Sub Code: ECT043 **ROLL NO……..……..**

EVEN SEMESTER EXAMINATION, 2023 – 24

2nd yr B.Tech. –Electronics & Communication Engineering

Electromagnetic Field Theory

Duration: 3:00 hrs **Max Marks: 100**

Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q 1.	Answer any four parts of the following. a) If $A=\left[3a_r+2a_\theta+-6a_\phi\right]\&\ B=\left[4a_r+3a_\phi\right]$, determine:(1) $A.B$ (2) $\lvert A\times B\rvert$ (3) The vector component of A along a_z at $\left(1,\frac{\pi}{3},\frac{5\pi}{4}\right)$ b) Explain Farady's Law? c) Find the electric flux density and volume charge density if the electric field , $E = x^2a_x + 2y^2a_y + z^2a_z\ V/m$ in a medium whose ε_r =2. d) Explain Biot-Savart's Law and show that the magnetic field intensity due to an infinitely long filamentary current I along the z-axis in cylindrical coordinates, is inversely proportional to the radial distance to the field point e) What is distortion less transmission line? f) Explain Poynting vector and its use?	5x4=20
Q 2.	Answer any four parts of the following. a) A plane wave propagating through a medium $\left[\varepsilon_r=8,\mu_r=2,\sigma=0\right]$has electric field given by $\vec{E}=0.5\sin(10^8t-\beta z)$ V/m. Calculate the wave impedance? b) State and prove divergence theorems? c) A transmission line has a characteristic impedance of 50 ohms and a resistance of 0.1ohm/m. If the line is distortion less, calculate the attenuation constant (Np/m)? d) Derive an expression for magnetic field intensity of due to finite long straight element? e) State and explain Ampere's Circuital Law in point form? f) Explain Quarter wave transformer with suitable diagram?	5x4=20
Q 3.	Answer any two parts of the following. a) Medium 1 has the electrical permittivity $\varepsilon_1=1.5\varepsilon_0$ farad/m occupies the region to the left of $x=0$ plane. Medium 2 has the electrical permittivity $\varepsilon_2=2.5\varepsilon_0$ and occupies the region to the right of $x=0$ plane. If Electric field in Medium 1 is $E_1=2a_x-3a_y+1a_z$ V/m. Find Electric field in Medium 2? b) The propagation constant of a lossy transmission line is (2+j5)/m and its characteristic impedance is 50 ohms at $w=10^6 rad/s$. The value of the line constants L,R,C,G are respectively? c) Derive expression for instantaneous pointing vector, average pointing vector and average power?	10x2= 20

Q 4.	Answer any two parts of the following. a) A plane wave propagating through a medium with $\varepsilon_r = 8, \mu_r = 2$ has $E = 0.5e^{-z/3}\sin(10^8 t - \beta z)a_x$ V/m. Determine (a) β (b)the loss tangent (c)intrinsic impedance (d) wave velocity (e) H field b) Explain ampere's circuit law and applications of ampere's circuit law in details? c) (1) Using the differential length dl, find the length of each of the following curves:(i) $\rho = 3, \frac{\pi}{4} \prec \phi \prec \frac{\pi}{2}, z = c$, where c is constant (ii) $r = 1, \theta = \frac{\pi}{6}, 0 \prec \phi \prec \frac{\pi}{3}$, (iii) $r = 4, \frac{\pi}{6} \prec \theta \prec \frac{\pi}{2}, \phi = c$, where c is constant. (2) Explain Gauss's law and its applications?	10x2= 20
Q 5.	Answer any two parts of the following. a) Write a short note on Propagation of electromagnetic waves in conducting medium? b) Write a short note on Smith chart along with its applications. c) In free space $(z \le 0)$, a plane wave with $H_i = 10\cos(10^8 t - \beta z)a_x$ mA/m is incident normally on a lossless medium with $\varepsilon = 2\varepsilon_o, \mu = 8\mu_o$ in region $z \ge 0$. Determine the reflected wave and transmitted wave H_r, E_r and H_t, E_t.	10x2= 20

****