Subject Code: 24EC11RC18 **R-24** **Reg No:** | | | | | | | | | | | | |

GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING FOR WOMEN
(Autonomous)
(Affiliated to Andhra University, Visakhapatnam)
II B.Tech. - II Semester Regular Examinations, April – 2026
ELECTROMAGNETIC FIELD THEORY AND TRANSMISSION LINES
[Electronics and Communication Engineering]

1. All questions carry equal marks
2. Must answer all parts of the question at one place

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

UNIT-I

1. a. Derive an expression for the electric field intensity due to an infinite sheet in xy-plane with uniform charge density ρ_s using Coulomb's law. **[7M]**
   b. Derive the expression for the capacitance of a parallel-plate capacitor. **[7M]**

OR

2. a. Find the electric field intensity at point (2, 4, 5) due to point charges 2nC, 6nC, 9nC located at (1, 2, 3), (3, 4, 7) and (5, 2, 1) respectively. **[7M]**
   b. (i) Derive the Continuity equation from the principle of conservation of charge at any point. **[4M]**
   (ii) Write a short note on Convection and conduction currents. **[3M]**

UNIT-II

3. a. Derive an expression for magnetic flux density due infinite conductor carrying current *I*. **[7M]**
   b. A circular loop located on $x^2 + y^2 = 4,\ Z = 0$ carries a current of 5 A along $a_\emptyset$. Determine **H** at (0, 0, 2) and (0, 0, -2). **[7M]**

OR

4. a. (i) Define magnetic flux density and give the expression for magnetic flux through a surface *S*. **[4M]**
   (ii) State and explain Biot-Savart's law. **[3M]**
   b. State and explain Ampere's Law. Apply Ampere's law to derive an expression for the magnetic field intensity in an infinite sheet of current in the $Z = 0$ plane. **[7M]**

UNIT-III

5. a. Explain the inconsistency in Ampere's circuital law and describe how Maxwell modified it to resolve the inconsistency for time varying fields. **[7M]**
   b. Apply the boundary conditions to determine the electric and magnetic field at an interface separating dielectric and dielectric. **[7M]**

OR

6. a. State and explain Maxwell's equation in its differential and integral form for time varying field. **[7M]**
   b. What are boundary conditions? Derive boundary conditions in the case of dielectric and conductor. **[7M]**

UNIT-IV

7. a. Define uniform plane wave. Formulate the wave equations for uniform plane waves in a conducting medium and establish the relations for propagation constant, attenuation and phase constants. **[7M]**

   b. Define Brewster angle, critical angle, total internal reflection. **[7M]**

OR

8. a. A plane wave propagating through a medium with $\varepsilon_r = 2,\ \mu_r = 4$, has $\bar{E} = 2e^{-2z}cos(10^8 t + \beta z)\hat{a}_x$ V/m. Determine the direction of the wave, β, Intrinsic impedance, Wave velocity.
   b. State and Prove Poynting theorem. **[7M]**

UNIT-V

9. a. Draw an equivalent circuit for transmission line and obtain the expression for voltage and current of a Transmission Line. **[7M]**
   b. Explain the significance and utility of λ/8, λ/4, λ/2 transmission line. **[7M]**

OR

10. a. A transmission line operating at 500 MHz has Zo = 80 **Ω**, α = 0.04 Np/m, β = 1.5 rad/m. Determine the line parameters R, L, G, and C. **[7M]**
    b. What is a Smith chart? Explain the significance of the Smith chart. **[7M]**