Physics Notes (Description and Property of Fields)

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6. Description and Property of Fields

6.1 Concept of Fields

- **Definition:** In Physics, a field is a physical quantity that has a value for every point in space and time. It is a way of describing how a force acts over a distance without direct contact.
- **Types of Fields:**
  - **Scalar Field:** A field where the value at every point is a scalar quantity (magnitude only). Examples: Temperature field, Pressure field, Gravitational Potential.
  - **Vector Field:** A field where the value at every point is a vector quantity (magnitude and direction). Examples: Wind velocity field, Gravitational Field, Electric Field, Magnetic Field.

6.2 Gravitational Field (Brief Recap)

- **Source:** Any object with **mass**.
- **Effect:** Exerts a force of **attraction** on any other object with mass.
- **Representation:** Gravitational Field Lines (always directed toward the center of the mass).
  - **Strength:** Gravitational Field Strength ($\mathbf{g}$), measured in N/kg or m/s^2.
  - **Force Law:** Newton's Law of Universal Gravitation ($\mathbf{F} \propto \frac{m_1 m_2}{r^2}$).

6.3 Magnetism and Magnetic Field (Brief Recap)

- **Source: Magnets** or **moving electric charges** (electric current).
- **Effect:** Exerts a force on other magnets, magnetic materials, or moving charges.
- **Representation:** Magnetic Field Lines (emerge from North pole, enter South pole, form closed loops).

- **Strength:** Magnetic Field Strength ($\mathbf{B}$) or Magnetic Flux Density, measured in Tesla (T).
- **Force Law:** Force on a moving charge is the Lorentz Force ($\mathbf{F} \propto qvB$).

6.4 Summary

- Fields are mathematical tools to describe non-contact forces in space.
- Three primary vector fields: Gravitational (mass as source), Electric (charge as source), and Magnetic (current/moving charge as source).
- Field lines are used to visualize the direction and strength of these vector fields.