



**BRCM COLLEGE OF
ENGINEERING & TECHNOLOGY
BAHAL, BHIWANI**

**Lab
Manual**

Practical Experiment Instructions Sheet

Exp. Title	To study the Brinell hardness testing machine & perform the Brinell hardness test.	EXP. NO. 1
SOM Lab	Semester-4th	Page No. 1- 3

Aim: To study the Brinell hardness testing machine & perform the Brinell hardness test.

Requirements:

1. Brinell Hardness Tester
2. Test Piece
3. Hardened steel ball 10mm diameter
4. Microscope

Theory:

Hardness represents the resistance of a material to indentation, and involves the measurement of plastic deformation caused when a loaded ball or diamond is applied to the surface of material.

Brinell Method: In this a hardened steel ball is pressed into the surface under a specified load which is held on for a fixed period and then released.

Brinell Hardness is defined as the quotient of the applied force F, divided by the spherical area of impression.

From fig..... we find that:

Brinell Hardness, HB = Test load/Surface area of indentation

$$= 2F/\pi D(D-\sqrt{D^2-d^2}) \text{ N/mm}^2$$

Procedure:

1. Place the test specimen and the test table of the testing machine.
2. Apply load slowly and progressively to the specimen at right angle to the surface and maintain full load for 15 seconds.
3. Release the load and remove the specimen from the table.
4. Measure the diameter of impression on the test specimen by microscope fitted with a scale.

Observations:

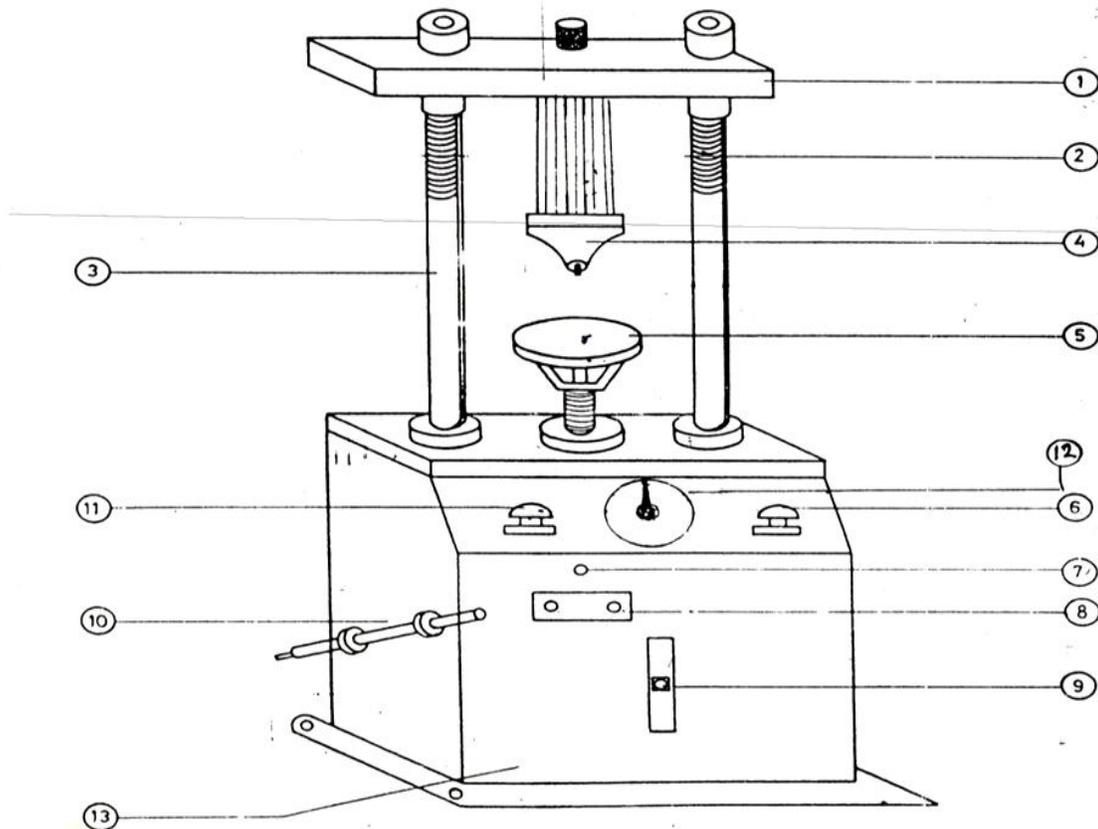
Material of test piece =
Diameter of ball =
Load 'F' =
Load application time =
Diameter of Impression 'd' =

Calculations:

Brinell Hardness HB = Test load / Surface area of indentation

$$= \frac{2F}{\pi D(D - \sqrt{D^2 - d^2})} \text{ N/mm}^2$$

BRINELL HARDNESS TESTER 3000 Kgf CAPACITY



Brinell Hardness Testing Machine

Sr. No	DESCRIPTIONS
<u>1</u>	ADJUSTABLE CROSS HEAD
<u>2</u>	PROVING RING DYNAMOMETER
<u>3</u>	CRROMIUM PLATED PILLARS
<u>4</u>	BALL INDENTOR
<u>5</u>	BASE PLATE
<u>6</u>	CONTROL VALVE
<u>7</u>	INDCATOR
<u>8</u>	ON/OFF PUSH BUTTON
<u>9</u>	PROVISION FOR HAND OPERATION
<u>10</u>	HANDLE FOR MANUAL OPERATION
<u>11</u>	RELEASE VALVE
<u>12</u>	DIAL GAUGE
<u>13</u>	DUST PROOF CABINET

Precautions:

1. The surface of test piece should be smooth and test spot free of oil and dirt should be polished to get a clear impression.
2. The load value of indenter diameter should be selected from table 1 depending upon material of test specimen of its thickness.

Result:

Brinell Hardness =



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Exp. Title	To study the Rockwell hardness testing machine & perform the Rockwell hardness test.	EXP. NO. 2
SOM Lab	Semester-4th	Page No. 4 -5

AIM: To study the Rockwell hardness testing machine & perform the Rockwell hardness test.

APPARATUS REQUIRED: 1. Emery paper 2. Penetrator

THOERY:

In Rock well hardness test consists in touching an indenter of standard cone or ball into the surface of a test piece in two operations and measuring the permanent increase of depth of indentation of this indenter under specified condition. From it Rockwell hardness is deduced. The ball (B) is used for soft materials (e.g. mild steel, cast iron, Aluminum, brass.Etc.) And the cone (C) for hard ones (High carbon steel. etc.)

