Student Exam No:-_____

GANPAT UNIVERSITY
B.TECH SEM-IV ELECTRICAL ENGINEERING
REGULAR EXAMINATION April - June 2015
2EE405:-ELECTROMAGNETICS

Time: 3 Hours **Total Marks:-70**

Instructions: - 1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

SECTION-I

Q:1 **(A)** Define (i) Del operator (ii) Gradient of a scalar (iii) Divergence of a vector in to rectangular, cylindrical and spherical coordinate system. **(6)**

(B) Three field quantities are given by $P= 2a_x-a_z$, $Q =2a_x-a_y+2a_z$, $R=2a_x-3a_y+a_z$. Determine (i) Q.R× P (ii) $\sin\theta_{QR}$ (iii) P× (Q × R) (iv) A unit vector perpendicular to both Q and R. (v) The component of P along Q. **(6)**

OR

Q:1 **(A)** Convert Following points to Cartesian coordinates: **(6)**
(a) $P_1(5,120°,0)$ (b) $P_2(1,30°,-10)$ (c)$P_3(10,3\pi/4, \pi/2)$ (d)$P_4(3,30°,240°)$

(B) Transform each of the following vectors to spherical coordinates at the point specified: (a) 5 a_x at B ($r = 4, \theta = 25°, \emptyset = 120°$), (b) 5 a_x at A(x=2, y=3, z = -1) (c) $4a_x - 2a_y - 4a_z$ at P(x= -2, y = -3, z=4) **(6)**

Q:2 **(A)** Calculate E at M(3, -4, 2) in free space caused by: (a) a charge $Q_1 = 2\mu C$ at $P_1(0, 0, 0)$; (b) a charge $Q_2 = 3\mu C$ at $P_1(-1, 2, 3)$; (c) a charge $Q_1 = 2\mu C$ at $P_1(0, 0, 0)$ and a charge $Q_2 = 3\mu C$ at $P_1(-1, 2, 3)$. **(6)**

(B) Derive the expression for electric field intensity at any point due to a line charge with uniform charge density ρ_L C/m on the infinitely long Z-axis. **(5)**

OR

Q:2 **(A)** Calculate the numerical values of V and ρ_v at point P in free space if: $V = 5\rho^2 \cos 2\phi$, at point P ($\rho = 3$, $\varphi = \Pi/4$, $z = 2$). **(6)**

(B) A line charge density of 24 nC/m is located in free space on the line y = 1, z = 2. (a)Find E at P(6, -1, 3). (b)what point charge Q_A should be located at Q (-3, 4, 1) to cause E_y to be equal to zero at P? **(5)**

Q:3 **Attempt any Three:** **(12)**

(A) Calculate the work done in moving a 4 C charge from B(1, 0, 0) to A(0, 2, 0) along the path y = 2 – 2x, z = 0 in the field E = 5x a_x + 5y a_y V/m.

(B) If we take zero reference for potential at infinity, find the potential at (0, 0, 2) caused by 12 nC/m on the line $\rho = 2.5$ m, z = 0.

(C) State the coulomb's law. Explain the equation of force between two point charges Q_1 and Q_2

(D) Prove that electric field intensity E = - grad V, where V is the Potential.

SECTION-II

Q:4 (A) Define Boundary Condition and explain boundary conditions of electrostatic fields for dielectrics and dielectrics material. (6)

(B) Write Laplace's and Poisson's Equations in Cartesian co-ordinate system. & Discuss them in detail. (6)

OR

Q:4 (A) State and explain the Ohm's law for conductors. What is analogous relation in the static electric field? (6)

(B) Derive Boundary Condition of Magnetic Circuit. (6)

Q:5 (A) Discuss Ampere's Law and its significance with respect to Maxwell's Equation for magneto statics. (6)

(B) Explain Gauss law in Differential form and Integral form. (5)

OR

Q:5 (A) Derive Capacitance due to Co-axial cable and Spherical cable. (6)

(B) Evaluate the closed line integral of H from P_1 (5,4,1) to P_2 (5,6,1) to P_3 (0,6,1) to P_4 (0,4,1) to P_1, using straight line segments, if $H = 0.1y^3a_x + 0.4x\ a_z$ A/m. (5)

Q:6 **Attempt any Two:** (12)

(A) State and Explain Ampere's circuital law and Biot-Savart's law.

(B) What are the magnetic scalar and vector potentials? What are their importance?

(C) The region $y<0$ contains a dielectric material for which $\varepsilon_{r1} = 4$,while the region $y>0$ is characterized by $\varepsilon_{r2} = 6.5$ Let $E_1 = -30\ a_x + 50\ a_y + 70\ a_z$ V/m & Find (a) DN_2 (b) Dt_2 (c) D_2 (d) P_2 (e) Θ_2

END OF PAPER

Best of Luck