

THE KAVERY ENGINEERING COLLEGE
(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

Fourth Semester

Electronics and Communication Engineering

EC3452 - Electromagnetic Fields

Regulations - 2021

Duration : 3 Hrs

Maximum: 100 Marks

PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)

Q.No	Questions	BLT	CO	Marks
1.	Relate the transformation between spherical and cartesian coordinates.	RE	1	2
2.	Justify that electric field is conservative.	UN	1	2
3.	Define electric field intensity.	RE	2	2
4.	Compare Poisson's and Laplace's equation.	AN	2	2
5.	Write about magnetic flux and flux density.	RE	3	2
6.	Generalize the phenomenon of hysteresis with reference to ferromagnetic materials.	UN	3	2
7.	State Lenz's law.	RE	4	2
8.	Write the phenomenon of electromagnetic induction.	AN	4	2
9.	Can a magnetic field exist in a good conductor if it is static or time varying? Justify.	AN	5	2
10.	Calculate the velocity of a plane wave in a lossless medium having a relative permittivity of 4 and a relative permeability of 1.2.	AP	5	2

PART – B (ANSWER ALL QUESTIONS) (Marks 5*13 = 65)

Q.No	Questions	BLT	CO	Marks
11.	a Estimate the spherical coordinates of A and Cartesian coordinates of B for the two given points A ($x = 2, y = 1, z = 3$) and B ($\rho = 1, \phi = 450, z = 2$).	AP	1	13
	Or			
	b i Find the expression for the curl of a vector and write its significance.	CR	1	7
	ii State and formulate Stokes theorem to relate line integral and surface integral.	CR	1	6
12.	a Analyze the importance of Poisson's and Laplace's equation in electromagnetic with necessary equations.	AN	2	13
	Or			
	b A cylindrical capacitor consists of an inner conductor of radius 'a' & an outer conductor whose inner radius is 'b'. The space between the conductors is filled with a dielectric permittivity ϵ_r & length of the capacitor is L. Estimate the value of the capacitance.	AN	2	13

13.	a	Determine the expression for ampere circuital law. Apply the law for any two applications with necessary illustrations.	AP	3	13
		Or			
	b	Examine the magnetic field intensity within a magnetic material where: i) $M=150\text{A/m}$ and $\mu=1.5\times 10^{-5}\text{ H/m}$ ii) $B=300\mu\text{T}$ and $\chi_m=15$.	AP	3	13
14.	a	Illustrate the integral and point form of Maxwell's equations for static fields.	AP	4	13
		Or			
	b i	Illustrate with necessary fundamentals the equation of continuity of current in differential form.	AP	4	7
	ii	Prove that modified ampere's law is consistent with the time varying field.	AP	4	6
15.	a	Derive the wave equation for the electric and magnetic fields for free space conditions.	AP	5	13
		Or			
	b	E and H waves travelling in free space are normally incident on the interface with a perfect dielectric with $\epsilon_r = 3$. Compute the magnitudes of incident, reflected and transmitted E and H waves at the interface.	AP	5	13

*PART – C (Marks 1*15 = 15)*

<i>Q.No</i>		<i>Questions</i>	<i>BLT</i>	<i>CO</i>	<i>Marks</i>
16.	a	Analyze the boundary conditions between conductor and dielectrics from the boundary conditions between conductor and free space.	AN	2	15
		Or			
	b	From the Biot-Savart's law, derive write the expression for magnetic field intensity at a point P and distance R from the infinitely long straight current carrying conductor.	AN	3	15