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EXPERIMENT NO.1

AIM: - To determined tensile test on a metal.

OBJECT: - To conduct a tensile test on a mild steel specimen and determine the following:

(i) Limit of proportionality
(ii) Elastic limit
(iii) Yield strength
(iv) Ultimate strength
(v) Young's modulus of elasticity
(vi) Percentage elongation
(vii) Percentage reduction in area

APPRETERS:-

(i) Tensile testing machine
(ii) Mild steel specimens
(iii) Graph paper
(iv) Dividers
(v) Ruler

DIAGRAM:-

THEORY:-

The tensile test is most applied one, of all mechanical tests. In this test ends of a 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 from 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

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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 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. As 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.

PROCEDURE:

1) Measure the original length and diameter of the specimen. The length may either be length of gauge section which is marked in the specimen with a preset punch or the total length of the specimen.
2) Insert the specimen into grips of the test machine and attach strain-measuring device to it.
3) Begin the load application and record load versus elongation data.
4) Take readings more frequently as yield point is approached.
5) Measure elongation values with the help of dividers and a ruler.
6) Continue the test till Fracture occurs.
7) By joining the two broken halves of the specimen together, measure the final length and diameter of specimen.

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OBESERVATION:

Record The Data In The Following Table

A) Material:

Original dimensions

Length = ------------

Diameter = ---------

Area = --------------

B) Final Dimensions:

Length = -------------------

Diameter = -----------------

Area = ------------------------

OBESERVATION TABLE:

S.No	Load(N)	Original Gauge length	Extension (mm)	Stress= $\frac{\text{Load}}{\text{Area}}$ (Nlmm2)	Strain= $\frac{\text{Increase in length}}{\text{Original length}}$
1					
2					
3					
4					
5					

To plot the stress strain curve and determine the following.

(i)Limit pf proportion

$$= \frac{\text{Load at limit of proportionaliy}}{\text{Original area of cross-section}} = \ldots.\text{N/mm}^2$$

(ii)Elastic limit

$$= \frac{\text{Load at limit of proportionaliy}}{\text{Original area of cross-section}} = \ldots.\text{N/mm}^2$$

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(iii) Yield strength

$$= \frac{\text{Yield load}}{\text{Original area of cross-section}} = \ldots\text{N/mm}^2$$

(iv) Ultimate strength

$$= \frac{\text{Maximum tensile load}}{\text{Original area of cross-section}} = \ldots\text{N/mm}^2$$

(v) Young's modulus, E

$$= \frac{\text{Stress blow proportionality}}{\text{Corresponding strain}} = \ldots\text{N/mm}^2$$

(vi) Percentage elongation

$$= \frac{\text{Final length (at fracture)} - \text{original length}}{\text{Original length}} = \ldots\%$$

(vii) Percentage elongation

$$= \frac{\text{Original area-area at fracture}}{\text{Original area}} = \ldots\%$$

PRECAUTION:

If the strain measuring device is an extensometer it should be removed before necking begins.

RESULT:

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EXPERIMENT NO 2.

AIM:- To determined hardness of mild steel.

OBJECT: - To conduct hardness test on mild steel, carbon steel brass and aluminum specimens

APPRETERS:- Hardness tester, soft and hard mild steel.

DIAGRAM:-

THEORY: - The hardness of a material is resistance to penetration under a localized pressure or resistance to abrasion. Hardness tests provide an accurate, rapid and economical way of determining the resistance of materials to deformation. There are three general types of hardness measurements depending upon the manner in which the test is conducted:

1. Scratch hardness measurement,
2. Rebound hardness measurement
3. Indention hardness measurement.

In scratch hardness method the material are rated on their ability to scratch one another and it is usually used by mineralogists only. In rebound hardness measurement a standard body is usual used by mineralogists only. In rebound hardness measurement, a standard body is usually dropped on to the material surface and the hardness is measured in terms of the height of its rebound .the general means of judging the hardness is measuring the resistance of a material to indentation. The indenters usually a ball cone or pyramid of a material much harder than that being used. Hardened steel, sintered tungsten carbide or diamond indenters are generally used in indentation tests a load is applied by pressing the indenter at right gales to the surface being tested. The hardness of the material depends on the

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resistance which it exerts during a small amount of yielding or plastic. The resistance depends on friction, slasticity, viscosity and the intensity and distribution of plastic strain produced by a given tool during indentation

PROCEDURE:

1. Place the specimen securely upon the anvil.
2. Elevate the specimen so that it come into contact with the penetrate and put the specimen under a preliminary or minor load of 100_+2N without shock
3. Apply the major load……by loading lever.
4. Watch the pointer until it comes to rest.
5. Remove the major load.
6. Read the Rockwell hardness number or hardness scale.

