GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2021

Subject Code:3141009   **Date:04/01/2022**
Subject Name:Electromagnetic Theory
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.
4. Simple and non-programmable scientific calculators are allowed.

			Marks
Q.1	(a)	'The curl of the gradient of potential is zero'-Justify the statement.	03
	(b)	Convert vector $A = 5a_x + a_y + 3a_z$ in cylindrical coordinate system.	04
	(c)	What is divergence? with help of divergence prove that $\text{Del} \bullet D = \rho_v$, and Find the volume charge density that is associated with $D = (10xyz^2 + 4x)a_x + 5x^2z^2a_y + 10x^2yza_z \text{ nC/m}^2$	07
Q.2	(a)	Find the a_y dot a_ϕ and a_x dot a_θ	03
	(b)	For a coaxial cable find the electric field density (D) inside the inner core, in between inner and outer core and outside the cable.	04
	(c)	Five identical 15 μC point charges are located at the center and corners of a square defined by -1< x, y < 1 and z =0. 1. Find the force on the 10 μC point charge at (0,0,2). 2. Calculate the electric field intensity at (0,0,2).	07

OR

	(c)	Given the flux density $D = (\cos\theta/r^3) a_r + (2\sin\theta/r^3) a_\theta$ c/m², evaluate both sides of the divergence theorem for the region defined by 1< r < 3 , $0 < \theta < \pi/2$, $0< \phi< \pi/2$	07
Q.3	(a)	Define scalar, vector and retarded potential.	03
	(b)	What is the importance of boundary conditions? Describe the boundary condition between free space and conductor.	04
	(c)	Write Maxwell's equations in integral form and explain physical significance of equations.	07

OR

Q.3	(a)	Explain Lorentz Force equation.	03
	(b)	State and derived the Biot-Savart Law.	04
	(c)	Write Maxwell's equations in point form and explain their physical significance.	07
Q.4	(a)	Explain Poynting vector.	03
	(b)	State and explain Ampere's circuital law. Find the magnetic field intensity due to long straight conductor using Ampere's circuital law.	04
	(c)	In a certain conducting region $H = yz (x^2+y^2)a_x - y^2 xz a_y +4 x^2y^2 a_z$ A/m	07

1. Determine J at (5,2,-3)
2. Show that Del dot B = 0

OR

Q.4	**(a)**	Compare Cartesian and Cylindrical coordinate systems.	**03**
	(b)	What is curl? With help of curl meter explain the physical interpretation of curl and state its applications.	**04**
	(c)	If $F = x^2ya_x - 2za_y + (3z^2 + xy)a_z$ find Del × [Del (Del●F)]	**07**
Q.5	**(a)**	Explain propagation constant and characteristic impedance of transmission line.	**03**
	(b)	Derive the voltage and current equations of transmission line.	**04**
	(c)	Write short note on plane wave propagation in general directions.	**07**

OR

Q.5	**(a)**	Explain VSWR and Reflection coefficient.	**03**
	(b)	Define and explain the following terms: (i) Hall Effect (ii) Skin Effect	**04**
	(c)	Write short note on loss less and distortion less transmission line.	**07**