MEASUREMENT OF BORES BY INTERNAL MICROMETER AND DIAL BORE INDICATOR

Aim:
To measure the diameters of the given work piece at various sections using micrometer.

Equipment Required:

1. Outside micrometers range = (0-25mm)
2. Work piece of various cross sections with different diameters.

Principle:
Micrometer is one of the most common and most popular forms of measuring instrument for precise measurement with 0.01mm accuracy. It works on the principle of screw and nut. We know that when a screw is rotated through one revolution it advances by one pitch distance i.e. one rotation of screw corresponding to a linear movement of a distance equal to pitch of the screw thread. If the circumference of the screw is divided into number of equal parts say n its rotation through one division will cause the screw to advance through (pitch/n) length.

Least Count of Micrometers:
Least count is the minimum distance which can be measurement accurately by the instruments. The micrometer has a screw of 0.5mm pitch, with a thimble graduated in 50 divisions to provide a direct reading of pitch/n.
Least count of micrometer

Total reading = main scale reading + L.C x (reading on thimble)

Procedure:

1. The least count is to be determined.
2. The w/p is placed between the two anvils after the instruments are adjusted for zero error.
3. Work piece is held strongly without applying under pressure on the instrument.
4. The value of the main scale is noted down. The main scale division just coincides with the index line. This is called the main scale division which just procedures edge of the main scale is noteddown. This is called thimble scale reading (T.S.R).

Diameter of the work piece is given by
D= main scale reading + L.C. x (Thimble scale reading)

Precautions:
1. First clean the micrometer by wiping off all the dirt, dust and grit etc.
2. Clean the measuring faces of paper or cloth.
3. Set the zero reading of the instrument to before measuring

Observations;

1. First least count of the outside micrometer must be cal
2. The corresponding readings are then enforced into following tables.

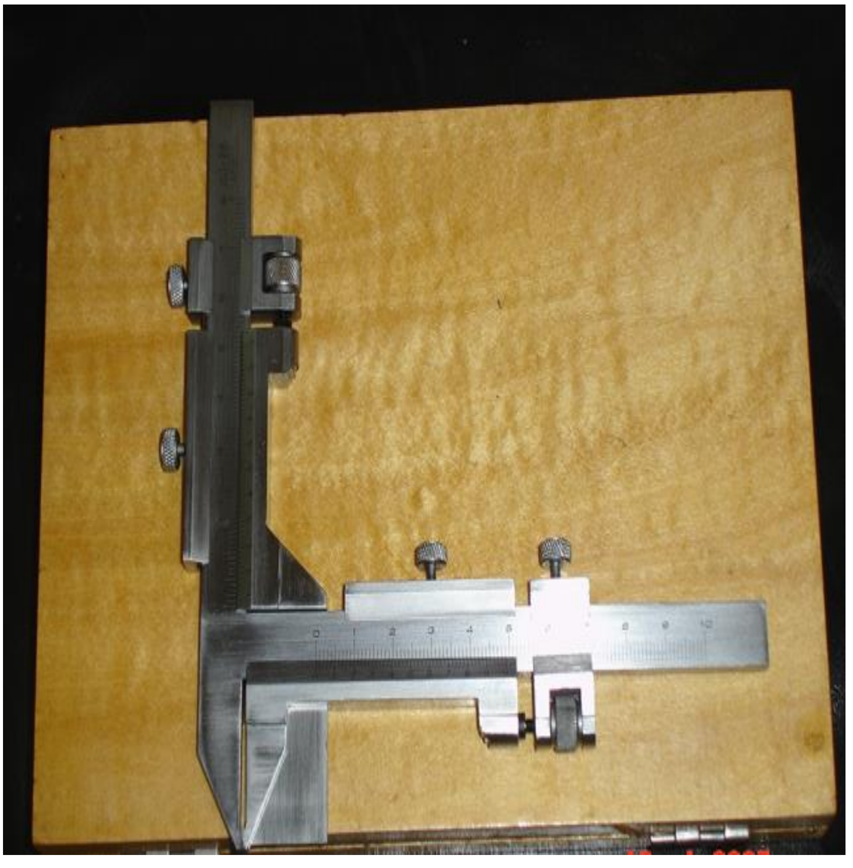
Tabular column:

S.NO.	M.S.R.	V.S.R. or P.S.R.	Total Reading (M.S.R. + V.S.R. X L.C.)
1			
2			
3			

Sketch:

Result:
Outside diameter of the work piece No 1:
Outside diameter of the work piece No 2:
Outside diameter of the work piece No 3:

Use of gear teeth vernier caliper and checking the chordal addendum and chordal height of spur gear



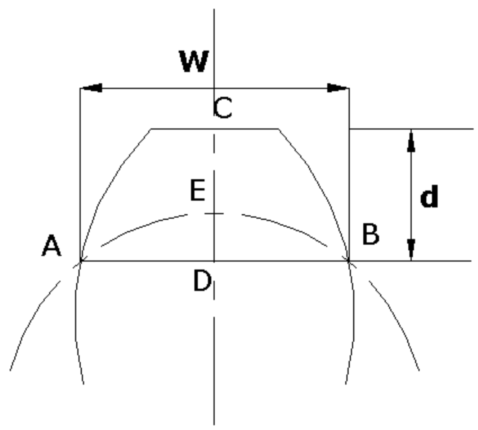
Use of gear teeth vernier caliperand checking the chordal addendum and chordal height of spur gear

AIM: To determine module, pressure angle and Chordal Tooth thickness of the given gear specimen.

APPARATUS: Vernier Calipers, Gear Tooth Vernier Calipers.

THEORY:

Gear is a toothed wheel, which is used to transmit the motion and power. Involutes profile gears are widely used compared to cycloidal profile gears. The performance of a gear depends on the uniform thickness of teeth, concentricity and pitch. The thickness of a gear tooth varies from the base to tip. Hence to specify the thickness of the tooth pitch circle will be taken as the reference. The thickness of a gear tooth is defined as the arc distance measured along the pitch circle from its intercept with one flank to its intercept with the other flank of the same tooth. As the tooth thickness is defined as the length of an arc, it is difficult to measure directly. In most of the cases it is sufficient to measure the chordal thickness i.e. the chord joining the intersection of the tooth profile with the pitch circle. From the figure tooth thickness is specified as an arc distance AEB and chordal tooth thickness is ADB. d, is called chordal addendum because it is slightly greater than the addendum CE.



