

**B.TECH. SEM -V ELECTRONICS 2014 COURSE (CBCS) : WINTER
- 2017**

SUBJECT: ELECTROMAGNETIC ENGINEERING

Day: **Saturday**
Date: **20/01/2018**

Time: **02.30 PM TO 05.30 PM**
Max. Marks: **60**

W-2017-2148

N.B.:

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

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- Q.1 a)** Transform vector $A = 10a_x - 9a_y + 7a_z$ to spherical coordinates at point $(10, -6, 4)$. **(07)**
- b)** Define Curl, Divergence and Gradient. **(03)**

OR

- Q.1 a)** i) Give the rectangular coordinates of point $(r = 4.4, \phi = -115^\circ, z = 2)$ **(07)**
ii) Give cylindrical coordinates of point $D(x = -3.1, y = 2.6, z = -3)$.
- b)** Define line charge, surface charge and volume charge distributions. **(03)**

- Q.2 a)** Infinite uniform line charges of 10 nC/m lie along positive and negative x and y axes in free space. Find E at $P_A(0, 0, 6)$ and $P_B(0, 3, 4)$. **(04)**
- b)** Discuss boundary conditions at dielectric- dielectric and dielectric- conductor interface. **(04)**
- c)** Define capacitance of co- axial capacitor and concentric spherical conductors. **(02)**

OR

- Q.2 a)** Given electric flux density $D = 0.3r^2 a_r \text{ nC/m}^2$ in free space. Find E at point $P(r = 2, \theta = 25^\circ, \phi = 90^\circ)$. **(04)**
- b)** Derive potential for electric dipole and define dipole moment. **(03)**
- c)** Derive expression for continuity equation. **(03)**

- Q.3 a)** Find magnetic field intensity H at a point $P(2.5, 2, 3)$ caused by a current filament of 16A in a_z direction on z-axis extending from 0 to 6 . **(06)**
- b)** The point charge $Q = 18 \text{ nC}$ has velocity of $5 \times 10^6 \text{ m/s}$ in the direction $a_v = 0.60a_x + 0.75a_y + 0.30a_z$. Calculate magnitude of force exerted on charge by field $B = -3a_x + 4a_y + 6a_z \text{ mT}$. **(04)**

OR

- Q.3 a)** If $H = \left[\frac{1}{r} \cos \phi \right] a_r \text{ A/m}$ determine magnetic flux for surface described by $r = 3\text{m}, 0 < \phi \leq \pi/2, 0 \leq z \leq 3\text{m}$. **(06)**
- b)** Define magnetic torque and moment. **(04)**

P. T. O.

- Q.4 a)** Determine whether following pairs of fields satisfy Maxwell's equations in region where $\sigma = 0$, $\epsilon = 2.5\epsilon_0$, $\mu = 10\mu_0$. (04)
- i) $E = 9y a_y$ ii) $H = 6x^2 a_x$

- b)** Discuss reflection of plane waves from perfect dielectric. (06)

OR

- Q.4 a)** If $J_d = 5 \cos(2 \times 10^8 t - kz) a_x \mu A / m^2$ in a material for which $\sigma = 0$, $\epsilon = 5\epsilon_0$, $\mu = 4\mu_0$ find: (04)
- i) D ii) E iii) B iv) H.

- b)** A 9.35 GHz uniform plane wave is propagating in polyethylene ($\epsilon_r = 2.26$). If the amplitude of electric field intensity is 500 v/m and material is assumed to be lossless find: (06)
- i) Phase constant ii) wave length
iii) Velocity of propagation iv) intrinsic impedance

- Q.5 a)** Discuss the principles of impedance matching in transmission line (stub matching). (04)

- b)** An open wire transmission line has following Primary constants. (06)

$$R = 4\Omega / km, L = 3.5 mH / km$$

$$C = 0.009 \mu F / km, G = 0.29 \mu \Omega^{-1} km^{-1}$$

Determine:

i) Z_0 ii) α iii) β

iv) V_p

for frequency of operation 1kHz.

OR

- Q.5 a)** A transmission line with a characteristics impedance of 350 ohms is terminated in purely resistive load. While making SWR measurements, the meter reads a maximum voltage of $7.5 \mu v$ and a minimum of $5 \mu v$. What is value of load resistance? (04)

- b)** Find R, L, G, C for a distortion less line given: (06)
- $$Z = 50\Omega, \alpha = 20 mNeper / m, v_p = 0.6v_0.$$

- Q.6 a)** Give the significance of phase velocity and group velocity in waveguide. (04)

- b)** Write short note on EMI and EMC concepts. (04)

- c)** Find radiation resistance of a dipole antenna $\lambda/10$ long. (02)

OR

- Q.6 a)** Discuss Transverse electric and transverse magnetic modes in rectangular waveguide. (06)

- b)** Write short notes on finite length dipole. (04)