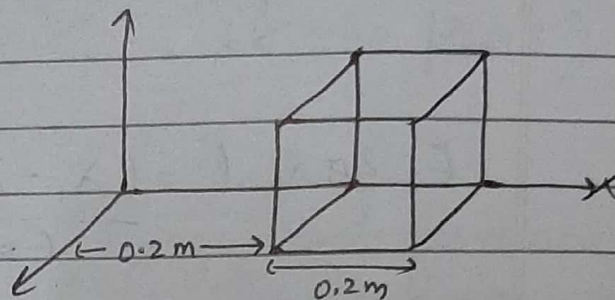


Time 1 hr:

Q1. The electric field component due to a charge inside the cube of side 0.2 m are as shown

$$E_x = \alpha x \quad \text{where } \alpha = 600 \text{ N/cm}$$

$$E_y = 0, \quad E_z = 0$$



Calculate

i) The flux through the cube

ii) The charge inside the cube.

(2)

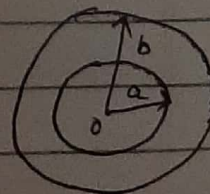
Q2. State Gauss's theorem, obtain an expression for electric field intensity at a point near a thin infinite plane sheet of charge density $\sigma \text{ C m}^{-2}$.

(2)

Q3. A point charge $+Q$ is placed at the centre O of an uncharged hollow spherical conductor of inner radius 'a' and outer radius 'b'. Find the following:

i) The magnitude and sign of the charge induced on the inner and outer surfaces of the shell.

ii) The magnitude of electric field vector at a distance a) $r = a/2$ b) $r = 2b$ from the centre of the shell.

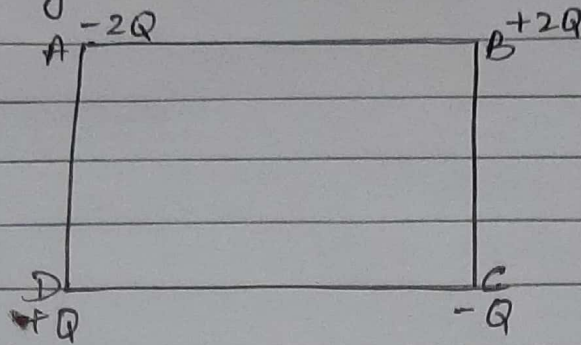


(3)

Q4. Four point charges are kept at corners of a square of side 4 cm. Find the magnitude and direction of the electric field at the centre O of

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the square if four point charges are of ~~same~~ charge $Q = 0.08 \mu\text{C}$ as shown (3)



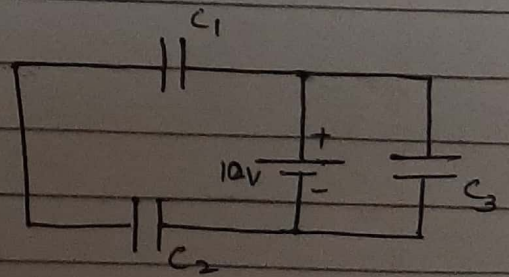
Q5. Sketch the equipotential surface for
 i) two point charges $+q$ and $-q$
 ii) two point charges $+q$ and $+q$ separated by a small distance (2)

Q6. Derive an expression for energy density of an electric field in a capacitor (2)

Q7. Three identical capacitors C_1 , C_2 , and C_3 of capacitance $4 \mu\text{F}$ each are connected to a 10V battery as shown in figure.

Find

- charge on each capacitor
- capacitance of the network
- energy stored in network of capacitors. (3)



Q8. A slab of material of dielectric constant K has the same area as the plates of a parallel plate capacitor but has a thickness $2d/3$, where d is the separation of plates. How is the capacitance change when the slab is inserted between the plates? (3)