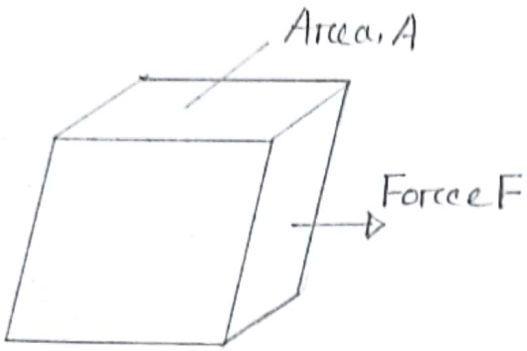
Experiment No:

Experiment Name: Determination of the direct sheare test of the mild steel.

Introduction:

Shearing Stress:

- When an external force acts on an object, it undere goes deformation. If the direction of the force is parcallel to the plane of the object. The deforcmation will be along that plane. The stress experianced by the object here is sheare stress or tangential stress.
- It arises when the force vector components which arce parcallel to the crcoss-sectional area of the material. In the case of normal / longitudinal stress, The force vectorcs will be perpendicular to the crcoss-sectional area on which it acts



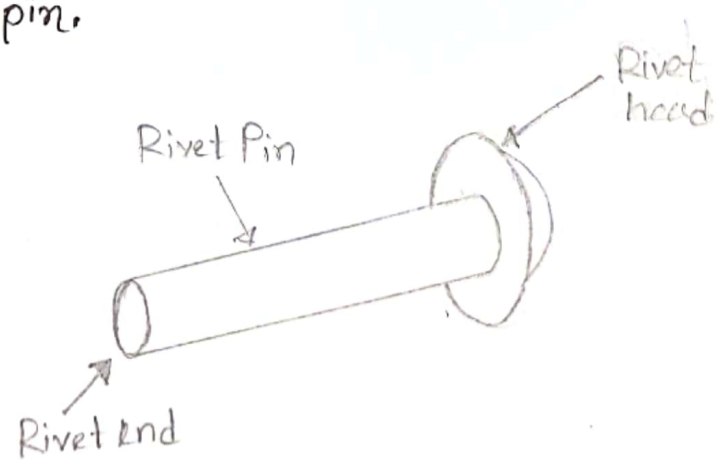
Where,

- τ is the sheare stress.
- F is the force applied.
- A is the area of cross section, that is parallel to the force vector

$$\text{Sheare stress, } \tau = \frac{F}{A}$$

Rivet:

A rivet is a mechanical fastener composed of a head-on one end and a cylindrical stem on another (called the tail) which has the appearance of a metal pin.