HRB means Rockwell hardness measured on B scale

HRC means Rock well hardness measured on C scale.

PROCEDURE:

1. Clean the surface of the specimen with an emery sheet.
2. Place the specimen on the testing platform.
3. Raise the platform until the longer needle comes to rest
4. Release the load.
5. Apply the load and maintain until the longer needle comes to rest
6. After releasing the load, note down the dial reading.
7. The dial reading gives the Rockwell hardness number of the specimen.
8. Repeat the same procedure three times with specimen.
9. Find the average. This gives the Rockwell hardness number of the given specimen.

TABULATION

S.No.	Material	Scale	Load (kgf)	Rockwell hardness			Rockwell hardness Number(Mean)
				1	2	3	

RESULT:

Rockwell hardness number of the given material is _____



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Practical Experiment Instructions Sheet

Exp. Title	To study the Erichsen sheet metal testing machine & perform the Erichsen sheet metal test	EXP. NO. 3
SOM Lab	Semester-4th	Page No. 6 -7

Aim: To study the Erichsen sheet metal testing machine & perform the Erichsen sheet metal test.

Requirements: Cupping test machine, test specimen, vernier calliper, steel rule.

Theory:

This is a mechanical test used to determine the ductility and drawing properties of sheet metal. It consists in measuring the maximum depth of bulge or cup which can be formed before fracture.

Cupping number is the depth of impression at fracture, in the cupping test, usually expressed in millimetres.

Procedure:

1. Measure the dimension of the test piece.
2. Place the test piece in the machine dies and touch the penetrator.
3. Rotate the handle of the machine to penetrate the penetrator in the test piece by pressing the retaining ring.
4. As soon as crack appears in the test piece stop rotating the handle.
5. Determine the depth of cup from med, which is the cupping number.

OBSERVATION:

1. Thickness of testpiece: 0.5 to 2 mm.
2. Rotation speed: 5 to 20 mm per minute.
3. Diameter of ball: 20 mm

Sr.No.	Test piece thickness in mm	Reading		Cupping Number
		Initial	Final	
1				

2			
---	--	--	--

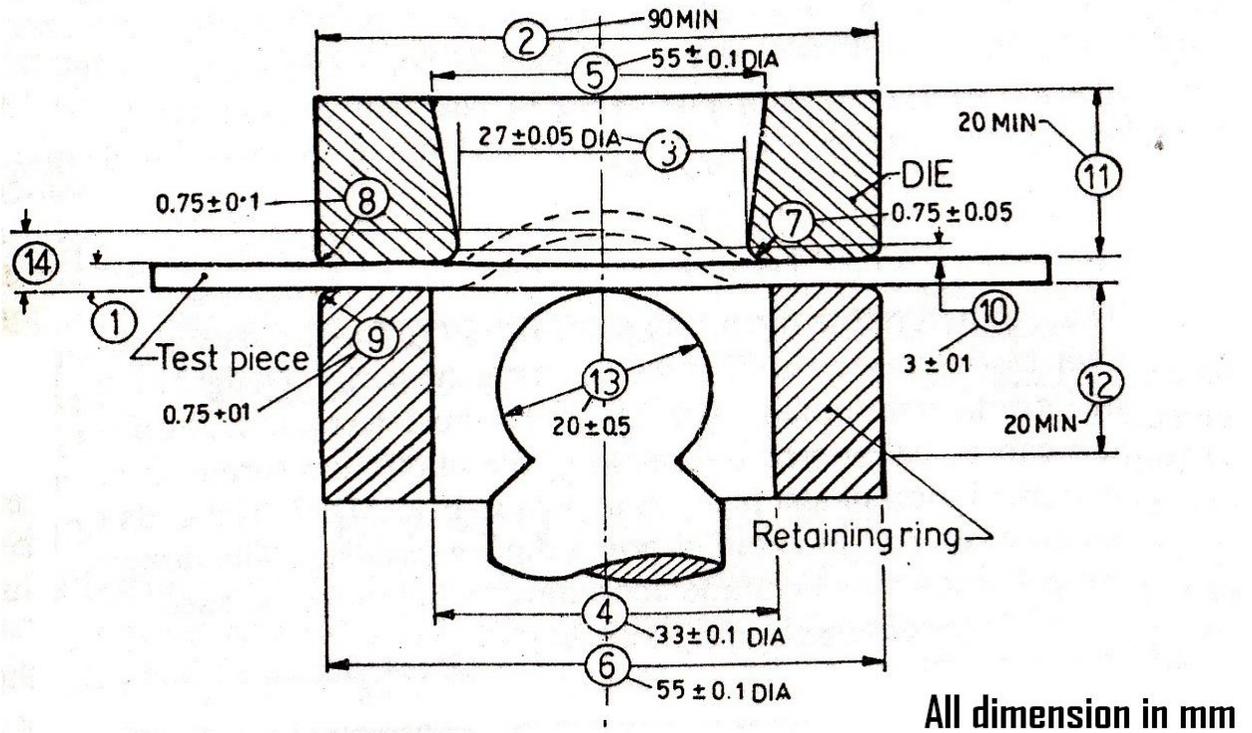


FIG.-MODIFIED ERICHSEN CUPPING TEST

Precaution:

1. Test piece should be perfectly flat.
2. Testpiece should be free from foreign matter.
3. The cup formed should be continuously watched.
4. The handle should be rotated uniformly and continuously.

Sources of error:

1. Handle being rotated with jerks.
2. Test piece not perfectly flat.



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Practical Experiment Instructions Sheet

Exp. Title	To study the Impact testing machine and perform the Impact tests (Izod & Charpy).	EXP. NO. 4
SOM Lab	Semester-4th	Page No. 8-11

(A)

Aim: To determine the impact strength of a given specimen by Izod test.

