

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER- IV EXAMINATION – SUMMER 2020****Subject Code: 2140909****Date: 29/10/2020****Subject Name: Field 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.

- Q.1** (a) State Gauss's law. Also write limitations of Gauss' law. **03**
(b) Define and explain unit vectors in cylindrical and spherical co-ordinate systems. **04**
(c) Planes $x=2$ and $y=-3$, respectively carry charges 10 nC/m^2 and 15 nC/m^2 . If the line $x=0, z=2$ carries charge $10\pi \text{ nC/m}$, calculate E at $(1,1,-1)$ due to three charge distribution. **07**
- Q.2** (a) Define (1) Electric field intensity (2) Potential Difference (3) Potential gradient **03**
(b) State and prove Stoke's Theorem. **04**
(c) Express the vector $B = \frac{10}{r} a_r + r \cos \theta a_\theta + a_\phi$ in cartesian coordinate. Find vector B at $(-3, 4, 0)$ **07**
- OR**
- (c) What is an electric dipole? Derive expression for electric field intensity and potential due to an electric dipole. **07**
- Q.3** (a) Derive the relation between current and current density. **03**
(b) Find $\text{div } D$ at $P(5, \pi/2, 1)$ if $D = rz \sin \phi a_r + 3rz^2 \cos \phi a_\phi$ **04**
(c) State Ampere's circuit law and obtain magnetic field intensity due to infinite long straight conductor carrying current I using Ampere's Circuital law. **07**
- OR**
- Q.3** (a) State and Explain various types of charge distribution with mathematical equation. **03**
(b) Derive the equation of continuity equation in integral and differential form. **04**
(c) State and prove divergence theorem. **07**
- Q.4** (a) Explain briefly about lossless propagation of sinusoidal voltages. **03**
(b) Define dielectric strength and list three properties of dielectric material. **04**
(c) Write in details about techniques of controlling EMI. **07**
- OR**
- Q.4** (a) List any three effects of EMI. **03**
(b) Derive the capacitance of Co-axial cable. **04**
(c) With the help of equivalent circuit derive the general wave equations for the transmission line. **07**

- Q.5** (a) Derive the expression for the force between two differential current elements. **03**
(b) Write Maxwell's equations in point form and integral form **04**
(c) State and prove Uniqueness theorem. **07**

OR

- Q.5** (a) Derive Poisson's and Laplace's Equations. **03**
(b) State and explain Faraday's law for statically induced emf with derivation. **04**
(c) Explain magnetic boundary conditions for normal component and tangential component. **07**

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