Student Exam No:-_____

GANPAT UNIVERSITY
B.TECH SEM-IV ELECTRICAL ENGINEERING
REGULAR EXAMINATION MAY-JUNE-2014
2EE405:-ELECTROMAGNETICS

Date: 26/05/2014 **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 the current density vector J. using Ampere's circuital law derive the relationship between B and J. **(6)**

(B) Express the vector field $W = (x^2-y^2)a_y - xz\,a_z$ in **(6)**
(i) Cylindrical co-ordinates at P($\rho = 6, \emptyset = 60°, Z = -4$)
(ii) Spherical co-ordinates at Q($r = 4, \theta = 30°, \emptyset = 120°$)

OR

Q:1 (A) If $A = -4\,a_x + 2\,a_y + 3\,a_z$ and $B = = 3\,a_x + 4\,a_y - a_z$ Find **(6)**
(i)A.B
(ii) A× B.
(iii)the magnitude of 5A- 2B
(iv) unit vector in the direction of (5A- 2B)/|A|.
(v)vector component of A that is perpendicular to B

(B) Express following vector in Cartesian coordinate system. **(6)**
$A = \rho z \cos\phi\, a_\rho + 3\,\rho \sin\phi\, a_\emptyset + \rho \cos\phi \sin\phi\, a_z$

Q:2 (A) Discuss the similarities and dissimilarities between Biot-Savart law and Coulomb's law. **(5)**

(B) Points P and Q are located at (1,-2,4) and (-5,4,2). Determine **(6)**
(a) The position vector of P.
(b) The distance vector from P to Q.
(c) The distance between P & Q.
(d) A vector parallel to PQ with magnitude of 10

OR

Q:2 (A) Explain the concept of (a)the gradient of a scalar field, ∇V, (b)the divergence of vector field , $\nabla . A$. **(5)**

(B) (i)Given $V = x^2y + xy^2 + xz^2$,Find(a)Gradient of V (b) evaluate it at (1,-1,3) **(6)**
(ii) Convert the coordinate (1,2,0) from Cartesian to cylindrical and spherical coordinates:

Q:3 **Attempt any two:** **(12)**
(A) Write a short note on the continuity of current equation and explain how it predicts the conservation of charge.
(B) What are the magnetic scalar and vector potentials? What are their importances?
(C) State and express the Divergence of vector flux density D.

SECTION-II

Q:4 (A) Define and Derive the surface charge density for electric flux density and electric field intensity with neat sketches. (6)

(B) Find the total charge inside each of the volume indicated. (6)

a. $\rho_v = 10\, z^2 e^{-0.1x} \sin \Pi y, -1 \leq x \leq 2, 0 \leq y \leq 1, 3 \leq z \leq 3.6$

b. $\rho_v = 4xyz^2, 0 \leq \rho \leq 2, 0 \leq \varphi \leq \frac{\Pi}{2}, 0 \leq z \leq 3$

OR

Q:4 (A) Using the Divergence theorem express the Gauss law in differential form and also state the significant of electric flux. (6)

(B) State and explain Stoke's theorem and show line integral of magnetic field intensity is equal to the curl of H over the surface. (6)

Q:5 (A) State and explain the Ohm's law for conductors. What is analogous relation in the static electric field? (5)

(B) Define Boundary Condition and explain boundary conditions of electrostatic fields for dielectrics and dielectrics material. (6)

OR

Q:5 (A) 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 $H = 0.1y^3 a_x + 0.4x\, a_z$ A/m. (b) Determine the quotient of the closed line integral and they are enclosed by the path as an approximation to $(\nabla * H)_z$ (5)

(B) Derive point form of Ampere's circuital law and show relation between J and H. (6)

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

(A) Find the relative permittivity of dielectric material used in a parallel-plate capacitor if
(a) C = 40nF , d= 0.1 mm, and S= 0.15 m^2
(b) d= 0.2 mm, E= 500kV/m, and ρ_s = 10μc/ m^2
(c) D= 50μc/ m^2 and the energy density is 20 J/ m^3 .

(B) Derive the Laplace and Poisson's equation in rectangular co-ordinate system

(C) Derive Capacitance due to Co-axial cable and Concentric spheres.

END OF PAPER

Best of Luck