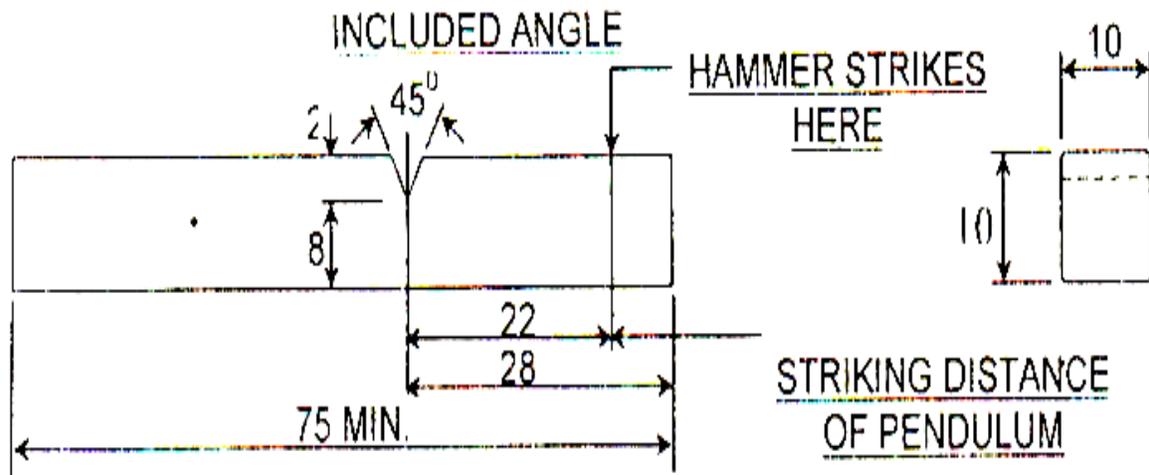
Apparatus Used: Mild Steel Specimen, Impact testing machine

Theory:-

Impact: The capacity of a material to resist or absorb shock energy before it fractures is called Impact.

Strength: The strength of material is ability to resist the action of an external force without breaking. It is usually defined as tensile strength, Compressive strength, Shear strength etc. Energy absorbed by specimen during impact test is known as impact strength.

Izod Impact Test: In the Izod impact test, the surface of the specimen should be smooth and free from grooves running parallel to the plane of symmetry of notch. The centre of percussion shall be at the point of Impact of the hammer.



SINGLE - NOTCH SQ. SPECIMEN FOR IZOD IMPACT TEST

The machine should have following specification:

Angle between top of grip and face holding the specimen vertical: 90°

Angle of tip of hammer: 75°

Angle between normal to the specimen and the underside of the hammer at striking point: 10°

Speed of hammer Impact: 3 to 4 m/s.

Striking energy: 165.6 ± 3.4 N-m

The longitudinal axis of the test piece should lie in the plane of swing of the centre of gravity of the hammer. The notch shall be positioned so that its plane of symmetry coincides with the top face of the grips. The notch shall be at right angle to the plane of swing of centre of gravity of hammer.

Procedure:

1. The given specimen is fully or dimensionally prepared in a lab.
2. To locate the position of specimen where experiment will be done.
3. To set the pointer in Izod scale set.
4. Take the reading from the performance.

Observation:

Charpy Notched Impact test:

The test piece should be machined all over at 55 mm long and off square cross-section with 10 mm side. The notch is made at the centre of the test specimen.

The notch should be prepared carefully by any machining method like milling, shaping. The test piece should lie squarely against the supports with the plane of the notch within 0.5 mm at the plane midway between them.

Specimen: A standard mild steel specimen of square section 10×10×55 mm, with a 45° V-Notch of 2 mm depth, provided at the centre of one side and is supported horizontally.

Procedure:

1. The given specimen is fully or dimensionally prepared on a lab.
2. To locate the position of specimen where experiment will be done.
3. To set the pointer in a charpy scale set.
4. Take the reading from the performance.

Observation:

S.No.	Initial Reading	Final Reading	No. of division (Initial-Final Reading)	Observed Energy (2× No. of division)	Mean Energy Stored
1					
2					
3					
4					
5					

Result: Mean energy stored by the specimen= J



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Practical Experiment Instructions Sheet

Exp. Title	To study the Universal testing machine and perform the tensile test.	EXP. NO. 5
SOM Lab	Semester-4th	Page No. 12-14

Aim: To study the Universal Testing Machine & perform the Tensile Test.

Requirements:

1. Universal Testing Machine
2. Test specimen
3. Micrometer
4. Steel scale

Theory:

When a metal piece is loaded by tensile force, metal piece get strained due to which tensile stress is induced in test specimen. Tensile test consists in straining a test piece by tensile stress, generally to fracture, with a view of determining one or more of the continuously properties. This test is done on UTM.

UTM: This machine is consists of three cross heads. Upper & Lower cross heads are rigidly connected to columns. Lower cross heads is connected to the working piston & third cross head can be moved up with the help of motor by rotating the threaded spindles. Specimen is fixed between two cross heads according to tensile or compression test.

Procedure:

1. The diameter of the test piece is measured by means of a micrometer at least at three plane and determine the mean value. The gauge length is marked.
2. Suitable scale is selected.
3. The test specimen in the grips is inserted by adjusting the cross-heads of the machine.
4. The extensometer on the test piece and set its scale dials to zero position.
5. Graph recording system is activated.
6. Machine is started and readings of dials on the extensometer is taken for a particular value of load.
7. The rate of loading may be 10 mpc/sec initially and should be reduced to 7.5mpc/sec. when the yield point is reached.
8. Load is applied continuously till the specimen breaks and then stop the machine.
9. Plot load vs extension diagram.

Observation:

L.C. of micrometer =

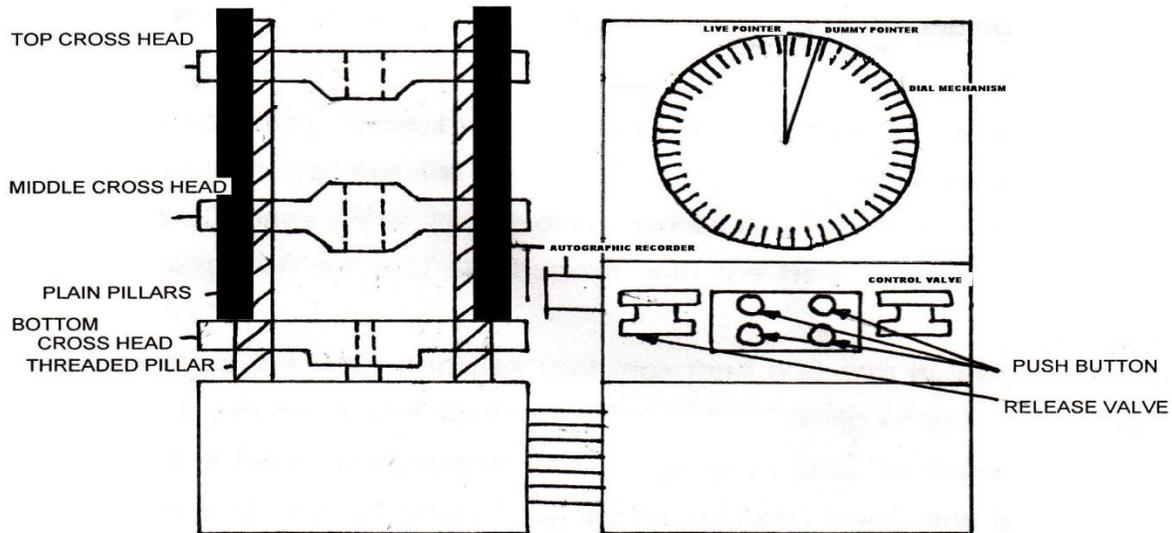
Original dia. of specimen (d) =

Dia after fracture (du) =

Gauge length (Lo) =

Total length after fracture (Lu) =

L.C. of extensometer =



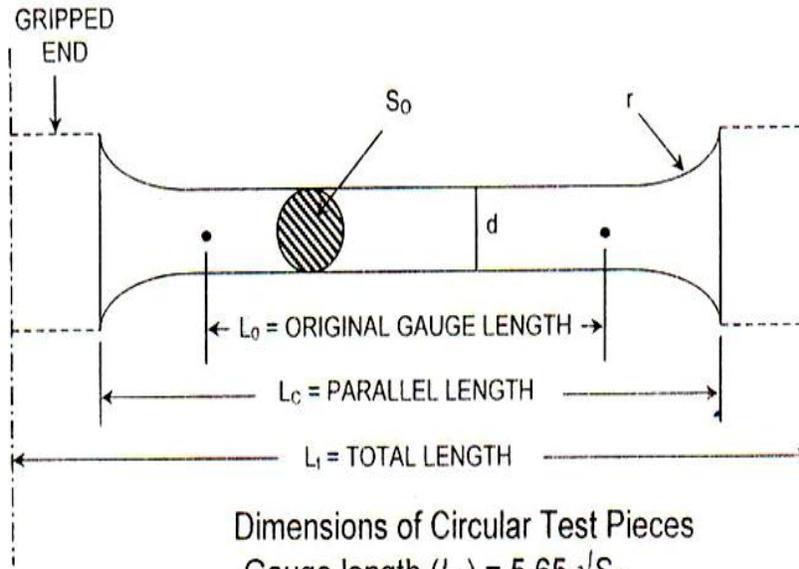
UNIVERSAL TESTING MACHINE

Calculations:

Stress (Strength) = Load/Area

Percentage elongation = $100(L_u - L_o)/L_o$

Percentage reduction in area = $100(S_u - S_o)/S_o$



Dimensions of Circular Test Pieces
 Gauge length (L_0) = $5.65 \sqrt{S_0}$

Cross Sectional area (S_0) (mm ²)	Diameter (d) (mm)	Gauge length (L_0) (mm)	Minimum parallel length $L_c = 5.5 d$ (mm)	Minimum transition radius (r) (mm)
400	22.56	113	124	23.5
200	15.96	80	88	15
150	13.82	69	69*	13
100	11.28	56	56	10
50	7.98	40	40	8
25	5.64	28	28	5
12.5	3.99	20	20	4

Results:

- Proportional limit, MPa =
- Yield strength, Mpa =
- Percentage elongation =
- Ultimate Strength, MPa =
- Percentage reduction in area =
- Breaking strength, MPa =
- Modulus of elasticity (GPa) =



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Practical Experiment Instructions Sheet

Exp. Title	To perform compression & bending tests on UTM.	EXP. NO. 6
SOM Lab	Semester-4th	Page No. 15-17

Aim: To perform Compression test & find out the compressive strength of test piece.

Requirements:

1. Universal Testing Machine
2. Test piece

Theory:

Compression Test consists in straining a test piece by compression loading. Specimen for compression test on metal are usually circular, and for concrete square, in-section. To prevent failure by bulking, the length should be of about the same order as the minimum width. In the ductile material distortion takes place while in case of brittle materials, usually fail by shearing.

Procedure:

1. Measure the diameter of the test piece at three different planes and take the average value.
2. Place the specimen between middle and lower cross heads and apply the compressive load.
3. Increase the load gradually until the specimen fails.

Observations:

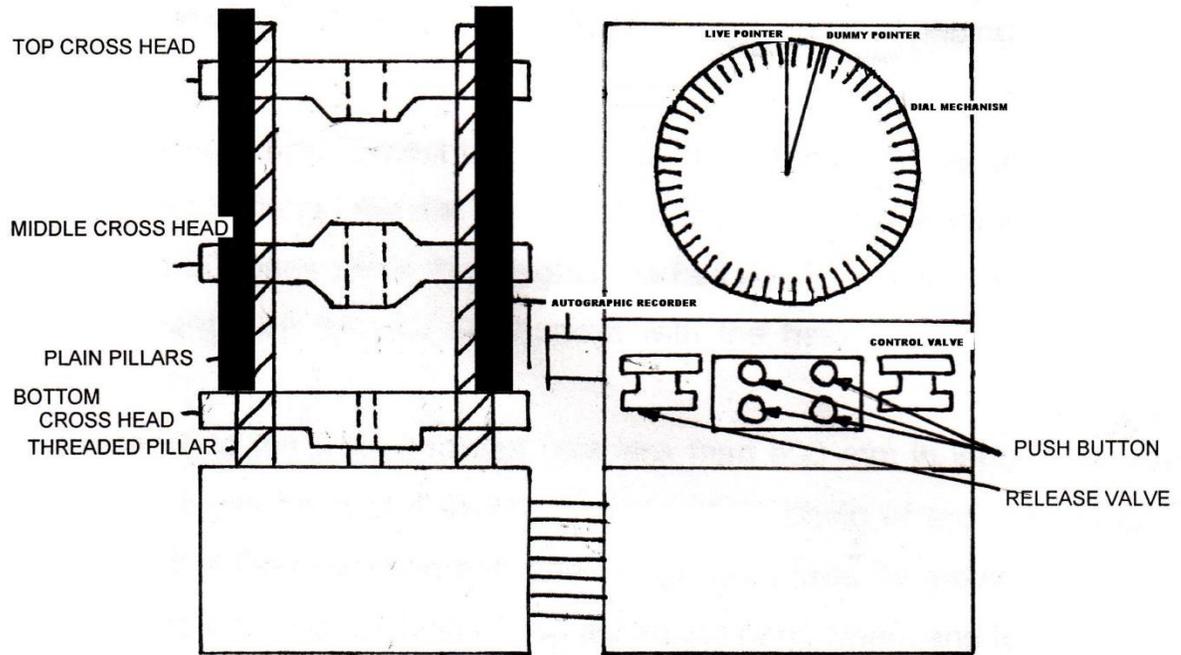
Ultimate load =
Average diameter of test piece (D) =

