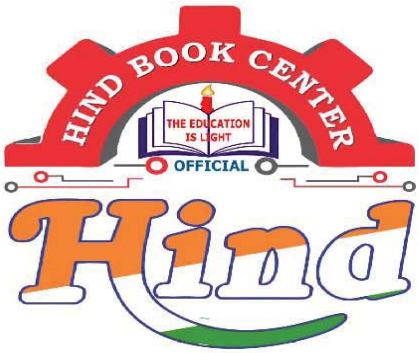

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NAME -: HARIT JOSHI
SUB -: STRENGTH OF MATERIALS
BY -: VIVEK GUPTA SIR

Strength of Materials
Mechanics of Solid
Mechanics of Materials
Mechanics of deformable body

SOM ←
S.A ←
R.C.C ← 33% of Technical Marks
Steel structure

SOM = 40% of 33% of Technical Marks

Recommended Literature

- Gere and Goodno, 9th edition
- R.C Hibbler, 10th edition (S.I Unit)
- My class Notes
- My Workbook
- PYQ of GATE and ESE
- Test Series

CHAPTER-01

BASIC CONCEPTS

1.1. Introduction :-

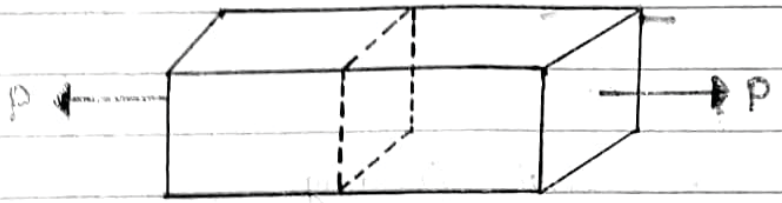
- Structural Engineering
  - Analysis (S.O.M, S.A)
    - Equilibrium
    - Compatibility
    - Energy
  - Design (R.C.C, Steel, Masonary)
    - Safety
    - Serviceability
    - Durability
    - Economy
    - Aesthetic

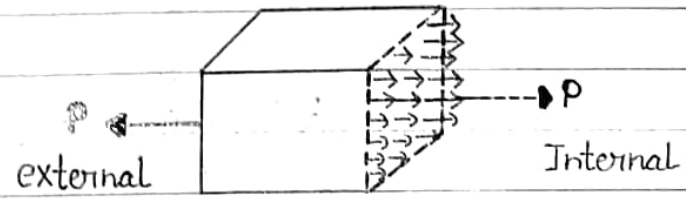
1.2. Need of strength of Materials :-

Civil Engineering structures are made up of some solid material. If structure is subjected to any load then effect of load inside the solid need to be covered to understand behaviour of structure under that load.

- Body
  - Deformable
  - Non Deformable (Rigid) — Ideal Condition

1.3. External and Internal Forces (Part-I) :-



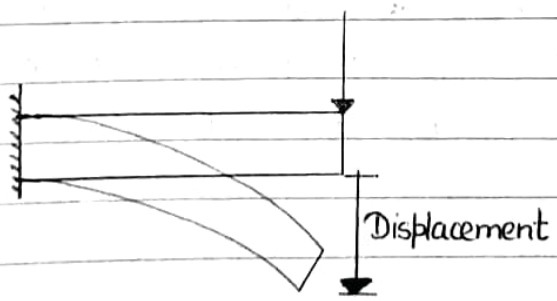


1.4. Difference blw Some Terms :-

1.4.1. Deformation Vs Displacement :-

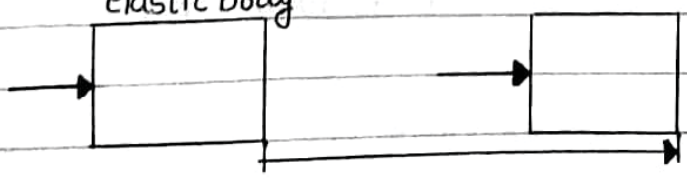
- Change of shape is deformation.
- Change of position is displacement.

→ Deflection and rotation are subset of Displacement.



Straight member ⟶ Curved Member = Deformation

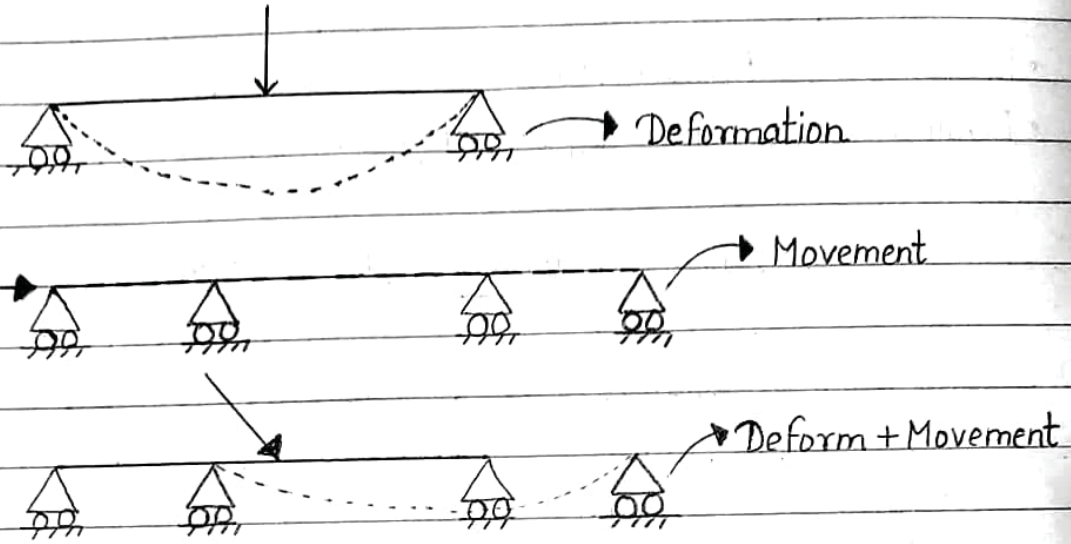
elastic body



Displacement but no deformation.