The chordal tooth thickness can be very conveniently measured by a gear tooth vernier (Shown in fig.). Since the gear tooth thickness varies from the tip to the base circle of the tooth, the instrument must be capable of measuring the tooth thickness at a specified position on the tooth.

Further this is possible only when there is some arrangement to fix that position where the measurement is to be taken. The gear tooth vernier has two vernier scales and they are set for the width 'w' of the tooth and the depth'd' from the top at which 'w' occurs.

PROCEDURE:

(1) *Module (m)*: Count the number of teeth on the given gear specimen and measure its outer diameter with the help of vernier calipers. Then find out the module by the following relation.

Addendum circle diameter = m (T+2)

Where m = module

T = no. of teeth

Find the pitch circle diameter Dp by the relation m = $\frac{Dp}{z}$

(2) *Pressure Angle (θ):* with the help of Vernier caliper measure width of two teeth, three teeth and four teeth. Find out the base pitch by following formula.

$$P_b = \frac{(z-y)+(y-x)}{2}$$

Where x = width of two teeth

Y = width of three teeth

Z = width of four teeth

Calculate base circle diameter D_b by the following formula.

$$\text{Base pitch } P_b = \frac{\Pi \times \text{Diameter of base circle}}{T}$$

$D_b \quad = \dfrac{T \times P_b}{\Pi}$

Calculate the pressure angle of the gear by following relation

Diameter of base circle, D_b = pitch circle diameter x cosθ

Where θ = pressure angle of the gear

$$\cos\theta = \frac{Db}{Dp}$$

(3) Chordal tooth thickness (w):

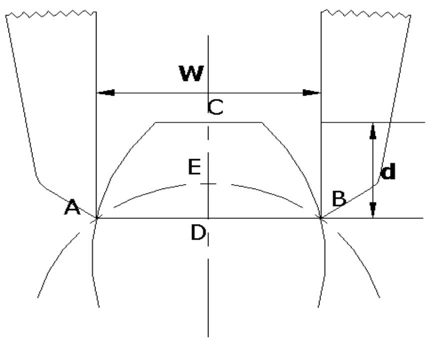
First calculate the value of chordal addendum'd' by the formula:

$$d = \frac{Tm}{2}\left[1 + \frac{2}{T} - \cos\left(\frac{90}{T}\right)\right]$$

Where m = module

T = Number of teeth on the gear.

Set the vertical scale of the Gear tooth vernier equal to Chordal addendum, then adjust the horizontal scale in such a way that the tips of two jaws of vernier touch exactly at the intersections points of pitch circle and two opposite flanks as shown in the figures. The reading of horizontal scale of the gear tooth vernier is the measured value of chordal tooth thickness.



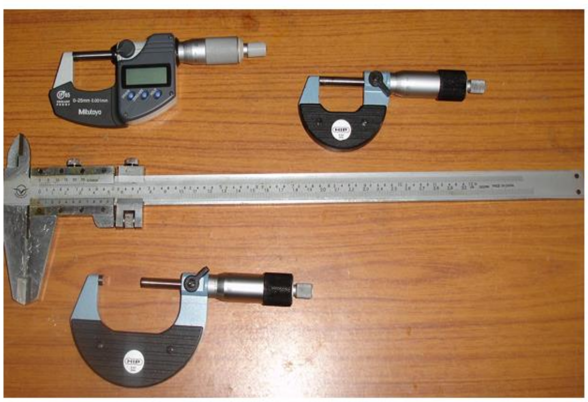
Theoretically $\qquad w = m\,T\,\sin\dfrac{90}{T}$

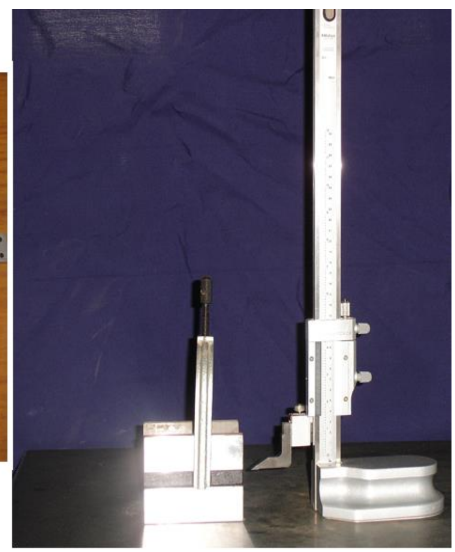
Compare the values of chordal tooth thickness theoretically and practically. Find out the percentage.

RESULT:

Module of the gear	:	
Pressure angle	:	
Chordal Tooth thickness	:	
Measured value	:	
Theoretical Value	:	
Percentage error	:	

Measurement of Lengths, heights, diameters by Vernier caliper & Micrometer etc.





Measurement of Lengths, heights, diameters by Vernier caliper & Micrometer etc.

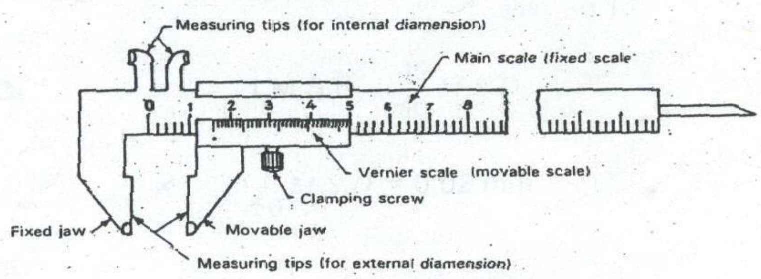
AIM: To get acquainted with measuring instruments like Vernier Calipers, Micrometers.

APPARATUS:

Vernier Calipers, outside Micrometer

VERNIER CALIPERS:

The Vernier Calipers consists of two scales one is fixed and the other is movable. The fixed scale called main scale is calibrated on L-Shaped frame and carries a fixed jaw. The movable scale called Vernier Scale slides over the main scale and carries a movable jaw. The movable jaw carries measuring tip. When the two jaws are closed the zero of the Vernier Scale coincides with the zero of the main scale. For precise setting of the movable jaw an adjustment screw is provided. Also an arrangement is provided to lock the sliding scale on the fixed main scale.



Vernier calliper

USE: Vernier Calipers are employed for both internal and external measurements. It is generally used by closing the jaws on to the work surface and taking the readings from the main as well as the Vernier scale. To obtain the reading the number of divisions on the main scale is first read off. The Vernier scale is then examined to determine which of its division coincide or most coincident with a division on the main scale.

