No. of Printed Pages : 4

BIEE-009

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

Term-End Examination

00303 **December, 2018**

BIEE-009 : APPLIED ELECTROMAGNETICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. Assume the necessary data, if not given in the question. Symbols have their usual meanings. Use of scientific calculator is permitted.*

1. (a) Show that the energy stored per unit volume in a parallel plate capacitor is given by $\frac{1}{2}\varepsilon E^2$. 7

(b) Discuss the basic idea of impedance matching in transmission lines. State the salient features of single stub matching. 7

2. (a) For copper $\sigma = 58\ MSm^{-1}$, for Teflon $\sigma = 30\ nSm^{-1}$ and $\varepsilon = 2{\cdot}1\ \varepsilon_0$. Verify that at 1 MHz, Copper is a good conductor and Teflon is a good dielectric. 7

(b) Show that the field

$$\vec{F} = \left(\frac{150}{\rho^2}\right) \hat{a}_\rho + 10\,\hat{a}_\phi$$ in cylindrical coordinates is rotational. 7

3. (a) Given magnetic vector potential

$$\vec{A} = 10\, r^{1.5}\, \hat{a}_z \text{ Wbm}^{-1}$$

in free space. Determine

(i) magnetic field intensity $\vec{H}$

(ii) current density $\vec{J}$. 7

(b) Derive Ampere's Circuital Law in integral and differential form. 7

4. (a) State and derive Poynting's theorem 7

(b) For uniform plane waves in sea water

$\sigma = 4\ \text{Sm}^{-1}$, $\varepsilon = 80\ \varepsilon_0$, $\mu = \mu_0$.

Find α, β, η, and λ at a frequency of 10,000 MHz. 7

5. (a) Explain Divergence and Curl of a vector. Write their expressions in cylindrical and spherical coordinates. 7

(b) Derive Poisson's equation. State condition at which it becomes Laplace's equation. In spherical co-ordinates V = 0 at r = 0·2 m and V = 200 volts at r = 4 m. Calculate $\vec{E}$ and $\vec{D}$, assuming free space between these concentric spherical shell. 7

6. (a) State and explain Gauss's law of volume charge density of a given charge distribution and is given by $\rho = \rho_0 \left(\frac{a}{r}\right)$ in spherical coordinates.

Determine the electric flux density and field intensity at any point and also find V, if V = 0 at r = 0. 7

(b) Derive general expressions for reflection and transmission coefficient for $\vec{E}$ and $\vec{H}$ fields when an EMT wave is incident normally on the boundary separating two different media characterized by $(\sigma_1, \varepsilon_1, \mu_1)$ and $(\sigma_2, \varepsilon_2, \mu_2)$ parameters. 7

7. (a) Derive $\nabla^2 \times H = \mu \varepsilon \frac{\delta^2 H}{\delta t^2}$ for perfect dielectric conditions, starting from Maxwell's equation. *10*

(b) Explain *4*

(i) Biot-Savart's Law

(ii) Ampere's Law