PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION DECEMBER 2025
(Third Semester)

Branch - PHYSICS

ELECTROMAGNETIC THEORY

Time: Three Hours   Maximum: 75 Marks

SECTION-A (10 Marks)
Answer ALL questions
ALL questions carry EQUAL marks   (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	Which is related to electric displacement vector? a) $D=\varepsilon_0 E+P$ b) $D=\varepsilon_0+P$ c) $D=P$ d) $D=\varepsilon_0 E$	K1	CO1
	2	Infer how does electric field of a dipole vary at a large distance. a) $1/(r^2)$ b) $1/(r^3)$ c) $1/(r^4)$ d) $1/(r)$	K2	CO1
2	3	Find the divergence of a magnetic field. a) Positive b) Infinity c) Zero d) Negative	K1	CO2
	4	Show how vector potential A is related to B. a) $A=\nabla\times B$ b) $A=\nabla \cdot B$ c) $B=\nabla \cdot A$ d) $B=\nabla\times A$	K2	CO2
3	5	How is the conservation of electric charge in Maxwell's equations ensured? a) The curl of B b) The divergence of E c) The continuity equation d) The Lorentz force equation	K1	CO3
	6	Relate the induced electric field intensity (E) in terms of the vector potential (A). a) $\nabla \cdot A$ b) $-\partial A/\partial t$ c) $\nabla\times A$ d) $\partial A/\partial x$	K2	CO3
4	7	What is the direction of wave propagation in an electromagnetic wave? a) Perpendicular to both electric and magnetic fields b) Parallel to both electric and magnetic fields c) Perpendicular to the magnetic field only d) Perpendicular to the electric field only	K1	CO4
	8	Relate the ratio of the magnitudes of electric field E and magnetic field H of a plane electromagnetic wave in free space. a) $1/c$ b) c c) μ_0 d) ε_0	K2	CO4
5	9	Which of the following is a mode of wave propagation in a rectangular waveguide? a) TEM b) TE only c) TM only d) TE and TM	K1	CO5
	10	Infer, which quantity has only magnitude? a) Scalar b) Vector c) dipole d) magnetic field	K2	CO5

SECTION - B (35 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** Marks $(5 \times 7 = 35)$

Module No.	Question No.	Question	K Level	CO
1	11.a.	Derive and explain Poisson's equation.	K2	CO1
		(OR)		
	11.b.	Illustrate the derivation of Clausius-Mossotti equation.		
2	12.a.	Build the derivation of Biot-Savart law and explain its significance.	K3	CO2
		(OR)		
	12.b.	Construct the expression of Ampere's circuital law in differential form.		
3	13.a.	Derive an expression for induced electromotive force by applying Faraday's law.	K3	CO3
		(OR)		
	13.b.	Develop and explain the Lorentz condition and its importance in electrodynamics.		
4	14.a.	Analyze the propagation of electromagnetic waves in free space with necessary equations.	K4	CO4
		(OR)		
	14.b.	Simplify the wave equation for a plane electromagnetic wave in a non-conducting medium.		
5	15.a.	Discover the different modes of wave propagation in a waveguide.	K4	CO5
		(OR)		
	15.b.	Differentiate Scalar and Vector potential.		

SECTION -C (30 Marks)
Answer **ANY THREE** questions
ALL questions carry **EQUAL** Marks $(3 \times 10 = 30)$

Module No.	Question No.	Question	K Level	CO
1	16	Simplify the derivation for Laplace's equation and discuss its applications.	K4	CO1
2	17	Analyze the concept of vector potential A and its relationship with B.	K4	CO2
3	18	State and categorize Maxwell's equations in detail.	K4	CO3
4	19	Examine the propagation of plane electromagnetic waves in conducting media.	K4	CO4
5	20	Analyze the working of a coaxial waveguide and its applications.	K4	CO5

Z-Z-Z   END