Calculations:

Cross-sectional area =
Ultimate compressive strength =

Precautions:

1. The specimen should be straight and ends of specimen must be at right angle to the axis of specimen.
2. The length of specimen has to be kept small to avoid the buckling of the specimen.



UNIVERSAL TESTING MACHINE

Result:

Ultimate Compressive Strength =

Aim: To perform bend test on universal testing machine

Apparatus: UTM machine, wooden specimen of rectangular section, bending dogs, scale.

Theory:

When a beam is subjected to a bending moment M . Bending theory relates the moment to the beam's curvature, deflection and stress.

Assumptions:

- 1) Small deflections
- 2) Linear-elastic behavior
- 3) Plane sections remain plane - line ab straight before and after bending
- 4) Pure bending - no shear or axial forces - in practice stress and deflections due to shear and axial forces can be calculated separately and added on using superposition.

Overall simple bending equation $M/I = E/R = \sigma/y$

- Procedure:**
- (i) Measure the dimensions of the specimen of wood.
 - (ii) Note the zero error on UTM if any.
 - (iii) Place the wooden specimen in the lower zone (compression zone) of UTM
 - (iv) Fix the bending dogs in UTM.
 - (v) Lower the moveable arm of the UTM so that bending dog touches the specimen firmly.
 - (vi) Read the load on the machine if any.
 - (vii) Now apply load on the specimen with the help of loading wheel slowly till the wooden beam breaks.
 - (viii) Note the load on the UTM.
 - (ix) Calculate moment of inertia ' I ' of the specimen.
 - (x) Measure y of the beam.
 - (xi) Calculate the stress at rupture by using the simple bending equation.
 - (xii) Find the standard value of rupture stress from the handbook.
 - (xiii) Compare the determined and standard value and write the possible reasons of deviations.



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Practical Experiment Instructions Sheet

Exp. Title	To perform the shear test on UTM.	EXP. NO. 7
SOM Lab	Semester-4th	Page No. 18

Aim: To perform the shear test on UTM.

Apparatus Used: A UTM, Specimen, shearing attachment, vernier caliper etc.

Theory: A type of force which causes or tends to cause two contiguous parts of the body to slide relative to each other in a direction parallel to their plane of contact is called the shear force. The stress required to produce fracture in the plane of cross-section, acted on by the shear force is called shear strength.

Procedure:

The method for determining the shear strength consists of subjecting a suitable length of steel specimen in full cross-section to double shear, using a suitable test rig, in a testing m/c under a compressive load or tensile pull and recording the maximum load 'F' to fracture.

Observation:

- Applied compressive force (F) = -----kgf.
- Diameter of specimen = -----mm.

Calculations:

The shear strength shall be calculated from the following formulae :

$$\tau_s = (F/2) / (\pi d^2/4) = 2F / \pi d^2$$

where 'd' is the actual diameter of the specimen

Conclusion: Shear strength of specimen = -----



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Practical Experiment Instructions Sheet

Exp. Title	To study the torsion testing machine and perform the torsion test.	EXP. NO. 8
SOM Lab	Semester-4th	Page No. 19-22

Aim: To study the Torsion Testing Machine & perform torsion test.

Requirements:

1. Torsion Testing Machine
2. Specimen
3. Micrometer
4. Steel Scale

Theory:

A circular cylindrical shaft is said to be subjected to pure torsion when the torsion is caused by a couple, so that the axis of the applied couple coincides with the axis of the shaft. In such a case the state of stress at any point in the cross-section of the shaft is pure shear.

Torsional formula is given by:

$$T/J = t/r = G\theta/L$$

Where,

- T= Twisting Moment
- J= Polar M.O.I. of original cross-section
- t= Shear Stress induced in specimen
- r= Radius of original cross-section
- G= Modulus of Rigidity
- θ = Angle of Twist
- L= Parallel length of initial specimen

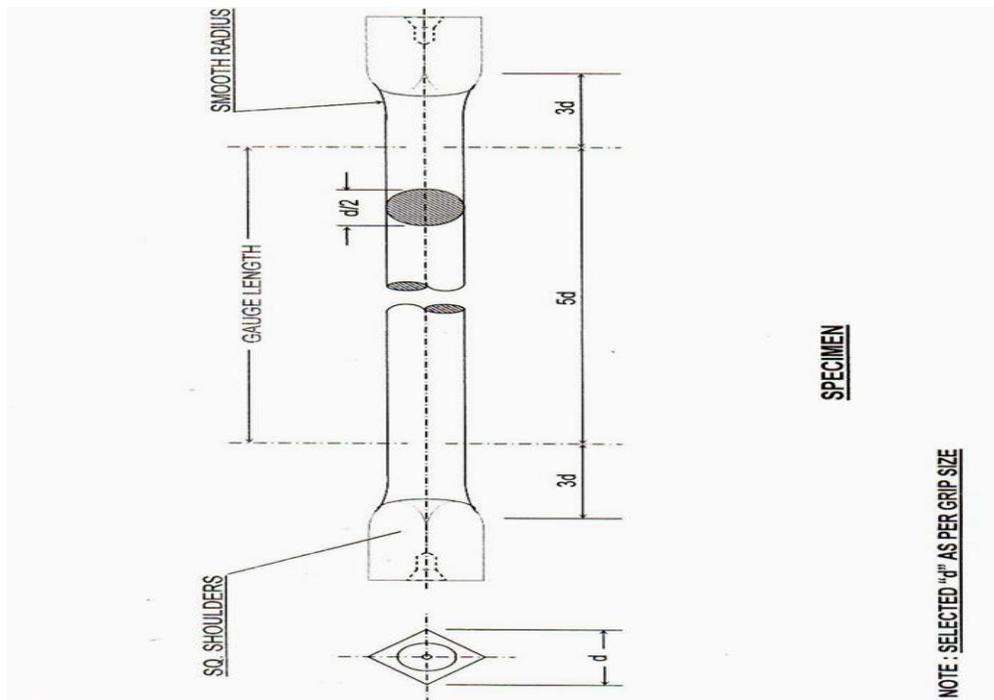
Procedure:

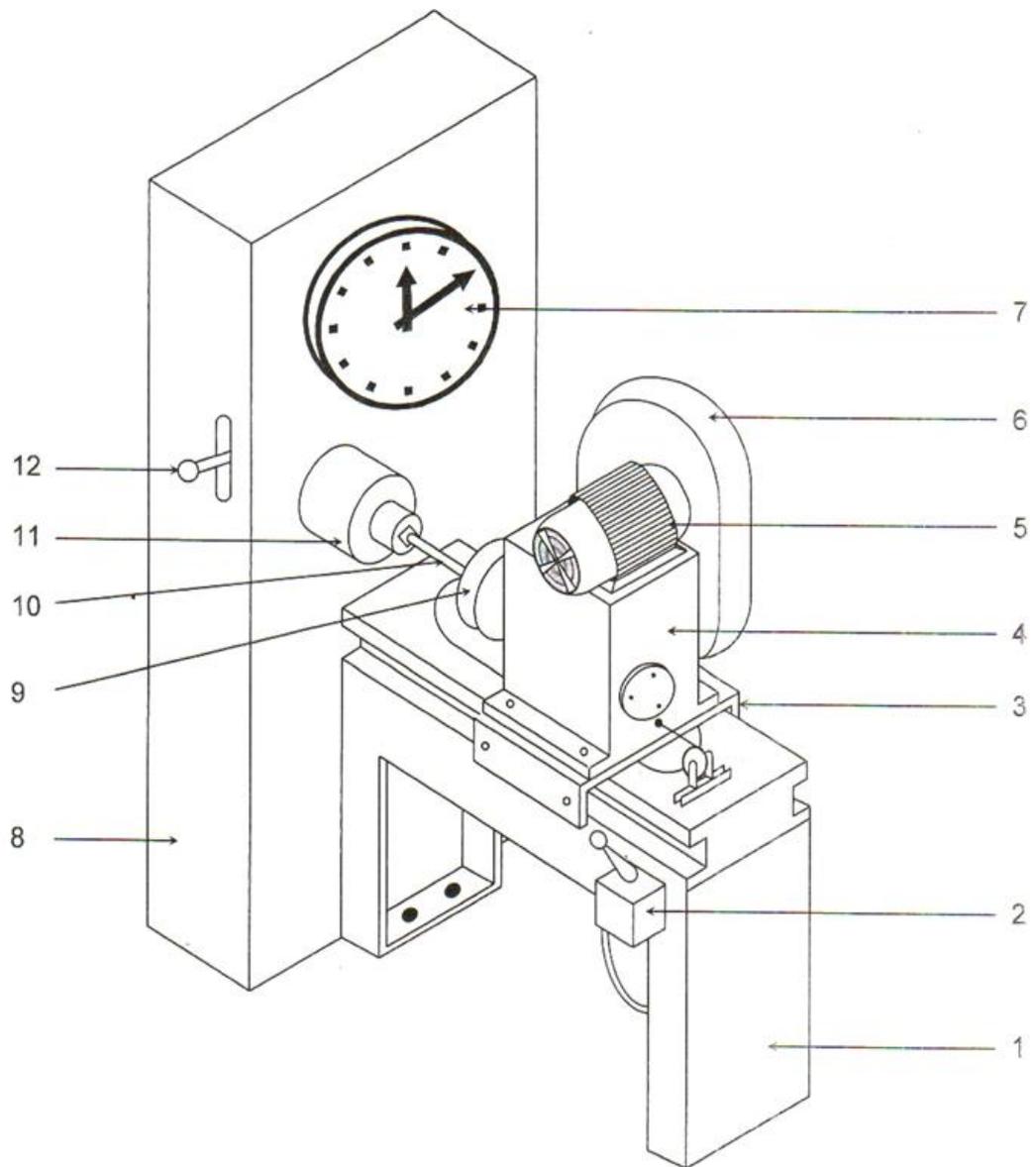
1. Measure the diameter of the test piece of four different planes on its parallel length by using a Micrometer. At each plane measure the diameter at right angle to each other.
2. Measure the parallel length of the test piece.
3. Insert the test piece in the grips of the machine.
4. Select a suitable scale on the digital indicator and adjust the initial torque and angle of twist reading to zero position.
5. Apply the torque on specimen with the driving chuck. To activate the driving chuck, switch on the. Electrical lever control, with this, the test specimen start twisting and with the increased load, the digital display on the digital indicator unit progressed.

6. Torque is applied until specimen breaks and maximum torque that sample has taken is read out from Digital Indicator unit by pressing the PEAK push button.
7. Angle of twist is noted from Angle of twist measuring wheel after the specimen has failed.
8. Initially a line may be marked parallel to the length of the test piece to visually see the helix formation.

Observations:-

1. Material of test specimen=
2. Least count of micrometer=
3. Parallel length of test specimen=
4. Diameter:
5. Maximum torque (N-m) =
6. Breaking torque (N-m) =
7. Angle of twist θ =





**TORSION TESTING M/C
(FOR RODS)**

S. No.	DESCRIPTION	S. No.	DESCRIPTION
1	Base Frame	7	Dial Gauge
2	On - Off Switch	8	Measuring Panel
3	Trolley	9	Drive Chuck
4	Gear Box	10	Test Piece
5	Motor	11	Driven Chuck
6	Chain Guard	12	Rack

Calculations:-

Modulus of rupture $t_s = Tr/J$

Modulus of rigidity $G = Tl/J\theta$

Where:

T= Maximum twisting moment.

r= Original outer radius of specimen

J= Polar moment of inertia of the original cross-section

θ = Angle of twist

l= Parallel length of specimen.