OBESERVATION TABLE:

S.NO	**Specimens**	**Reading (HRC/)**			**Mean**
1	Mild Steel				HRB =
2	High Carbon steel				HRC =
3	Brass				HRB =
4	Aluminum				HRB =

PRECAUTION

1. Brielle test should be performed on smooth, flat specimens from which dirt and scale have been cleaned
2. The test should not be made on specimens so thin that the impression shows through the metal, nor should impression be made too close to the edge of a specimen.

RESULT:

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EXPERIMENT No 3.

AIM:- To determined torsion test on mild steel rod.

OBJECT: - To conduct torsion test on mild steel or cast iron specimens to find out modulus of rigidity

APPRETERS: -
1. A torsion testing machine.
2. Twist meter for measuring angles of twist
3. A steel rule and calipers or micrometer.

DIAGRAM:-

THEORY: -

A torsion test is quite instrumental in determining the value of modulus of rigidity of a metallic specimen. The value of modulus of rigidity can be found out thought observations made during the experiment by using the torsion equation

$$\frac{T}{I\,p} = \frac{C\theta}{t} \quad \text{or} \quad C = \frac{T1}{Ip\theta}$$

Where,

T	=	Torque applied,
Ip	=	Polar moment of inertia,
C	=	Modulus of rigidity,
Θ	=	Angle of twist (radians), and
I	=	Gauge length

PROCEDURE:

1. Select the driving dogs to suit the size of the specimen and clamp it in the machine by means of a sliding spindle.
2. Measure the diameter at about three places and take the average value.
3. Choose the appropriate range by capacity change lever

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4. Set the maximum load pointer to zero.
5. Set the protector to zero for convenience and clamp it by means of knurled screw.
6. Carry out straining by rotating the handweel in either direction.
7. Load the machine in suitable increments, observing and strain readings,
8. Then load out to failure as out to failure as to cause equal increments of strain reading.
9. Plot a torque- twist (T- θ) graph.
10. Read off co-ordinates of a convenient point from the straight line portion of the torque twist(T- θ)graph and calculate the value of C by using relation

$$C = \frac{Tl}{\theta I_p}$$

OBESERVATION

Gauge length of the specimen, l = ………

Diameter of the specimen, d = ………

Polar moment of inertia, $I_p = \frac{\pi}{32} d^4 = ...$

OBESERVATION TABLE:

Torque (T)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Angle of twist(θ)in 'radians'															

PRECAUTION

RESULT

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EXPERIMENT No 4.

AIM: - To determined impact strength of steel.

OBJECT: - To Determine the impact strength of steel by Izod test

APPRETERS: -
1. Impact testing machine
2. A steel specimen 75 mm X 10mm X 10mm

DIAGRAM:-

THEORY:-

An impact test signifies toughness of material that is ability of material to absorb energy during plastic deformation. Static tension tests of unnotched specimens do not always reveal the susceptibility of a metal to brittle fracture. This important factor is determined by impact test. Toughness takes into account both the strength and ductility of the material. Several engineering materials have to withstand impact or suddenly applied loads while in service. Impact strengths are generally lower as compared to strengths achieved under slowly applied loads. Of all types of impact tests, the notch bar tests are most extensively used. Therefore, the impact test measures the energy necessary to fracture a standard notch bar by applying an impulse load. The test measures the notch toughness of material under shock loading. Values obtained from these tests are not of much utility to design problems directly and are highly arbitrary. Still it is

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important to note that it provides a good way of comparing toughness of various materials or toughness of the same material under different condition. This test can also be used to assess the ductile brittle transition temperature of the material occurring due to lowering of temperature.

