Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – V (NEW) EXAMINATION – WINTER 2015

Subject Code: 2151002 **Date:05/12/ 2015**

Subject Name: Engineering Electromagnetic

Time:10:30am to 1:00pm **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)**	With neat and clean sketches explain cylindrical coordinate system.	**06**
	(b)	Solve the followings(Four Marks each) 1) The vector from the origin to point A is given as (6,-2,-4) and the unit vector directed from the origin toward point B is given by (2,– 2,1)/3**.** If point A & B are 10 unit apart, find the coordinate of B. 2) Transform the given vector $\mathbf{A} = r^2\,\mathbf{a_r} + \sin\theta\,\mathbf{a_\phi}$ into rectangular coordinate.	**08**
Q.2	**(a)**	Derive the expression for the electric field due to infinitely long line charge located on the z axis at any arbitrary point P(ρ, ϕ, z).	**07**
	(b)	Define line charge. Infinite uniform line charge of 5 nC/m, lie along the (positive and negative) x and y axes in free space. Find **E** at point P(0,0,4).	**07**
		OR	
	(b)	Define sheet charge. Planes x = 2 and y = -3, respectively carry charges 10 nC/m^2 and 15 nC/m^2. Calculate **E** at P(1,1,-1) due to these charge distributions.	**07**
Q.3	**(a)**	State and prove Gauss's Law. Derive the point form of Gauss's Law relates the flux leaving any closed surface to the charge enclosed.	**07**
	(b)	Evaluate both sides of divergence theorem for the field $\mathbf{D} = 2xy\,\mathbf{a_x} + x^2\,\mathbf{a_y}$ 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.3	**(a)**	Write a brief note on potential gradient.	**07**
	(b)	A dipole of moment $\mathbf{p} = 6\mathbf{a_z}$ nC.m is located at the origin in free space. Find the potential V & Electric Field intensity **E** at point P(r = 4, θ = 20º, ϕ = 0º).	**07**
Q.4	**(a)**	Write brief note boundary conditions for perfect dielectric materials.	**07**
	(b)	Find E at point P(3,1,2) for the two coaxial conducting cylinders, if potential V = 50 V at ρ = 2 m and V = 20 V at ρ = 3 m.	**07**
		OR	
Q.4	**(a)**	State Bio-Savart law for the steady magnetic field. Also derive the expression for the magnetic field intensity for an infinitely long straight filament carrying a direct current I.	**07**
	(b)	For any vector field, show explicitly that divergence of the curl of any vector is zero.	**07**
Q.5	**(a)**	Derive the expression for the torque acting on the loop in the presence of magnetic field **B**, relating the dipole moment and the magnetic field **B**.	**07**
	(b)	State Maxwell's equations in integral form and explain physical significance of the equations.	**07**
		OR	
Q.5	**(a)**	State and prove Poynting's theorem relating to the flow of energy at a point in space in an electromagnetic field.	**07**

(b) Write a brief note on uniform plane wave propagation in free space. **07**

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