MODULE - 2

Refer Benjamin

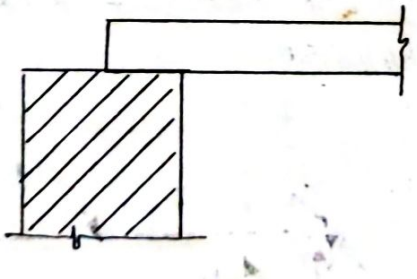
BEAMS :

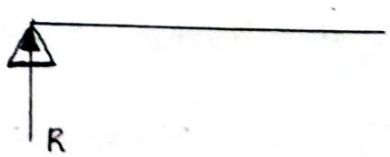
A beam is a structural element which has one dimension considerably larger than the other two dimensions and is acted upon by a system of external loads acting transverse to its axis. Beams are primarily subjected to bending. To apply load on the beam, it should be supported. Beams are subjected to lateral loads as a result of which reactions develop at supports.

TYPES OF SUPPORTS

(I) Simple Support or Knife Edge Support

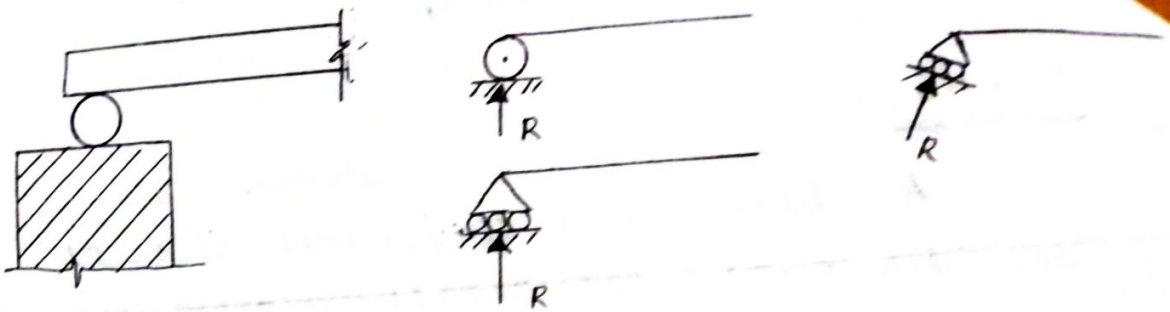
When the end of a beam is kept simply on a smooth flat surface, the support is called simple support. The direction of reaction will be perpendicular to the support and the beam is free to move in the direction of its axis and also it is free to rotate about the support





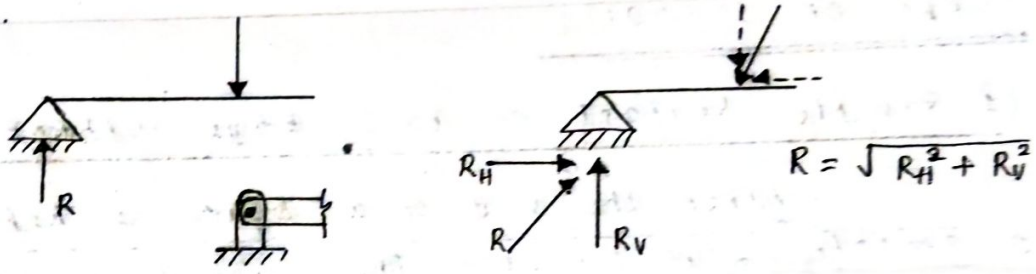
(II) Roller Support :

The beam is supported on rollers. The reaction is normal to the surface on which rollers are placed since the rollers can be treated as frictionless. At roller support the beam is free to move along the surface and can rotate about the support also



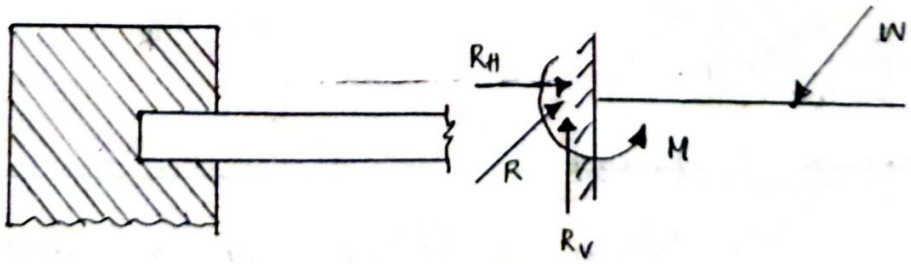
(iii) Hinged or pinned support:

The beam is hinged or pinned at the support. The beam cannot move in any direction but it can rotate about the hinge. The direction of reaction depends on the direction of the external load on the beam.



