No. of Printed Pages : 3

BIEL-006

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

00286

Term-End Examination

June, 2016

BIEL-006 : ELECTROMAGNETIC FIELD THEORY

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Symbols used have their usual meanings.*

1. (a) (i) Transform the vector $\overline{R} = -\rho\overline{a}_{\phi} + z\overline{a}_{z}$ into Cartesian coordinate system.

(ii) Determine the divergence of the vector $\overline{A}$ at the point $(1, -2, 3)$ where

$$\overline{A} = yz\,\overline{a}_{x} + 4xy\,\overline{a}_{y} + y\,\overline{a}_{z}$$ *5*

(b) Prove the following identity :

$$\overline{A} \cdot (\overline{B} \times \overline{C}) = \overline{B} \cdot (\overline{C} \times \overline{A}) = \overline{C} \cdot (\overline{A} \times \overline{B})$$ *5*

2. (a) State Coulomb's law and express it mathematically. *5*

(b) Define the term 'electric field intensity'.
An infinitely long line charge of uniform density $\lambda_L C/m$ is situated along z-axis. Derive the expression for the electric field intensity at a point $P(\rho, \phi, z)$. *2+3=5*

3. Derive the expression for the capacitance of a cylindrical capacitor of length 'L' formed by two coaxial cylinders of radii 'a' and 'b' by
(a) using Gauss law.
(b) using Laplace's equation. *10*

4. (a) State and explain Ampere's circuital law. Express it in integral form. *5*

(b) The inner and outer radii of a long hollow cylindrical conductor with its axis along the z-axis of cylindrical coordinates are 4·0 mm and 6·0 mm respectively. The current in the conductor is 150 A. Calculate the magnetic field intensity vector at r = 3·0 mm, 5·0 mm and 7·0 mm. *5*

5. (a) Write Maxwell's equations for time varying fields in differential form. From the set obtain the integral form of the equations. *5*

(b) Give the physical meanings of each equation. *5*

6. (a) Derive the relationship between $\overline{E}$ and $\overline{H}$ for a uniform plane wave and show that $\overline{E}$ and $\overline{H}$ are transverse. *5*

(b) State Poynting theorem and express it mathematically. *5*

7. Derive the expression for reflection coefficient and transmission coefficient for a uniform plane wave incident normally on the boundary surface between any two media characterised by intrinsic impedances Z_1 and Z_2. Hence obtain the relationship between reflection coefficient and standing wave ratio. *10*

8. (a) List the simplifying assumptions which are made to study wave propagation in the rectangular wave guide. *5*

(b) Define TEM waves and explain why TEM waves cannot exist in a single hollow metallic conductor. *5*

9. Make a comparison between the following : *2×5=10*

(a) Divergence of a vector and Curl of a vector

(b) Displacement current and Conduction current

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

(a) Poisson's equation

(b) Boundary conditions for magnetic field

(c) Propagation of plane wave in lossy dielectric