Exam No: _____

GANPAT UNIVERSITY

B. TECH SEM- IV (ELECTRICAL)

REGULAR EXAMINATION– APRIL-JUNE 2017

2EE402: Engineering Electromagnetics

Time: 3 Hrs **TOTAL MARKS: 60**

Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate marks.
(3) Be precise and to the point in answering the descriptive questions.

SECTION I

Q.1

(A) Given vector points A(2, -1, 2), B (-1, 1, 4) and C (4, 3, -1) find (i) dot product between $\bar{R}_{AB}$ *and* $\bar{R}_{AC}$ (ii) the angle between $\bar{R}_{AB}$ *and* $\bar{R}_{AC}$ (iii) scalar projection of $\bar{R}_{AB}$ on $\bar{R}_{Ac}$ (iv) the (scalar) area of triangle ABC. [05]

(B) Transform each of the following vectors to cylindrical co-ordinates at the point specified. [05]
(a) 5ax at P ($\rho = 4$, $\phi = 120°$, $z = 2$)
(b) 5ax at Q ($x = 3$, $y = 4$, $z = -1$)
(c) 4ax -2ay -4az at A ($x = 2$, $y = 3$, $z = 5$)

OR

Q.1

(A) What is electrical field intensity? Derive the expression for electric filed intensity due to surface charge. [05]

(B) Given points A (x=2, y= 3, z= -1) and Point B ($\rho = 4, \emptyset = -50, z = 2$), find a unit vector in cylindrical coordinates (a) at point B directed towards point A (b) at point A directed towards point B. [05]

Q.2

(A) State gauss law and prove that $\rho_v = div\ \bar{D}$. [05]

(B) Let $\bar{E} = \left(-6y/x^2\right)\bar{a}_x + (6/x)\bar{a}_y + 5\bar{a}_z$ V/m.,Calculate (i) V_{PQ} given P(-7, 2, 1) and Q(4, 1, 2) (ii) V_P if V = 0 at Q (iii) Vp if V=0 at (2, 0, -1). [05]

OR

Q.2

(A) Eight point charges of 1 nC each are located at the corners of a cube in free space that is 1m on side. Find $|\bar{E}|$ at the center of (a) the cube (b) a face (c) an edge. [07]

(B) Let $E = (2x + 4y - 3)a_x + (4x - 2y)a_y$. Find the equation of the direction line passing through P(1,2,z) also sketch the direction line and show E at P. [03]

Q.3 **Attempt following questions.** [10]

(A) Define potential and potential difference and also get the expression for potential difference in the field of line charge.

(B) A uniform line charge density of 20 nC/m lies on the z axis between z = 1 and z = 3m. no other charge is present. Find E at (a) the origin (b) P (4,0,0).

SECTION II

Q.4

(A) Derive the continuity equation and from that define the term "relaxation time". [05]

(B) Find the incremental field ΔH_2 at P_2 caused by a source at P_1 of $I_1\ \Delta L_1$ [05]

(a) $2\pi a_z\ \mu$ Am given P_1 (4,0,0) and P_2 (0,3,0)

(b) $2\pi a_z\ \mu$ Am given P_1 (4,-2,3) and P_2 (0,3,0)

(c) $2\pi(0.6a_x - 0.8a_y)\ \mu$Am given P_1 (4,-2,3) and P_2 (1,3,2).

OR

Q.4

(A) Write a short note on the continuity equation and explain how it predicts the conservation of charge [05]

(B) State and Explain Ampere's circuital law and Biot-Savart's law. [05]

Q.5

(A) (i) Show that P= $(\varepsilon - \varepsilon_0)$ E and D= $\frac{\varepsilon_r}{\varepsilon_r - 1}$ P. [04]

(ii)Given that Xe= 6.4 and D= 600 C/, Find ε_r, E and P.

(B) If J= $1/r^3$ (2 cos θ ar + sin θ $a\theta$)A/m2, calculate the current passing through [04]

(a) a hemispherical shell of radius 20cm, $0 < \theta < \pi 2$,$0 < \emptyset < 2\pi$.

(b) a spherical shell of radius 10cm

(C) The relaxation time of a material with dielectric constant of 6 is 53 seconds. Calculate the conductivity of the material. [02]

OR

Q.5

(A) Prove that $\bar{J} = \rho_v\ \bar{v}$. [06]

(B) Given the magnetic flux density, $\bar{B} = 6 \cos 106\ t \sin 0.001x\ \bar{a}z\ m\ T$, find (1) the magnetic flux passing through the surface z=0, $0 < x < 20$, $0 < y < 3$m, at t= 1 μs; (2) the value of the closed integral of E around the perimeter of the surface specified above, at t = 1 μs. [04]

Q.6 **Attempt following questions.** [10]

(A) A wire of diameter 1 mm and conductivity 5×10^7 sec/m has free electrons per cubic meter when an electric field of 10 mV/m is applied. Determine

(a) The charge density of free electrons

(b) The current density

(c) The current in wire

(d) The drift velocity of the electrons.

(B) Derive point form & integral form of Maxwell's second equation from ampere's circuital law.

END OF PAPER