DATE 26/09/18 PAGE NO. 01 EXPT. NO. 01.

EXPERIMENT – 01

CLOSED COIL HELICAL SPRING

i) Tension test arrangement for spring :-

The lower compression plate (10) is removed. Two 'U' type hooks are provided (7) with the machine which is having threaded at one side. Both of the 'U' pieces are fighted in the 4 and 3. The pins from that 'U' pieces is removed and fixed the end portion of tension spring again inserted that pin.

For the fixing of the spring for tension test the fig-01 is reffered.

Then the load tare digital panel is pressed and is assumed zero reading of that pointer which is on scale on digital display. The nut no. 1 is rotated clockwise so, that tension load will be applied on spring. Tensile load is observed on panel and deflection is observed on metric scale.

ii) Compression test arrangement for spring :-

The spring is kept in between two compression plates (3 and 10). Now by rotating the handle no. 1 anticlockwise upto that the upper compression plate is just touches the upper portion of the spring. Then the load tare button is pressed from digital panel and is assumed the zero position of pointer. The handle is rotated anticlockwise and applied load on spring observe load on digital display and deflection is shown on metric scale.

LOKENATH®

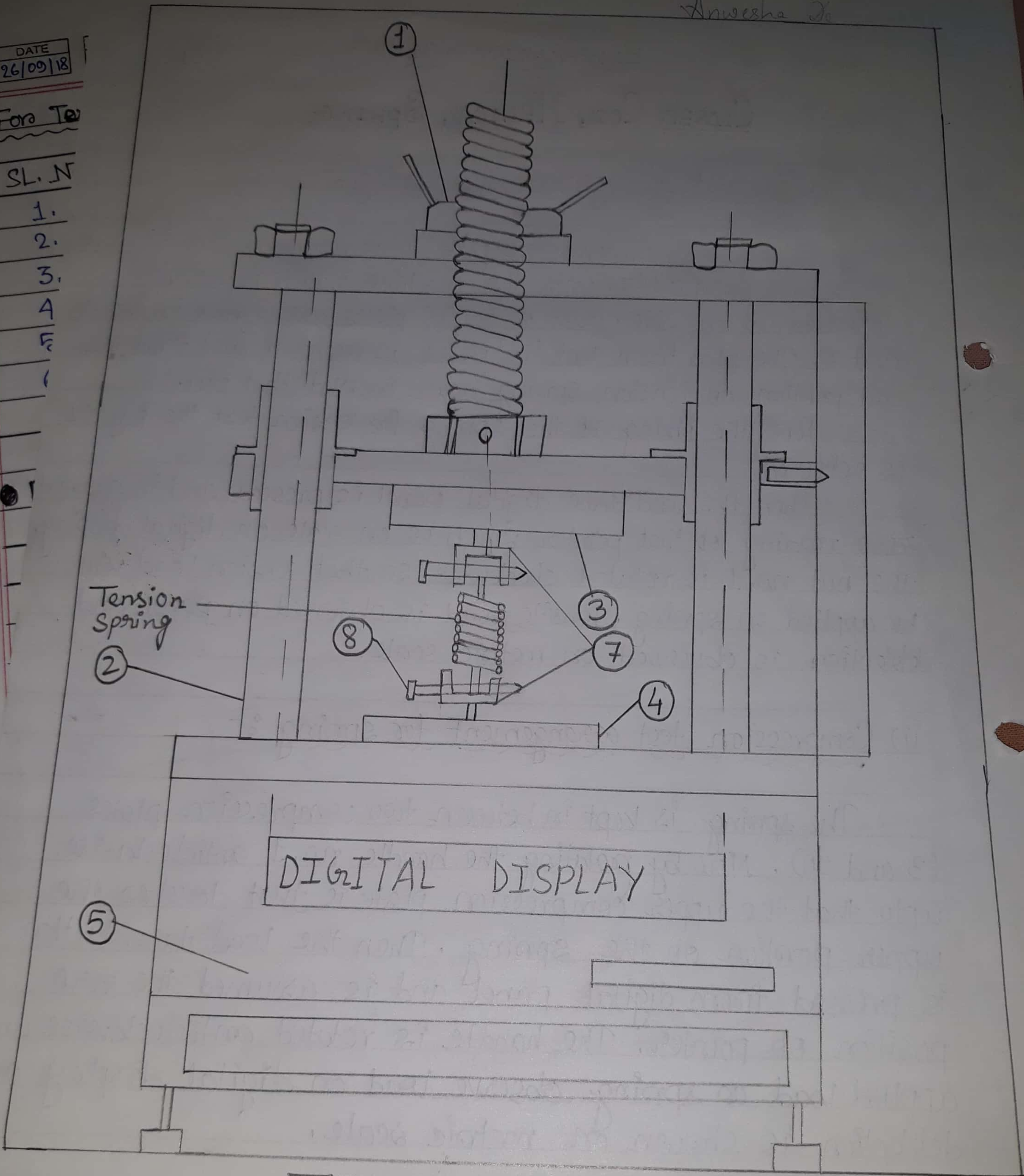
EXPT. NO.

