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BIEL-006

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

00896

Term-End Examination

June, 2015

BIEL-006 : ELECTROMAGNETIC FIELD THEORY

Time : 3 hours *Maximum Marks : 70*

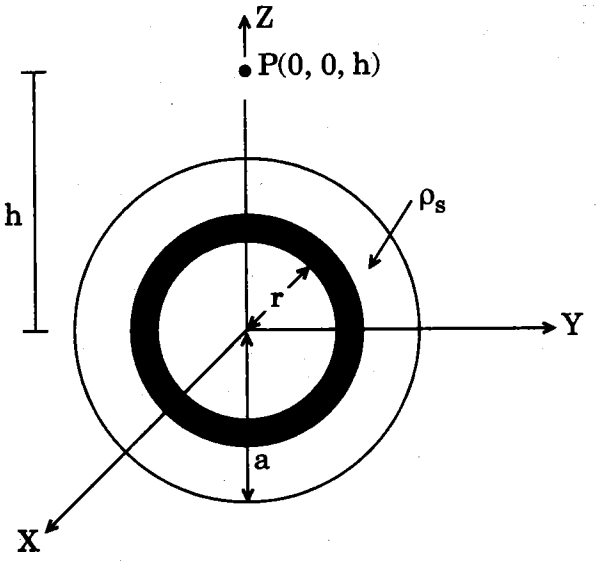
Note : *All questions have same weightage (10 marks). Attempt any **seven** questions.*

1. (a) A vector field is given by $B = \hat{z}\frac{\cos\phi}{r}$. Verify Stokes' theorem for a segment of a cylindrical surface defined by $r = 2$; $\pi/3 \le \phi \le \pi/2$ and $0 \le z \le 3$. *5*

(b) A sphere of radius 2 cm contains a volume charge density ρ_v given by $\rho_v = 2\cos^2\theta$ C/m^3. Find the total charge Q contained in the sphere. *5*

2. (a) State Ampere's circuital law and write point form of Ohm's law for perfect dielectric and perfect conductor. *5*

(b) Find the electric field at a point P(0, 0, h) in free space at a height h on Z-axis due to a circular disk of charge in the X-Y axis with uniform charge density ρ_s as shown below. 5



3. (a) Derive an expression for total magnetic force on a current carrying conducting wire when placed in a uniform magnetic field. 5

(b) Explain charge-continuity equation. 5

4. (a) Derive an expression for skin depth, when the wave is propagating in lossy medium. 5

(b) Define characteristic impedance of the line. What are the units of transmission line parameters ? 5

5. (a) A 100 Ω transmission line is connected to a load consisiting of a 50 Ω resistor in series with a 10 pF capacitor. Find the reflection coefficient at the load for a 100 MHz signal. *5*

(b) Show that $|\Gamma| = 1$ for a purely reactive load in transmission lines. *5*

6. (a) Derive an expression for Snell's law with a neat diagram. *5*

(b) Define reflection coefficients and transmission coefficients for normal incident wave, with diagram. *5*

7. (a) The dimensions of a waveguide are 2·5 × 1 cm. The operating frequency is 8·6 GHz. Find the following : *5*

(i) Possible modes

(ii) Cut-off frequency

(iii) Guided wavelength

(b) Derive the equation for field components (E_x, E_y, H_x, H_y) within the rectangular waveguide placed in a rectangular co-ordinate system. *5*

8. (a) What is the condition for a wavelength to propagate through a rectangular waveguide ? How does it depend on the physical dimensions of a rectangular waveguide ? *5*

(b) Compare degenerate modes with dominant modes. 5

9. (a) Define magnetic dipole. Derive an expression for magnetic energy density stored in solenoid inductor, in terms of H. 5

(b) Given vectors : $A = 2\hat{x} - 3\hat{y} + \hat{z}$,

$B = 2\hat{x} - \hat{y} + 3\hat{z}$, $C = 4\hat{x} + 2\hat{y} - 2\hat{z}$.

Show that C is perpendicular to both A and B. 5

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

(a) Biot-Savart's Law

(b) Impedance Matching

(c) Divergence Theorem