# ELECTROSTATIC POTENTIAL AND CAPACITANCE MINDMAP

## # Electric Potential (V) →

- Work done in moving a unit (+ve) charge from infinity to point.
- Point Charge, $V = \frac{Kq}{r}$
- Ring
  - At center, $V = \frac{Kq}{r}$
  - Along axis, $V = \frac{Kq}{\sqrt{r^2+x^2}}$
- Electric Dipole
  - $V_{axial} = \frac{Kp}{r^2}$
  - $V_{equitorial} = 0$
- Hollow Sphere / Metallic Conductor
  - $V = \frac{Kq}{R}$ $(r \le R)$
  - $V = \frac{Kq}{r}$ $(r \ge R)$

## # Capacitor (Charge Storage Device) →

$C = \frac{Q}{V}$

- Parallel plate Capacitor
  - Air medium, $C = \frac{A\varepsilon_0}{d}$
  - Dielectric completely filled b/w plates, $C = \frac{KA\varepsilon_0}{d}$
  - Dielectric filled upto thickness t and same area as plates, $C = \frac{A\varepsilon_0}{d - t\left[1 - \frac{1}{K}\right]}$
- Series / parallel combination.
- Energy stored $E = \frac{Q^2}{2C} = \frac{V^2C}{2}$
- RC Circuit
  In Charging → At t=0, C as wire. t=∞, C as open circuit.

(Initially uncharged capacitor)

## # Electric Potential Energy →

- Two point charges, $U_{12} = \frac{Kq_1q_2}{r}$ (with sign consider)
- Multiple charges, $U = U_{12} + U_{13} + U_{23} + \ldots$
- Dipole in ext field $U = -\vec{p}.\vec{E}$
- Energy Conservation

## # Electrostatics Of Conductors :→

$E_{inside} = 0$ $E_{surface} = \frac{\sigma}{\varepsilon_0}$ (along normal direction).

- Excess charge only on surface.

$V_{inside} = V_{surface}$.

- Electrostatic Shielding

(E inside uncharged cavity is always 0)

## # Dielectrics and Polarisation →

- Dielectric : Non conducting substance.
- For dielectric, $\vec{E}_{net,inside} \neq 0$

$\vec{E}_{induced} = \frac{\vec{E}_{ext}}{K}$

- Polarisation $\vec{P} = \chi \vec{E}$

(dipole moment per unit volume)

## # Potential Difference and Field →

$\Delta V = V_f - V_i$

$dV = -\vec{E}.d\vec{r}$ or $E = -\frac{dV}{dr}$

- Work done in moving charge q, $W = q\Delta V$
- Equipotential Surfaces.

NEET SLAYER