

Answer the following questions: (Assuming any missing data)

- 1) Point charges of 50 nC each are located at A(1,0,0), B(-1,0,0), C(0,1,0), and D(0,-1,0) in free space. Find the total force on the charge at A. (10 degrees)
- 2) A uniform volume charge density of  $80 \mu\text{C}/\text{m}^3$  is present throughout the region  $8 \text{ mm} < r < 10 \text{ mm}$ . (10 degrees)
  - a- Find the total charge inside the spherical surface  $r=10 \text{ mm}$ .
  - b- Find  $D_r$  at  $r=10 \text{ mm}$ .
  - c- If there is no charge for  $r > 10 \text{ mm}$ , find  $D_r$  at  $r=20 \text{ mm}$ .
- 3) If the potential is given by  $V=80 r^{0.6}$ . Assuming free space conditions, find: (5 degrees)
  - a- The electric field E,
  - b- The volume charge density at  $r=0.5 \text{ m}$ , and
  - c- The total charge lying within the surface  $r=0.6 \text{ m}$ .
- 4) The surface  $x=0$  separates two perfect dielectrics. For  $x>0$ , let  $\epsilon_{r1}=3$ , while  $\epsilon_{r2}=5$  where  $x<0$ . If  $E_1=80a_x-60a_y-30a_z \text{ V/m}$ . Find: (5 degrees)
  - a-  $E_{t1}$ ,
  - b-  $E_{t2}$ ,
  - c-  $D_{N1}$ , and
  - d-  $D_{N2}$ .
- 5) a- Find  $\mathbf{H}$  in Cartesian components at p(2, 3, 4) if there is a current filament on the z axis carrying 8 mA in the  $a_z$  direction. (10 degrees)
  - b- Repeat if the filament is located at  $x = -1, y = 2$ .
  - c- Find  $\mathbf{H}$  if both filaments are present.
- 6) For a plane wave propagates in a lossless material, find: (10 degrees)
  - a- Attenuation constant,
  - b- Phase constant,
  - c- Phase velocity,
  - d- Group velocity, and
  - e- Wave impedance.