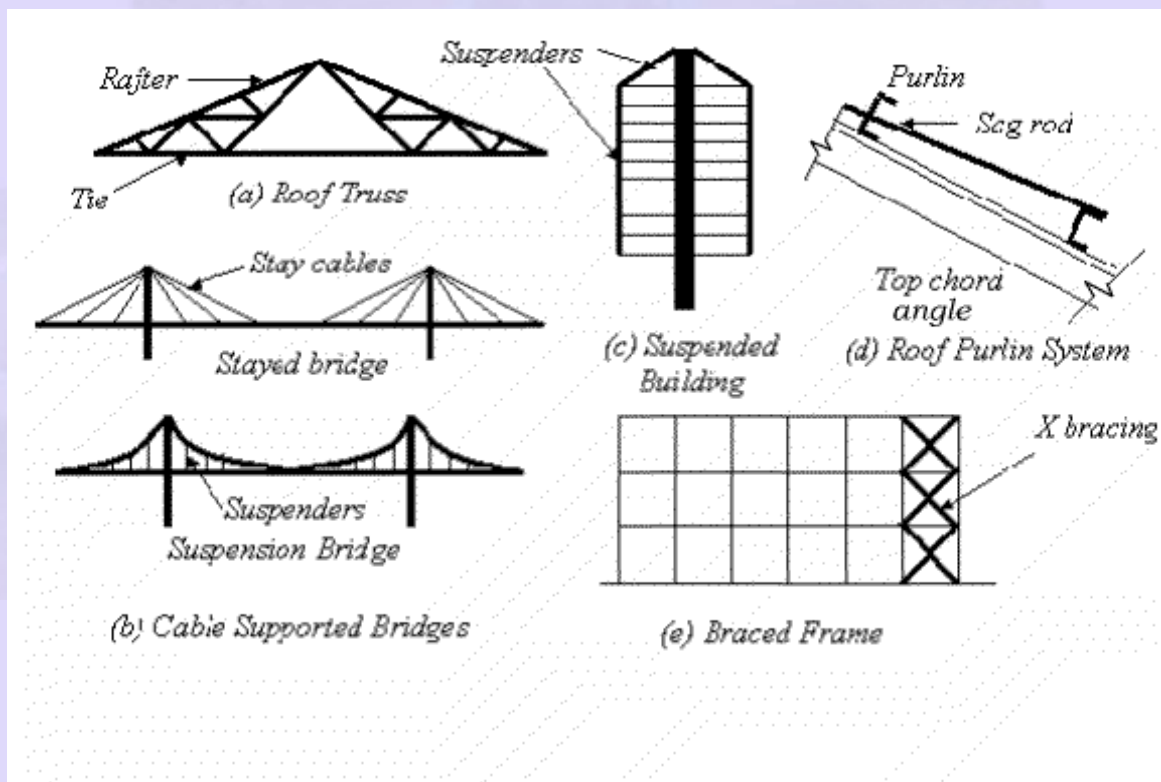


## 4. TENSION MEMBERS

### 4.1 Introduction

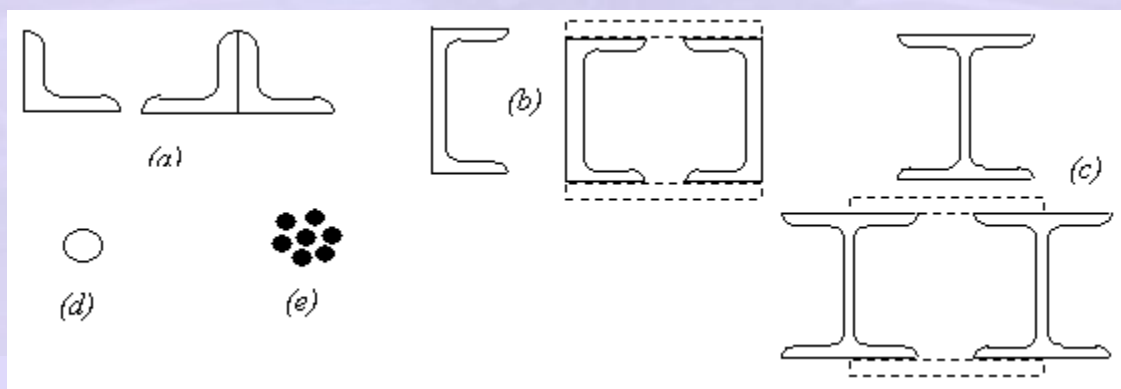
Tension members are linear members in which axial forces act so as to elongate (stretch) the member. A rope, for example, is a tension member. Tension members carry loads most efficiently, since the entire cross section is subjected to uniform stress. Unlike compression members, they do not fail by buckling (see chapter on compression members). Ties of trusses [Fig 4.1(a)], suspenders of cable stayed and suspension bridges [Fig.4.1(b)], suspenders of buildings systems hung from a central core [Fig.4.1(c)] (such buildings are used in earthquake prone zones as a way of minimising inertia forces on the structure), and sag rods of roof purlins [Fig4.1(d)] are other examples of tension members.



**Fig 4.1 Tension members in structures**

Tension members are also encountered as bracings used for the lateral load resistance. In X type bracings [Fig.4.1(e)] the member which is under tension, due to lateral load acting in one direction, undergoes compressive force, when the direction of the lateral load is changed and vice versa. Hence, such members may have to be designed to resist tensile and compressive forces.

The tension members can have a variety of cross sections. The single angle and double angle sections [Fig.4.2 (a)] are used in light roof trusses as in industrial buildings. The tension members in bridge trusses are made of channels or I sections, acting individually or built-up [Figs.4.2(c) and 2(d)]. The circular rods [Fig.4.2 (d)] are used in bracings designed to resist loads in tension only. They buckle at very low compression and are not considered effective. Steel wire ropes [Fig.4.2 (e)] are used as suspenders in the cable suspended bridges and as main stays in the cable-stayed bridges.



**Fig 4.2 Cross sections of tension members**