ROHINI COLLEGE OF ENGIEERING AND TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

ENGINEERING MECHANICS

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(Assistant Professor)

NEED FOR SUPPORT

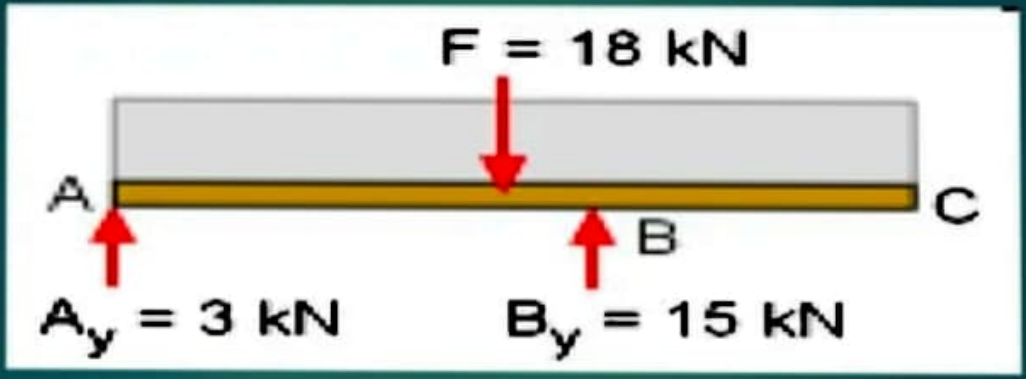
- THE LOAD CARRYING STRUCTURES NEED SUPPORTS TO AVOID

