LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **PHYSICS**

FIRST SEMESTER – **NOVEMBER 2024**

PPH1MC02 – ELECTRODYNAMICS

Date: 11-11-2024 Dept. No. Max. : 100 Marks

Time: 01:00 pm-04:00 pm

	SECTION A – K1 (CO1)	
	Answer ALL the questions	**(5 x 1 = 5)**
1	**Fill in the blanks**	
a)	The energy of a magnetic field is related to the _____ of current-carrying elements.	
b)	The reflection of electromagnetic waves at a conducting surface is also known as _____.	
c)	In the presence of a uniform magnetic field, charged particles move in _____ paths.	
d)	MHD involves the study of the behavior of conducting fluids in the presence of a _____ field.	
e)	At interfaces between different media, there are specific conditions that the electromagnetic fields must satisfy to ensure _____of the fields.	
	SECTION A – K2 (CO1)	
	Answer ALL the questions	**(5 x 1 = 5)**
2	**Match the following**	
a)	Divergence and curl of E	Tensor algebra
b)	Poynting's theorem	Calculation of radiated power by a moving charge
c)	Power radiated by a point charge	Boundary conditions
d)	Essential conditions for guided waves	Electric scalar potential
e)	Four vectors	Propagation in linear media
	SECTION B – K3 (CO2)	
	Answer any THREE of the following	**(3 x 10 = 30)**
3	Use Gauss's law to find the electric field at a distance x from an infinitely long wire having a uniform line charge density λ.	
4	Write down the differential form of the Poynting's theorem and explain the significance of each term.	
5	Derive the Abraham-Lorentz formula for the radiation reaction force.	
6	Explain how a coaxial transmission line supports propagation of TEM waves.	
7	Three long parallel conductors in free space are separated by a distance of 50 cm each. All conductors carry a current of 100 A. The first and the second conductors carry current in the same direction. What is the force acting on the first, second and third conductors?	

SECTION C – K4 (CO3)		
	Answer any TWO of the following	**(2 x 12.5 = 25)**
8	Outline the theory of multipole expansion of electrostatic potential in powers of (1/r).	
9	Explain the phenomena of dispersion and anomalous dispersion in matter and hence derive Cauchy's formula.	
10	What are retarded potentials? Derive expressions for retarded scalar and vector potentials. (2.5 + 10)	
11	Calculate the percentage contraction of a rod moving with a velocity of 0.8c in a direction inclined at 60° to its own length. (6.5) Find the velocity at which the mass of a particle is double its rest mass. (6)	
SECTION D – K5 (CO4)		
	Answer any ONE of the following	**(1 x 15 = 15)**
12	Derive the Lienard-Wiechert potentials for a moving point charge.	
13	Appraise and prioritize the importance of gauge transformations and their interconnection with electromagnetic potentials. Reframe the concepts of Coulomb gauge and Lorenz gauge, emphasizing their significance.	
SECTION E – K6 (CO5)		
	Answer any ONE of the following	**(1 x 20 = 20)**
14	Obtain Maxwell's equations in matter.	
15	What are waveguides? Obtain expressions for the longitudinal components E_z and B_z.	

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