

Course: B. Tech. Branch : Electronics Engineering Semester : V

Subject Code & Name: Electromagnetic Field Theory (BTEXPE504A)

Max Marks: 60

Date: 08/02/2023

Duration: 3 Hr.

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

		(Level/CO)	Marks
Q. 1	Solve Any Two of the following.		12
A)	Three field quantities are given as $\mathbf{A} = 2\mathbf{a}_x + \mathbf{a}_y - 3\mathbf{a}_z$, $\mathbf{B} = \mathbf{a}_y - \mathbf{a}_z$, $\mathbf{C} = 3\mathbf{a}_x + 5\mathbf{a}_y + 7\mathbf{a}_z$. Determine (i) $\mathbf{A} - 2\mathbf{B} + \mathbf{C}$ (ii) $\mathbf{C} - 4\mathbf{A} + \mathbf{B}$ (iii) $\mathbf{A} \cdot \mathbf{C} - \mathbf{B} ^2$		6
B)	Express the Following Points in Cartesian Coordinates (i) $P(1, 60^\circ, 2)$ (ii) $Q(2, 60^\circ, -4)$ (ii) $R(4, \pi/2, \pi/6)$		6
C)	State and Verify Divergence Theorem		6
Q.2	Solve Any Two of the following.		12
A)	If an Infinite surface Charge is uniformly distributed in XY plane with charge density ρ_s then Evaluate electric field intensity at any point	Understand	6
B)	Derive an current continuity equation for time varying field	Remember	6
C)	Calculate E, at $M(3,-4,2)$ in free space caused by a) a charge $Q_1=2 \mu\text{C}$ at $P_1(0,0,0)$ a) a charge $Q_2=3 \mu\text{C}$ at $P_1(-1,2,3)$ a) Both Q_1 and Q_2	Understand	6
Q. 3	Solve Any Two of the following.		12
A)	Explain In short (i) Biot savart's law (ii) Maxwell's Equation in final forms	Remember	6
B)	A Telephone line has $R = 30\Omega/\text{km}$, $L = 100\text{mH}/\text{km}$, $G = 0$, $C = 20\mu\text{F}/\text{km}$. At $f = 1 \text{ kHz}$, Obtain a) The characteristic impedance of the line b) The propagation constant c) The Phase velocity	Understand	6
C)	State and Explain Ampere's Circuital Law with its Application.	Remember	6

Q.4	Solve Any Two of the following.		12
A)	Select the values of 'k' so that following pair of field satisfies the Maxwell's equation in region. Where a) $E = (kx - 100t)ay \frac{v}{m}$ $H = (x + 20t)az \frac{A}{m}$ (Take $\mu=0.25 H/m, \epsilon= 0.01F/m$) b) $D = 5ax - 2yay + kzaz \frac{\mu c}{m^2}$ $B = 2ay \text{ mWb}/m^2$ (Take $\mu= \mu_0, \epsilon=\epsilon_0$)	Remember	6
B)	What are the Applications and Types of Transmission Line?	Remember	6
C)	Define: Propagation constant, characteristic impedance, reflection coefficient and VSWR	Remember	6
Q. 5	Solve Any Two of the following.		12
A)	State and explain Poynting theorem in detail in electromagnetic fields.	Remember	6
B)	The Electric field Intensity associated with a plane travelling in a perfect dielectric , non- magnetic medium is given by, $Ex(Z, t) = 10 \cos(3\pi \times 10^8 t - 2\pi z)$ Compute the wavelength, frequency, and velocity of propagation.	Understand	6
C)	Explain Circular & Elliptical polarization	Understand	6
*** End ***			