Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI (OLD).EXAMINATION – WINTER 2016

Subject Code: 160906 Date: 25/10/2016

Subject Name: Theory of Electromagnetics

Time: 10:30 AM to 01:00 PM Total Marks: 70

Instructions:

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

Q.1 **(a)** Explain dot product and cross product of two vectors. **07**
If the vector field $\mathbf{G}=y\,\mathbf{a}_x - 2.5x\,\mathbf{a}_y + 3\,\mathbf{a}_z$ and the point Q (4,5,2),find the vector component of **G** at Q in the direction of $\mathbf{a}_N = 1/3\,(\,2\mathbf{a}_x + \mathbf{a}_y - \mathbf{a}_z\,)$.

(b) Transform the vector field $\mathbf{G}=(\,xz/y\,)\mathbf{a}_x$ into spherical coordinates and Give the Cartesian coordinates of the point C (4.4, -115^0 ,2) **07**

Q.2 **(a)** Define potential difference V. calculate V_1 if point P_1 is located at P_1 (-2, 3, -1) and V=5V at (2,0,4) for a 15 nC point charge is at the origin in free space. **07**

(b) Derive the expression for electric field intensity at a point (ρ , Φ , z) due to an infinite line charge density ρ_L along z-axis. **07**

OR

(b) State and explain Guass's law. **07**
$\mathbf{D}=8xyz^4\,\mathbf{a}_x + 4x^2z^4\,\mathbf{a}_y + 16\,x^2yz^3\,\mathbf{a}_z$ pC/m^2 in free space. Find the total electric flux passing through the rectangular surface z=2 , 0<x<2 , 1<y<3 in the $\mathbf{a}_z$-direction.

Q.3 **(a)** Define electric dipole & dipole moment. Derive expressions for V and **E** for an electric dipole at a distant point P. **07**

(b) State and explain Biot- Savert's law. **07**

OR

Q.3 **(a)** For the potential field $V=2x^2y - 5z$ and point P(-4, 3, 6),find at P i)the potential, ii) the electric field intensity **E ,** iii)the direction of **E** and iv) the volume charge density ρ_v. **07**

(b) Derive Poisson's and Laplace's equation. **07**

Q.4 **(a)** State and explain Lorentz force equation on charge particle. **07**

A negative point charge Q= - 40nC is moving with a velocity of 6×10^6 m/s in a direction specified by the unit vector $\mathbf{a}_V = -0.48\,\mathbf{a}_x - 0.6\,\mathbf{a}_y + 0.64\,\mathbf{a}_z$. Find the vector force exerted on the moving particle by the field $\mathbf{B} = 2\,\mathbf{a}_x - 3\,\mathbf{a}_y + 5\,\mathbf{a}_z$ mT.

(b) Write short note on magnetic materials. **07**

OR

Q.4	**(a)**	Write Maxwell equation in point form and integral form.	**07**
	(b)	State and explain Stoke's theorem.	**07**
Q.5	**(a)**	Derive boundary conditions for perfect dielectric materials.	**07**
	(b)	Evaluate both sides of the divergence theorem for the field $D = 2xy\, a_x + x^2\, a_y$ C/m^2 and the rectangular parallelepiped formed by the planes x=0 and 1, y=0 and 2, and z=0 and 3.	**07**

OR

Q.5	**(a)**	Explain applications of numerical techniques in engineering.	**07**
	(b)	Calculate **E** at P (1, 1, 1) caused by four identical 3- nC charges located at P_1 (1, 1, 0), P_2(-1,1,0),P_3 (-1, -1, 0), and P_4 (1, -1, 0).	**07**

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