There are five basic properties:-

(i) closure property :→ $a, b \in G \Rightarrow a * b \in G$

(ii) Associativity property :→ $a*(b*c) = (a*b)*c, \forall a,b,c \in G$

(iii) Existence of identity Element :→

$\exists\, e \in G : \underbrace{a * e}_{\text{right identity}} = a = \overbrace{e * a}^{\text{left identity}} \quad \forall\, a \in G$

(iv) existence of inverse :→

$\forall\, a \in G\ \exists\, b \in G : a * b = b * a = e.$

then b is said to be inverse of a.

(v) commutative property :- $a * b = b * a \quad \forall\, a, b \in G$

→ An algebric structure $(G, *)$ is said to be

Name of Group	must hold property	Example
quasi group	(i)	$(N,+), (N,\cdot), (Z,+), (Z,\cdot)$ $(W,+), (W,\cdot), (R,+), (R,\cdot)$ etc.
Semi group	(i), (ii)	——— " ——— (Same as quasi)
Monoid	(i), (ii), (iii)	$(N,\cdot), (W,+), (W,\cdot)$, $(Z,+), (Z,\cdot), (R,+)$, $(R,\cdot)$ etc.
Group	(i), (ii), (iii) & (iv)	$(Z,+), (R,+), (R,\cdot)$, $(C,+), (C,\cdot)$ etc.
Abelian group	(i), (ii), (iii), (iv) & (v)	$(Z,+), (R,+), (R,\cdot)$, $(C,+), (C,\cdot)$ etc.

Rings :- An algebric structure $(R, +, \cdot)$ is called a ring if
(i) $(R, +)$ is an abelian group.
(ii) $(R, \cdot)$ is a semigroup.
(iii) '$\cdot$' is distributive over the operation '+'

Eg :- $(\mathbb{Z}, +, \cdot)$, $(\mathbb{R}, +, \cdot)$, $(\mathbb{C}, +, \cdot)$
Integers, real no., complex no.

Smallest ring is null ring or zero ring containing only zero element (additive identity)

Field :- A ring $(R, +, \cdot)$ is called field if
(i) R is commutative ring
(ii) with unit element (w.r.to '$\cdot$')
(iii) Each non zero element of R has its multiplicative inverse in R.

Eg :- $(\mathbb{Q}, +, \cdot)$, $(\mathbb{R}, +, \cdot)$, $(\mathbb{C}, +, \cdot)$, $(\{0, 1, 2, 3, 4\}, +_5, \times_5)$ are some examples of field.

Internal and External operations:
(आन्तरिक एवं बाह्य संक्रियाएँ)

Let $V \neq \emptyset$, then the binary composition '$*$' defind as $* : V \times V \longrightarrow V$ is known as Internal operation in V
i.e. for Every $a, b \in V \Rightarrow a * b \in V$

Example :→ Addition '+' and multiplication '$\cdot$' is internal operations in R (real no.)

For eg $2.1 \in R$, $3.5 \in R \Rightarrow (2.1) + (3.5) \in R$

& $(2.1)(3.5) \in R$

→ Let V & F are two non-empty set. then the composition '$\cdot$' defined as

$$\cdot : F \times V \longrightarrow V$$

is known as External binary composition on V

i.e. for every $a \in F$, $v \in V \Rightarrow a \cdot v \in V$

Ex :- Let $F = Z$ (integers), V is the set of rational number Q and $\cdot$ → multiplication operation, then multiplication is External binary composition on Q. As we know that multiplication of a rational number by an integer is again a rational no