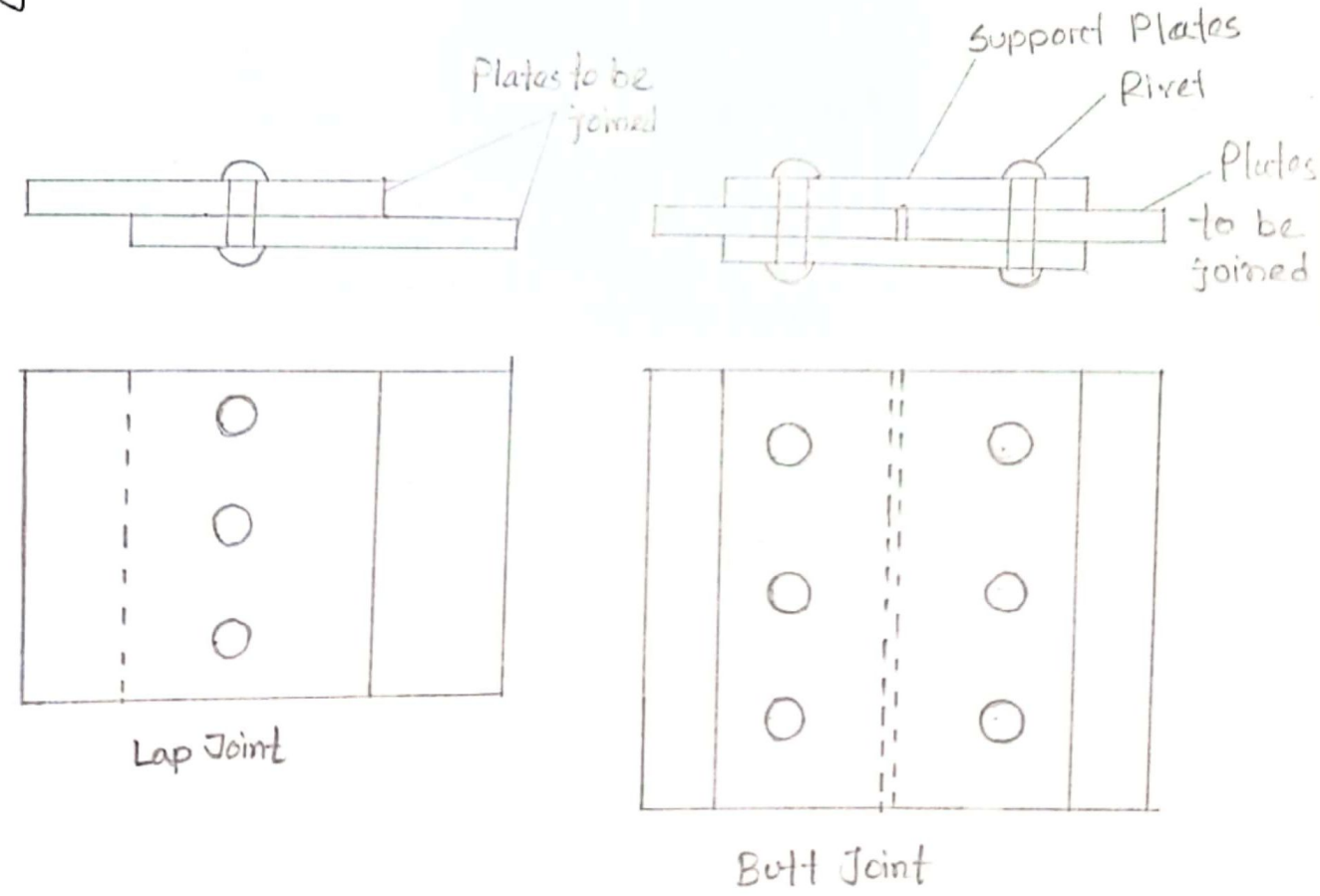


Types of Riveted and Bolted Joints:

There are two types of riveted and bolted joints.

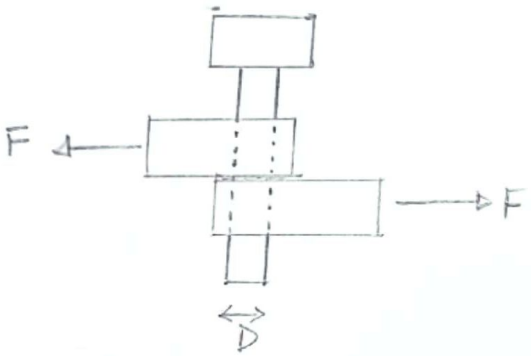
(i) Lap joints (ii) Butt joints

In lap joints the components to be joined overlap each other, while for butt joints an additional piece of material is used to bridge the two components to be joined which are butted up against each other.



Single Shear:

- Single shear is load applied in one plane.
- When single cross section of an element in a joint takes all the shear force it is called single shear.

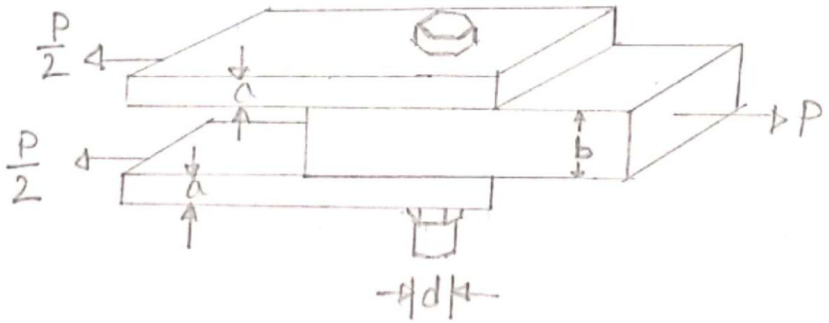


$$\tau = \frac{F}{A} = \frac{F}{\pi(r^2)} = \frac{4F}{\pi D^2}$$

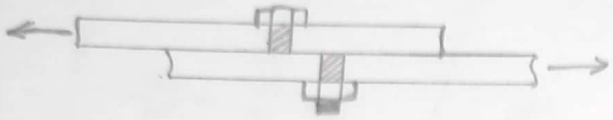
$$\therefore \tau = \frac{4F}{\pi D^2}$$

Double Shear:

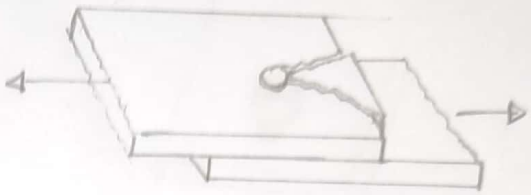
- When two cross sections of the element takes the shear load it is called double shear.
- Double shear is more safer and has higher safety factor.



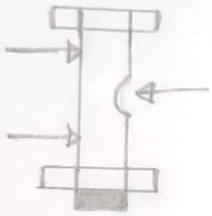
Possible Failure Modes:



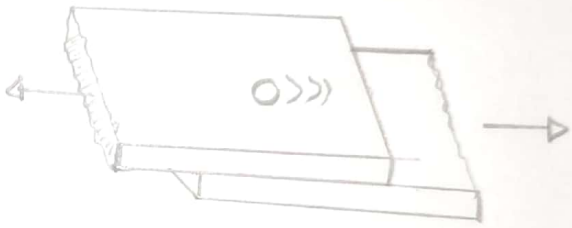
Sheare failure of Bolt
(a)



Sheare failure of plate
(b)