(iv) Fixed support or Built in support:

At fixed supports, the beam end is not free to move or rotate. The movement of the beam is prevented by developing support reaction in the required direction. Rotation of Beam is prevented by developing moment at support.

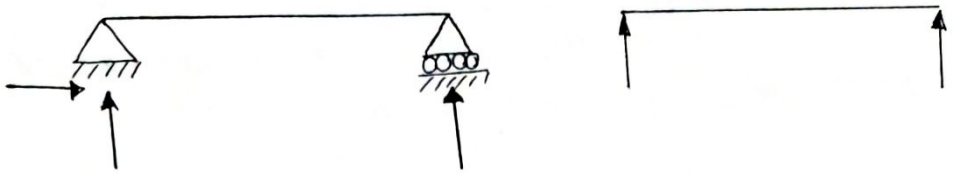


TYPES OF BEAMS:

Beams are classified according to the supports provided;

1) Simply Supported Beam

simply supported beams are free to rotate at the ends, when it bends.



2) Cantilever Beam

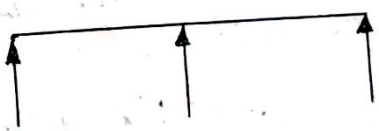
It is fixed at one end and free at the other end.

3) Fixed Beam:

Its both ends are fixed

4) Continuous Beam:

A beam having more than two supports is known as continuous beam



5) Overhanging Beam:

When the beam is projecting beyond the support, it is called overhanging beam.

R_A R_{AV}

$R_{AV} = 4.0196$ KN

$R_A = \sqrt{R_{AH}^2 + R_{AV}^2} = \sqrt{1^2 + 4.0196^2} = \underline{4.1421 \text{ KN}}$, $\theta = \tan^{-1}\frac{R_{AV}}{R_{AH}}$

TYPES OF LOADS

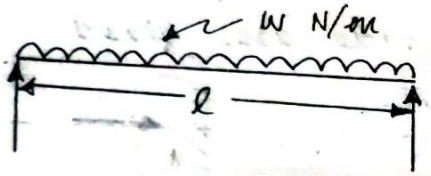
A beam may be subjected to the following types of loads.

i) Concentrated or point load

It is the one which is considered to act at a point. It is expressed in N.

ii) Uniformly Distributed Load: (UDL)

Uniformly distributed load is a load which has the same intensity of load over a certain length of the beam, or over the entire span of the beam. The rate of loading is expressed as Newton per metre.



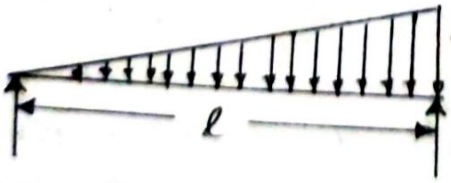
$l \rightarrow$ span of the beam or distance b/w supports

Total Load : $w \times l$

UDL can also be assumed to be acting as a point load at the middle of the loaded length.

iii) Uniformly Varying Load. (UVL)

When the load varies uniformly from one point to another point on the beam, the load is called uniformly varying load.



Total load = $\frac{1}{2} \times w \times l$

UVL can also be considered as a point load acting at the centre of gravity of the triangle.

REACTION AT SUPPORTS

To resist the applied loads, reactions develop at supports of the beam. The applied loads and the reactions keep the beam in equilibrium. Hence the eqns of equilibrium can be applied to beams to find the reactions at supports.

ie, $\Sigma F_x = 0$ $\Sigma F_y = 0$ $\Sigma M = 0$