## UNIT- II

## "LAW OF FORCES"
(बलों के नियम)

## FORCE :-

A Force is any interaction that, when unopposed will change the motion of the object.

Has magnitude and direction. Hence, it is vector quantity.

⇒ Newton's 1st law gives the concept of force.

## UNITS :-

(1) F.P.S.

Force → Pound

→ Pound × $\dfrac{Foot}{Sec^2}$ ⇒ Poundal.

(2) C·G·S.

Force → gram

→ Gram × $\dfrac{cm}{Sec^2}$ ⇒ Dyne

(3) M·K·S·

Force → Kg.

→ $\dfrac{Kg-m}{Sec^2}$ ⇒ Newton

(4) S.I.

Force → Newton.

\* Representation of Force → (F)

unit → N

**NOTE:-** → $1N = 10^5$ Dyne

→ $1N = \dfrac{1\ Kg-m}{Sec^2}$

→ 1 pound = 453.592 gram = 0.4535 Kg

# EFFECTS OF FORCE :-

(i) Try to pull (or) push a body.

(ii) Try to generate linear Motion in a body.

(iii) Try to rotate a body about an axis (or) point. (Generate rotational Motion, called moment of force.

(iv)
↻ A.C.W. → ⊕ve
↻ C.W. → ⊖ve.

(v) Try to deform the body (Internal effect of force).

# CHARACTERISTICS OF FORCE :-

(1) Magnitude :- Can be represented by N, Dyne, gram-Weight, Kg-Weight.
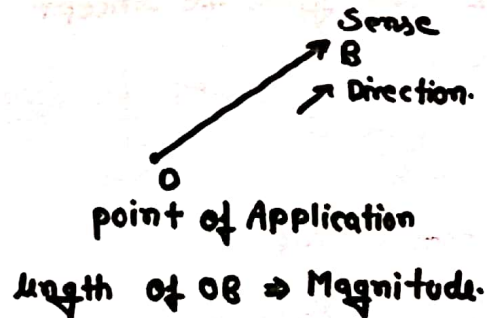
(2) DIRECTION :-
In which the force is acting.
UP (↑), down (↓), Left(←), Right(→)
Any Angle.

(3) point of Application :-
The point at which, the force is acting.

(4) Line of Action of force :-
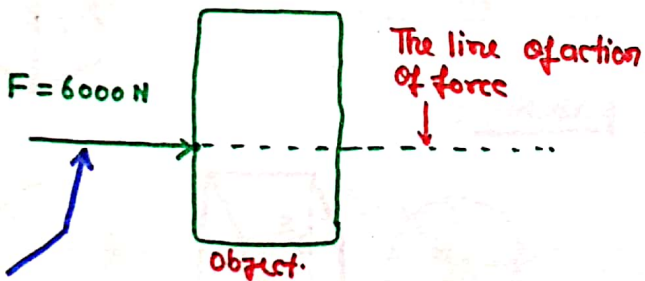Direction of force. Sense and point of application is represented through line of Action of force.

length of OB ⇒ Magnitude.

## TYPES OF FORCE :-

### (1) POINT FORCE (or) CONCENTRATED FORCE :-
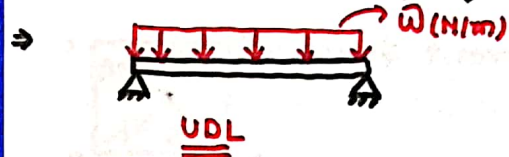
→ A point force is any force where the point of application is considered to be a single point.

→ In reality Most forces are surface forces.

$F = 6000 N$

The line of action of force

Object.

A vector representation of a point force.

### (2) UNIFORMLY DISTRIBUTED FORCE :-

The Magnitude of force/Load remains uniform throughout the whole element. ( Beam, Slab)

→ $\omega$ (N/m)

UDL

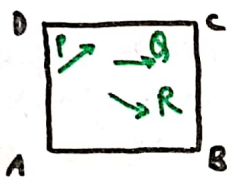### (3) UNIFORMLY VARYING FORCE :-

Force/ Load is zero at one end and increase uniformly to the other end.
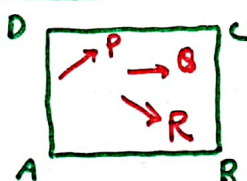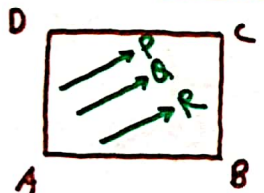
(UVL)

# SYSTEM OF FORCES

## COPLANAR FORCES



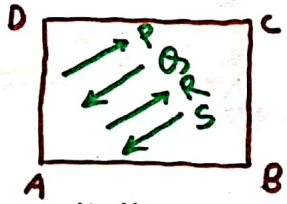### (1) Concurrent forces :-



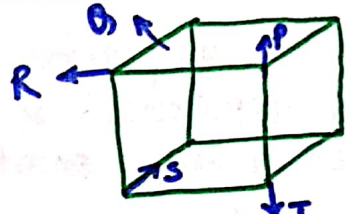### (2) Non-Concurrent forces :-
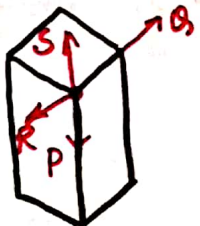


### (3) Parallel forces



Like parallel forces.

Unlike parallel forces.

## NON-COPLANAR FORCES

### (1) Non-Concurrent forces :-



### (2) concurrent :-



### (3) parallel :-