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

# CMR ENGINEERING COLLEGE: : HYDERABAD
## UGC AUTONOMOUS
## III–B.TECH–I–Semester End Examinations (Supply) – December 2024
## 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 in equation form. | [2M] |
| b) | State Coulomb's 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 Lorenz 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 RWG. | [2M] |
| j) | Mention the applications of Micro strip lines. | [2M] |

**PART-B** **(50 Marks)**

| | | |
|---|---|---|
| 2. | Write short notes on 3 coordinate systems 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 y-axis. Use the Biot-Savart's Law 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. | [5M] |
| b) | A dielectric sphere of $\varepsilon_r = 5.7$ 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 [5M]
i) Total internal reflection ii) Brewster Angle.

b) A plane wave having a frequency of 10MHz has an average Poynting vector of 1W/m2. 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 $\alpha$, $\beta$, $\gamma$ and $\eta$. [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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