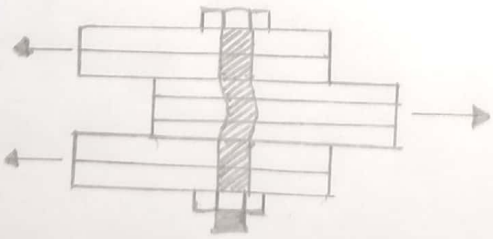


Bearing Failure of Bolt
(c)

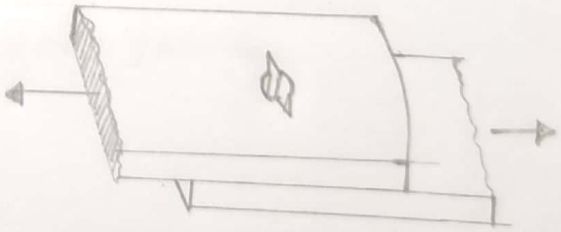


Bearing Failure of Plate
(d)

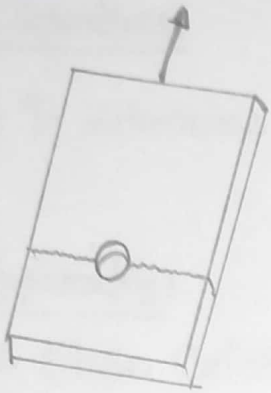
Tensile Failure of Bolts
(e)



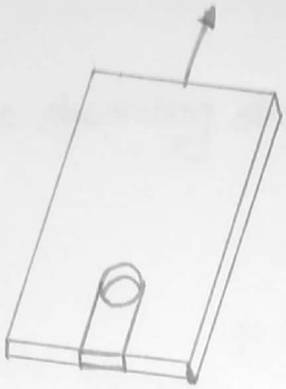
Bending Failure of Bots
(f)



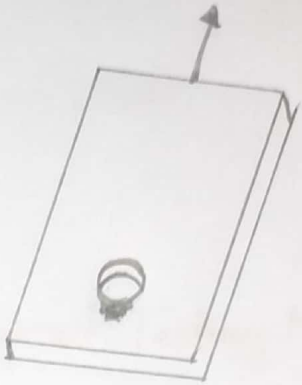
Tensile Failure of plate
(g)



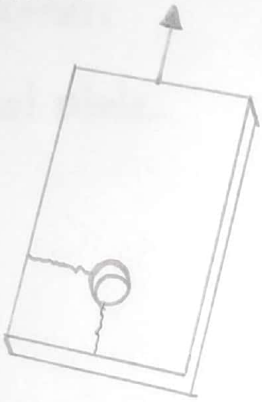
net tension



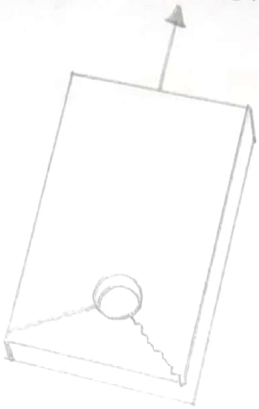
Shear-out



bearing

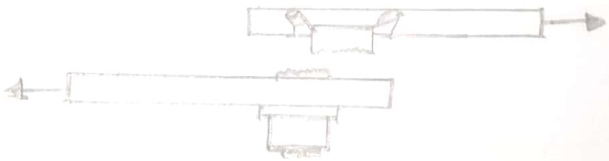


Cleavage



Loading

Pull-through



Fastener failure

Objectives:

(i) To determine the shearing stress of rivet.

Apparatus:

1. Slide Calipers
2. Universal Testing Machine (UTM)
3. Hammer
4. Rivet
5. Steel plate
6. Drill Machine

Procedure:

1. At first, the diameter of rivet was recorded by measuring with slide calipers.
2. Then the rivet was attached with two plates like the arrangements of single shearing.
3. After that, mutually opposite sides of two plates were taken under universal testing machine and the different loads were applied on the plates untill the rivet got separated along the common plane of two plates.
4. That load was recorded at which the rivet got separated along one plane from utm.
5. In such a way, the process were repeated multiple times to get the average shearing stress.

Observation Sheet & Calculations:

Diameter of rivet, d = 9.4 mm = 0.94 cm

Strength of rivet, P = 42 KN (From UTM machine)

Area of the rivet, $A = \frac{\pi}{4} d^2$ cm^2

$= \frac{\pi}{4} \times (0.94)^2$ cm^2

$= 0.694$ cm^2

Shearing stress, $S = \frac{P}{A}$

$= \frac{42}{0.694}$ KN/cm^2

$= 60.52$ KN/cm^2

Data Table:

Sample No	Diameter of rivet (mm)	Area (cm^2)	Load (kN)	Shearing stress S_s (kN/cm^2)	Average Shearing Stress, S_s (kN/cm^2)
1	9.4	0.694	42	60.52	
2	9.6	0.724	43	59.39	59.86
3	9.8	0.754	45	59.68	

Results:

The Average Shearing Stress of rivet = 59.86 KN/cm²

Discussion:

Some drawbacks of universal testing machine were avoided or considered as those were deniable. So, the loads at which rivets got failed were recorded carefully from utm as fare as possible. The diameter of rivet was measured by slide calipers which was quite accurate. So, the average shearing stress was calculated almost accurately.