Code No: R2031042 **R20** SET - 1

III B. Tech I Semester Supplementary Examinations, July -2023
ELECTROMAGNETIC WAVES AND TRANSMISSION LINES
(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
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UNIT-I

1. a) Derive the transmission line equations. [9M]
   b) Write in detail about primary and secondary constants of a transmission line. [5M]

(OR)

2. a) Discuss the characteristics of a distortion less transmission line and also obtain the expressions for propagation constant and characteristic impedance of a distortion less transmission line. [6M]
   b) A distortion less line has $Z_o = 60\Omega$, $\alpha = 20$ mNp/m, $u = 0.6c$, where c is speed of light in vaccum. Find R, L, G and C at 110 MHz. [8M]

UNIT-II

3. a) An antenna of impedance $40 + j30\Omega$ is to be matched to a 100Ω lossless line with a shorted stub. Determine the distance between the stub and antenna using smith chart. [7M]
   b) Derive the expression for reflection coefficient of a transmission line. [7M]

(OR)

4. a) Present the application of quarter wave transformer in impedance matching. [7M]
   b) Obtain the expressions for input impedance of i) open circuited transmission line and ii) short circuited transmission line. [7M]

UNIT-III

5. a) Derive Laplace's equation. [7M]
   b) Planes x=2 and y =-3, respectively carry charges $10nC/m^2$ and $15nC/m^2$. Calculate **E** at (1,1,-1) due to these charge distributions. [7M]

(OR)

6. a) Apply Gauss's law to find the **E** due to an infinite sheet charge. [7M]
   b) Given the potential [7M]

$$V = \frac{10}{r^2} \sin\theta \cos\phi,$$

Find the electric flux density at $(2,\pi/2,0)$.

UNIT-IV

7. a) Apply Ampere's law to find **H** due to infinite line current. [7M]
   b) Given the magnetic vector potential $A = -\rho^2/4 \ \mathbf{a_z}$ Wb/m, calculate the total magnetic flux crossing the surface $\varphi = \pi/2$, $1 \le \rho \le 5$ m. [7M]

(OR)

8. a) Obtain the expressions for transformer and motional EMFs. [7M]
   b) Write the Maxwell's equations in differential forms and also write the word statements of Maxwell's equation and explain. [7M]

UNIT-V

9. a) State and prove Poynting's theorem. [9M]

   b) Discuss propagation of plane waves in Good conductors. [5M]

(OR)

10. a) A uniform plane wave in air with $\mathbf{E} = 8\cos(\omega t - 4x - 3z)\,\mathbf{a}_y$ V/m is incident on a dielectric slab ($z \geq 0$) with $\mu_r = 1$ and $\varepsilon_r = 2.5$, $\sigma = 0$. Find the reflected **E** field. [6M]

    b) Explain the terms Brewster angle, Skin depth, critical angle and total internal reflection. [8M]