

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV(NEW) – EXAMINATION – SUMMER 2019

Subject Code:2140909

Date:20/05/2019

Subject Name: Field 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. Bold letters indicate vector quantity.

		MARKS
Q.1	(a) Explain cylindrical coordinate system in brief.	03
	(b) Explain unit vectors of Cartesian, cylindrical and spherical coordinate systems.	04
	(c) Transform the vector $4\mathbf{a}_x - 2\mathbf{a}_y - 4\mathbf{a}_z$ into spherical coordinates at a point $P(x = -2, y = -3, z = 4)$.	07
Q.2	(a) State and explain Coulomb's law.	03
	(b) Derive the expression for electric field due to infinite surface charge distribution in free space.	04
	(c) An infinite uniform line charge having line charge density of $\rho_L = 30 \text{ nC/m}$ placed at $y = 3, z = 5$. Find the total electric field intensity at $(5, 6, 1)$.	07
	OR	
	(c) Point charges of 120 nC are located at $A(0, 0, 1)$ and $B(0, 0, -1)$ in free space. Find (1) Find $\mathbf{E}$ at $(0.5, 0, 0)$ (2) What single charge at origin would provide the identical field strength.	07
Q.3	(a) State and prove the Gauss's law.	03
	(b) Derive Maxwell's first equation as applied to electrostatics, using Gauss's law.	04
	(c) Calculate the divergence of $\mathbf{G}$ at $P(2, -3, 4)$ if $\mathbf{G} = (a) x \mathbf{a}_x + y \mathbf{a}_y + z \mathbf{a}_z$ (b) $\rho \mathbf{a}_\rho$ (c) $r \mathbf{a}_r$ (d) $6r^2 \sin \theta \mathbf{a}_r + 2r^2 \cos \theta \mathbf{a}_\theta$.	07
	OR	
Q.3	(a) Explain physical significance of Divergence.	03
	(b) Find divergence D at the origin if $\mathbf{D} = e^{-x} \sin y \mathbf{a}_x - e^{-x} \cos y \mathbf{a}_y + 2z \mathbf{a}_z$	04
	(c) A co-axial conducting cylinder has charge density of ρ_s on the outer surface of the inner cylinder. Use Gauss' law to find 'D' in all the regions. Assume that inner cylinder has radius of 'a' metres and outer cylinder has radius of 'b' metres	07
Q.4	(a) Derive Poisson's and Laplace's equation.	03
	(b) Explain electric dipole. Derive the expression for $\mathbf{E}$ at any distant point from dipole.	04
	(c) Explain boundary conditions between two perfect dielectric materials.	07
	OR	
Q.4	(a) Explain concept of electric potential difference.	03
	(b) State and explain Ampere's circuital law.	04
	(c) Write a short note on EMI & EMC.	07
Q.5	(a) State and explain BiotSavart's law.	03
	(b) Explain the physical significance of the term: Curl of a vector.	04
	(c) Explain Stoke's theorem with its mathematics expression.	07

OR

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| Q.5 | (a) | Classify magnetic materials. | 03 |
| | (b) | Explain primary constant and secondary constant of transmission line. | 04 |
| | (c) | Describe the physical description of transmission line propagation. | 07 |