PROCEDURE: **(a) Izod test**

1. With the striking hammer (pendulum) in safe test position, firmly hold the steel specimen in impact testing machine's vice in such a way that the notch face the hammer and is half inside and half above the top surface of the vice.
2. Bring the striking hammer to its top most striking position unless it is already there, and lock it at that position.
3. Bring indicator of the machine to zero, or follow the instructions of the operating manual supplied with the machine.
4. Release the hammer. It will fall due to gravity and break the specimen through its momentum, The total energy is not absorbed by the specimen. Then it continues to swing. At its topmost height after breaking the specimen, the indicator stops moving, While the pendulum falls back. Note the indicator at that topmost final position.

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5. Again bring back the hammer to its idle position and back

OBESERVATION

Izod test.

Impact value = --------------N-m

PRECAUTION

1. Measure the dimensions of the specimen cafully.
2. HoId the specimen (lzod test) firmly.
3. Note down readings carefully.

RESULT:

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EXPERIMENT No 05.

AIM: - To determined impact strength of steel.

OBJECT: - To Determine the impact strength of steel by Charpy test

APPRETERS: -
1. Impact testing machine
2. A steel specimen 55 mm X 10mm X 10mm

DIAGRAM:-

THEORY:-

An impact test signifies toughness of material that is ability of material to absorb energy during plastic deformation. Static tension tests of unnotched specimens do not always reveal the susceptibility of a metal to brittle fracture. This important factor is determined by impact test. Toughness takes into account both the strength and ductility of the material. Several engineering materials have to withstand impact or suddenly applied loads while in service. Impact strengths are generally lower as compared to strengths achieved under slowly applied loads. Of all types of impact tests, the notch bar tests are most extensively used. Therefore, the impact test measures the energy necessary to fracture a standard notch bar by applying an impulse load. The test measures the notch toughness of material under shock loading. Values obtained from these tests are not of much utility to design

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problems directly and are highly arbitrary. Still it is important to note that it provides a good way of comparing toughness of various materials or toughness of the same material under different condition. This test can also be used to assess the ductile brittle transition temperature of the material occurring due to lowering of temperature.

PROCEDURE: **(a) Charpy Test**

1. With the striking hammer (pendulum) in safe test position, firmly hold the steel specimen in impact testing machine’s vice in such a way that the notch face s the hammer and is half insider and half above the top surface of the vice.
2. Bring the striking hammer to its top most striking position unless it is already there, and lock it at that position.
3. Bring indicator of the machine to zero, or follow the instructions of the operating manual supplied with the machine.
4. Release the hammer. It will fall due to gravity and break the specimen through its momentum, The total energy is not absorbed by the specimen. Then it continues to swing. At its topmost height after breaking the specimen, the indicator stops moving, while the pendulum falls back. Note the indicator at that topmost final position.

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5. The specimen is placed on supports or anvil so that the blow of hammer is opposite to the notch.

OBESERVATION

Charpy test

Impact value = --------------Nm

PRECAUTION

1. Measure the dimensions of the specimen carefully.
2 Locate the specimen (Charpy test) in such a way that the hammer. Strikes it at the middle.
3 Note down readings carefully.

RESULT:

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EXPERIMENT NO 6.

AIM: - To determined young's modulus of elasticity of material of beam simply supported at ends

OBJECT:- To find the values of bending stresses and young's modulus of elasticity of the material of a beam simply supported at the ends and carrying a concentrated load at the centre

APPARATERS:-

a. Deflection of beam apparatus
b. Pan
c. Weight.
d. Beam of different cross-sections and material(say wooden and steel beams)

DIAGRAM:-

THEORY:-

If a beam is simply supported at the ends and carries a concentrated load at its centre, the beam bends concave upwards. The distance between the original position of the beams and its position after bending is different points along the length of the beam, being maximum at the centre in this case. This difference is know is 'deflection'

In this particular type of loading the maximum amount of deflection (δ) is given by the relation,

$$\delta = \frac{Wl^3}{48\ EI} \qquad \ldots\ldots\ldots\ldots \text{(i)}$$

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$$\delta = \frac{Wl^3}{48\,\delta\,I} \qquad \ldots\ldots \text{(ii)}$$

or,
where

W = Load acting at the center, N

l = Length of the beam between the supports mm

E = Young's modulus of material of the beam, N/mm^2

I = Second moment of area of the cross- section(e.i., moment of inertia)of the beam, about the neutral axis, $mm.^4$

Bending stress

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

Where, M = Bending moment, Nmm

I = Moment of inrtia, $mm.^4$

σ_b = Bending stress, n/mm^2, and

y = Distance of the top fiber of the beam from the neutral axis

PROCEDURE:

1. Adjust cast- iron block along the bed so that they are symmetrical with respect to the length of the bed.
2. Place the beam on the knife edges on the block so as to project equally beyond each knife edge. See that the load is applied at the centre of the beam
3. Note the initial reading of vernier scale.

