

## GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2020

**Subject Code:2151002**
**Date:22/01/2021**
**Subject Name:Engineering Electromagnetics**
**Time:10:30 AM TO 12:30 PM**
**Total Marks: 56**
**Instructions:**

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		MARKS
<b>Q.1</b>	(a) Transform the following vectors to spherical coordinates at the points given: $Y = 10 \mathbf{a}_y$ . At point $Q (\rho = 5, \phi = 30^\circ, z = 4)$	<b>03</b>
	(b) A field is given as $\mathbf{G} = [25 / (x^2 + y^2)](x \mathbf{a}_x + y \mathbf{a}_y)$ . Find a unit vector in the direction of $\mathbf{G}$ at $P(3, 4, -2)$ . Also find the angle between $\mathbf{G}$ and $\mathbf{a}_x$ at $P$ . State the Biot Savart Law.	<b>04</b>
	(c) Express biot savart law in terms of differential current element $d\mathbf{L}$ , surface current density $\mathbf{K}$ and current density $\mathbf{J}$ .	<b>07</b>
<b>Q.2</b>	(a) Stat and explain in brief : The divergence theorem	<b>03</b>
	(b) Determine an expression for the volume charge density associated with each $\mathbf{D}$ field: $\mathbf{D} = \sin \theta \sin \phi \mathbf{a}_r + \cos \theta \sin \phi \mathbf{a}_\theta + \cos \phi \mathbf{a}_\phi$ .	<b>04</b>
	(c) Explain the term: Electric Flux Density. Determine an equation for the electric fields due to volume charge distribution.	<b>07</b>
<b>Q.3</b>	(a) Define potential and potential difference	<b>03</b>
	(b) State conductor properties and its boundary condition.	<b>04</b>
	(c) Define capacitance. State and explain the problem of the parallel plate capacitor. Find the expression for capacitance for parallel plate capacitor.	<b>07</b>
<b>Q.4</b>	(a) Define current and current density	<b>03</b>
	(b) An electric field is expressed in rectangular coordinates by $\mathbf{E} = 6x^2 \mathbf{a}_x + 6y \mathbf{a}_y + 4 \mathbf{a}_z$ V/m. Find: (a) $V_{MN}$ if points $M$ and $N$ are specified by $M(2, 6, -1)$ and $N(-3, -3, 2)$ ; (b) $VM$ if $V = 0$ at $Q(4, -2, -35)$	<b>04</b>
	(c) State the Nature of Dielectric Materials and Boundary Conditions for Perfect Dielectric Materials.	<b>07</b>
<b>Q.5</b>	(a) State the magnetic boundary conditions.	<b>03</b>
	(b) The point charge $Q = 18\text{nC}$ has a velocity of $5 \times 10^6$ m/s in the direction $\mathbf{a}_v = 0.60 \mathbf{a}_x + 0.75 \mathbf{a}_y + 0.30 \mathbf{a}_z$ . Calculate the magnitude of the force exerted on the charge by the field: $\mathbf{B} = -3\mathbf{a}_x + 4\mathbf{a}_y + 6\mathbf{a}_z$ mT	<b>04</b>
	(c) Define CURL. Derive the expression of curl of magnetic field intensity in rectangular co-ordinate.	<b>07</b>

- Q.6** (a) Find the magnetization  $M$  in a magnetic material where: **03**  
 $\mu = 1.8 \times 10^{-5}$  H/m and  $H = 120$  A/m
- (b) Define force and Torque on a close circuit. **04**
- (c) State the ampere's circuital law. Derive the expression for magnetic field intensity at any point for co-axial cable which carries the uniform distribution of current. **07**
- Q.7** (a) Explain : Wave Polarization and Standing Wave Ratio **03**
- (b) State and explain Lorentz force equation . **04**
- (c) Derive MAXWELL's equation in point form. **07**
- Q.8** (a) State and explain faraday's law. **03**
- (b) Explain : The Retarded Potentials **04**
- (c) Evaluate a Poisson's and Laplace's Equations **07**

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