PROCEDURE: Verify the number of divisions available on the Vernier. Also observe, how many number of divisions of main scale divisions are equal to number of divisions on the Vernier.

Least count or LC of the Vernier = 1 M.S.D. – 1 V.S.D.

Where M.S.D = Main Scale Division

V.S.D = Vernier Scale Division

Also L.C of the Vernier = $\frac{oneMSD}{No.ofdivisionsonthevernier}$

Example:

Let the number of divisions on the Vernier are 50 and let us say these 50 divisions are coinciding with 49 divisions on the main scale. If each division on main scale is equal to 1 mm, then the L.C. of the Vernier Calipers may be obtained as follows:

L.C = 1MSD - 1VSD

49 M.S.D = 50 V.S.D ➔ 1 V.S.D = $\frac{49}{50}M.S.D$

L.C. = 1 M.S.D. - $\frac{49}{50}M.S.D$

= $\frac{1}{50}M.S.D$ = 0.02 mm.

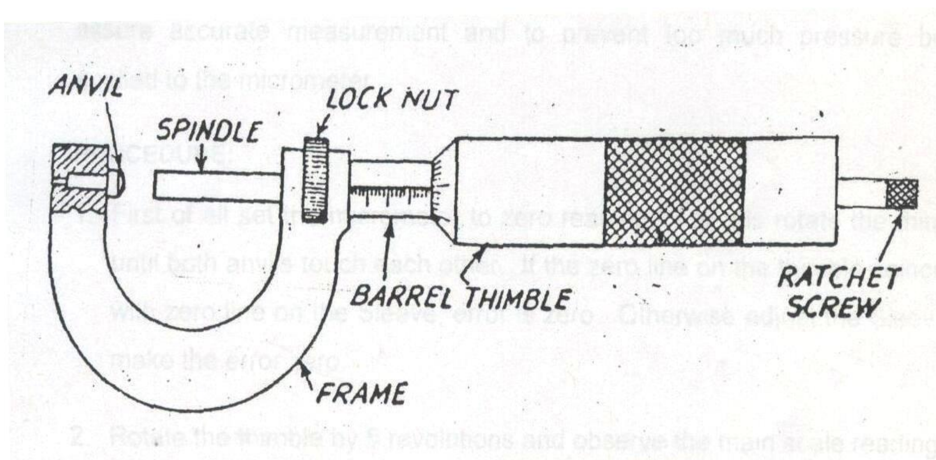
(a) **MICROMETER**:

Most Engineering precision work has to be measured to a much greater accuracy than 0.02 mm, which is available with Vernier Calipers, to achieve interchangeability of component parts. To achieve this greater precision, measuring equipment of a greater accuracy and sensitivity must be used. Micrometer is one of the most common and most popular forms of measuring instrument for precise measure with 0.01 mm accuracy. Micrometers with 0.001 mm accuracy are also available.

PRINCIPLE OF MICROMETER:

Micrometers work on the principle of screw and nut. When a screw is turned through nut by one revolution, it advances by one pitch distance. If the circumference of the screw is divided into number of equal parts say 'n' its rotation through one division will cause the screw to advance through $\left(\frac{Pitch}{n}\right)$ length. Thus the minimum length that can be measured by such arrangement will be $\left(\frac{Pitch}{n}\right)$. By reducing the pitch of the screw thread or by increasing the number of divisions on the circumference of the screw the length value of one circumferential division can be reduced and accuracy of measurement can be increased considerably.

CONSTRUCTION:



The outside micrometer has U-Shaped or C shaped frame. It holds all the micrometer parts together. The gap of the frame permits the maximum diameter or length of the job to be measured. It is generally made of steel, cast steel, malleable C.I or light alloy. It is desirable that the frame of the micrometer be provided with conveniently placed finger grips of heat insulating material.

The micrometer has a fixed anvil protruding 3 mm from the left hand side of the frame. Another anvil known as movable anvil is provided on the front of the spindle. The anvils are accurately ground and lapped with its measuring faces flat and parallel to the spindle. The spindle engages with nut and it runs freely and smoothly throughout the length of its travel. There should be no backlash between the spindle screw and nut.

Lock nut: A lock nut is provided on the micrometer spindle to lock it when the micrometer is at its correct reading, without altering the distance between the measuring faces.

Sleeve or Barrel: The Sleeve is accurately divided and clearly marked in 0.5 mm division along its length which serves as a main scale. It is chrome plated and adjustable for zero setting.

Thimble: The Thimble can be moved over the Sleeve. It has 50 equal to assure accurate measurement and to prevent too much pressure being applied to the micrometer.

PROCEDURE:

1. First of all set the micrometer to zero reading. For this rotate the thimble until both anvils touch each other. If the zero line on the thimble coincides with zero line on the Sleeve, error is zero. Otherwise adjust the Sleeve to make the error zero.

2. Rotate the thimble by 5 revolutions and observe the main scale reading.

3. Determine the pitch of the screw as $\frac{MainScale\ \mathrm{Re}ading}{No.of\ \mathrm{Re}volutionsofthimble}$

4. Finally determine the least count L.C $= \frac{Pitch}{No.ofdivisionsonthethimble}$

PRECAUTIONS:

