

**B.TECH. SEM -V (E & TC ENGG.) 2014 COURSE (CBCS) : WINTER
- 2017**

SUBJECT : ELECTROMAGNETIC ENGINEERING

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

W-2017-2148-A

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

N.B.

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.

Q.1 a) Transfer the vector $\vec{B} = y\hat{a}_x - x\hat{a}_y + z\hat{a}_z$ into cylindrical co-ordinates. **(05)**

b) Express Divergence Theorem. Explain it. **(05)**

OR

Q.1 a) For a vector field \vec{A} , show explicitly that, $\nabla \cdot \nabla \times \vec{A} = 0$ that is the divergence of the curl of any vector field is zero. **(05)**

b) What is laplacian equation? Express the laplacian of a scalar field. **(05)**

Q.2 a) What is Coulomb's law? Also define the electric field intensity due to distributed charges. **(05)**

b) Derive an expression of electric fields due to line charge distribution. **(05)**

OR

Q.2 a) Point charges 1mC and -2mC are located at (3,2,-1) and (-1,-1,4) respectively. Calculate the electric force on a 10 nC charge located at (0,3,1) and the electric field intensity at that point. **(05)**

b) State Gauss's law. Define electric flux density. **(05)**

Q.3 a) State and explain Biot- Savart's Law. **(05)**

b) Given the magnetic vector potential $\vec{A} = -\frac{\rho^2}{4}\hat{a}_z \text{ Wb/m}$. Calculate the total magnetic flux crossing the surface $\phi = \pi/2$, $1 \leq \rho < 2m$, $0 \leq z \leq 5m$. **(05)**

OR

Q.3 a) What is the boundary condition for magnetic field? **(05)**

b) What is magnetic dipole? Find out the magnetic flux density in terms of magnetic dipole. **(05)**

Q.4 a) What is the integral form of Maxwell's equation? **(05)**

b) A parallel plate capacitor with plate area of 5 cm² and plate separation of 3 mm has a voltage $50 \sin 10^3 t \text{ V}$ applied to its plates. Calculate the displacement current assuming $\epsilon = 2\epsilon_0$. **(05)**

P.T.O.

OR

- Q.4** a) Explain the inconsistency of Ampere's law. (06)
- b) What is *mmf*? Derive an expression of it. (04)
- Q.5** a) What is skin depth? (04)
- b) In a lossless dielectric for which $\eta = 60\pi$, $\mu_r = 1$ and $\vec{H} = -0.1 \cos(\omega t - z) \hat{a}_x + 0.5 \sin(\omega t - z) \hat{a}_y$ A/m. Calculate ϵ_r , ω and E . (06)

OR

- Q.5** a) What is polarization? Explain types of polarization. (04)
- b) In free space ($z \leq 0$), a plane wave with $\vec{H} = 10 \cos(10^8 t - \beta z) \hat{a}_x$ mA/m is incident normally on lossless medium ($\epsilon = 2\epsilon_0$, $\mu = 8\mu_0$) in region $z \geq 0$. Determine the reflected wave \vec{H}_r, \vec{E}_r and the transmitted waves \vec{H}_t, \vec{E}_t . (06)
- Q.6** a) A distortionless line has $Z_0 = 60\Omega$, $\alpha = 20$ mNp/m, $u = 0.6c$. Where c is the speed of light in a vacuum. Find R, L, G, C and λ at 100MHz. (05)
- b) What is voltage reflection coefficient? Explain it. (05)

OR

- Q.6** a) Define the following terms: (05)
- i) Characteristic impedance
- ii) Input impedance.
- b) What is matched line? What is the effect of standing wave ratio on matched line? (05)

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