*R20 Regulation* *Subject code: 3P4DE*

# TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

## B.Tech IV Semester Supplementary Examinations, February 2024

## ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

(ELECTRONICS & COMMUNICATION ENGINEERING)

***Maximum Marks: 70*** Date: 26.02.2024 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

| All the following questions carry equal marks (10x2M=20 Marks) | | CO | Bloom Tx |
|---|---|---|---|
| 1 | State Coulomb's law? | CO1 | L2 |
| 2 | Define Electric Potential? Give the relation between V and E? | CO1 | L2 |
| 3 | State Faraday's law? | CO2 | L2 |
| 4 | Write the expression for Lorentz force equation. | CO2 | L2 |
| 5 | Define Surface impedance? | CO3 | L1 |
| 6 | What is Critical angle | CO3 | L2 |
| 7 | Draw the equivalent circuit of the transmission line? | CO4 | L2 |
| 8 | Write secondary constants in terms of primary constants? | CO4 | L2 |
| 9 | Define reflection coefficient and VSWR, what is the relationship between them? | CO5 | L2 |
| 10 | List the applications of smith chart? | CO5 | L1 |

Part-B

| Answer All the following questions. (5X10M=50Marks) | | | |
|---|---|---|---|
| 11 | a. Define electric field strength and derive an expression for electric field intensity due to infinite line charge located along z-axis from $-\infty$ to $\infty$. [5M]<br>b. Derive the two Maxwell's equations in electrostatics [5M] | CO1 | L4<br>L4 |
| | OR | | |
| 12 | a. Develop an expression for electric potential. [5M]<br>b. A circular disk of radius 'a' is uniformly charged with $\rho_s$ C/m$^2$ . The disk lies on z = 0 plane with its axis along the z-axis. Derive the expression for the electric field intensity at a point (0, 0, h) [5M] | CO1 | L3<br>L4 |
| 13 | Obtain the expression for magnetic field intensity at any point in free space due to a long current carrying conductor using Biot-Savart's law [10M] | CO2 | L4 |
| | OR | | |
| 14 | a. Derive the two Maxwell's equations in magneto statics. [5M]<br>b. What is the inconsistency in Ampere's Law? How it is rectified by Maxwell? [5M] | CO2 | L4<br>L4 |

| | | | |
|---|---|---|---|
| 15 | a. Derive an expression for reflection and transmission coefficient for a uniform plane wave incident normally between two dielectric media. [5M]<br>b. Explain parallel polarization of wave in perfect conductors with oblique incidence. [5M] | CO3 | L4<br>L5 |
| | OR | | |
| 16 | a. Find the skin depth and surface resistance of an aluminium at 100MHz having conductivity $\sigma = 5.8 \times 10^7$ mho/m, $\mu r = 100$. [5M]<br>b. What is uniform plane wave and obtain wave equations for good conductors? [5M] | CO3 | L4<br>L4 |
| 17 | a. Derive the transmission line equations for V and I, in terms of the source parameters? [5M]<br>b. At 8 MHz the characteristic impedance of transmission line is (40- j2) Ω and the propagation constant is (0.01+j0.18) per meter. Determine the primary constants [5M] | CO4 | L4<br>L5 |
| | OR | | |
| 18 | a. Derive the expression for loss less transmission line? [5M]<br>b. A generator of 1V, 1 KHz supplies power to a 100 km long line terminated in Zo and having the following constants, R = 10.4Ω/km, L = 0.00367 H/km, G= $0.8 \times 10^{-6}$ mho/km and C = $0.00835 \times 10^{-6}$ F/km. Calculate Zo, attenuation constant α, phase constant β, wavelength λ and velocity V. [5M] | CO4 | L4<br>L4 |
| 19 | a. Explain the basis for construction of Smith chart. Illustrate as to how it can be used of an Admittance chart. [5M]<br>b. A 100 loss less line connects a signal of 100 KHz to a load of 140. The load power is 100mW. Calculate i. Voltage Reflection coefficient ii. VSWR [5M] | CO5 | L5<br>L4 |
| | OR | | |
| 20 | a. Define the following terms used in connection with transmission line. [5M]<br>i. Propagation constant<br>ii. Characteristic impedance<br>b. Explain the principle of impedance matching with quarter wave transformer. [5M] | CO5 | L4<br>L5 |