

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2015

Subject Code: 2140909

Date: 08/06/2015

Subject Name: FIELD THEORY

Time: 10:30am-1.00pm

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) Explain cylindrical coordinate system in brief. Also write the equations of differential length, differential surfaces and differential volume elements. **07**
- (b) The given points are $A(x = -1, y = 2, z = 3)$, $B(\rho = 3, \Phi = 60^\circ, z = 6)$ and $C(x = 2, y = 3, z = -1)$. Find (i) Cylindrical co-ordinates of A (ii) Cartesian co-ordinates of B and (iii) Spherical co-ordinates of C . **07**
- Q.2** (a) An infinite uniform line charge having line charge density of $\rho_L = 30 \mu C/m$ placed on the z -axis. Find the total electric field intensity at $(3, 4, 5) m$. **07**
- (b) Derive the equation of total electric field intensity in vector form due to infinite uniform sheet charge distribution in free space. **07**
- OR**
- (b) A positively charged circular ring with $\rho_L = 10 nC/m$ having radius of $5 m$ lies on $z = 0$ plane with its centre at origin. Find $\vec{E}$ at point $(0, 0, 5) m$ and also find the value of a point charge Q which will produce the same $\vec{E}$ at a point $(0, 0, 5) m$. **07**
- Q.3** (a) State and explain the Gauss's law. **07**
- (b) Derive the Maxwell's first equation applied to Electrostatic by using equations of divergence and Gauss's law for electric flux density $\vec{D}$. **07**
- OR**
- Q.3** (a) Define the potential gradient. Derive relationship between potential and electric field intensity. **07**
- (b) Derive equation of potential difference V_{AB} within the electric field produced by a point charge Q . **07**
- Q.4** (a) Write a short note on continuity equation. **07**
- (b) Explain boundary conditions between two perfect Dielectric materials. **07**
- OR**
- Q.4** (a) Derive Poisson's and Laplace's equations. **07**
- (b) State Maxwell's equations in point form and explain physical significance of the equations. **07**
- Q.5** (a) State and Explain Ampere circuital law. **07**
- (b) A point charge, $Q = -10 \mu C$, is moving with a velocity of $6 \times 10^6 m/s$ in a direction specified by the unit vector $\vec{a}_v = 0.5\vec{a}_x - 0.6\vec{a}_y + 0.2\vec{a}_z$. Find the magnitude of the vector force exerted on that moving charge by the field: (a) $\vec{B} = 2\vec{a}_x - 3\vec{a}_y + 5\vec{a}_z T$; (b) $\vec{E} = 2\vec{a}_x - 3\vec{a}_y + 5\vec{a}_z kV/m$; (c) $\vec{B}$ and $\vec{E}$ acting together. **07**
- OR**
- Q.5** (a) Explain loss less propagation of sinusoidal voltage in transmission line. **07**
- (b) Write a short note on sources of EMI. **07**