Anwesha

DATE 26/09/18

Fora Te

SL. N
1.
2.
3.
4
5



TENSION TEST

- For Tension Test :-

SL. No.	LOAD (KN)	DEFLECTION (mm)
1.	0.28	1.7
2.	0.3	2
3.	0.33	2.3
4.	0.35	2.4
5.	0.36	2.4
6.	0.41	2.5
7.	0.42	2.7

- For compression Test :-

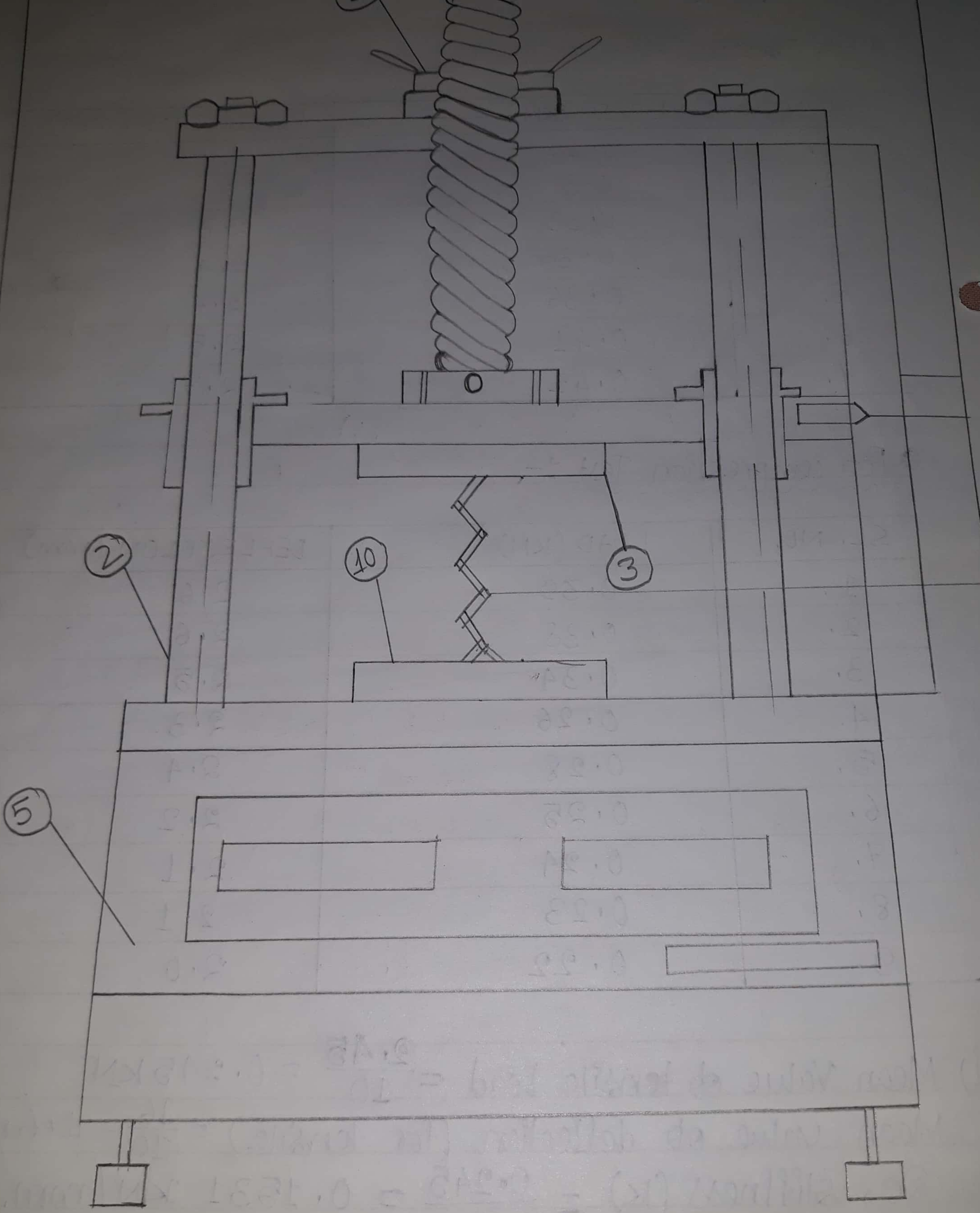
SL. NO.	LOAD (KN)	DEFLECTION (mm)
1.	0.39	2.6
2.	0.38	2.6
3.	0.34	2.5
4.	0.26	2.3
5.	0.28	2.4
6.	0.25	2.2
7.	0.24	2.1
8.	0.23	2.1
9.	0.22	2.0