S.NO.	M.S.R.	V.S.R. or P.S.R.	Total Reading (M.S.R. + V.S.R. X L.C.)
1			
2			
3			

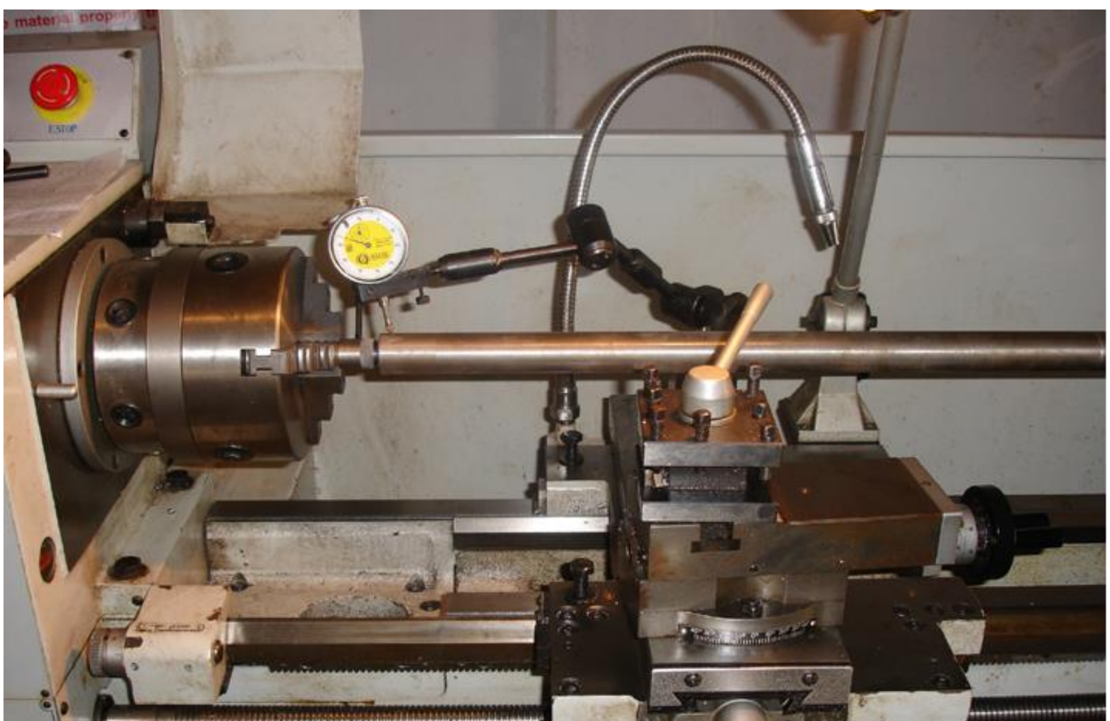
1. Before using the instrument clean it by cleaning cloth.
2. Readings must be observed without parallax error.
3. The line of measurement must coincide with line of scale.
4. The measuring instrument must always be properly balanced in hand and held lightly in such away that only fingers handle the moving and adjusting screws.

NOTE: By using the above instruments measure the external diameter and the height of the given work piece. Use the following table.

Average

RESULT:

MACHINE TOOL ALIGNMENT TEST ON LATHE



MACHINE TOOL ALIGNMENT TEST ON LATHE

INTRODUCTION:

The surface components produced by machining processes are mostly by generation. As a result, the quality of surface produced depends upon the accuracy of the various movements of the machine tool concerned. It therefore becomes important to know the capability of the machine tool by evaluating the accuracy of the various mechanisms that are directly responsible for generating the surface. For this purpose a large variety of tests have been designed.

MEASURING INSTRUMENTS USED FOR TESTING:

The accuracy of the machine tools employed should be higher than the accuracy of the components that it produces. Similarly the quality of the measuring equipment used for machine tool testing should be commensurate with the quality expected from such testing. A few commonly used equipments are

- Dial Indicators
- Test mandrels
- Straight edges
- Spirit levels

TEST PROCEDURES:

The major tests that are conducted on machine tool are:

- Testing the quality of the slide ways and the locating surfaces
- Testing the accuracy of the main spindle and its alignment with respect to other parts of the machine tool.
- Testing the accuracy of the parts produced by the machine tool.

ACCEPTANCE TESTS

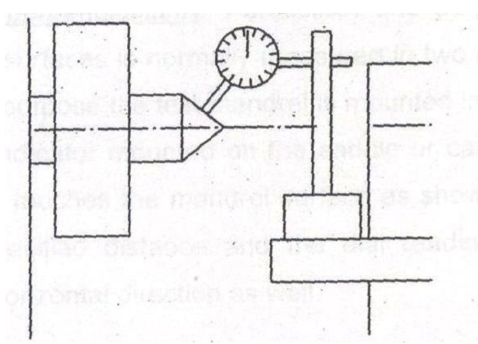
LATHE MACHINE

Tests that can be conducted on Lathe machine:

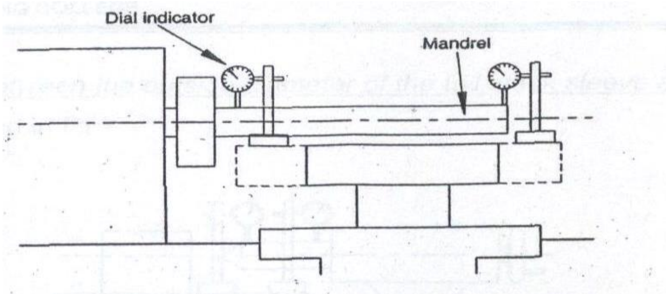
1. **Quality of slide ways**: To test the quality of the slide ways it is necessary to mount the dial indicator on a good datum surface. Then the plunger is moved along the longitudinal direction of the slide ways which provides an indication of the undulations present on the surface of the slide ways.
2. **Accuracy of the spindle**:

   These tests are related to the true running of the spindle and the centre located in the spindle along with the alignment, parallelism and perpendicularity of the spindle with the other axes of the concerned machine tool.

   True running of the centre: The live centre may be loaded into the lathe spindle and a dial indicator mounted as shown in fig. This test is required only for machines where the work piece is held between centres. The readings of the dial indicator are taken while rotating the spindle through full rotation.



   True running of the spindle: the taper shank of the test mandrel of about 300 mm length is mounted into the spindle as shown in fig. The plunger of the dial indicator rests on the cylindrical surface of the mandrel. The spindle is rotated slowly and the readings of the dial indicator are noted. The deviation should normally be less than 0.01mm. The test is to be repeated with the dial indicator positioned close to the spindle bore as well as at the extreme end of the test mandrel.

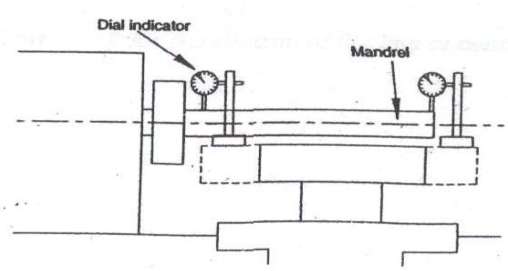


Test set-up for true running of the spindle of a lathe

Squreness of the face: this test is used to measure the squreness of the shoulder face with reference to the spindle axis. The plunger of the dial indicator rests on the extreme radial position of the shoulder face and the reading is taken. It is repeated by slowly rotating the spindle till the dial indicator comes to a point that is diametrically opposite to the reading taken earlier.

