Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI • EXAMINATION – SUMMER • 2014

Subject Code: 160906 Date: 30-05-2014

Subject Name: Theory of Electromagnetics

Time: 10:30 am - 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 the physical significance of the term : (i) Divergence of a vector field and (ii) curl of a vector field.	**07**
	(b)	Give the basic concepts of transformation of one coordinate system to another.	**07**
Q.2	**(a)**	Derive Maxwell's first equation as applied to the electrostatics, using Gauss's law. Also state the Divergence theorem.	**07**
	(b)	Find the force on a point charge q located at (0,0,h) m due to charge of surface charge density ρ_s C/m^2 uniformly distributed over the circular disc $r \leq a$, z=0 m.	**07**
		OR	
	(b)	Develop an Expression for electric field intensity at a general point P due to a semi –infinite straight line charge with charge density ρ_l C/m.	**07**
Q.3	**(a)**	In a field E= -50y a_x- 50x a_y+30 a_z V/m, calculate the differential amount of work done in moving 2 µC charge a distance 5 µm from A(1,2,3) to B(2,4,1).	**07**
	(b)	Discuss Poisson's and Laplace's equation.	**07**
		OR	
Q.3	**(a)**	Potential is given by V= $2(x+1)^2 (y+2)^2 (z+3)^2$ V in free space. At point P (2,-1,4) calculate : (i) The potential at point P, (ii) electric field intensity E at point P,(iii) volume charge density at P.	**07**
	(b)	Explain boundary condition for dielectric material.	**07**
Q.4	**(a)**	Derive the expression curl H= J.	**07**
	(b)	Find the magnetic field intensity at a point P(r,ϕ,z) due to an infinitely long straight filament carrying a current I in the positive z direction.	**07**
		OR	
Q.4	**(a)**	Write Maxwell equation in point form and in integral form	**07**
	(b)	A straight conductor of 0.2 m lies on the x- axis with one end at origin. The conductor is subjected to a magnetic flux density B= 0.04 a_y T and velocity v = $2.5\sin 10^3 t$ a_z m/s. Calculate the motional electric field intensity and emf induced in the conductor.	**07**
Q.5	**(a)**	Explain applications of numerical techniques in engineering.	**07**
	(b)	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 a_v = - 0.48a_x - 0.6a_y + 0.64a_z. Find the magnitude of the vector force exerted on the moving particle by the field : (a) B = 2a_x -3a_y +5a_z Mt; (b) E = 2 a_x – 3 a_y +5a_z KV/m ; (c) B and E acting together.	**07**
		OR	
Q.5	**(a)**	State and Explain Eddy current testing of materials.	**07**
	(b)	A loop of wire is constructed of three straight segments connecting (0,0,0) to (0.6,0,0) to (0.4,1,0.7) to (0,0,0). A current of 8mA is in the ax direction in the first segment. Given a uniform magnetic field B = 0.2a_x -0.1a_y +0.2a_z T, find (a) The total force on the loop; (b) the torque on the loop about an origin at (0,0,0)	**07**

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