i) Mean Value of tensile Load $= \frac{2.45}{10} = 0.245$ KN

Mean value of deflection (for tensile) $= \frac{16}{10} = 1.6$ mm.

So, stiffness (k) $= \frac{0.245}{1.6} = 0.1531$ KN/mm.

6 নং পিছনের
13 নং "



COMPRESSION TEST

DATE 26/09/18 PAGE NO. 03 EXPT. NO. 01

Now, $K = \frac{Gd^4}{64R^3n}$

a) G = Modulus ob rigidity.
b) d = Diameter ob spring wire = 1 mm.
c) R = Mean coil radius = D/2 = $\frac{0.706}{2}$ = 0.353 mm
d) n = Number ob active coils = 24.

$$G = \frac{64KR^3n}{d^4} = \frac{64 \times 0.1531 \times (0.353)^3 \times 24}{(1)^4}$$

$$= 10.34 \text{ KN/mm}^2$$

ii) Mean value of compressive load = $\frac{2.59}{10}$ = 0.259 KN.
" " " Deflection (for compressive load) = $\frac{15.29}{10}$

= 1.529 mm

Stiffness (K) = $\frac{0.259}{1.529}$ = 0.1694 KN/mm.

$$G = \frac{64 \times 0.1694 \times (0.353)^3 \times 24}{(1)^4} = 11.445 \text{ KN/mm}^2$$

EXPERIMENT NO : 02

DATE 03/09/18 | PAGE NO. 04 | EXPT. NO. 02

TENSION TEST

- **Aim :-** To determine the tensile strength ob specimen.

- **Specimen and Equipment :-** i) Universal testing machine, ii) Specimen ob different ferrous and non-ferrous materials.

- **Theory :-** The tensile test is most applied one, ob all mechanical tests. In this test ends ob a test piece are fixed into grips connected to a straining device and to a load measuring device. If the load is too large, then the material can bea deformed permanently. The initial part ob the tension curve which is recoverable immediately abter unloading, is termed as elastic and rest ob the undergoes plastic debormation is entirely elastic is known as the "yield strength ob material". During plastic debormation at larger extensions strain hardening cannot compensate for the decrease in section and thus the load passes through a max and then begins to decrease. At this stage the "Ultimate Strength" which is debined as the ratio ob specimen to original cross-section area, reaches a maximum value.

- **Procedure :-**

i) Measurement ob the dimension :-

Diameter (d) = 12.13 mm.

Total length ob a specimen = 556 mm.

Cross-sectional Area (A_0) = 115.56 mm^2

Markage length (L_0) at three differentporotions on the specime

LOKENATH®

DATE	PAGE NO.	EXPT. NO.
03/09/18	05	02

covering effective length of specimen.

ii) Grip the specimen in the fixed head of a machine.
iii) Fix the extensiometer within the gauge length marked on this specimen. Adjust the dial of extensiometer at '0'.
iv) Adjust the dial of a machine to 'zero', to read load applied.
v) Select suitable increments of loads to be applied so that corresponding elongation can be measured from dial guage.
vi) Remove the specimen from machine and study the fracture observes of type.
vii) Measure dimensions of tested specimen. Fit the broken parts together and measure reduced diameter and final gauge length.