  -DEFORMATION

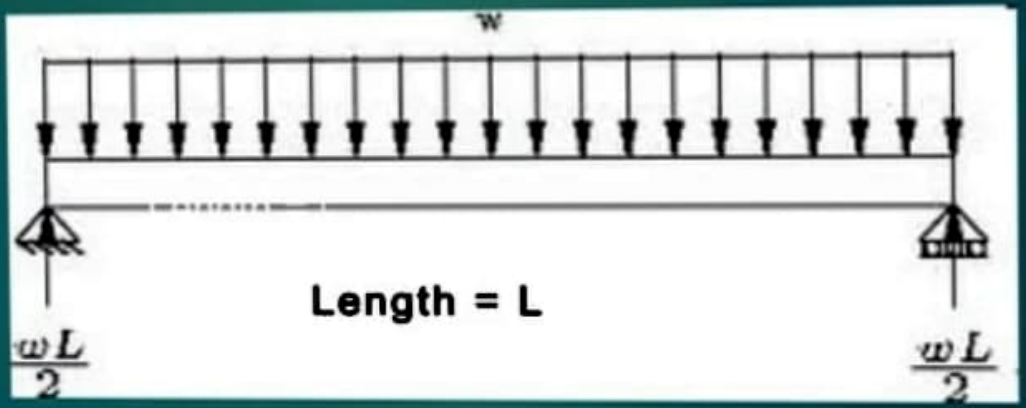
  -BENDING

  -INSTABILITY

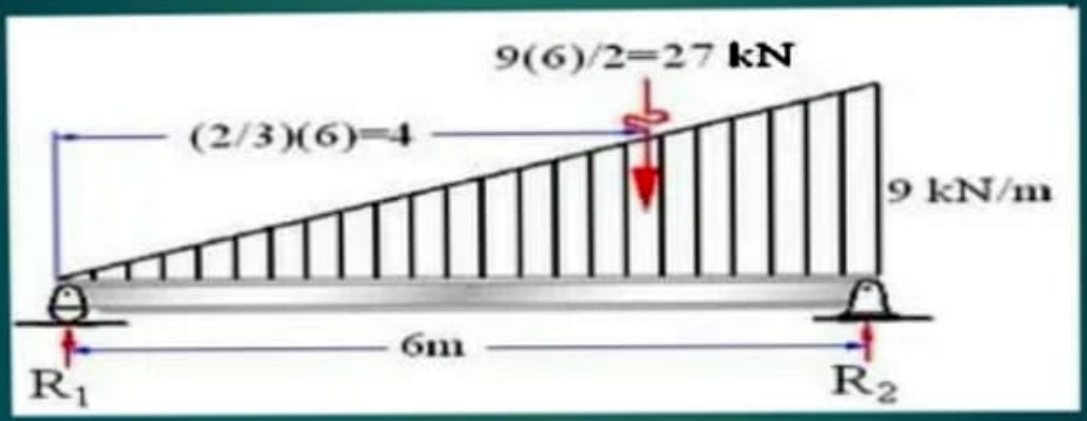
POINT LOAD



UDL(Uniformly Distributed Load):-



UNIFORMLY VARYING LOAD



TYPES OF SUPPORT

- 2 OR MORE VERTICAL SUPPORTS
- JUST PIVOTS
- TAKES ONLY VERTICAL LOADS

- 2 (USUALLY ONE) ROLLER SUPPORTS
- SUPPORTS ALLOW FREE EXPANSION
- TAKES VERTICAL LOADS NORMAL TO ROLLER PLANE

- 2 (USUALLY ONE) HINGED SUPPORTS
- SUPPORTS TAKE VERTICAL AND HORI...LOAD
- USUALLY DESIGNED WITH A ROLLER SUPPORT FOR FREE EXPANSION OF ONE END
- VERTICAL AND HORI... LOADS DETERMINE REACTION AND LINE OF

Types of Support

- In order for loaded parts to remain in equilibrium, the balancing forces are the reaction forces at the supports
- Most real life products have support geometries which differ from the idealized case
- Designer must select the conservative case

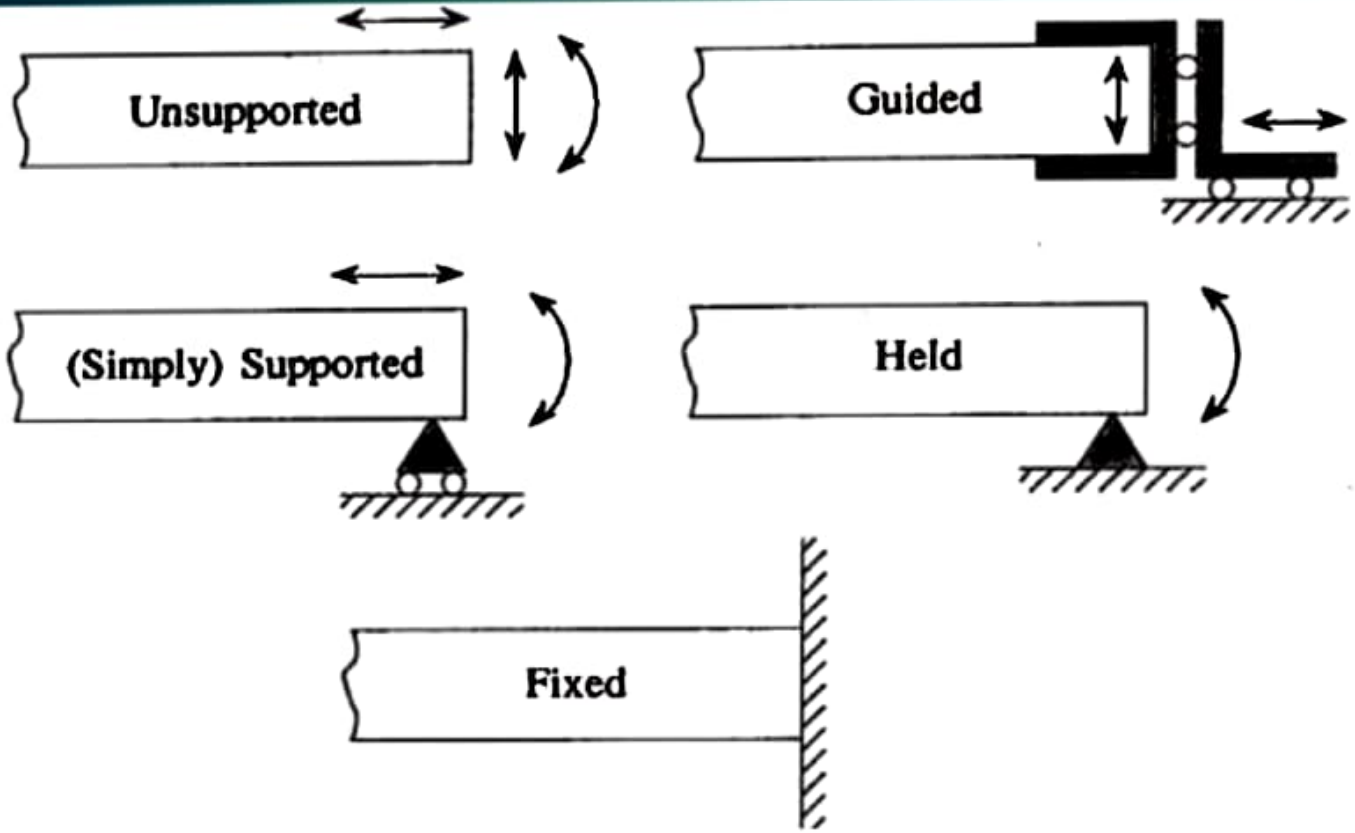
Types of Support

- *Guided is support at the end of the beams that prevent rotation, but permits longitudinal and transverse displacement*
- *Free or unsupported is when the beam is totally free to rotate in any direction*
- *Held is support at the end of the beam that prevents longitudinal and transverse displacement but permits rotation*

