Radiation from an arbitrary source.	K1-K5	6	CO1 – CO5	Lecture: presentation and videos	Component – test III: 20 marks (Problems: K1-K5 level; Units – 1 to 5)
Oct 8 - 14, 2026 (Day Order 1 - 6)	3.3	Power radiated by a point charge -Larmor	K1-K5	6	CO1 – CO5	Lecture: chalk and board	Written test: Essay type

		formula.					
Oct 15 - 21, 2026 (Day Order 1- 4)	**REVISION**						

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