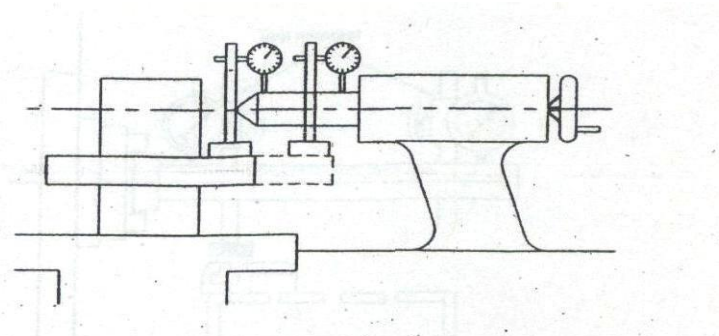
3. **Alignment tests**:

Parallelism and perpendicularity: Parallelism and perpendicularity between two axes or two surfaces is normally measured in two planes, horizontal and vertical. For this purpose the test mandrel is mounted in the spindle as shown in fig. with dial indicator mounted on the saddle or carriage. The plunger of the dial indicator touches the mandrel surface as shown in fig. the saddle is moved for a specified distance and the dial reading noted. The test is repeated in the horizontal direction as well.



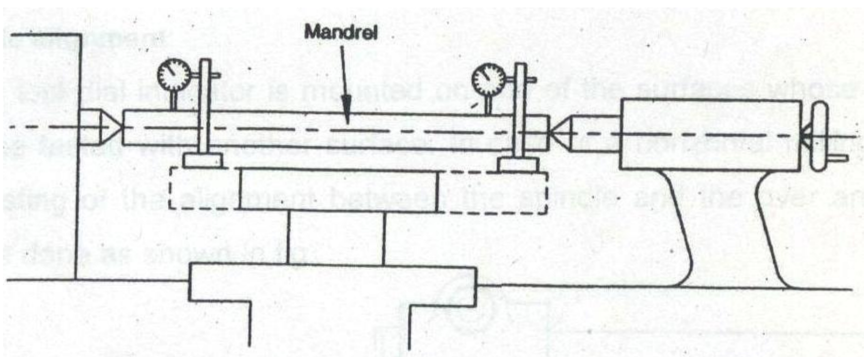
Test set-up for parallelism between the spindle axis and the slideways in a lathe

<u>Parallelism between the outside diameter of the tail stock sleeve and the slide ways</u> as shown in fig.



Test set-up for the parallelism of the tail stock sleeve

<u>Parallelism between the line of centres and the slide ways</u> shown in fig.



Test set-up for parallelism of the line of centres in a lathe

SURFACE ROUGHNESS MEASUREMENT

AIM :

To measure the surface roughness of a given specimen

APPARATUS :

SJ-210

Introduction:

Surface Roughness is like a fingerprint left behind by the manufacturing process.

1. The surface irregularities of small wavelength are called primary texture or roughness these are caused by direct action of the cutting elements on the material i.e., cutting tool shape, feed rate or by some other disturbances such as friction, wear or corrosion.
2. The surface considerable wavelength of a periodic character are called secondary texture or waviness. These irregularities result due to in accuracies of slides, wear of guides, misalignment of centers, nonlinear feed motion, vibrations of any kind etc.

Elements of Surface Texture:

Actual Surface: It refers to the surface of apart which is actually obtained after manufacturing process.

Nominal surface: A nominal surface is theoretical, geometrically perfect surface which does not exist in practice, but it is an average of the irregularities that are superimposed on it.

Profile: It defined as contour of any section through a surface.

Lay: It is the direction of predominant surface pattern produced by the tool marks or scratches, generally surface roughness is measured perpendicular to the lay.

Sampling Length: It is the length of the profile necessary for the evaluation of the irregularities to be taken in to account

Roughness Height: This is rated as the arithmetical average deviation expressed in micro-meters normal to an imaginary center line, running through the profile

Roughness Width: Roughness width is the distance parallel to the normal surface between successive peaks or ridges that constitute the predominant pattern of the roughness.

Measuring instruments:

1. **Profilo graph**

This is an optical instrument and is used for direct measure of the surface quality. The principle of operation is shown in fig.1 A finely pointed stylus mounted in the pickup unit, is traversed across the surface either by hand or motor drive. The work to be tested is placed on the table of the instrument. It is traversed by means of a lead screw. The stylus, which is pivoted to a mirror, moves over a tested surface. A light sources ends a beam of light through lens and a precision slit to the oscillating mirror. The reflected beam of light is directed to a revolving drum, upon which a sensitized film is arranged. The drum is rotated through 2-bevel gears from the same lead screw. A profilograph will be obtained from the sensitized film, that may be subsequently analyzed to determine the value of the surface roughness.

2. Tomlinson surface meter

This is purely a mechanical lever operated piece of equipment. The diamond stylus on the recorder is held by spring pressure against the surface of a lapped steel cylinder. The stylus attached to the bodyof the instrument by means of a leaf spring and it has some height adjustment. The lapped cylinder is supported on one side by the stylus andon the other by two fixed rollers as shown in fig.2 The stylus is restrained from all motions except the vertical one by the tension in the coil and leaf spring. The tensile forces in these two springs also keep the lapped cylinder in horizontal position. Alight arm is attached to the lapped steel cylinder, and it carries at its tip a diamond scriber which leans against a smoked glass. While traversing across the surface of the job, any vertical movement of the stylus caused by the surface irregularities causes the lapped cylinder to roll. Thus, vertical movement coupled with horizontal movement produces a track on the glass magnifies in vertical direction and there being no horizontal magnification.

3. Taylor-Hobson-Talysurf

Taylor-Hobson-Talysurf is a stylus and skid type of instrument working on carrier modulating principle. Its response is more rapid and accurate as compared to Tomlinson Surface Meter. The measuring head of this instrument consists of sharply pointed diamond stylus of about 0.002mm tip radius and skip or shoe which is drawn across the surface by means of a motorized driving unit. In this instrument the stylus is made to race the profile of the surface irregularities, and the oscillatory movement of the stylus is converted in to changes in electric current by the arrangement as shown in fig.3 The arm carrying the stylus forms an armature which pivots about the centre piece of E-shaped stamping. On two legs of (outer pole pieces) the E-shaped stamping there are coils carrying an a.c current. These two coils with other two resistances form an oscillator. As the armature is pivoted about the central leg, any movement of the stylus causes the air gap to vary and thus the amplitude of the original a.c current flowing in the coils is modulated. The output of the bridge thus consists of modulation only as shown in fig3 this is further demodulated so that the current now is directly proportional to the vertical displacement of the stylus. The demodulated output is caused to operate a pen recorder to produce permanent record and the meter to give numerical assessment directly.

