

M.Sc. Physics (Sem II) Unit III

Abstract Group Theory

The concept of group has come its origin more than 150 years ago, in beginning of the nineteenth century. This theory was developed by famous mathematician Gauss, Cauchy, Abel Hamilton, Galois, Sylvester, Cayley and others. The advantages of group theory in Physics in 1925, were soon recognised and the new tool was put to use in calculations of atomic structures and spectra by H.A. Bethe, E.P. Wigner and others. The group theory is also applicable in most branches of Physics and physical chemistry.

GROUP:-

A group is a set of distinct elements $G \equiv \{E, A, B, C, \dots\}$ operated with a law of composition such as addition, multiplication, matrix multiplication etc, such that the following properties are satisfied:-

(i) Closure Properties:-

The composition of any two elements A and B of G under the given law results in an element which also belongs to G, Thus

$$A \circ B \in G, B \circ A \in G \quad \forall A, B \in G.$$

(ii) Associative Properties:-

The law of composition of group is associative if $A \circ (B \circ C) = (A \circ B) \circ C \quad \forall A, B, C \in G$.