Code No.: EC504PC | R20 | H.T.No. | | | 8 | R | | | | | |

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
III–B.TECH–I–Semester End Examinations (Supply) – December 2025
ELECTROMAGNETIC FIELDS AND WAVES
(ECE)

[Time: 3 Hours]   **[Max. Marks: 70]**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks.

PART-A   (20 Marks)

1. a) Define Continuity equation. Write equation in point form. [2M]
   b) State Coulomb Law in electrostatics. [2M]
   c) If a point charge is place in E&B fields, calculate 'F' on a Charge Particle? [2M]
   d) State the point form of Ampere's circuital law [2M]
   e) Write Lorentz force equation [2M]
   f) Explain briefly Lorentz condition for potentials. [2M]
   g) State Poynting Theorem. [2M]
   h) Define uniform plane wave and state its properties. [2M]
   i) What are Dominant and Degenerate modes in Rectangular Wave Guide. [2M]
   j) Mention the Applications of Micro strip lines. [2M]

PART-B   (50 Marks)

2. Write short notes on Rectangular, cylindrical and spherical coordinate systems. [10M]

OR

3. Derive the electric field boundary conditions between dielectric and conductor? [10M]

4.a. State and prove Ampere's Force law. [5M]
   b. Using Ampere's circuit Law, find H due to an infinite sheet of current. [5M]

OR

5.a. A filamentary current of 15A is directed in from infinity to the origin on the positive x axis and then back out to infinity along the position yaxis. Use the Biot-Savart's law of find H at P (0, 0, 1)? [5M]
   b. Find the magnetic field intensity at centre of a square of sides equal to 5m and carrying a current equal to 10 A. [5M]

6.a. Explain (i) Conduction Current. (ii) Displacement current. [5M]
   b. Derive the Maxwell's four equations for time varying fields [5M]

OR

7.a. Derive the boundary conditions for a dielectric – conductor interface for magnetic fields. [5M]
   b. A dielectric sphere of ε_r = 5.7 and of radius 10 cm has a point charge 2µc placed at its centre. Calculate the surface density of polarization charge on the surface of the sphere. [5M]

8.a. Write short Notes on Total internal reflection [5M]
  b. A plane wave having a frequency of 10MHz has an average Poynting vector of $1W/m^2$. If the medium is lossless with relative permeability 2 and relative permittivity 3, find the velocity of propagation, Wavelength, impedance of medium and rms value of the electric field. [5M]

OR

9.a. Define Brewster angle and derive an expression for Brewster angle when a wave is parallel polarized. [5M]
  b. For good dielectrics derive the expressions for α, β, γ and η. [5M]

10. Explain in detail about the wave guide parameters in Rectangular waveguide and derive its equations. [10M]

OR

11. Derive the wave equation for a TE wave and obtain all the field components in a rectangular wave guides. [10M]

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