Code No: 124CU **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, September/October - 2023
ELECTROMAGNETIC THEORY AND TRANSMISSION LINES
(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

1.a) Four equal point charges Q = 20nC are located at 1,2,3 and 4 m. Find the potential at origin. [2]

b) A circular disc of radius 5m with a surface charge density $\rho_s = 10\sin\varphi$ is enclosed by surface. What is the net flux crossing the surface? [3]

c) Calculate the emf when the flux is given by 5sin t + 4cos t. [2]

d) Find the work done in an inductor of 12H when a current 0.3A is passed through it. [3]

e) In free space, the ratio of frequency to the velocity of light gives the phase constant. Comment on this. [2]

f) Find the refractive index of a material with permittivity 1.4. [3]

g) The attenuation constant causes phase distortion and the phase constant causes frequency distortion. Comment on this. [2]

h) The length of a transmission line is same as that of the wavelength of the signal and the load is 50 ohms. Determine the input impedance. [3]

i) A short circuited line is having 100 ohms characteristic impedance. Determine the input impedance. [2]

j) If the maxima and minima voltage of the standing wave are 4 and 1.6 respectively. Determine the standing wave ratio. [3]

PART-B

(50 Marks)

2.a) Establish Gauss Law in point form and integral form. Give its usefulness with an illustrative example.

b) The point Charges -1nc, 4nC, and 3nC are located at (0,0,0),(0,0,1) and (1,0,0), respectively . Find the energy in the System. [6+4]

OR

3.a) Prove that E=-▼ V.

b) Point charges 1 mC and -2mC are located at (3,2,-1) and (-1,-1,4) respectively. Calculate the electric force on a 10nC charge located at (0,3,1) and the electric field intensity at that point. [5+5]

4.a) State and explain Ampere's law and also mention its applications.

b) Derive the electric field boundary conditions between dielectric and conductor for time varying fields. [5+5]

OR

5.a) Explain the concept of displacement current density with necessary equations.

b) An electron with velocity u = (3ax +12 ay -4az) 10^5 m/s experiences no net Force at a point in a magnetic field B= $10a_x$ +$20a_y$+$30a_z$ mWb/m^2. Find E at that point. [5+5]

6.a) Derive reflection coefficient of E& H fields when Uniform plane wave propagating from dielectric to conductor Medium.

b) A uniform wave in air has E= $10\cos(2\pi \times 10^6 t - \beta z)a_y$ V/m . Calculate β and λ. [5+5]

OR

7.a) Discuss poynting theorem. Write the significance of it.

b) A signal in air ($z \geq 0$) with the electric field component E=$10\sin(\omega t+3z)a_x$ V/m, hits normally the ocean surface is smooth and that ε=80ε0, μ=μ0, σ =4 S/m in ocean ,determine i) ω ii) The wavelength of the signal in air. [4+6]

8.a) List out the various transmission lines. Write the applications of transmission lines.

b) The constants per km of a certain cable are: R = 6.75ohms; L = 5.5mH; C = 0.00872 μf and G = 0.4 μ mhos. Calculate the Characteristic impedance, attenuation constant and phase velocity, when w = 5000 radians per second. [5+5]

OR

9.a) Differentiate between phase and group velocities with illustrative examples.

b) A distortion less line has Zo=60Ω, α=20mNp/m, u=0.6c, where c is the Speed of light in vacuum. Find R, L, G, C and λ at 100MHz. [5+5]

10.a) Give the steps involved in single stub matching.

b) The observed standing wave ratio on a 100Ω lossless line is 8. If the first maximum voltage occurs at 0.3λ from the load, calculate the load impedance. [5+5]

OR

11.a) List out the advantages and applications of smith chart.

b) A short –circuited Coaxial transmission line has Z_0=60Ω and γ=j8.5/m. Calculate the input impedance, if the length of the line is i) 25 cm ii) 2.5m. [4+6]

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