

Code No: R20A0407

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech II Semester Regular/Supplementary Examinations, July 2023**Electromagnetic Fields & Waves**

(ECE)

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Time: 3 hours**Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

SECTION-I**Marks**

- 1 **A** Express the vector A in the three coordinate systems. Write the transformation equation from any one coordinate system to any other coordinate system. **[8M]**
- B** Two uniform vector fields are given by $E = -5a_p + 10a_0 + 3a_z$ and $F = a_p + 10a_0 - 6a_z$. Calculate
- (a) magnitude of $E \times F$ **[3M]**
- (b) The vector component of E at $P(5, \pi/2, 3)$ parallel to the line $x=2, z=3$ **[3M]**

OR

- 2 **A** Define the Electric Flux Density. Determine the Electric flux density at a point P due to infinite line of uniform Charge density ρ_L C/m. **[7M]**
- B** A Point Charge of 20 nC is Located at the Origin. Determine the Magnitude and direction of the electric field intensity at the Point $(1, 3, -4)$. **[7M]**

SECTION-II

- 3 **A** Classify Maxwell equations for electrostatic fields in both differential and integral form. **[7M]**
- B** Determine the Relationship between E and V **[7M]**
- OR
- 4 **A** Discuss the boundary conditions for dielectric to dielectric conditions. **[7M]**
- B** Discuss the importance of Poissons and Laplace equations. **[7M]**

SECTION-III

- 5 **A** Consider a differential current element, and calculate the differential magnetic field intensity. **[7M]**
- B** Draw the various current distributions available in magnetostatics. Write the magnetic vector potential equations for the above current distributions. **[7M]**

OR

- 6 **A** State Amperes circuital law. Calculate the magnetic field intensity for an infinite current carrying conductor? **[7M]**
- B** Discuss the concept of Faradays law with equations. **[7M]**

SECTION-IV

- 7 **A** Explain and derive the characteristics of wave propagation in free space. **[8M]**

- B** The electric field in the free space is given by, $E = 50\cos(10^8 t + \beta x)a_y$ V/m.
- i. Find the direction of propagation [3M]
- ii. Calculate β [3M]

OR

- 8** **A** Determine the expression for intrinsic impedance and propagation constant in a good conductor. [7M]
- B** In a lossless medium for which $\eta = 60\pi$, $\mu_r = 1$, and $H = -0.1 \cos(\omega t - z)a_x + 0.5 \sin(\omega t - z)a_y$ A/m, calculate ϵ_r , ω ? [7M]

SECTION-V

- 9** **A** State and Prove Poynting theorem? [7M]
- B** In free space ($z \leq 0$), a plane wave with $H = 10 \cos(10^8 t - \beta z)a_x$ mA/m is incident normally on a lossless medium ($\epsilon = 2\epsilon_0$, $\mu = 8\mu_0$) in region $z \geq 0$. Determine the reflected wave H_r , E_r [7M]

OR

- 10** **A** Evaluate the expressions for reflection coefficient and transmission coefficient by a normal incident wave for a dielectric medium. [7M]
- B** Explain the importance of Critical Angle and Total Internal Reflection and their applications. [7M]
