11th Physics Unit - 1

Nature of the Physical World and Measurement

- The word **science** comes from a Latin word ***"scientia"*** which means ***'to know'***.
- ***Sir Issac Newton*** was the first one to give an **exact definition** for ***force***.
- **Forces** are **four** types
  - ✓ Gravitational force.
  - ✓ Electromagnetic force.
  - ✓ Strong nuclear force.
  - ✓ Weak nuclear force.
- **Gravitational force -** force between any two objects in the universe.
- **Electromagnetic force -** force between charged particles.
- **Strong nuclear force -** ***strongest*** of all forces and has the shortest range of 10^{-15} **m** and this force holds the ***protons and neutrons together*** in the nucleus of an atom.
- **Physical quantities** is of **two** types.
  - ✓ Fundamental quantities.
  - ✓ Derived quantities.
- **Fundamental quantities –** Quantities which **cannot** be expressed in terms of **physical quantity.**
- **Derived quantities -** Quantities that **can** be expressed in terms of **fundamental quantities.**
- The Kelvin is the fraction of $\frac{1}{273.16}$ of the thermodynamic temperature of the **triple point of water.**
- **1 light year =** ***9.467 × 1015 m.***
- **1 Astronomical unit (AU) =** ***1.496 × 1011 m.***
- **Prefixes for power of ten**

- ✓ 10^{-15} **femto**
- ✓ 10^{-12} **pico**
- ✓ 10^{-9} **nano**
- ✓ 10^{9} **giga**
- ✓ 10^{12} **tera**
- ✓ 10^{15} **peta**

- **Laser pulse method -** distance of moon from the Earth can be determined
- **Quartz clocks - piezoelectric property** is the principle of quartz clock and have an accuracy of one second in every ***10^9 seconds***.
- **Atomic clocks -** make use of **periodic vibration** taking place within the atom and have an accuracy of 1 part in ***10^{13} seconds.***
- The **uncertainity in the measurement** of a physical quantity is called ***error***.
- **Error** is of **four** types.
  - ✓ Constant Errors.
  - ✓ Systematic Errors.
  - ✓ Gross Errors.
  - ✓ Random Errors.
- **Constant Errors –** same error repeated every time in a series of observations and is due to faulty calibration of the scale in the measuring instrument.
- **Systematic Errors -** errors which occur due to a certain pattern or system and is due to external sources.
- **Gross Errors –** It occurs due to the carelessness.
- **Random Errors -** repeated measurements of a quantity gives values which are slightly different from each other and will not have regular pattern.
- **Dimensional Constants -** Constants which ***possess dimensions.***
- **Dimensional variables** - physical quantities which possess dimensions but do not have a fixed value.

- **Dimensionless quantities -** quantities which ***do not possess dimensions.***
- **Principle of homogeneity of dimensions -** equation is dimensionally correct if the dimensions of the ***various terms on either side of the equation are the same.***

Important Quantities and Their Units

Physical Quantity	Unit
Area	m^2
Volume	m^3
Velocity	$m\ s^{-1}$
Acceleration	$m\ s^{-2}$
Angular velocity	$rad\ s^{-1}$
Angular acceleration	$rad\ s^{-2}$
Density	$kg\ m^{-3}$
Momentum	$kg\ m\ s^{-1}$
Moment of intertia	$kg\ m^2$
Force	$kg\ m\ s^{-2}$ or N
Pressure	$N\ m^{-2}$ or Pa
Energy (work)	N m or J
Impulse	N s
Surface tension	$N\ m^{-1}$
Moment of force (torque)	N m
Electric charge	A s
Current density	$A\ m^{-2}$
Magnetic induction	$N\ A^{-1}\ m^{-1}$