R16

Code No: 135AP

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, May/June - 2019
ELECTROMAGNETIC THEORY AND TRANSMISSION LINES
(Electronics and Communication Engineering)

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) State Gauss law. [2]
b) Mention the differences between scalar and vector magnetic potentials. [3]
c) If the flux flowing through closed surface is 3 nc. What is the total charge enclosed by that surface? [2]
d) Find the input impedance of a section of a $50\,\Omega$ lossless transmission line that of length $0.1\,\lambda$ long and is terminated in a short circuit. [3]
e) Define reflection coefficient and VSWR. [2]
f) Derive expression for electrostatic energy of a capacitor. [3]
g) State Maxwell's four laws in derivative form. [2]
h) Find skin depth at 1GHz for copper having conductivity 5.7×10^{7} mho/m. [3]
i) What are the different types of loading? [2]
j) What are characteristics of infinite transmission line? [3]

PART - B

(50 Marks)

2.a) Derive Poisson's and Laplace's equations from fundamentals. List few of its applications concerned to electrostatic fields.
b) An infinitely long uniform line charge is located at $y=3,\ z=5$. If $\rho_l = 30nc/m$, find field $\vec{E}$ intensity at (i) infinity (ii) P(3, 4, 2). [5+5]

OR

3.a) State and prove coulomb's law.
b) Distinguish between conduction and convection currents. [5+5]

4. Derive the boundary conditions at the interface between
a) Dielectric-Dielectric
b) Dielectric-conductor. [5+5]

OR

5.a) Derive Maxwell's equations in integral form. Based on this obtain the corresponding differential equation by applying Stroke's theorem.
b) State and prove Biot-Savart's law. [5+5]

6.a) Evaluate the reflection and transmission coefficients for the case of an electromagnetic wave in air incident normally upon the copper sheet at frequency of 1 MHz. Given $\mu_1 = \mu_0 = \mu_2$, $\varepsilon_1 = \varepsilon_2 = \varepsilon_0$, $\sigma_1 = 0$, $\sigma_2 = 5.8\times10^7$ v/m.

b) Find the energy stored in a standing wave incident normally on a perfect conductor over a distance $-\lambda/4$ to 0 per unit in x, y coordinates. [5+5]

OR

7.a) State and prove Poynting theorem and also write its applications.

b) Derive the equation in conducting medium. Discuss skin effect and find the skin depth at 1 GHz for copper having conductivity 5.7×10^7 mho/m. [5+5]

8.a) Discuss in brief about inductance loading of telephone cables.

b) A lossless transmission line of length 0.434 lambda and characteristic impedance 100 Ω is terminated in an impedance 260 + j 180 Ω. Find
i) Voltage reflection co-efficient
ii) Standing wave ratio
iii) Input Impedance. [4+6]

OR

9.a) The attenuation constant on a 50 ohm distortionless transmission line is 0.01 dB/m. The line has a capacitance of 0.1 nF/m. Find the resistance, inductance and conductance per meter of the line.

b) A loss less line of 100 ohms is terminated by a load which produces SWR=3. The first maximum is found to be occurring at 320cm. If f=300 MHz determine the load matching. [5+5]

10.a) Write a short notes on reflection losses on unmatched transmission line.

b) The input impedance of a s short-circuited lossy transmission line of length 2m and characteristic impedance $75\,\Omega$ is $45 + j\,225\,\Omega$.
i) Find α and β of the line.
ii) Determine the input impedance if load is $Z_L = 67.5 - j4.5\,\Omega$. [4+6]

OR

11.a) Determine the input impedance of the transmission lines of length λ/4, λ/2 and λ/8. Assume if any data is needed.

b) A line having Z_o of 100 ohms is terminated into a load of 50 - j 50 ohms. It is desired to provide matching between the time and the load by means of a short circuit sheet. Determine the length of the stub if signal frequency is 10 KHz. [5+5]

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