

UNIT II

ANALYSIS OF PLANE TRUSSES

2.1 INTRODUCTION

A structure made up of several bars (or members) riveted or welded together is known as frame.

TYPES OF FRAMES

The different types of frame are :

- (i) Perfect frame and
- (ii) Imperfect frame.

Imperfect frame may be a deficient frame or redundant frame.

PERFECT FRAME.

The frame which is composed of such members, which are just sufficient to keep the frame in equilibrium, when the frame is supporting an external load, is known as perfect frame.

The simplest perfect frame is a triangle as shown in Fig.5.1

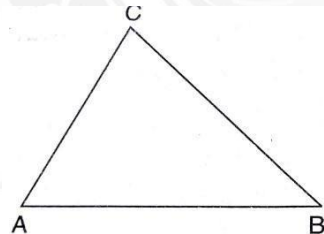


Fig.5.1

It consists of three members AB, BC and AC whereas the three joints are A, B and C. This frame can be easily analyzed by the condition of equilibrium given below.

$$n = 2j - 3$$

Where n = Number of members and j = Number of joints.

IMPERFECT FRAME

A frame in which the number of members and number of joints are not given by $n = 2j - 3$ is known as imperfect frame.

DEFICIENT FRAME AND REDUNDANT FRAME

If the number of members in an imperfect frame is less than $2j - 3$, then the frame is known as deficient frame and if the number of members in an imperfect frame is more than $2j - 3$, then the frame is known as redundant frame

ASSUMPTIONS MADE IN FINDING OUT THE FORCES IN A FRAME

The assumptions made in finding out the forces in a frame are:

- (i) The frame is a perfect frame
- (ii) The frame carries load at the joints
- (iii) All the members are pin jointed.

ANALYSIS OF A FRAME

A frame is analyzed by the following methods:

- (i) Method of joints,
- (ii) Method of sections,
- (iii) Tension Coefficient method and
- (iv) Graphical method.

Example of determinate structures

simply supported beams, cantilever beams, single and double overhanging beams, three hinged arches, etc.

Examples of indeterminate structures

fixed beams, continuous beams, fixed arches, two hinged arches, portals, multistoried frames, etc. Special methods like strain energy method, slope deflection method, moment distribution method, column analogy method, virtual work method, matrix methods, etc are used for the analysis of redundant structures.

1. The truss shown in Fig. a has 11 members, 7 joints, and 3 support reactions.

Since $11 + 3 = (2)(7)$, the truss is statically determinate.

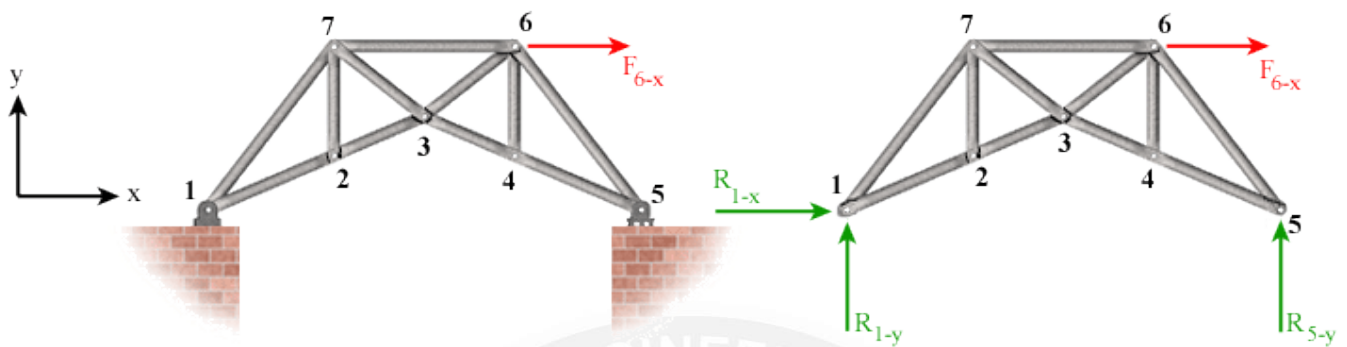


Fig. a Statically determinate truss

2. The truss in Fig. b is the same as that in Fig. a with the exception that it is pin supported at joints 1 and 5. Therefore, there are 4 unknown reactions. The number of members plus reactions is 15, which is larger than 2 times the number of joint. Therefore, this is a statically indeterminate truss. In this case, the truss has one redundant support reaction.

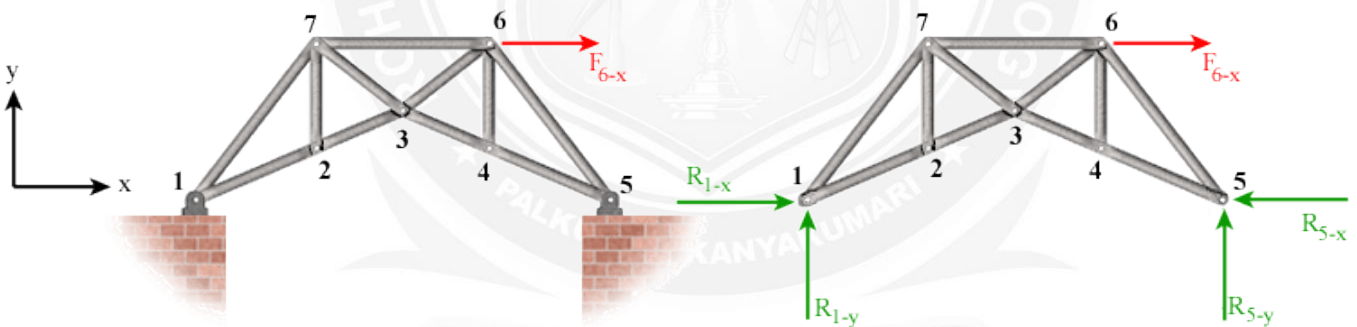


Fig. b Statically indeterminate truss with one redundant restraint