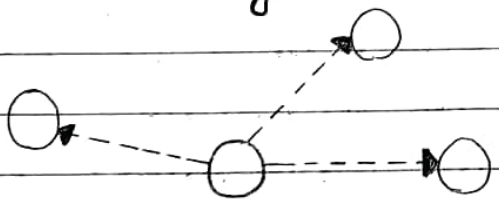
- This is called Rigid body movement, even body is elastic. (Bcoz no deformation)

1.4.2. Movement Vs Deformation :-



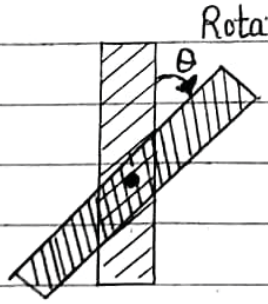
1.4.3. Translation Vs Rotation :-

- Straight Line movement in any direction is Translation.

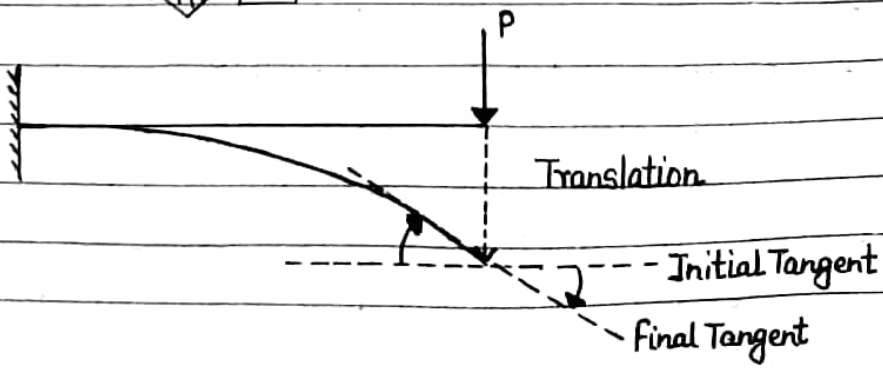


Translation movement

- Rotation :- Circular movement about any point is called Rotation.



- Direction of rotation is Initial to final.



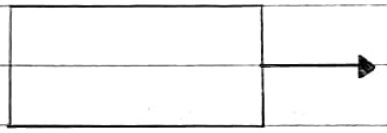
1.4.4. Rotation VS Bending :-

- Rotation - Already defined earlier.
- Bending - It is a type of deformation.

Rotation may be due to Bending.

1.4.5. Force and Axial Force :-

- Force - Vector (Magnitude and direction)
- Axial Force - Scalar (Magnitude)

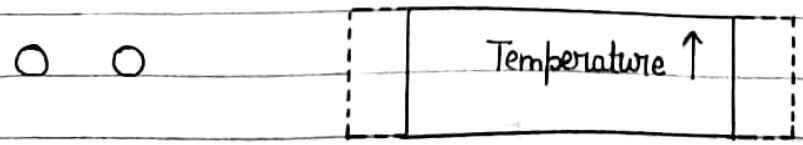


Magnitude = P
Direction = x-axis

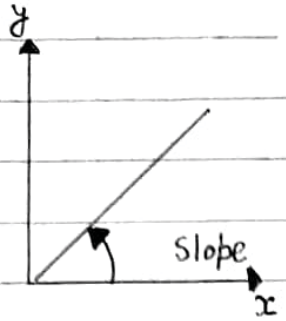
Magnitude = F
Direction = No Direction

- Tension and Compression are not directions, they are effects.
- Axial force is the combination of two equal and opposite forces.
- +ve and -ve doesn't mean direction. Anything can be recognised as +ve or -ve.
  For Example - Corona

1.4.6 Elongation VS Expansion :-



1.4.7. Rotation Vs slope :-



Rotation = +ve if clockwise
Rotation is visual.

- Slope = Measured From x-axis to y-axis.
- Slope is mathematical.

1.5. Equilibrium and static Equilibrium :-

- Equilibrium - IF net force and moment acting on a body is Zero in all direction then body is in equilibrium. For E.g:- bodies in space, vehicle moving with constant velocity.

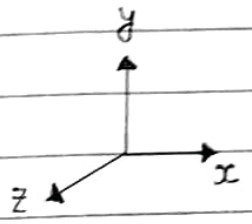
$$\Sigma Fx = 0 \qquad \Sigma Mx = 0$$
$$\Sigma Fy = 0 \qquad \Sigma My = 0 \quad \text{—— For 3D}$$
$$\Sigma Fz = 0 \qquad \Sigma Mz = 0$$

$$\Sigma Fx = 0 \qquad \Sigma Mz = 0 \quad \text{—— For 2D (x-y plane)}$$
$$\Sigma Fy = 0$$

- Static Equilibrium - If net force and moment acting on a body is Zero and body is in rest/static state then only body can be classified as static Equilibrium. For E.g:- Buildings, Bridges etc.

1.6. Sign Convention :-

	Positive
x- axis	→
y- axis	↑
Z- axis	$\vec{x} \times \vec{y}$
Rotation	Clockwise
Force	Along Axis
Moment	Clockwise
Deflection	Along Axis



1.7. Free Body diagram :-

It is the graphical representation of body with all forces (internal or external) acting upon it.

Method to draw FBD :-

- Make body Free From all loads and Reactions.
- Apply all loads and support reactions.
- Apply all internal forces at cut section to satisfy conditions of equilibrium.