Types of Support

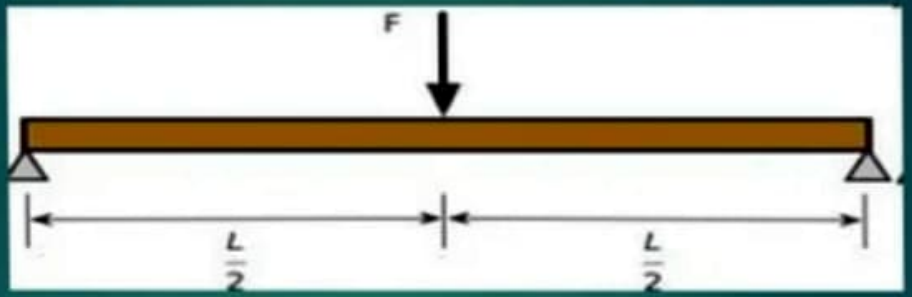
- *Simply Supported is support at the end of the beam that prevents transverse displacement, but permits rotation and longitudinal displacement*
- *Fixed is support at the ends of the beam that prevents rotation and transverse displacement, but permits longitudinal displacement*

Idealized Supports



Some idealized conditions of end or edge support for beams or plates.

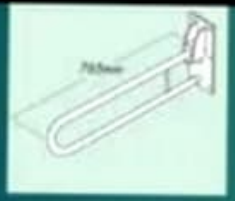
SIMPLE SUPPORT



ROLLER SUPPORT

LOCATION OF ROLLER BEARING TO SUPPORT JET ENGINE ROTOR

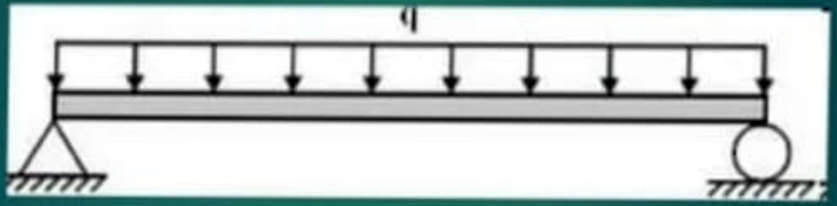
HINGED SUPPORT



KNEE

COMBINED SUPPORT

DISTRITIBUTED LOAD = w



HINGED SUPPORT

ROLLER SUPPORT

Types of loads

- Concentrated loads (eg. P_1, P_2, P_3, P_4)
- When a load is spread along the axis of a beam is a distributed load. Distributed loads are measured by their intensity q (force per unit distance)
- Uniformly distributed load has constant intensity q (fig 4-2a)
- A varying load has an intensity q that changes with distance along the axis. Linearly varying load from q_1 - q_2 (fig 4-2b)
- Another kind of load is a couple of moment M_1 acting on the overhanging beam (fig 4-2c)

