Code No: 124CU **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, May - 2017
ELECTROMAGNETIC THEORY AND TRANSMISSION LINES
(Common to ECE, ETM)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 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 and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Derive the expression for continuity current equation. [2]
b) Write Maxwell's equations for electrostatic fields. [3]
c) Explain gauss law for magnetic fields [2]
d) State Ampere's law and discuss its significance. [3]
e) Define Uniform plane wave. [2]
f) Describe instantaneous, time averaged and reactive power. [3]
g) Differentiate group and phase velocities. [2]
h) A lossless transmission line of length 50cm with L=10μH/m and C=40pF/m is operating at 30MHz. Find its electrical length. [3]
i) List the properties of smith chart [2]
j) In an air line, adjacent maxima are found at 12.5cm and 37.5cm. Calculate the operating frequency. [3]

PART-B

(50 Marks)

2.a) What is Gauss Law. Explain any two applications of Gauss Law.
b) Derive the expression of Electric field at a point due to an infinite sheet of charge. [5+5]

OR

3.a) Discuss energy density in electrostatic fields.
b) Three point charge -1nc, 4nc and 3nc are located at (0,0,0) (0,0,1) and (1,0,0) respectively. Find the energy in the system. [5+5]

4.a) State Farday's Law. Explain the methods that cause variation of flux with time.
b) Explain the concept of displacement current. [6+4]

OR

5.a) Express Maxwell's equation in differential form and integral form. Derive Boundary conditions at dielectric to dielectric boundary.
b) Derive the Lorentz condition for potentials. [6+4]

6.a) Explain oblique incidence wave propagation with perpendicular polarization.

b) What is skin depth? Mention its importance citing some applications. Calculate skin depth of copper with following conditions $f=10^{10}$Hz, $\mu=\mu_0$, $\sigma = 5.8 \times 10^7$S/m. [5+5]

OR

7.a) What is poynting theorem? Derive the expression for poynting vector.

b) Explain wave propagation in conducting medium. [6+4]

8.a) Short circuited and open circuited measurements at a frequency of 5KHz on a line length 100km yields the following results. $Z_{oc}=570|\underline{-48^0}$, $Z_{sc}=720|\underline{34^0}$. Find characteristic impedance and propagation constant of the line.

b) Derive the transmission line equations in terms of receiving end voltages and currents. [5+5]

OR

9.a) An open wire unloaded line of 75km is operating at frequency of 1000KHz. $Z_{oc}=170|\underline{-48^0}$, $Z_{sc}=20|\underline{34^0}$. Calculate line parameters.

b) Derive the expression for attenuation and phase constants expressed in terms of primary constants. [5+5]

10.a) Derive the construction of smith chart.

b) A lossless line is terminated in a resistance is found to have a VSWR of 4, characteristic impedance is calculated as 100 Ω. A short circuited stub that matches the line to the load is placed at < $\lambda/8$ distance from the load using smith chart. Find the value of load resistance and stub length in wavelength. [5+5]

OR

11.a) Explain how UHF lines can be used as circuit elements.

b) Mention the importance of $\lambda/2$, $\lambda/4$ and $\lambda/8$ lines. [5+5]

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