Practical:

To determine maximum shear strength of mild steel and cast iron.

Objective:

To determine the maximum shear strength of mild steel and Cast iron.

Theory:

A material when subjected to a tensile load, resist the applied load by developing internal resisting force. This resistance comes due to atomic bonding between atoms of the material. The resisting force per cross sectional area is known as stress. The value of stress in material goes on increasing with an increase in applied tensile load, but it has a certain maximum limit too. The maximum stress at which a material fails is called ultimate tensile strength.

During a tensile test of a bar, it is possible to observe a very interesting phenomenon. At a certain value of the tensile stress $\sigma = P/A$ visible slip bands approximately inclined by $45°$ to the axis of the bar will appear on the flat sides of the specimen. These lines, called *Lueders' lines,* indicate that the material is failing in shear, even though the bar is being loaded in simple tension. This relative sliding along 45°-planes causes the specimen to elongate axially, and after unloading it will not return to its original length. The axial tensile stress $\sigma_{y.p.} = P/A$ at which this occurs may be designated as the *yield stress* in tension, even though the failure is not a true tension failure of the material.

Laboratory experiments indicate that both shearing and normal stress under axial loading are important since a brittle material loaded in tension will fail in tension on transverse plane whereas a ductile material loaded in tension will fail in shear on the 45^o plane.

Apparatus:

Tensile testing machine, vernier caliper, Graph paper

Procedure:

- Take the bars of mild steel and cast iron bars and find their diameter.
- Mark the gauge length of bars.
- Then placed the bars between the grips of tensile testing machine.
- Apply the loads and note the value of load (P_y) at which yielding occurs.
- Also note down the value of load at which bar breaks (P_u).
- Maximum shear strength of a bar is given by
- Yield strength is given by

- Ultimate strength is given by

Graphical Method:

- A *stress-strain diagram* is obtained by plotting the various values of the stress and corresponding strain in the specimen
- From graph note the value of stress at which yielding starts.
- If graph does not have well-defined yield point, thus it is standard practice to define its *yield strength* using a graphical procedure called the offset method.
- In Offset method to determine yield strength, normally, a 0.2 % strain is chosen.
- From this point on the ε axis, a line parallel to initial straight-line portion of stress-strain diagram is drawn.
- The point where this line intersects the curve defines the yield strength (σ_y).
- Maximum shear strength of a bar is given by

Observation and calculation:

Yield Load (P_y)	Yield load (P_y)	Ultimate Load (P_u)	Ultimate Load (P_u)	Area (A)	Yield Strength (σ_y)	Ultimate Strength (σ_u)	Elongation
(KN)	(lb)	(KN)	(lb)	(in^2)	(psi)	(psi)	(%)

Maximum Shear strength =

=

% elongation =