[Time: 3 Hours] **[Marks:80]**

Please check whether you have got the right question paper.

N.B:
1. Question No.1 is compulsory.
2. Answer any three from the remaining five questions.
3. Figures to the right indicate full marks.

Q.1 Solve **any four:-** **(20)**

a) Find a unit vector in cylindrical coordinates pointing from a point in xy plane to a point Q (0,0,z).
b) State and explain Ampere's circuital law.
c) Derive dielectric –dielectric boundary condition.
d) What is Lorents force equation for a moving charge?
e) What do you mean by irrotational and solenoidal fields?

Q.2 **(20)**

a) A total charge of (40/3) nC is uniformly distributed around a circular ring of radius 2m, Find the potential at a point on the axis 5m from the plane of the ring.
b) Point charges Q1 = 300μC located at (1,-1,-3) m experiences a force $\hat{F}_1$=8$\hat{a}_x$-8 $\hat{a}_x$+4$\hat{a}_x$ N due to point charge Q2at (3,-3,-2) m. Determine Q2.

Q.3 **(20)**

a) Derive an electric field intensity due to infinite line charge.
b) Given that $\bar{D}\ \frac{5r^2}{4\bar{a}_r}$ in spherical coordinates, evaluate both sides of the divergence theorem for the volume enclosed between r=1 and r=2.

Q.4 **(20)**

a) In a cylindrical conductor of redius 2mm, the current density varies with distance from the axis according to J = $10^3 400\rho(A/m^2)$. Find the total current.
b) V = 0volts for r=0.1m and V = 100volts for r = 2m in spherical co-ordinates assuming free space between the concentric spherical shells. Find $\dot{E}$ *and* $\dot{D}$ using Laplace's equation.

Q.5 **(20)**

a) Derive magnetic field intensity due to infinite wire carrying a current I.
b) Given $\bar{E} = E_0 z^2 e^{-t}\hat{a}_x$ in free space .Determine if there exists a magnetic field such that both Faraday's law and ampere's circuital law are satisfied simultaneously.

Q.6 **(20)**

a) Derive the wave equation for electric field and magnetic field in free space.
b) Calculate the intrinsic impedance ,propagation constant and the wave velocity for a conducting medium in which $\sigma = 58\frac{Ms}{m}, \mu_r = 1$, at a frequency f=100MHz

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