Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2021

Subject Code:3141009 Date:08/09/2021

Subject Name:Electromagnetic Theory

Time:02:30 PM TO 05:00 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.**

Q.1	(a)	$\vec{P} = 2\hat{a}_x - \hat{a}_z, \vec{Q} = 2\hat{a}_x - \hat{a}_y + 2\hat{a}_z, \vec{R} = 2\hat{a}_x - 3\hat{a}_y + \hat{a}_z$ Determine 1. $\vec{P} \cdot \vec{Q} \times \vec{R}$ 2. $\vec{P} \times \left(\vec{Q} \times \vec{R}\right)$	3
	(b)	Prove that the divergence of curl of any vector field is zero.	4
	(c)	Given the point P(-2,6,3) and $\vec{A} = y\hat{a}_x + (x+z)\hat{a}_y$. Express P and vector A in cylindrical co-ordinate system.	7
Q.2	(a)	State and explain Gauss's Law.	3
	(b)	State and explain Divergence Theorem.	4
	(c)	Derive the expression for the electric flux density due to infinite sheet of charge lying on the z=0 plane.	7
		OR	
	(c)	Derive the expression for the electric flux density due to infinite line charge placed on the z axis.	7
Q.3	(a)	Two dipoles with dipole moment -5az nC.m and 9az nC.m are located at the points (0,0,-2) and (0,0,3) respectively. Find the potential at the origin.	3
	(b)	Derive the expression $\vec{E} = -\nabla V$	4
	(c)	The point charges -1nC, 4nC and 3nC are located at (0,0,0), (0,0,1) and (1,0,0) respectively. Find the energy in the system.	7
		OR	
Q.3	(a)	Write Maxwell's equation in differential form and integral form for static electric and magnetic fields.	3

(b) State and prove Stokes's Theorem. 4

(c) 7

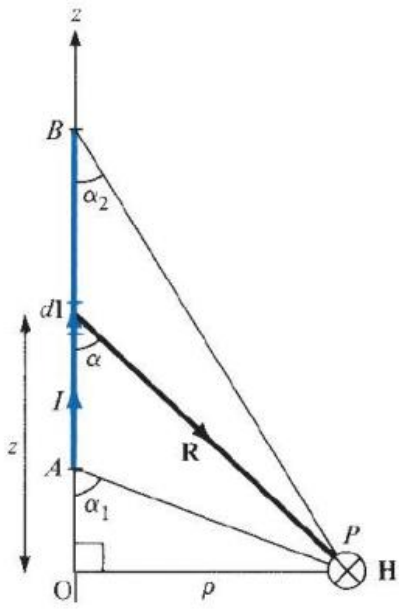

Figure 1

Derive the expression for the magnetic field at the point P due to a straight current carrying filamentary conductor of finite length AB, shown in figure 1.

Q.4 (a) State and explain Faraday's Law. 3

(b) Derive the expression for Lorentz force equation. 4

(c) 7

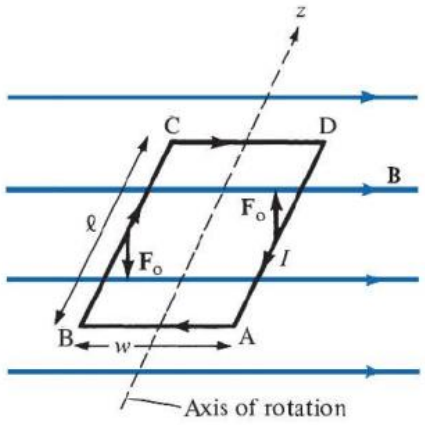

Figure 2

Obtain the expression of magnetic dipole moment for a rectangular planar loop placed in uniform magnetic field as shown in figure 2.

OR

Q.4 (a) Explain the concept of conduction current and convection current. 3

(b) Briefly describe magnetic boundary condition between two different media. 4

	(c)	Explain the boundary condition between two dielectric material having permittivity ε_1 and ε_2.	7
Q.5	(a)	Explain the concept of retarded potential.	3
	(b)	Explain the concept of skin effect.	4
	(c)	Write short note on wave propagation in good conductor.	7

OR

Q.5	(a)	Define following terms: 1. Standing wave ratio 2. Reflection coefficient 3. Characteristic impedance	3
	(b)	Obtain the expression of impedance for a lossless transmission line terminated in short circuit.	4
	(c)	Draw the equivalent circuit of the transmission line and derive its voltage and current equations.	7

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