

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 50Ω lossless transmission line that of length 0.1λ 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 $5.7 \times 10^7 \text{ mho/m}$. [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 $\rho_l = 30 \text{ nc/m}$, 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 $\mu_1 = \mu_0 = \mu_2$, $\epsilon_1 = \epsilon_2 = \epsilon_0$, $\sigma_1 = 0$, $\sigma_2 = 5.8 \times 10^7$ 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 0.434λ and characteristic impedance 100Ω is terminated in an impedance $260 + j 180 \Omega$. Find
- Voltage reflection co-efficient
 - Standing wave ratio
 - 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 75Ω is $45 + j 225 \Omega$.
- Find α and β of the line.
 - 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 $\lambda/4$, $\lambda/2$ and $\lambda/8$. Assume if any data is needed.
- b) A line having Z_0 of 100 ohms is terminated into a load of $50 - j 50$ ohms. It is desired to provide matching between the line and the load by means of a short circuit sheet. Determine the length of the stub if signal frequency is 10 KHz. [5+5]