SUBJECT : ELECTROMAGNETIC ENGINEERING

Day - Saturday | **W-2018-2411** | Time 02.30 PM TO 05.30 PM
Date 01/12/2018 | Max. Marks : 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.

Q.1 Transform $A = ya_x + xa_y + \frac{x^2}{\sqrt{x^a + y^2}}\, a_z$ from Cartesian to cylindrical coordinates. **[10]**

OR

a) Compare spherical coordinate system with cylindrical coordinate system. **[05]**
b) Give spherical coordinates of point P(2, 3, -1). **[05]**

Q.2 **a)** Give boundary conditions for electrostatic fields at dielectric – dielectric interface. **[05]**
b) Find workdone in moving a point charge Q = -20μC from origin to (4, 2, 0) in the field. E = 2(x + 4y) a_x + 8x a_y (V/m) along the path $x^2 = 8y$. **[05]**

OR

a) A point charge Q = 30 nC is located at the origin in Cartesian coordinates. Find electric flux density D at (1, 3, -4). **[06]**
b) ~~Define cap~~acitance of co-axial capacitor. **[04]**

Q.3 **a)** A current filament of 5A in a_y direction is parallel to the y-axis at x = 2, z = -2. Find H at origin. **[05]**
b) Define magnetic torque, moment and dipole. **[05]**

OR

a) In cylindrical coordinates $B = \left(\frac{2}{r}\right) a_\phi\ (T)$. Determine magnetic flux Φ crossing the plane surface defined by $0.5 \leq r \leq 2.5$ and $0 \leq z \leq 2$. **[06]**
b) Discuss magnetic boundary conditions. **[04]**

Q.4 **a)** Find skin depth δ at a frequency of 1.6 MHz in aluminum, where σ = 38.2 MS/m and $\mu_r = 1$. Also find γ and wave velocity. **[06]**
b) Derive the expression for Poynting vector. **[04]**

OR

a) If $J_d = 5\cos\left(2\times10^8 t - kz\right)\hat{a}_x\ \mu A/m^2$ in a material for which σ = 0, $\varepsilon = 5\varepsilon_0$, $\mu = 4\mu_0$. Find D, E, B. **[06]**
b) ~~Discuss wave~~ propagation through good conductors. **[04]**

Q.5 At a frequency of 100 MHz, following are value for transmission line: **[10]**
L = 0.25 μH/m, C = 80 PF/m, R = 0.30 Ω/m, G = 8 μS/m. Calculate:
i) α **ii)** β **iii)** λ **iv)** v **v)** z_0.

OR

Derive the transmission line equations and their solutions in phasor form. **[10]**

Q.6 **a)** Find effective area of Hertzian dipole at frequency of 1 GHz. **[05]**
b) Write short note on antenna arryas. **[05]**

OR

Find: **i)** Propagation constant **ii)** Cutoff wavelength **iii)** Guide wavelength, give that for dominant mode excited at 10^9 Hz with dimensions of rectangular waveguide as 20 × 10 cm and medium in guide is free space. **[10]**

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