TRUSS

Truss:

A structure made up of slender members, pin-connected at the joints is known as a truss. The members are generally welded or riveted together at their joints, but for the calculation purpose the joints are assumed to be hinged or pin-connected.

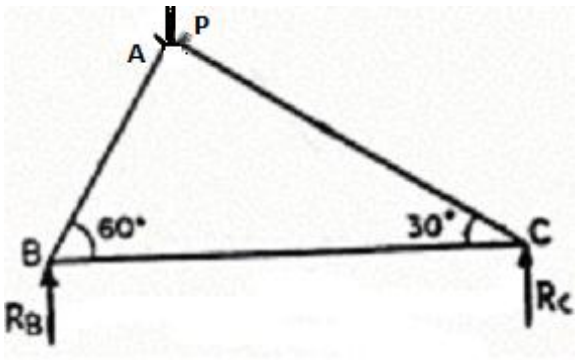

Fig. 1

Types of Truss:

(i) Perfect Truss or Just Rigid Truss:

The truss, which is having no of members, just sufficient to keep the truss in equilibrium under the action of external loads, is known as perfect truss. A perfect truss satisfies the relation

$$\mathbf{m = (2j - 3)}$$

where, j= number of joints and
m=number of members

(ii) Imperfect Truss

An imperfect truss is one which does not satisfy the relation given by the equation

$$\mathbf{m = (2j - 3)}$$

This means that the number of members in an imperfect truss will either be more or less than (2j-3).

It may be a deficient frame or a redundant frame.

(a) Deficient Truss or Under Rigid Truss:
If the number of members in a truss are less than (2j-3), then the truss is known as ***deficient truss***.

$$m < (2j-3)$$

(b) Redundant Truss or Over-Rigid Truss:
If the number of members in a truss are more than (2j-3), then the truss is known as ***redundant truss***.

$$m > (2j-3)$$

Truss analysis: Determination of forces (magnitude and nature) in different members of a loaded truss is known as truss analysis.

Assumptions of truss analysis:
The assumptions made in finding out the forces in a frame are,

i. Loads act only at the joints.
ii. All the members are connected by pin-joints.
iii. Each joint of the truss is in equilibrium; hence the whole truss is also in equilibrium.
iv. The self-weight of the members of the truss is negligible.
v. Cross-section of the members is uniform.

Methods of truss analysis:
Two methods are used.

i. Method of joints
ii. Method of section

(i) Method of joints:
In this method first select the joint which is having only two unknown forces and then apply equations of equilibrium for concurrent force system i.e. $\sum \mathbf{V=0}$ **&** $\sum \mathbf{H = 0.}$ This step is repeated until forces in all the members of truss are known.

(ii) Method of section:
In this method the truss is divided into two parts by a line and the line is taken in such a way that maximum three unknown members are intersected. Now forces in members are calculated by considering any

one part and applying the equations of equilibrium for non-concurrent force system i.e. **$\sum V=0$ & $\sum H = 0$ and $\sum M=0$**.

Zero force members in a truss:

(i) Two force joint: If a joint has only two forces which are not collinear then for equilibrium of joint both forces must be equal to zero.

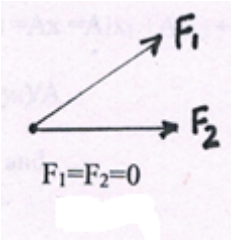

Fig. 2

(ii) Three force joint: If a joint has three forces and two of them are collinear then for the equilibrium of the joint the third force should be equal to zero and collinear forces will be equal and opposite.

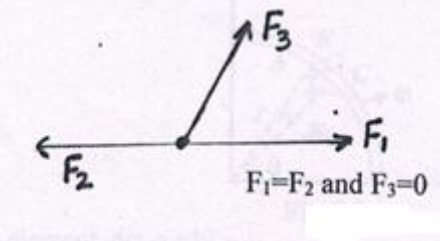

Fig. 3

(iii) Four force joint: If a joint has four forces with two pair of collinear forces (plus or cross joint) then collinear forces will be equal and opposite.

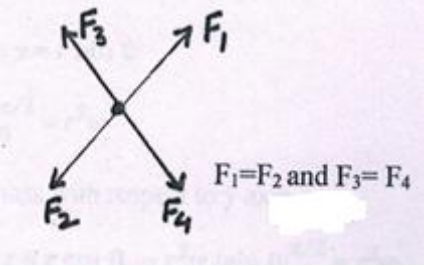

Fig. 4