Results:-

1. Maximum torque=

2. Breaking torque=

3. Total angle of twist to fracture

4. Modulus of rupture=

5. Modulus of rigidity=



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Practical Experiment Instructions Sheet

Exp. Title	To determine Mechanical Advantage and Efficiency of Single and Double Purchase Winch Crab.	EXP. NO. 9
SOM Lab	Semester-4th	Page No. 23-25

Aim: To determine Mechanical Advantage and Efficiency of Single and Double Purchase Winch Crab.

Apparatus used: Winch crab apparatus, weights.

Theory: Winch crab is a kind of lifting m/c in which velocity ratio obtained by employing spur gears. This m/c. is basically used on boats ships to raise starboard or tightening rope and on bridges and dam to operate lockage. These are classified as:

1. Single purchase Winch crab.
2. Double purchase Winch Crab

Single Purchase Winch Crab :- It consists of two parallel spindles, upper one called effort spindle and lower one is called as load spindle. One effort spindle a small touched wheel pinion is mounted in such a way that pinion and a lever is attached to apply the effort. On load spindle, a large toothed wheel known as spur wheel is mounted in such a way that pinion meshes with it. The load spindle also carries a cylinder of dia 'd'. Both the spindles are suitably mounted on a rigid frame. A rope is wound round the cylinder while load is attached on the other end,

Let,

P = Effort applied

W = load lifted

T_p = No. of teeth on pinion

T_w = No. of teeth on wheel

l = length of the lever arm

d = diameter of the cylinder

Suppose, lever arm is rotated by one revolution

Therefore distance moved by effort = $2\pi l$

The pinion will also make one revolution and the spur wheel makes T_p/T_w rev.

Distance moved by load in T_p/T_w revolutions of spur wheel = $\pi d * T_p/T_w$

Velocity ratio = Distance moved by effort / Distance moved load.

$$= 2\pi l / \pi d * T_w / T_p$$

$$= 2l / d * T_w / T_p$$

$$M. A. = W / P$$

Double Purchase Winch Crab :- In this case to obtain velocity ratio compound gear train is used, because intermediately gears are compound wheel mounted on the same shaft. Other arrangements are similar to that of single purchase winch crab.

Let,

T1 & T3 = No. of teeth on pinion.

T2 & T4 = No. of teeth on the spur wheels.

l = Length of the lever

d = Dia. of the load spindle

W = Load lifted,

P = Effort applied to lift the load, at the end of the handle.

For one revolution of lever, distance moved by effort is $2\pi l$,

No. of revolutions made by spur wheel of load spindle can be calculated by considering it a case of compound by train.

Therefore No. of revolutions made by the pinion-1 = 1

And no. of revolutions made by the wheel-2 = $T1 / T2$ = revolution of pinion-3

And no. of revolutions made by the wheel-4 = $T1 \times T3 / T2 \times T4$

Distance moved by load = $\pi d \times T1 \times T3 / T2 \times T4$

$$V.R. = 2l / d * T2 \times T4 / T1 \times T3$$

Procedure:

1. Count the number of teeth of the pinion A and spur gear B.
2. Measure the circumference of pulley and of load drum with a string and meter rod or measure the diameter with an outside caliper.
3. Wrap the string round the effort pulley and the other free end of the string will carry the effort.
4. Wrap another string round the load drum to carry load W in such a manner so that as the effort is applied, the load is lifted up.
5. Suspend a load W on the string of the load drum and put the weights in the effort pan so that load start moving up gradually.
6. Note down the values of W and P and calculate the M.A., V.R. and efficiency.
7. Increase the load W and again find the value of P.
8. In this way take at least six reading at different values of load.
9. Plot the graph between W & P and W & Efficiency.
10. Take W along horizontal axis.
11. Repeat the same procedure for double winch crab.

Observation:

For single winch crab:

S.No.	Load (W) in Nt.	Effort (P) in Nt.	Distance moved by effort	Distance moved by load	V.R.	M.A.	Efficiency

For double winch crab:

S.No.	Load (W) in Nt.	Effort (P) in Nt.	Distance moved by effort	Distance moved by load	V.R.	M.A.	Efficiency

Calculations:

$$M.A. = W/P$$

$$V.R. =$$

$$\text{Efficiency} = M.A./V.R$$

Conclusion: Hence the winch crab is studied.



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Exp. Title	To determine Mechanical Advantage, V.R. and Efficiency of worm and worm gear of single, double and triple start.	EXP. NO. 10
SOM Lab	Semester-4th	Page No. 26-28

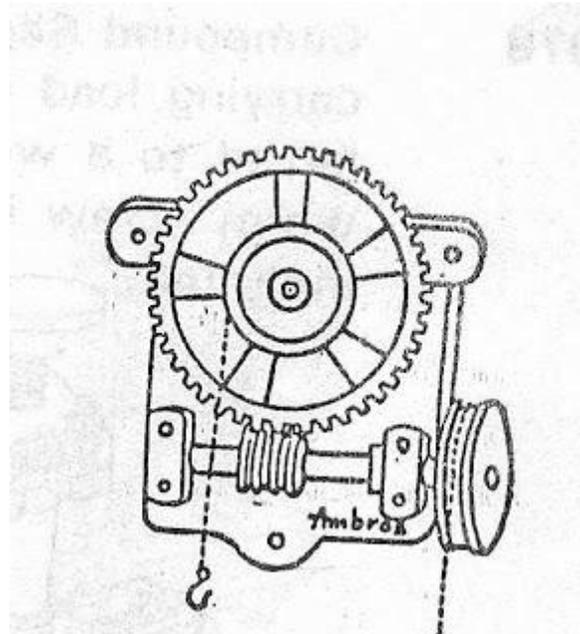
Aim: To determine Mechanical Advantage, V.R. and Efficiency of worm and worm gear of single, double and triple start.

Apparatus: Worm and worm gear of single, double and triple start and weights.

Theory: As the pulley of the worm moves through n revolutions, n teeth of the wheel pass completely through the worm. If there are N teeth in the worm wheel, then N revolutions will have to be given to the pulley of the worm to rotate completely the worm wheel. So that if the effort applied at the pulley of the worm moves through N revolution the load is raised up by the a distance equal to the length of the circumference of the pulley of the worm wheel.