Observations :-

i) Diameter (d) = 12.13 mm
ii) Gauge length (L_0) = 5×d = 556 mm
iii) Original cross-sectional area of the specimen (A_0) = 115.56 mm

iv) Final gauge length obtained = (L_0') = 595 mm
v) Final diameter obtained = 0.98 mm
vi) Elongation in length (%) = $\frac{-556+595}{556} \times 100\% = 7\%$.

vii) Reduction in Area (%) = $\frac{\pi/4\left[(12.13)^2-(0.98)^2\right]}{\cancel{\pi/4} \times (12.13)^2} \times 100$

= 99.35%.

DATE 03/09/18 PAGE NO. 06 EXPT. NO. 02

viii) Ultimate stress = $\frac{\text{Ultimate Load}}{\text{Area}} = \frac{54.805 \times 10^3}{\pi/4 \times (12.13)^2}$ ~~N/mm²~~

$= 474.25 \ N/mm^2$.

ix) Strain = $\frac{595 - 556}{556} = 70.14 \times 10^{-3}$

x) Modulus of Elasticity = $\frac{\text{Stress}}{\text{Strain}} = \frac{474.25}{70.14 \times 10^{-3}}$ N/mm²

$= 6.76 \times 10^3 \ N/mm^2$.

Results :-

i) After Calculating the stress and strain for every interval of applied load stress - strain curve is drawn.

ii) Compute the following :-

a) Modulus of Elasticity (E) = $\frac{\text{Stress}}{\text{Strain}} = 6.76 \times 10^3 \ N/mm^2$

b) Yeild stress : The point at which strain increases without increase in stress. Stress at yeild point is "Yeild Stress".

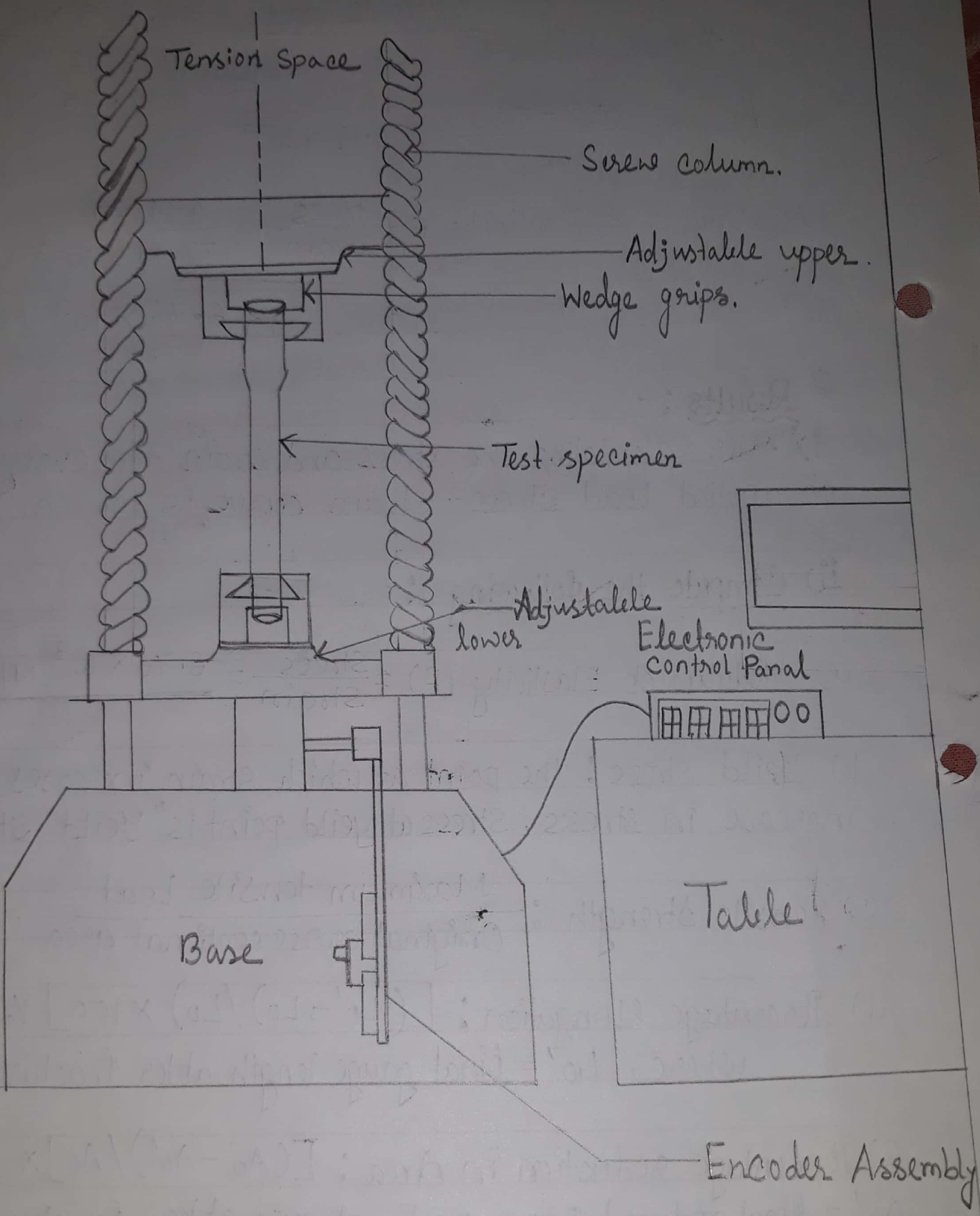
c) Tensile Strength : ~~Maximum tensile load / Original cross sectional area~~.