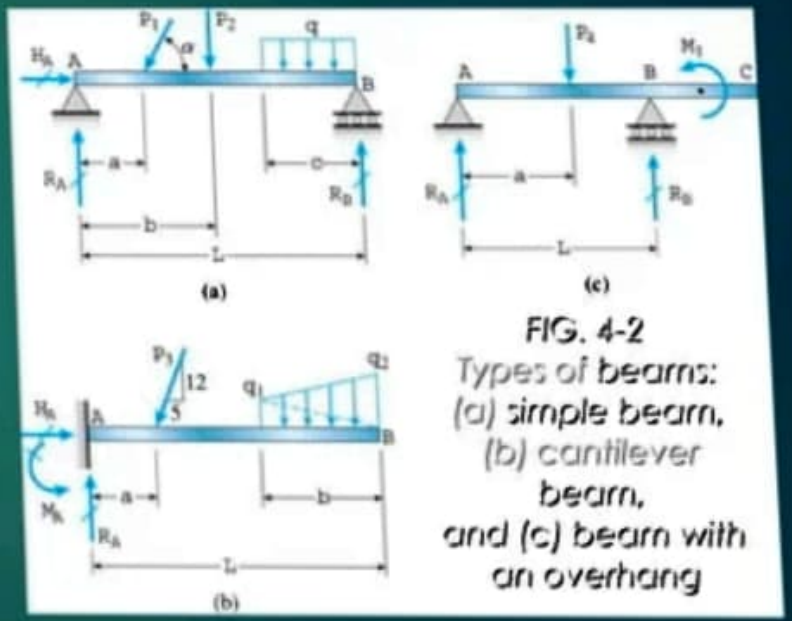
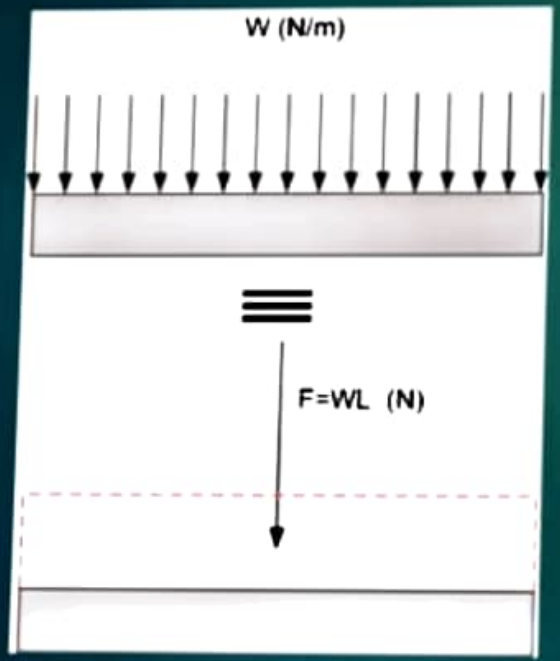


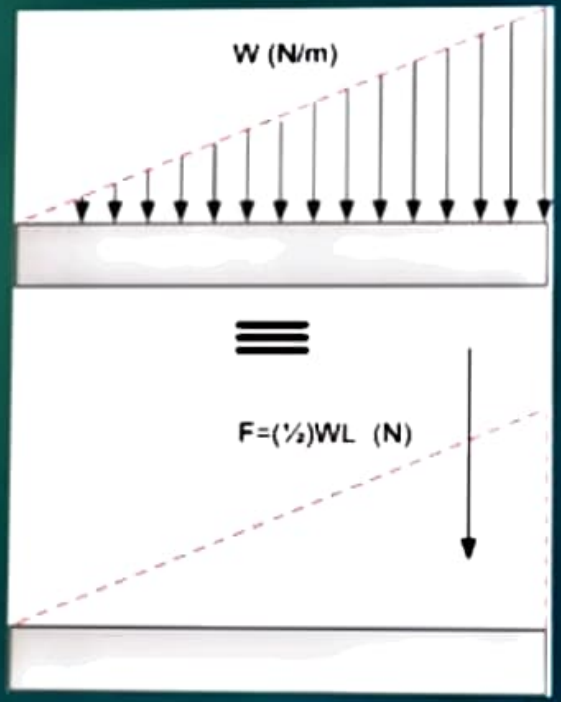
FIG. 4-2
Types of beams:
(a) simple beam,
(b) cantilever beam,
and (c) beam with an overhang

Distributed Load

For calculation purposes, distributed load can be represented as a single load acting on the center point of the distributed area.

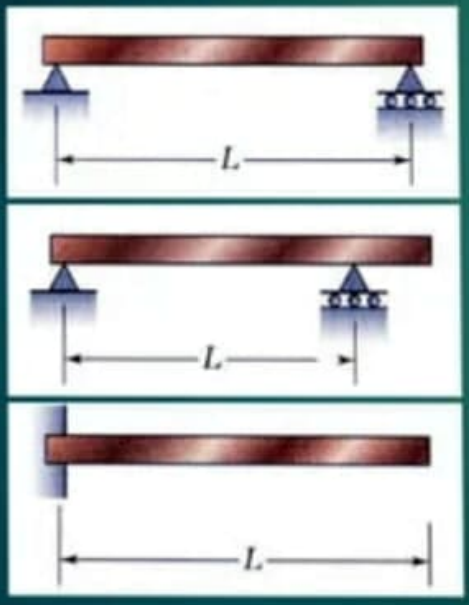
Total force = area of distributed load (W : height and L: length)
Point of action: center point of the area





