Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech.**

PCEE4302

6th Semester Back Examination 2017-18

ELECTROMAGNETIC THEORY

BRANCH : ELECTRICAL

Time : 3 Hours

Max Marks : 70

Q.CODE : C335

Answer Question No.1 which is compulsory and any Five from the rest.

The figures in the right hand margin indicate marks.

Q1. **Answer the following questions :** **(2 x 10)**

a) Determine the unit vector normal to $S(x, y, z) = x^2 + y^2 - z$ at point P (1,3, 0).

b) Is the magnetic field a conservative field? Explain.

c) What do we mean by magnetic vector potential?

d) A multilayer coil of 2000 turns of fine wire is 20mm long and has a thickness 5mm of winding. If the coil carries a current of 5mA, what is the mmf generated within the coil?

e) Specify the unit vector extending from the origin toward the point G (2,-2,-1).

f) What is Lorentz force equation?

g) What is Lenz's law? What is its significance?

h) What is the wavelength and frequency of a wave propagating in free space when β = 2?

i) A 20MHz uniform plane wave propagates through a lossy material so that it has phase shift of 0.5rad/m and its amplitude is reduced by 20% every meter travelled. Calculate attenuation constant and wave velocity.

j) State Poisson's equation for both inhomogeneous and homogeneous medium.

Q2. **a)** Given the Field $\vec{D} = 6\rho \sin\frac{1}{2}\emptyset\overrightarrow{a_\rho} + 1.5\rho\cos\frac{1}{2}\emptyset\overrightarrow{a_\emptyset}$ C/m^2, evaluate both sides of the divergence theorem for the region bounded by ρ = 2, $\emptyset = 0, \emptyset = \pi, z = 0, \text{and } z = 5$. **(5)**

b) Given the volume charge density $\rho_v = -2 \times 10^7 \in_0 \sqrt{x}$ C/m^3 in free space, let V=0 at x=0 and V=2volt at x=2.5mm. At x=1 mm, find : (a) V; (b) $\overrightarrow{E_x}$ **(5)**

Q3. **a)** Derive the expression of energy density in electrostatic field. **(5)**

b) It is found that $\vec{E} = 60\overrightarrow{a_x} + 20\overrightarrow{a_y} - 30\overrightarrow{a_z}$ mV/m At a particular point on the interface between air and a conducting surface. Find $\vec{D}$ and ρ_s at that point. **(5)**

Q4. **a)** Derive Magnetic Field Intensity for infinite sheet of current using Ampere's Law. **(5)**

b) Find $\vec{H}$ in rectangular components at P (2, 3, 4) if (a) there is a current filament in the z-axis carrying 8mA in the $\overrightarrow{a_z}$ direction, (b) if the filament is located at x = -1, y = 2. **(5)**

Q5. **a)** Three infinite uniform sheets of Charge are located in free space as follows: 3nC/m^2 at z=-4, 6nC/m^2 at z=1, and -8nC/m^2 at z=4. Find $\vec{E}$ at the point (a) P_A(2, 5, -5); (b)P_B(4, 2, -3). **(5)**

b) An electric dipole located at the origin in free space has a moment $P = 3\overrightarrow{a_x} - 2\overrightarrow{a_y} + \overrightarrow{a_z}$ nC.m. (a) Find V at $P_A(2,3,4)$. (b) Find V at r=2.5m, θ = 30^0, Φ = 40^0. **(5)**

Q6. **a)** Give the differential and integral forms of Faraday's law of electromagnetic inductiondue to a time varying flux. **(5)**

b) At 50 MHz, a lossy dielectric material is characterized by $\epsilon = 3.6\epsilon_0, \mu = 2.1\mu_0$ and $\sigma = 0.08\,S/m$. If $\overrightarrow{E_s} = 6e^{-\gamma x}\overrightarrow{a_z}$ V/m, compute (a) γ, (b) λ , (c) u , (d)η , (e)$\overrightarrow{H_s}$ **(5)**

Q7. **a)** Derive the formula for the capacitance $C = Q/V_0 = \frac{2\pi\epsilon L}{\ln\frac{b}{a}}$ of a cylindrical capacitorof radius a<ρ<b and length L filled with a homogeneous dielectric with permittivity ϵ by assuming V_0 and finding Q. **(6)**

b) Show that the attenuation constant of a plane wave in good conductor is approximately equal to the phase constant. **(4)**

Q8. **Write short notes on any TWO :** **(5 x 2)**

a) Plane wave in free space.

b) Continuity of Current Equation.

c) Maxwell's equations in final forms.

d) Biot Savart's Law.