

Code No: 114CU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, October/November - 2016

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) State Divergence theorem and Stokes theorem. [2]
- b) Mention the differences between scalar and vector magnetic potentials. [3]
- c) If the flux flowing through closed surface is $3nc$. 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 5.7×10^7 mho/m. [3]
- i) What is stub matching? Draw typical stub matching transmission line. [2]
- j) List the applications of smith chart. [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) origin (ii) P(5,6,1) [5+5]

OR

- 3.a) Develop an expression for potential due to dipoles.
- b) Evaluate the electric field intensity at a point P (-5, 7, -4) in free space due to a charge of 0.2 mille coulombs placed at point R (2,-1,-2). [5+5]

- 4.a) Distinguish between conduction and convection currents.
- b) Find the polarization 'P' in a dielectric material with $\epsilon_r = 2.8$ if $D = 3.0 \times 10^{-7} \hat{a}_n \text{ C/m}^2$
- c) Derive the boundary conditions at the interface between
(i) Dielectric-Dielectric (ii) Dielectric-conductor [3+3+4]

OR

- 5.a) Derive Maxwell's equations in integral form. Based on this obtain the corresponding differential equation by applying Stroke's theorem.
- b) Compare boundary conditions in Electrostatics and Magnetostatics. [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 $\mu_1 = \mu = \mu$, $\epsilon_1 = \epsilon_2 = \epsilon_0$, $\sigma_1 = 0$, $\sigma_2 = 5.8 \times 10^7$ 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.
- 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
- (i) Voltage reflection co-efficient
 - (ii) Standing wave ratio
 - (iii) Input Impedance [5+5]

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 of 100 ohms is terminated by a load which produces $SWR = 3$. The first maximum is found to be occurring at 320 cm. 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 as short-circuited lossy transmission line of length 2m and characteristic impedance 75Ω is $45 + j 225 \Omega$.
- (i) Find α and β of the line.
 - (ii) Determine the input impedance if the short-circuit is replaced by a $Z_L = 67.5 - j4.5 \Omega$ [5+5]

OR

- 11.a) Explain the basis for construction of Smith chart. Illustrate as to how it can be used of an Admittance chart.
- b) A line having Z_0 of 100 ohms is terminated into a load of $50 - j50$ ohms. It is desired to provide matching between the line and the load by means of a short circuit stub. Determine the length of the stub if signal frequency is 10 MHz.. [5+5]

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