

Physics Derivations List & Important Topics

Unit I – Electrostatics (17)

- Electric Dipole Moment.
- Expression of electric field intensity due to electric dipole at equatorial and axial positions.
- Expression of torque at a dipole placed at any point in electric field.
- Expression of work done in rotating a dipole in uniform electric field.
- Expression of work done to rotate the dipole from stable to unstable equilibrium in uniform electric field.
- Gauss Law + 3 Applications
- Expression of electric field intensity on the surface of charged conductor.
- Expression for capacitance of a parallel plate capacitor + energy stored in capacitor.
- Expression of capacitance of parallel plate capacitor having partially dielectric slab introduced.

Unit II – Current Electricity (12)

- Drift Velocity + Mobility
- Factors affecting resistance and resistivity + Graphs
- EMF, internal resistance, terminal voltage + (relation).
- Wheatstone bridge (principle).
- Meter bridge conceptual.
- Potentiometer (principle + sensitivity).
- Circuit diagram to determine internal resistance of primary cell using Potentiometer.

Unit III – Magnetic effect of current & Magnetism (18)

- Biot-Savart law + vector form + derivation.
- Expression of Magnetic Field Induction at the center of a circular current carrying coil.
- Magnetic Moment + Ampere's circuital law.
- Cyclotron + velocity selector.
- Limitations of Cyclotron.
- Expression of force acting on a current carrying conductor placed in a Magnetic Field.
- Expression of force per unit length acting on two parallel current carrying conductor + define 1 Ampere.
- Expression of torque acting on a current carrying coil placed in Magnetic Field.
- Moving Coil Galvanometer (principal + derivation)
- Shunt + uses of shunt.
- Conversion of Galvanometer into ammeter and voltmeter.
- Expression of Magnetic Moment associated with an atom due to orbital motion of electron + define Bohr's magneton.
- Show that current carrying Solenoid behaves like a bar magnet.
- Dia, Para & Ferromagnetism.

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Unit IV – EMI & AC (17)

- Lenz law is in accordance with the law of conservation of energy. Explain.
- Motional EMF
- Motional EMF by Lorentz Force. Prove $\epsilon = Blv \sin \theta$
- Self-Inductance + Expression for long Solenoid.
- Transformer (Principle + Derivation)
- Define mean value of A.C and derive it.
- Define mean value of EMF of AC and derive.
- AC Circuit with Capacitance only – Current leads by $\pi/2$
- AC Circuit with Inductor only – Voltage leads by $\pi/2$
- RL circuit in AC
- RC circuit in AC
- LC circuit in AC
- LCR circuit in AC
- Resonance with conditions.
- RMS value of AC
- Quality Factor.
- Power in LCR circuit.
- Power in AC circuit with only R
- Power in AC circuit with only C
- Power in AC circuit with only L
- Power in AC circuit with R and L
- Power in AC circuit with R and C
- Power in AC circuit with L and C
- AC Generator (Principle + Derivation)

Unit V – EM Waves (6)

- Displacement Current.
- Maxwell's modification of Ampere's Law.
- Properties of EM Waves.
- EM Waves Spectrum.
- Representation of EM Wave travelling along (z or any other) axis.