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BIEL-006

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

00019

December, 2014

BIEL-006 : ELECTROMAGNETIC FIELD THEORY

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Find the gradient of the following scalar field :

$$u = x^2y + xyz$$

(b) Find the Laplacian of the scalar field

$$v = \rho^2 Z \cos 2\phi$$ *2×5=10*

2. (a) If $D = [(2y^2 + z)\ \hat{a}_x + 4xy\ \hat{a}_y + x\ \hat{a}_z]\ C/m^2$, find the volume charge density at point P (– 1, 0, 3).

(b) State and prove Gauss's divergence theorem i.e. $\oint_v \nabla . A\ dv = \oint_s A\ ds$. *2×5=10*

3. (a) State Biot-Savart Law for magnetic field.

(b) Derive an expression for the magnetic flux density at a point P, located at a distance "R" from a current carrying wire of infinite length. *2×5=10*

4. (a) Derive the wave equations for lossless medium.

(b) Define the depth of penetration and hence, show that it is $\delta = \sqrt{\frac{2}{\omega \mu \sigma}}$ for conducting medium. *2×5=10*

5. (a) State and prove Poynting theorem.

(b) Deduce the equation of continuity and hence explain its significance. *2×5=10*

6. (a) Explain why impedance matching is needed if the load happens to be different from the characteristic impedance of the line. Describe a suitable method of impedance matching.

(b) Explain the term standing waves on a transmission line. What is a pure standing wave ? What are the properties of standing waves ? *2×5=10*

7. (a) Prove Snell's law of reflection and refraction taking the oblique incidence of electromagnetic wave on an interface.

(b) Deduce Brewster's law on the basis of electromagnetic theory. *2×5=10*

8. (a) In free space

$\vec{E}(z, t) = 50 \cos(\omega t - \beta z)\ \hat{a}_x$ V/m.

Calculate the average power crossing a circular area of radius 2·5 meters in the plane z = constant.

(b) Explain the term 'Polarization' in the context of electromagnetic wave propagation. Distinguish between circular and elliptic polarization. *2×5=10*

9. (a) Calculate the characteristic impedance of a coaxial line at 100 MHz, when the primary constants of the line are R = 0·098 Ω/m, G = $1{\cdot}5 \times 10^{-6}$ mho/m, L = 0·32 μH/m, C = 3·45 pF/m.

(b) Explain the types of transmission lines with neat and clean diagram. *2×5=10*

10. Write short notes on any ***two*** of the following : *2×5=10*

(a) Magnetic dipole

(b) Boundary relations in magnetic fields

(c) Hysteresis loss