DESCRIPTION OFSURFTEST SJ-210

The surf test SJ-301 is a stylus type surface roughness measuring instrument developed for shop floor use. The SJ-210 is capable of evaluating surface texture with variety of parameters according to various national standards and international standard. The measurement results are displayed digitally/graphically on the touch panel, and output to the built-in printer. The stylus of the SJ-210 detector unit traces the minute irregularities of the work piece surface. Surface roughness is determined from the vertical stylus displacement produced during traversing over the surface irregularities. The measurement results are displayed digitally/graphically on the touch panel.

OBSERVATIONS:

Specimen. No.	R_a Microns	R_q Microns	R_z Microns	R_t Microns	R_{sk}	R_{ku}
1						
2						
3						
4						
5						

Result :

The various roughness parameters for different specimens are tabulated.

Angle and taper measurements by Bevel protractor and Sine bar

Angle and taper measurements by Bevel protractor and Sine bar

AIM: To determine the taper angle of the given specimen using Sine Bar and check the angle using Bevel Protractor.

APPARATUS: Sine Bar, slip gauge set, Vernier Bevel Protractor.

THEORY:

Taper is defined as uniform reduction in dimension (may be width, height or diameter) over specified length. For example for the shank of a twist drill bit, if the taper is specified as 1:10, it means that for every 10 mm length there will be a reduction of diameter by 1 mm (from major to minor dia). Taper is employed on elements like cotter, keys and shanks of twist drill bits, end mills, reamers adapters etc. Presence of taper enables self locking of the element in the corresponding mating part.

Slip Gauges: Slip gauges for rectangular blocks of alloy steel having a cross section of about 30 by 10 mm. These blocks are carefully finished on the measuring faces to such a fine degree of finish. Flatness and accuracy that any two such faces when perfectly clean may be 'wiring' together. This is accomplished by pressing the faces into contact and then imparting a small twisting motion whilst maintaining contact pressure. When two gauges are wrung or more blocks so joined is exactly the sum of the constituent gauges. By combining gauges from a suitably arranged combination, almost any dimension may be built up.

SINE BAR

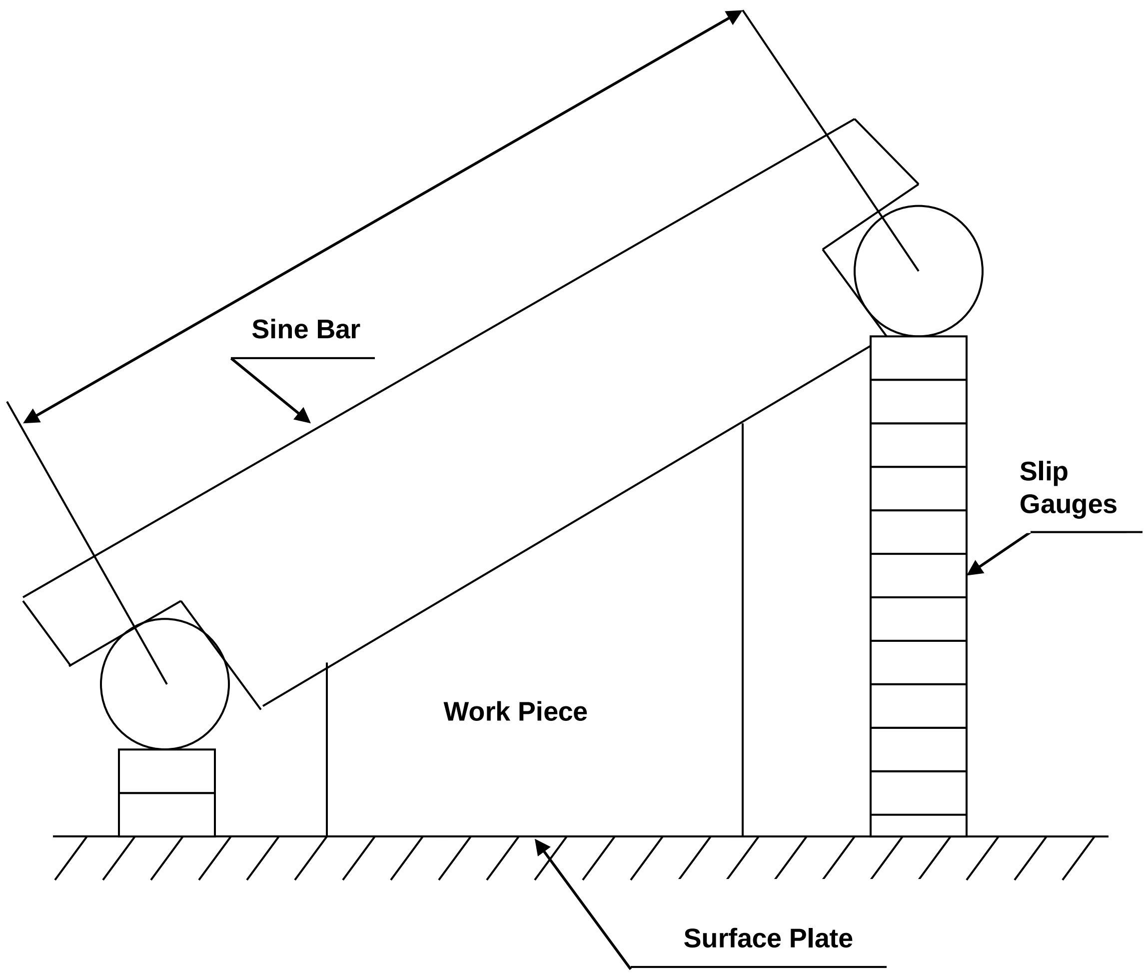
Sine Bar is a precision instrument used along with slip gauges for the measurement of angles sine bar is used:

(i) to measure the angles very accurately

(ii) to locate the work to a given angle within very close limits

It consists of a steel bar and two rollers. The sine bar is made of high carbon, high chromium corrosion resistant steel, suitably hardened, precision ground and stabilized. The rollers are of accurate and equal diameters. They are attached to the bar at each end. The axes of these rollers are parallel to each other and also to the upper surface of the bar. The normal distance between the axes of the rollers is exactly 100 mm, 200 mm or 300 mm.

