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

Please check whether you have got the right question paper.

N.B:
1. **Question No. 1** is **compulsory**.
2. Attempt **any three** questions out of remaining **five** questions.
3. Assume suitable **data** if **necessary** and **justify the same**.

1. a) Explain Coulomb's law in electrostatics and hence define Unit Charge. **(05)**

b) Explain the following vector in Cartesian co-ordinate system : **(05)**
$A = 2\cos\theta\ \hat{a}_r + 3r\ \hat{a}_\theta - 4\ \hat{a}_z$

c) State and explain relationship between Electric Intensity and Potential. **(05)**

d) What is Lorentz force equation for moving charge? Enlist two applications. **(05)**

2. a) Show that electric field due to infinite sheet of charge at a point is independent of distance at that point from the plane containing the charge. **(10)**

b) Three equal point charges of 2μc are in free space at (0, 0, 0), (2, 0, 0), (0, 2, 0) respectively. Find net force on fourth charge of 5μC at (2, 2, 0). **(10)**

3. a) Derive Poisson's and Laplace equation. Two plates of a parallel capacitors are separated by a distance 'd' and maintained at potential 0 and V_1 respectively. Find potential at any point between plates. **(10)**

b) Derive the set of Maxwell's equation for Static field and Time varying field. **(10)**

4. a) Explain Ampere circuital law and differentiate between condition current and displacement current. **(10)**

b) Find the capacitance of a co-axial conductor of length L, where inner and outer radius are r_1 and r_2 respectively. **(10)**

5. a) A current sheet $\bar{K}$ = 10 $\hat{a}_z$ A/m lies in X = 4 m plane and a second sheet $\bar{K}$ = -8 $\hat{a}_z$ A/m is at X = –5 m plane. **(10)**
Find $\bar{H}$ at points :
i) (1, 1, 1)
ii) (0, –3, 10)

b) Derive magnetic field intensity due to finite and infinite wire carrying a current. **(10)**

6. a) Formulate the wave equation from Maxwell's equations for perfectly conducting medium. **(10)**

b) Consider an interphase in Y - Z plane. The region X < 0 is medium 1 with μ_{r1} = 4.5 and magnetic field, $H = 4\ \hat{a}\ x + 5\ \hat{a}\ y - 6\ \hat{a}\ z$ A/m. The region X > 0 is medium 2 with μ_{r2} = 6. Find H_2 and B_2 in medium 2 and also calculate the angle made by H_2 with normal to interface. **(10)**