d) Percentage Elongation : $[(L_0' - L_0)/L_0) \times 100]$ %

where, L_0' = final gauge length after fracture.

e) Percentage reduction in Area : $[(A_0 - A_0')/A_0] \times 100$ %.

A_0' = final reduced cross - sectional area after fracture.


Tension Space
Screw column.
Adjustable upper.
Wedge grips.
Test specimen
Adjustable lower
Electronic Control Panal
Table
Base
Encoder Assembly

EXPERIMENT No : 03.

DATE	PAGE NO.	EXPT. NO.
03/09/18	07	03

COMPRESSION TEST

- **Aim :-** To find the compressive strength of a given specimen.

- **Material and Equipment :-** i) Universal testing machine, ii) Compression pads and iii) Speciman (Given).

- **Theory :-** This is the test to know strength of a material under compression. Generally compression test is carried out to know either simple compression characteristics of material or column action of structural members.

Members under compression usually bends along minor axis, i.e. along the test least lateral dimension. According to column theory slenderness ratio has more functional value. If this ratio goes on increasing, axial compressive stress goes on decreasing and member buckles more and more. End conditions at that time of test have a pronounced effect on compressive strength of materials. As the ends of the member is made plain and fit between two jaws of the machine, fixed end is assumed for calculation of effective length. Effective length is taken as 0.5 L where 'L' is actual length of specimen.

- **Observations :-**

Cross-sectional area of the specimen perpendicular to the load A = 12500 mm^2 (d = 126.16 mm)

DATE 03/09/18 PAGE NO. 08 EXPT. NO. 03

Load taken by the specimen at the time of failure $(W) = 102 \times 10^3$ (N)
Strength of the pin against shearing $(\sigma) = [W/A]$ N/mm^2.

Procedure :

i) Place the specimen in position between the compression pads.
ii) Switch on the UTM.
iii) Select the suitable range of loads and space the corresponding weight in the pendulum and balance it if necessary with the help of small balancing weights.
iv) Operate the button for driving the motor to drive the pump.
v) Note down the load at which the specimen shears.
vi) Stop the machine and remove the specimen.
vii) Repeat the experiment with other specimens.

Precautions :-

i) Place the specimen at centre of compression pads.
ii) Stop the UTM as soon as the specimen fails.
iii) Cross-sectional area of specimen for compression test should be kept large as compared to the specimen for tension test to obtain the proper degree of stability.

Result :-

Compressive strength of the specimen $\frac{102 \times 10^3}{12500} = 8.16\ N/mm^2$.

EXPERIMENT No : 04

DATE 03/10/18 | PAGE NO. 09 | EXPT. NO. 04

: BENDING TEST :

- **Aim** :- To find the values of bending stresses and Young's modulus of the material of a beam (say wooden or steel) simply supported at the ends and carrying a concentrated load at the centre.

- **Material and Equipments** :- i) Universal testing machine,
  ii) Beams of different cross-sections and materials (say wood or steel).

- **Theory** :- If a beam is simply supported at the ends and carries a concentrated load at the centre the beam bends concave upwards. The distance between the original position of the beam and the position after bending is different at different points (fig). along the length of the beam, being maximum at the centre in this case. This different is called "deflection."