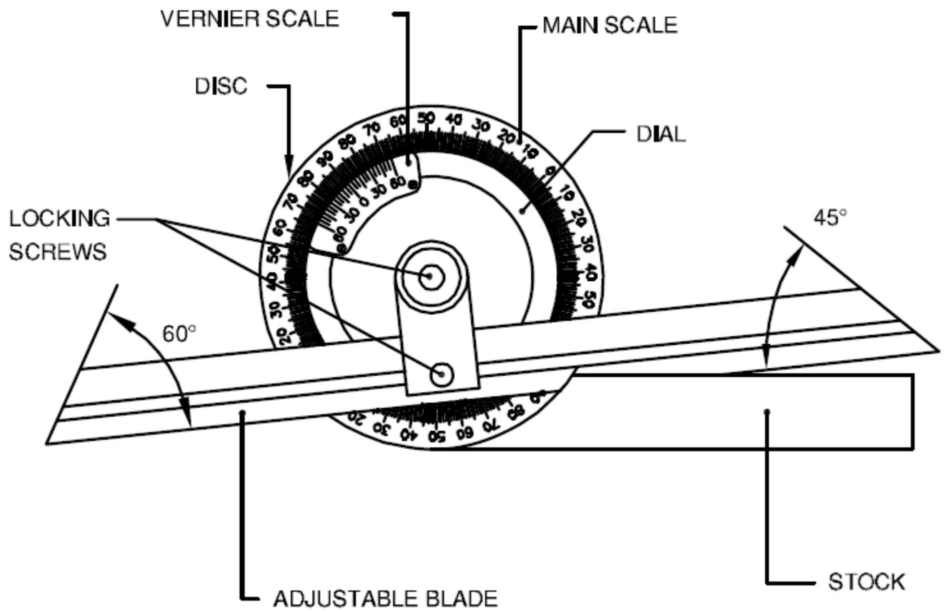
When the rollers are brought in contact with a flat surface, the top of the bar is parallel to the surface. The various parts are hardened and stabilized before grinding and lapping. All the working surfaces of the bar and the cylindrical surfaces are fined to surface finish of 0.2 μm. A grade sine bar is made with an accuracy of 0.01 mm/m of length, and B grade sine bars with an accuracy of 0.02 mm/m of length.



Principle of Sine bar: The principle of operation of a sine bar is based on the laws of trigonometry. To set a given angle, one roller of the bar is placed on the surface plate and the combination of slip gauges is inserted uner the second roller. If 'h' is the height of the combination of slip gauges and 'L' the distance between the rollers centers. Then $\text{Sin}\,\theta = \frac{h}{L}$ or $\theta = \text{Sin}^{-1}\left[\frac{h}{L}\right]$

Thus the angle to be measured or to be set is determined by indirect method as a function of sine, for this reason, the device is called a 'sine bar'.

Vernier Bevel Protractor:



The vernier bevel protractor is a precision instrument meant for measuring angles to an accuracy of 5 minutes.

Parts of a vernier bevel protractor

The following are the parts of a vernier bevel protractor.

1. **Stock :** – This is one of the contacting surfaces during the measurement of an angle. Preferably it should be kept in contact with the datum surface from which the angle is measured.
2. **Dial :**– The dial is an integrated part of the stock. It is circular in shape, and the edge is graduated in degrees.
3. **Blade**:- This is the other surface of the instrument that contacts the work during measurement. It is fixed to the dial with the help of the clamping lever. A parallel groove is provided in the centre of the blade to enable it to be longitudinally positioned whenever necessary.
4. **Locking Screws** :- Two knurled locking screws are provided, one to lock the dial to the disc, and the other to lock the blade to the dial..

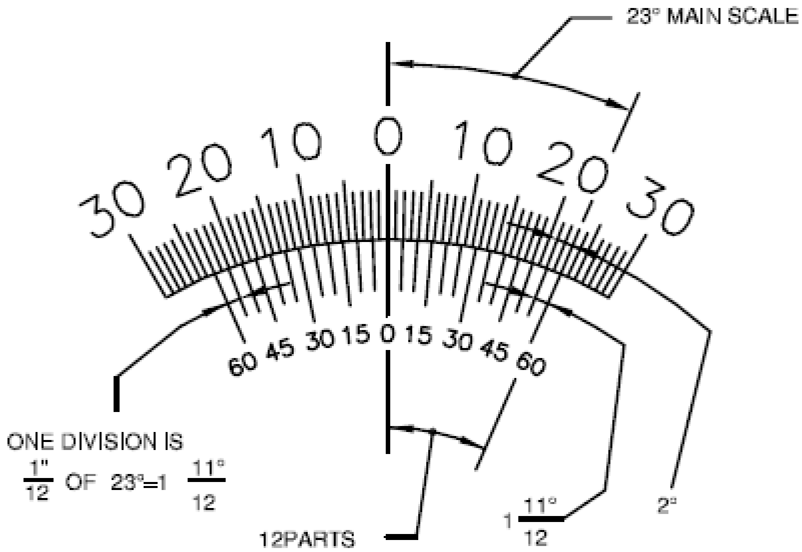
Use of Vernier Bevel Protractor

Apart from being used for measuring angles a vernier bevel protractor is also used for setting work-holding devices on machine tools, work-tables etc.

The vernier bevel protractor is used to measure acute angles than 90º obtuse angles more than 90º .

The least count of the vernier bevel protractor

Vernier Bevel Protractor Least Count



When the zero of the vernier scale coincides with the zero of the main scale, the first division of the vernier scale will be very close to the 2nd main scale division.

For any setting of the blade and stock, the reading of the acute angle and the supplementary obtuse angle is possible, and the two sets of the vernier scale graduations on the disc assist to achieve this.

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PRECAUTIONS:

1. Slip blocks must be cleaned properly and wrung together.

2. Readings must be observed without parallax error.

RESULT: Taper angle of the given specimen.

