**UNIT - 1 (ELECTROSTATICS)**

**Electric Charge and Field**

1. State and Explain Coulomb's law in electrostatics. Express the same in SI units
2. State and Explain superposition principle for electric forces.
3. Obtain expression for electric field intensity due to a point charge
4. Find the expression for the electric field intensity at any point on the axis of a uniformly charged ring or hoop. What happens if the ring is far away from the point.
5. Explain the term electric dipole and dipole moment. Derive an expression for electric field intensity at any point on the axial line of the dipole.
6. What is an electric dipole? Derive an expression for the electric field intensity at any point on the equatorial line of the dipole?
7. Derive an expression for the torque acting on an electric dipole placed in a uniform electric field.
8. Derive an expression for potential energy of an electric dipole placed in a uniform electric field.
9. Derive an expression for work done in rotating an electric dipole through angle θ in a uniform electric field.

**Electric potential and Flux**

1. Derive an expression for potential at a point due to a point charge.
2. Derive an expression for potential at a point due to an electric dipole.
3. Derive an expression for potential energy of a system of two charges.
4. State and prove Gauss's theorem in electrostatics.
5. Derive Coulomb's law from Gauss's theorem.
6. Using Gauss's law, derive an expression for electric field intensity at a point due to (i) a line of charge (ii) a uniformly charged spherical shell
7. Using Gauss's law, derive an expression for electric field intensity at a point due to (i) uniformly charged solid sphere (ii) an infinite plane sheet of charge
8. Derive an expression for work done in moving a charge in an electric field.

**Capacitance**

1. Derive an expression for the capacitance of a parallel plate air capacitor.
2. Derive an expression for the capacitance of a spherical capacitor.
3. What is the effect of introducing (i) a conducting slab (ii) a dielectric slab between the plates of a parallel plate capacitor on the capacitance of the capacitor.
4. Three capacitors C1, C2 and C3 are connected in series and then in parallel. Derive an expression for the equivalent capacitance respectively.
5. Derive an expression for the capacitance of a cylindrical capacitor.
6. Derive an expression for the energy stored in a parallel plate capacitor.
7. Derive an expression for the energy density of electric field.
8. Derive an expression for the capacitance of a parallel plate capacitor having a conducting slab between the plates.
9. Derive an expression for the capacitance of a parallel plate capacitor having a dielectric slab between the plates.
10. Explain the behaviour of non-polar and polar dielectrics in an electric field

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