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4. Add a weight of 20N (say) and again note the reading of the vrenier scale.
5. Go on taking readings adding 20N (say)each time till you have minimum six readings.
6. Find the deflection (δ) in each case by subtracting the initial reading of vernier scale.

7.Drew a graph between load (W) and deflection (δ) . On the graph choose any two convenient point and between these points find the corresponding values of W and δ. Putting these Values in the relation $\delta = \frac{Wl^3}{48\,\delta\, I}$ Calculate the value of E

8. Calculate the bending stresses for different loads using relation $\left(\delta_b = \frac{My}{I}\right)$ As given in the observation table

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OBESERVATION TABLE

S.No.	Load W (N)	Bending moment $M = \frac{WI}{4}$ (Nmm)	$\sigma_b = \frac{My}{I}$ (N/mm^2)	Defliection, δ (mm)	Young's Modulus of elasticity, $E = \frac{WI^3}{48\delta I}$
1					
2					
3					
4					
5					

PRECAUTION

1. Make sure that beam and load placed a proper position.
2. The cross- section of the beam should be large.
3. Note down the readings of the vernier scale carefully.

RESULT:

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EXPERIMENT NO 7.

AIM: - To determined Shear Test

OBJECT: - To conduct shear test on specimens under double shear:

APPARATRS: -

i) Universal testing machine.

ii) Shear test attachment.

iii) Given specimens.

DIAGRAM:-

THEORY:-

PROCEDURE:

1. Insert the specimen in position and grip one end of the attachment in the upper portion and one end in the lower portion.
2. Switch on the main switch of universal testing machine machine.
3. Bering the drag indicator in contact with the main indicator.
4. 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.
5. Operate (push) The buttons for driving the motor to drive the pump.
6. Gradually move the head control level in left-hand direction till the specimen shears.
7. Not down the load at which the specimen shears.
8. Stop the machine and remove the specimen

Repeat the experiment with other specimens.

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OBESERVATION TABLE:

PRECAUTION

1. The measuring range should not be changed at any stage during the test.
2. the inner diameter of the hole in the shear stress attachment should be slightly greater than that of the specimen.
3. Measure the diameter of the specimen accurately.

RESULT:

Shear strength of specimen = ……………… N/mm^2

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EXPERIMENT NO 8.

AIM: - To determined Spring Testing

OBJECT: - To determine the stiffness of the spring and modulus of rigidity of the spring wire

APPRETERS: -

i) Spring testing machine.
ii) A spring
iii) Vernier calliper.
iv) Micrometer .

DIAGRAM:-

THEORY:-

PROCEDURE:

1. By using the micrometer measure the diameter of the wire of the spring.
2. By using the vernier caliper measure the diameter of spring coils.
3. Count the number of turns.
4. Insert the spring in the spring testing machine and load the spring by a suitable weight and note the corresponding axial deflection in tension or compression.
5. Increase the load and take the corresponding axial deflection readings.
6. Plot a curve between load and deflection. The shape of the curve gives the stiffness of the spring.

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OBESERVATION

Least count of micrometer = ……mm

Diameter of the spring wire, d =………mm

(mean of three readings)

Least count of vernier caliper = ……mm

Diameter of the spring coil, D = ……mm

(mean of three readings)

Mean coil diameter, $D_m = D - d$……mm

Number of turns, n =

OBESERVATION TABLE:

S.NO	Load, W/ (N)	Deflection, δ /(mm)	Siffness, K = $\frac{W}{\delta}$ (N/mm)
1			
2			
3			
4			
5			

Mean k = ……

Modus of rigidity, $$C = \frac{8W D_m^3 n}{\delta d^4}$$

$$\text{Spring index} = \frac{D_m}{d}$$

PRECAUTION

RESULT:

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