Code No: 54011 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech II Year II Semester Examinations, December-2014/January-2015
ELECTROMAGNETIC THEORY AND TRANSMISSION LINES
(Common to ECE, ETM)

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

Answer any five questions
All questions carry equal marks

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1.a) Define the terms Electric Field Strength and Electrostatic Potential and derive their inter relations. Hence establish the Laplace's and Poisson's equations.

b) Find the volume charge density at (2, 2, 0) in a region having $\bar{D} = 8xy\hat{X} + 4x^2\hat{Y}$ C/sq.m. and the total charge enclosed by a cube of side 2 units, centered at the origin.

2.a) Derive an expression for the capacitance of a coaxial capacitor, and calculate the same if its outer conductor diameter is twice the diameter of the inner conductor, and the dielectric filling medium has relative permittivity of 2.56.

b) Distinguish between the terms-conduction and convection currents. Hence establish the continuity equation static fields, and evaluate the relaxation time for copper at 20 MHz. Take conductivity for copper medium as 5.8×10^7 mhos/m.

3.a) Define the Biot-Savart's Law, and hence find the field due to a semi-infinite conducting wire oriented along the z-axis, and carrying a current I.

b) Explain the significance of the term-Vector Magnetic Potential. Give $\bar{A} = (x^2 + y^2)\hat{z}$ Wb./m., find the corresponding magnetic field intensity at (1, 1, 1). Is this field solenoidal?

4.a) Define and derive the Maxwell's curl equations for time-varying fields in both point and integral forms.

b) List out the boundary conditions to be satisfied by the tangential and normal components of electric field on the surface of a perfect conductor.

5.a) Define the term Polarization, and establish the conditions for a UPW to be Linearly Polarized, when it propagates along $+\hat{z}$ direction.

b) For a UPW propagating in a medium with $\bar{E} = 20 \cos(1.5\times10^8\, t - \beta z)\, \hat{Y}$ V/m., $\varepsilon_r = 4$ and $\mu_r = 1$, find the attenuation and phase constants, direction of propagation, polarization, and intrinsic impedance.

6.a) State and Prove Poynting Theorem. List out all the mathematical relations involving Poynting Vector.

b) For a UPW normally incident from free space on to a perfect conductor, show that the resultant E field and H field distributions represent a Standing Wave.

7.a) Illustrate the equivalent circuit model of a 2-conductor lossy transmission line, and derive expressions for the voltage and current along the line, in terms of load parameters.

b) A 50 ohm lossless line has a phase constant of 3.14 rad./m. at 200 MHz. Find its primary constants. Is this a distortionless line?

8.a) Explain the significance and utility of quarter wave transformers and $\lambda/2$ lines. How can a line of 50 ohms be matched to a load of 100 ohms using one such line?

b) A 50 ohm line feeds an antenna load having an input impedance of 73 + j 43 ohms. Find the resultant reflection coefficient, VSWR, and Z_{max}, Z_{min} along the line.

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