Type of Beams

Statically Determinate



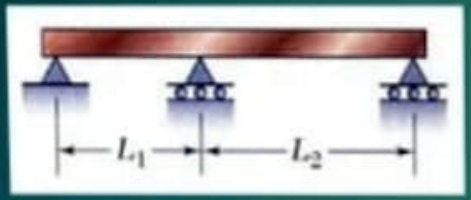
Simply Supported Beam

Overhanging Beam

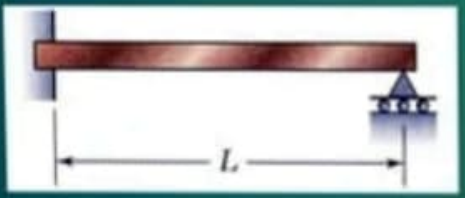
Cantilever Beam

Type of Beams

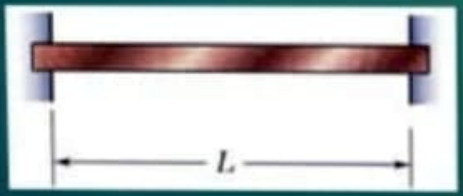
Statically Indeterminate



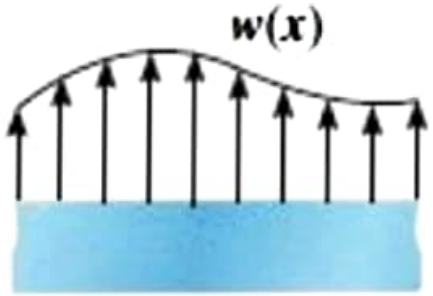
Continuous Beam



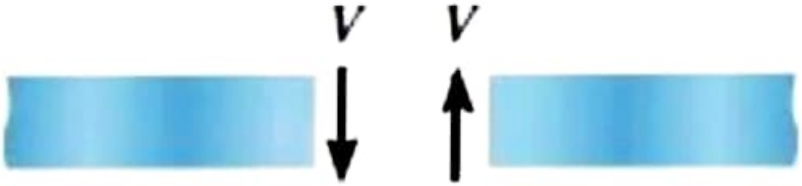
Propped Cantilever Beam



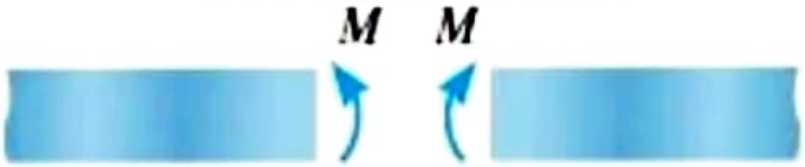
Fixed Beam



Positive external distributed load



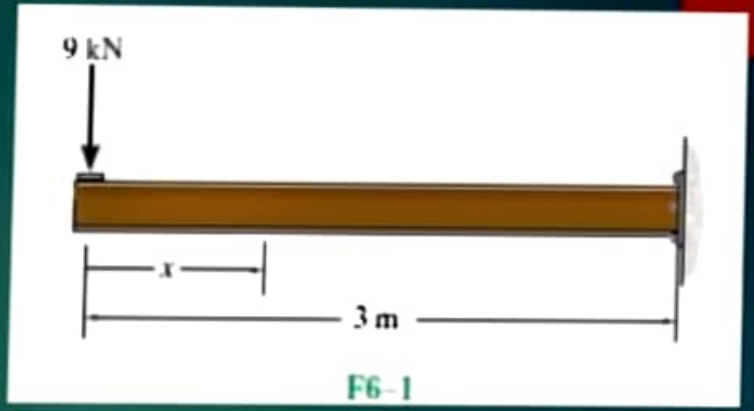
Positive internal shear



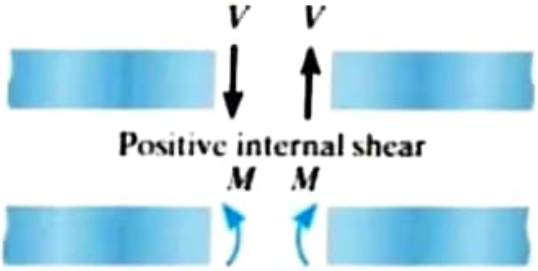
Positive internal moment

Beam sign convention

Example 1



F6–1



Equilibrium equation for $0 \le x \le 3m$

$$\sum F_y = 0$$
$$-F - V = 0$$
$$V = -9kN$$

$$\sum M = 0$$
$$Vx + M = 0$$
$$M = -9x(kNm)$$

* internal V and M should be assumed +ve

THANK YOU