



GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI (NEW) - EXAMINATION – SUMMER 2018

Subject Code: 2163203

Date: 01/05/2018

Subject Name: Engineering Electromagnetics & wave Propagation

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) Transform the given vector $\mathbf{A}=10 \mathbf{a}_z$ into spherical coordinates at Point P ($r=4, \theta=110^\circ, \phi=120^\circ$). **03**
- (b) Explain cross product and dot product in detail. **04**
- (c) Explain cylindrical coordinate systems. **07**
- Q.2** (a) Define volume surface and line charge density. **03**
- (b) Explain coulombs law and field intensity. **04**
- (c) Given the field $\mathbf{D} = 6\rho\sin(\phi/2) \mathbf{a}_\rho + 1.5\rho\cos(\phi/2) \mathbf{a}_\phi \text{ C/m}^2$. Evaluate both sides of the divergence theorem for the region bounded by $\rho=2, 0 < \phi < 180^\circ, 0 < z < 5$. **07**
- OR**
- (c) Find E at P (1, 5, 2) in free space if a point charge of $6 \mu\text{C}$ is located at Q(0, 0, 1), a uniform line charge of 180 nC/m lies along the z axis and a uniform sheet charge 25 nC/m^2 lies in the plane $z = -1$ **07**
- Q.3** (a) What do you mean by equipotential surface? **03**
- (b) State and prove maxwell's first law in integral form. **04**
- (c) Derive the equation to find energy stored in the field of a system of charges. **07**
- OR**
- Q.3** (a) Find the gradient of the following scalar field $= e^{-z} \sin 2x \cosh y$. **03**
- (b) If $V = 2$ volts at $x = 1\text{mm}$ and $V = 0$ volts at $x = 0$. Find E_x at $x = 1 \text{ mm}$ in free space for the volume charge density $-3 \times 10^8 \epsilon_0 x \text{ C/m}^3$. **04**
- (c) Write short note on boundary condition for perfect dielectric. **07**
- Q.4** (a) Derive the expression of following capacitor: 1) coaxial 2) Spherical **03**
- (b) Derive Poission's and Laplace's equation. **04**
- (c) Write short note on magnetic boundary conditions **07**
- OR**
- Q.4** (a) Explain biot-savart law. **03**
- (b) Explain ampere's circuital law **04**
- (c) Verify Stoke's theorem for the field $\mathbf{H} = 6xy\mathbf{a}_x - 3y^2 \mathbf{a}_y$ and the rectangular path around the region $2 \leq x \leq 5, -1 \leq y \leq 1$ and $z = 0$. Let the positive direction of $d\mathbf{s}$ be \mathbf{a}_z . **07**
- Q.5** (a) Derive an equation of force on moving charge under effect of EM field. **03**
- (b) Explain wave motion in free space. **04**
- (c) Explain point and integral form of Maxwell's equations. **07**
- OR**
- Q.5** (a) Define with respect to plane EM waves: 1) Phase 2) Phase constant 3) Phase velocity **03**
- (b) Explain skin effect. **04**
- (c) State and prove pointing vector theorem. **07**