So that velocity ratio is

$$\frac{N \times \text{circumference of pulley of worm}}{\text{Circumference of pulley of worm wheel}}$$



Procedure:

1. Wrap the string round the pulley of the worm the free end of which is to be tied to the effort.
2. Wrap another string to carry the load round the pulley the worm wheel in such a manner that as the effort is applied the load is lifted up.
3. Suspend a small weight (w) through the free end of the second string and suspend another weight (p) through the free end of the first string which should just move the load upward.
4. Note w and P, so that mechanical advantage is given by W/ P
5. Increase the load (w) gradually and increase the effort (p) correspondingly and take in this way about seven readings.
6. Measure the circumference of the pulley of the worm and also that of the worm wheel.
7. The percentage efficiency is given by $W \times 100 / PV$
8. Plot a graph between w and p.
9. The same procedure can be followed for single, double and triple start worm and worm wheel.

Observations :

1. Circumference of pulley of the worm ($2\pi R_1$) = _____ cm.
2. Circumference of pulley of the worm wheel ($2\pi R_2$) = _____ cm.
3. No of teeth in the worm wheel (N) = _____
4. Velocity ratio for single start = $(N \times 2\pi R_1) / ((2\pi R_2) \times 1)$
5. Velocity ratio for double start = $(N \times 2\pi R_1) / ((2\pi R_2) \times 2)$
6. Velocity ratio for triple start = $(N \times 2\pi R_1) / ((2\pi R_2) \times 3)$

Observations Table for single start:

S. No.	Weight Lifted (W)	Effort Applied (P)	Mech. Adv. = W/P	Velocity Ratio	% Efficiency = $W/PV \times 100$
1					
2					
3					
4					
5					
6					

Observations Table for double start:

S. No.	Weight Lifted (W)	Effort Applied (P)	Mech. Adv. = W/P	Velocity Ratio	% Efficiency = W/PV x 100
1					
2					
3					
4					
5					
6					

Observations Table for triple start:

S. No.	Weight Lifted (W)	Effort Applied (P)	Mech. Adv. = W/P	Velocity Ratio	% Efficiency = W/PV x 100
1					
2					
3					
4					
5					
6					

Conclusion: Hence the efficiency of single, double and triple worm and worm wheel is completed.



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**Lab
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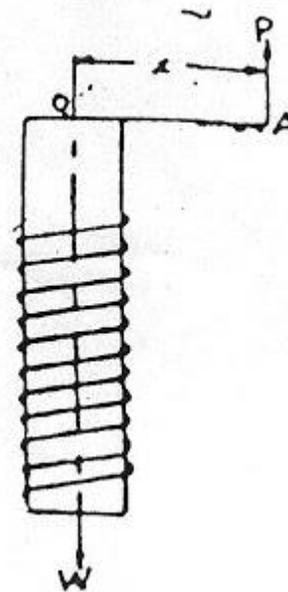
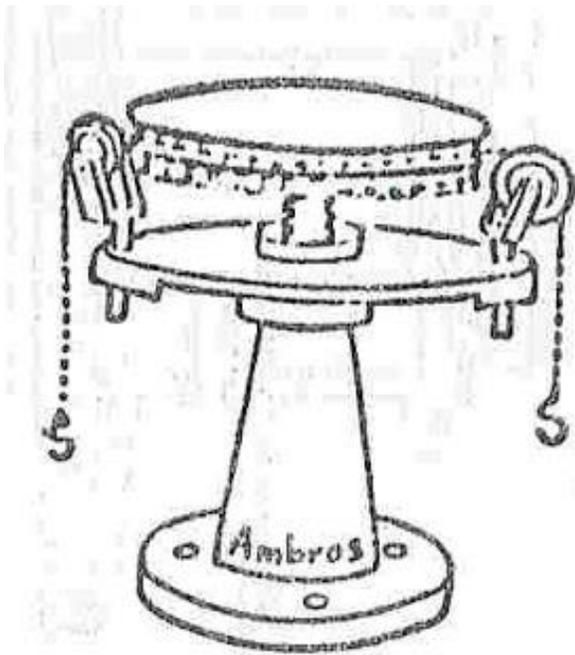
Practical Experiment Instructions Sheet

Exp. Title	To determine the M.A., V.R. and efficiency of a square thread screw jack and plot a graph between W and P and W and efficiency.	EXP. NO. 11
SOM Lab	Semester-4th	Page No. 29- 31

Aim: To determine the M.A., V .R. and efficiency of a square thread screw jack and plot a graph between W and P and W and efficiency.

Apparatus used:

1. Screw Jack Apparatus
2. Slotted & Conical Weights
3. Nylon String
4. Meter Rod & Pan



Theory:

This machine is used for lifting heavy load with the application of a smaller effort. It may have different shapes but the principle is same I, e, it works on the principle of a screw. The screw head carries the load w . the nut is fixed and the screw is rotated by means of a lever. The effort p is applied at the screw is rotated by means of a lever. The effort p is applied at the end of the lever. Please see fig.

Now if the screw head revolves through n number of revolutions, the load w placed on the screw head will move by a distance $p \times n$, where p is the pitch of the screw thread. The effort p will move a distance $n \times 2R$, where $2R$ is the circumference of the screw head over which P is coming.

There fore

$$V = \frac{\text{Distance moved by the effort } P}{\text{Distance moved by the load } W}$$
$$= \frac{n \times 2R}{n \times p} = \frac{2R}{p}$$

Procedure:

1. Wrap on string round the circumference of the screw head and take it over a small pulley . Effort p_1 is tied to the free end of this string.
2. Wrap another string around the circumference of the screw head in the same direction in which the above string is wounded and take it over the other small pulley.
3. Place a load w on the screw head.
4. Suspend p_1 and p_2 to the free ends of both the strings coming over the two small pulleys. This load p_1 and p_2 should be increased gradually suitable to give a just upward motion to the load w placed on the screw head.
5. Note down w and p to determine the M.A. i.e w/p . in this case p_1+p_2 will be the value of p .
6. p_1 and p_2 should be noted down carefully.
7. Take in this way about 10 reading by increasing w and finding out the corresponding value of $P(p_1+p_2)$.
8. Measure the circumference of the screw head.
9. Measure the pitch i.e. the distance between the two consecutive threads.

Observations

1. Circumference of the screw Head = $2\pi R =$
2. Pitch =

S. No.	Load Lifted Upward W	Effort P1	Effort P2	Total Effort P1+P2	M.A. = W/P	Velocity Ratio V	Percentage Efficiency
1.							
2.							
3.							
4.							
5.							

Conclusion: Hence efficiency of the screw jack is determined as _____.