Electrostatic Potential

Chapter 2: Electrostatic Potential and Capacitance

1. **Introduction**
   - Concept of potential energy and conservative forces
   - Work done in moving a charge in electrostatic field

2. **Electrostatic Potential**
   - Definition and significance
   - Potential at a point from infinity

3. **Potential Due to a Point Charge**
   - Derivation using work-energy principle
   - Sign of potential based on charge sign

4. **Potential Due to an Electric Dipole**
   - Superposition principle
   - Potential expressions in axial and equatorial positions
   - Dipole potential vs point charge potential

5. **Potential Due to a System of Charges**
   - Superposition of individual potentials
   - Continuous charge distribution
   - Spherical shell potentials (inside & outside)

6. **Equipotential Surfaces**
   - Definition and examples (point charge, dipole, uniform field)
   - Properties and relation to electric field
   - Equipotential maps

7. **Potential Energy of a System of Charges**
   - Two-charge system
   - Three-charge system and generalization
   - Work done by external forces

8. **Potential Energy in an External Field**
   - Single charge in external potential
   - Two charges in external field
   - Dipole in uniform field and energy expression

9. **Electrostatics of Conductors**
   - Properties of conductors
   - Shielding and surface field expressions
   - Electrostatic field inside cavities

10. **Dielectrics and Polarisation**
    - Polar and non-polar molecules
    - Induced dipole and alignment in field
    - Polarisation vector and susceptibility

11. **Capacitors and Capacitance**
    - Definition and types
    - Capacitance expression and units
    - Physical significance

12. **Parallel Plate Capacitor**
    - Derivation of capacitance
    - Fringing effects
    - Dependence on geometry

13. **Effect of Dielectric on Capacitance**
    - Field reduction and potential change
    - Dielectric constant (K)
    - Permittivity and capacitance relation

14. **Combination of Capacitors**
    - **Series combination**: formula and logic
    - **Parallel combination**: formula and logic

15. **Energy Stored in a Capacitor**
    - Energy expressions ($\frac{1}{2}CV^2$, $\frac{1}{2}QV$, $Q^2/2C$)
    - Energy density in electric field