No. of Printed Pages : 3

BIEE-009

B.Tech. – VIEP – ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

00046

June, 2016

BIEE-009 : APPLIED ELECTROMAGNETICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a) Explain the term standing waves on a transmission line. How can we classify a standing wave ? 7

(b) Define electrical dipole and dipole moment. Five equal point charges of $Q = 20 \times 10^{-9}$ C are placed at x = 2, 3, 4, 5 and 6 cm. Calculate the potential at origin. 7

2. (a) Derive the transmission line equation. 7

(b) An open-wire transmission line has R = 4·5 kΩ, L = 0·15 mH, G = 60 m mho, C = 12 nF. Operating frequency = 6 MHz and the length of transmission line is 300 m. Find the propagation constant (γ), characteristic impedance (Z_0) and velocity of propagation (v_p). 7

3. (a) What is a capacitor ? Derive an expression for the capacitance of a spherical capacitor. 7

(b) Find the current distribution producing the following field distribution using Ampere's law.

$$H = \begin{cases} J_o \gamma^2 \hat{a}_\phi \; ; & 0 < \gamma < a \\ J_o a^3 / \gamma \hat{a}_\phi \; ; & a < \gamma < b \\ 0 \; ; & b < \gamma < 0 \end{cases}$$ 7

4. (a) Using Maxwell's equations, show that the free space wave equation in E is

$$\nabla^2 E - \mu_0 \varepsilon_0 \frac{\partial^2 E}{\partial t^2} = 0 .$$ 7

(b) In free space, if

$$\vec{H}(z, t) = 1{\cdot}0 \, e^{j(1{\cdot}5 \times 10^8 t + \beta z)} \hat{a}_x ,$$

calculate the expression for $\vec{E}(z, t)$ and determine the direction of propagation. 7

5. (a) A lossless transmission line has a characteristic impedance of 75 Ω and phase constant of 3 rad/m at 100 MHz. Find the inductance and capacitance of the line per metre. 7

(b) Explain Standing-Wave Ratio and Reflection Coefficient with reference to EM wave. 7

6. (a) State and prove Poynting's theorem. Also give the physical interpretation of $\vec{E} \times \vec{H}$. 7

(b) Explain the physical significance of the following terms :

curl, gradient and divergence

Also, if $\vec{F} = x^2y\ \hat{a}_x + (x - y)\ \hat{a}_z$,

calculate $\nabla \times \vec{F}$. 7

7. Write short notes on any ***two*** of the following : *2×7=14*

(a) Laplace and Poisson's equations

(b) Method of Images

(c) Gauss's Law of Electrostatics

(d) Displacement Current