# Structural Analysis

(1) Trusses : { Analysis of trusses, deflections in trusses, Force in redundant trusses, I.L.D's for Forces in truss members. }

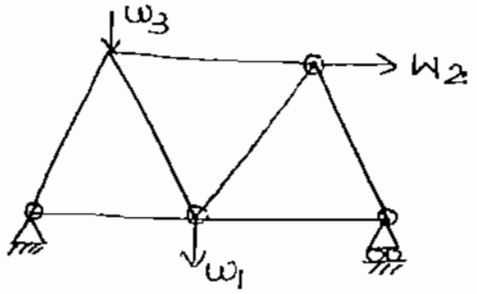
## Analysis of trusses :-

### Concept-1 :

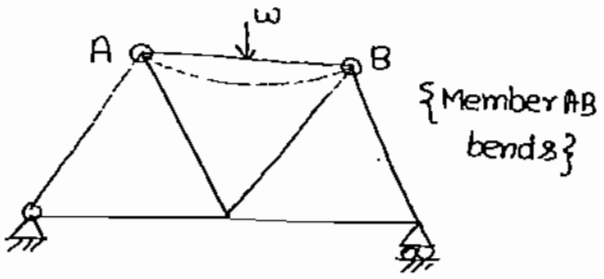
### Assumptions in the analysis of trusses :-

(1) It is assumed that all the loads are applied only at the joints. (otherwise if the loads are applied at intermediate locations of the members. then they will bend and the str. can not be called as a truss. It is called a frame.)

(a)



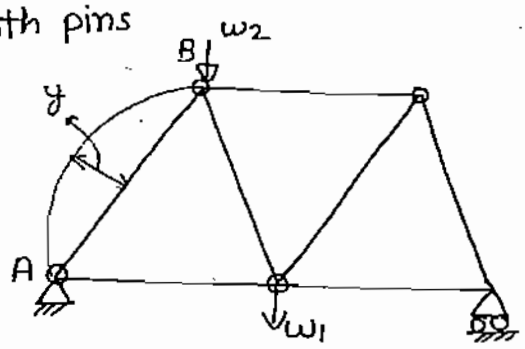

(Truss)




Not a truss (frame)

(2) All the members assumed to be straight and connected by so smooth pins. (otherwise, if the members are curved, then B.M. developed in those members & the structure can not be called as truss.)

(b) Smooth pins




(Member AB Bend due to initial Radius of curvature)

(3) B.M due to self wt. of member is neglected.

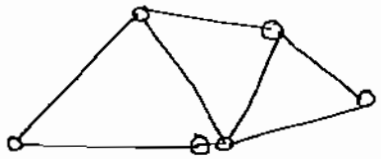
Concept-2

In a truss, total no. of members (m) & the total no. of joints (j) are related by

$\boxed{m = 2j-3}$ {if this cond$^n$ is satisfied, then we get stable tringulated truss}.

Ex. For I$^{st}$ 3 joints

→ 3 members



For each additional joint ⇒ 2 members

So, $\boxed{m = 2j-3}$

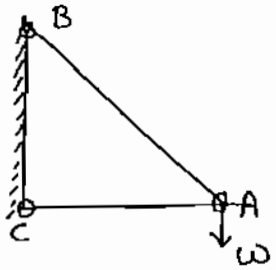
Note: (1) If $m = 2j-3$ ⟶ Perfect, stable truss.

$m < (2j-3)$ ⟶ Unstable (or) deficient truss.

$m > (2j-3)$ ⟶ Redundant (or) over rigid truss.

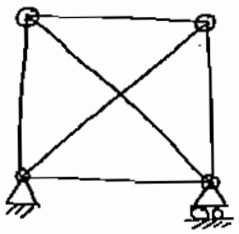
Ques: (1) For the truss shown in figure B.M. exists in the member —

(a) AB (b) AC (c) AB & AC both (D) No members.




Note : The assumptions in the analysis of trusses are made to ensure that the members are subjected to either tension or compression only. B.M is zero, everywhere in the truss.

Ques: (2) The truss shown in fig. is –



(A) Perfect

(B) Deficient

(C) Redundant

(d) None

$m = 2j - 3$

$m = 6$

$J = 4$

$\therefore \boxed{6 > (2\times4 - 3)}$ so, Redundant.

Concept-3

Analysis of trusses → (a) Method of Joints → It is a special case of method of sect$^n$ only.

→ (b) Method of Sections

(a) Method of Joints :-

(i) Equilibrium of a joint is considered in method of joints

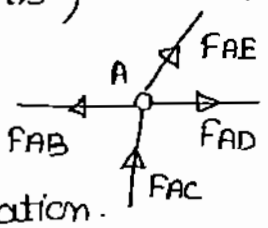
(ii) Procedure : Step-1 Find the support reactions, considering equilibrium of the entire truss.

Step-2

$\Sigma M = 0 \Rightarrow$ at joint $M = 0$

Consider equilibrium of a joint where only 2 unknown member forces are available & use $\Sigma x = 0$, $\Sigma y = 0$ to find them. Similarly, proceeded to the other joints (we have to select a joint where only two unknowns are available b/c we have only 2 equations of equilibrium at any joints)

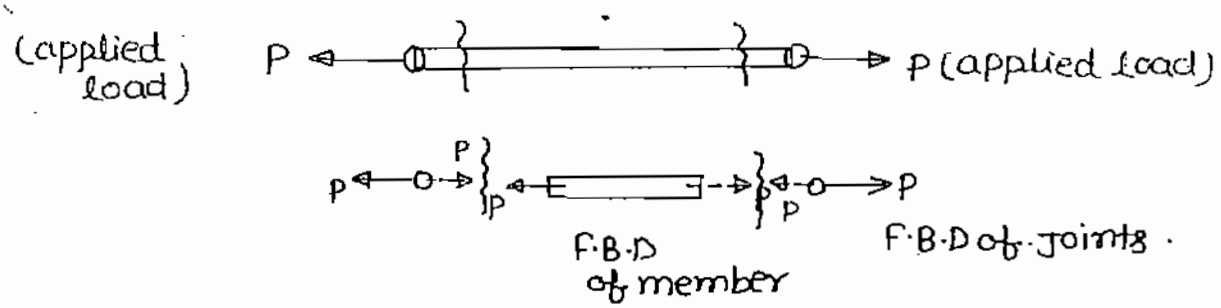
$\boxed{\Sigma A = 0 \Rightarrow 0 = 0}$




$\Sigma M = 0$ becomes useless equation.

Note:

(1) If arrow mark is away from the joints, it means that force in the member is tensile.




(2) If arrow mark is towards the joints, it means that force in the member is compressive.