In this type of loading of the max amount of deflections is given by the deflection.

$$\delta = \frac{Wl^3}{48EI}$$

(i) W = Load acting at the centre; (ii) l = length of the beam between the supports (mm); (iii) E = Young's Modulus of material of the beam, (N/mm^2); (iv) I = Moment of Inertia (mm^4).

Bending Stress :-

As per bending equation, $\frac{M}{I} = \frac{\sigma_b}{y}$.

where,
M = Bending moment (N-mm)
I = Moment of Inertia, (mm^4).
σ_b = Bending stress (N/mm^2).
y = distance of the fiber of the beam from the neutral axis.

Observations :-

Width of the beam = __________ mm (for rectangular cross section).

Depth of the beam (D) = __________ mm (for circular cross-section).

Moment of Inertia of rectangular section = $bd^3/12$
= __________ mm^4.

Moment of Inertia of Circular section = __________ mm^4.

Initial reading of the vernier = __________ mm.

DATE 03/10/18 PAGE NO. 11 EXPT. NO. 04

Precautions :-

i) Make sure that the beam and load is placed at the proper position.
ii) Cross-section of the beam should be large.
iii) Note down the readings of the vernier scale carefully.

Procedure :-

i) Adjust the supports along the UTM so that they are symmetrically with respect to the length of the bed.
ii) Cross-section of the beam should be Large.
iii) Place the beam on the knife-edges on the blocks so as to project equally beyond each knife-edge. See that the load is applied at the centre of the beam.
iv) Note the initial reading of vernier scale.
v) Apply a load and again note the reading of the vernier scale.
vi) Go on taking readings applying load in steps each time till you have 6 readings.
vii) Draw a graph between load (W) and deflection (δ). On the graph choose any two convenient points and between these points find the correcpending values of W and δ. Putting those between these points in the relation $E = \frac{Wl^3}{48\delta I}$ Calculate the value of E.
viii) Find the defection (δ) in each time by substracting the initial reading of vernier scale.
ix) Calculate the bending stresses for different loads

LOKENATH®

Scanned by CamScanner

DATE 03/10/18 PAGE NO. 12 EXPT. NO. 04

using relation $\sigma_b = \frac{My}{I}$ as given in the table.

x) Repeat the experiment for different beams.

- **Result :-**

i) Bending Stress ____________ units.

ii) Young's Modulus ____________ units.

Scanned by CamScanner

DATE 04/10/18 PAGE NO. 13

EXPERIMENT No : 05

EXPT. NO. 05

ROCKWELL HARDNESS TEST

- **Aim :-** To determine the hardness the of the given specimen using "Rockwell Hardness Test.".

- **Materials and Equipments required :-**
(i) Rockwell hardness testing machine; (ii) Black diamond cone indenter; (iii) Hard steel specimen.

- **Theory :-**

This test is an identation test used for smaller specimen and harder materials. The test is subjected of IS: 1586. In this test indenter is forced into the surface of a test piece in two operations, measuring the permanent increase in depth of an indentation from the depth increased from the depth reached under a datum load due to an additional load.

Measurement of indentation is made after removing the additional load. Indenter used is the cone having an angle of 120° made of black diamond.

- **Precautions :-**

i) Thickness of the specimen should not be less than 8 times the depth of Indentation to avoid the deformation to be extended to the opposite surface of a specimen.

ii) Rapid rate of applying load should be avoided. Load applied on the ball may rise a little because of its sudden action. Also rapidly applied load will restrict plastic flow

DATE 04/10/18 PAGE NO. 14 EXPT. NO. 05

of a material, which produces effect on size of indentation.

Procedure :-

i) Place the specimen on platform of a machine using the elevating screw raise the platform and bring the speciment just in contact with the ball. Apply an initial load will untill the smaller pointer shows red mark.

ii) Release the operating value to apply additional load. Immediately after the additional load applied; bring back operating value to its position.

iii) Read the position of the pointer on the c-scale, which gives the hardness number.

Observations :-

i) Take average of five values of indentation of each specimen. Obtain the hardness number from the dial of a machine.

ii) Compare Brinell and Rockwell hardness tests obtained.

Result :-

Rockwell hardness of given specimen is ____

LOKENATH®