Experiment Details

Department Name	Civil Engineering Department
Class	Second Year B.Tech
Semester	Sem -III
Subject Name	Solid Mechanics Lab
Experiment No.	01
Experiment Name	Tension Test on Mild Steel

Version History

Sr. No.	Version Number	Created By	Approved By	Date
1	v1.0	Haripriya Desai	Mr. Sheetal Koikar Sir	13/10/2020

AIM:

To determine tensile strength, percentage of elongation & other mechanical properties of Mild steel

THEORY:

Elasticity is the way a material initially responds when it is subjected to stresses. Elasticity refers to the material's ability to deform in a non-permanent way, meaning that when the stress load is removed from the material it will recover its original form. A material will continue to deform elastically as the stress upon it increases until the elastic limit is reached. The elastic limit can be found on stress-strain diagrams for all materials, and the limit varies by the material. For instance, steel experiences far less stress before reaching the elastic limit than rubber does. Engineers need to refer to stress-strain diagrams, because engineering design usually stays within the limitations of the elastic stresses.

The tensile test is most important test in material science to find out mechanical properties of metals. In this test ends of test piece are fixed into grips connected to a straining device and to a load measuring device. If the applied load is small enough, the deformation of any solid body is entirely elastic. An elastically deformed solid will return to its original form as soon as load is removed. However, if the load is too large, the material can be deformed permanently. The initial part of the tension curve which is recoverable immediately after unloading is termed. As elastic and the rest of the curve which represents the manner in which solid undergoes plastic deformation is termed plastic. The stress below which the deformations essentially entirely elastic is known as the yield strength of material. In some material the onset of plastic deformation is denoted by a sudden drop in load indicating both an upper and a lower yield point. However, some materials do not exhibit a sharp yield point. During plastic deformation, at larger extensions strain hardening cannot compensate for the decrease in section and thus the load passes through a maximum and then begins to decrease. This stage the "ultimate strength"' which is defined as the ratio of the load on the specimen to original cross-sectional area, reaches a maximum value. Further loading will eventually cause 'neck' formation and rupture.

PRE TEST:

1. Tensile test can be performed on
   a) Impact testing machine
   b) Universal testing machine
   c) Rockwell tester
   d) Brinell tester

(Ans:b)

2. The property by which a body returns to its original shape after removal of the force is called _____
   a) Plasticity
   b) Elasticity
   c) Ductility
   d) Malleability

(Ans:b)

3. Which law is also called as the elasticity law?
   a) Bernoulli's law
   b) Stress law
   c) Hooke's law
   d) Poisson's law

(Ans:c)

4. Where in the stress-strain curve, the hooke's law is valid?
   a) Strain hardening region
   b) Necking region
   c) Elastic range
   d) Valid everywhere

(Ans:c)

5. Which point on the stress strain curve occurs after the lower yield point?
   a) Yield plateau
   b) Upper yield point
   c) Ultimate point
   d) None of the mentioned

(Ans:a)

PROCEDURE:

1. Take exactly 1m long MS bar as a test specimen. Measure the diameter of the specimen at 2-3 locations with Vernier.
2. Mark gauge length at an interval of 5 times average diameter of bar on given test specimen.
3. Adjust the dial gauge pointer to zero and select the suitable loading range.
4. Fix the test specimen to loading frame with top and middle grips in the loading frame of U.T.M. Clamp the grips perfectly.
5. Apply the extensometer to middle portion of gauge length of test specimen.
6. Start the gradual loading and record load and corresponding deformations from extensometer in observation table.
7. Observe the load at yield point and motion of load pointer i.e. to and fro movement, to observe upper yield point and lower yield point, record the values.
8. When the elastic limit is crossed and material enters into plastic stage, the extensometer shows rapid change for very small increase in load at that moment, remove the extensometer and further deformation is to be recorded by extensometer fixed on loading frame of U.T.M.
9. Apply the further load till the specimen breaks and observe ultimate and breaking load with neck formation of specimen.
10. Calculate stress-strain and plot same graph on graph paper showing Strain on X-axis and Stress on Y-axis and critical points.

POST TEST:

1. In a tensile test on mild steel specimen, the breaking stress as compared to ultimate tensile stress is

a) More
b) Less
c) Same
d) Depends upon composition

(Ans: b)

2. Which equipment is used to measure elongation of mild steel

a) UTM
b) Vernier Caliper
c) Extensometer
d) Scale

(Ans: c)

3. Which c/s area is considered throughout the experiment to draw the engineering stress –strain curve

a) Original c/s area before test
b) Changed c/s Area after test
c) c/s Area changing after every interval
d) None of the above

(Ans: a)

4. Yield point is not visible on stress-strain curve of mild steel

a) True
b) False

(Ans: b)

5. _____ is correct formula to find out the Gauge length of circular bar.

a) $5.55\sqrt{A}$
b) $5.65\sqrt{A}$
c) $6.55\sqrt{A}$
d) $6.65\sqrt{A}$

(Ans: b)

REFERENCES:

1. IS :432 (PartI) – 1982 Specification For mild steel and medium tensile steel bars and Hard Drawn stebl wire for concrete reinforcement
2. IS 1608(2005): Metallic Materials - Tensile Testing At Ambient Temperature, Third Revision, July 2008.

3. Hearn E,J., Mechanics of Material, Pergaman Press, England,1972.
4. Beer and Johnston E.R., Mechanics of Material, 3rd Edition, Tata McGraw Hill,New-Delhi,2007.
5. Jindal U. C., Strength of Materials, 2012.
6. Mikell. P. Groover, Fundamentals of modern manufacturing materials, processes and systems, Second Edition, 2015.
7. G.E. Dieter, Mechanical Metallurgy, SI Metric Edition, McGraw â€“ Hill.
8. Joseph R. Davis, Tensile Testing, 2nd Edition, 2004.