By Sine Bar =

By Bevel protractor =

MEASUREMENT OF LINEAR AND ANGULAR DIMENSIONS BY TOOL MAKER'S MICROSCOPE

MEASUREMENT OF LINEAR AND ANGULAR DIMENSIONS BY TOOL MAKERS MICROSCOPE

AIM: To measure the following parameters of threaded specimen of small magnitude:

(1) Major Diameter

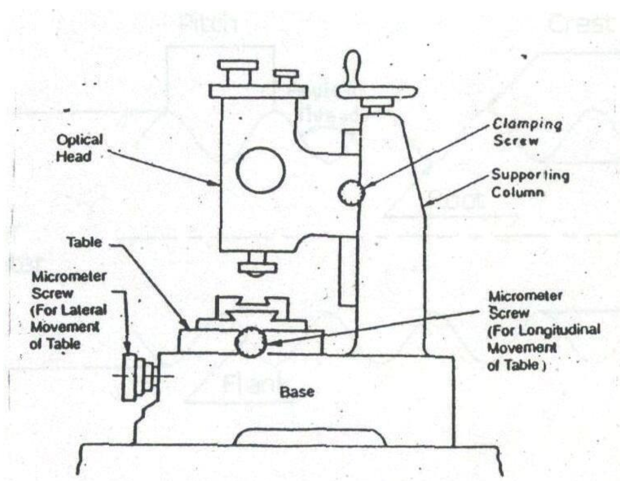
(2) Minor Diameter

(3) Pitch

(4) Included angle

APPARATUS: Tool Maker's Microscope

THEORY:

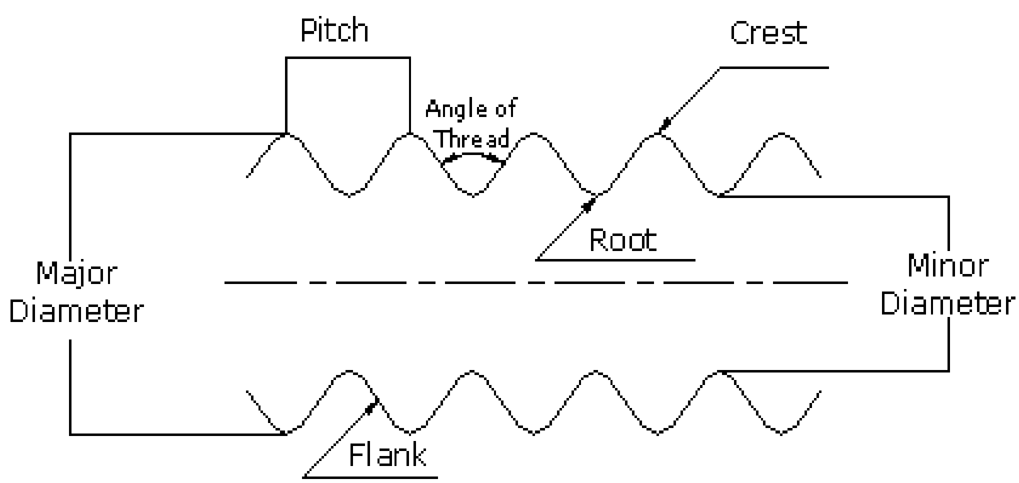


Tool-maker's Microscope

Tool Makers Microscope is an optical device used to view and measure very fine details, shapes and dimensions on small and medium sized tools, dies, and work pieces. It is equipped with a glass table that is movable in two principal directions and can be read to 0.01 mm. Microscope is also equipped with a protractor to measure the angular dimensions. It is also equipped with surface illumination. Provision is available to adjust the height of the viewing head to get a sharp image of the object.

Screw thread is a helical ridge produced by forming a continuous helical groove of the uniform section on the external or internal surface of a cylinder or cone. A screw thread formed on a cylinder is known as straight or parallel. Screw thread, while the one formed on a cone or frustum of a cone is known as tapered screw thread. In the present experiment, parameters of a straight screw thread of small magnitude are measured. Parameters of small screws such as screws used in watches, electrical plugs, and toys cannot be measured using instruments like vernier calipers or micrometers. Unless they are magnified it is not possible to measure all the parameters.

Some parameters of a straight screw thread are defined as follows:



Crest of a thread is defined as the prominent part of thread. Root of a thread is defined as the bottom of the groove between two flanks of thread.

Flanks of thread are straight edges which connect the crest with the root.

Angle of the thread also known as included angle is the angle between the flanks of the thread measured in axial plane.

The pitch of a thread is the distance measured parallel to the axis of the thread, between corresponding points on adjacent thread forms in the same axial plane and on the same side of axis.

Major diameter is the diameter of an imaginary cylinder Co-axial with the screw which just touches the crests of an external thread or roots of an internal thread.

Minor Diameter is the diameter of an imaginary cylinder co-axial with the screw which just touches the roots of an external thread or the crest of an internal thread

PROCEDURE:

1. Determination of the major diameter:

   Keep the specimen on the glass table. Here the given specimen is a thread. Switch on the light to get the silhouette of the thread. Adjust the height of the viewing head until a sharp image appears.

   Adjust the cross line of the instrument as shown below.

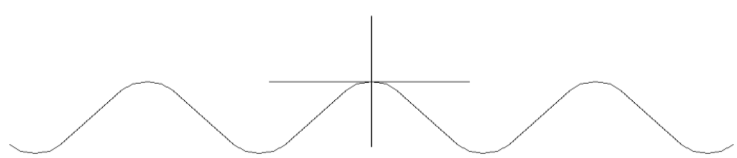


Fig.1

Now note-down the reading of the Micrometer. Now move cross line in such a way that, horizontal cross line occupies other sides of the crests as shown in fig-2. Again note-down the reading of the Micrometer. Difference of the two readings gives the major diameter of the thread.

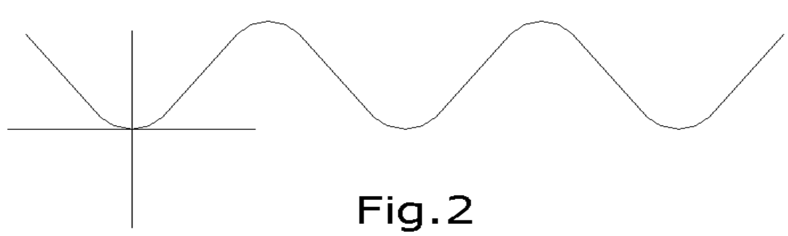


Fig.2

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2. Determination of the Minor diameter:

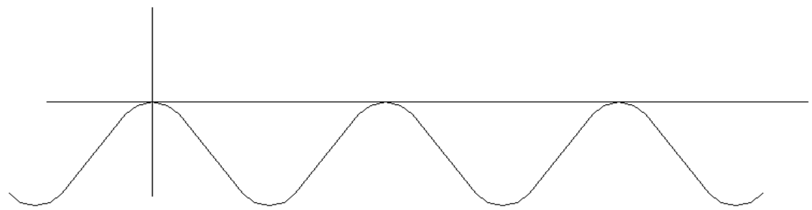

Fig.3

After obtaining the sharp image of the Threaded specimen let the horizontal cross line touch all the root points as shown in fig-3. At this position take the micrometer reading adjust the micrometer in such a way that, same horizontal line touches the other side of the root paints as shown in fig-4. Again note-down the reading of the micrometer. Difference of the readings gives minor diameter.

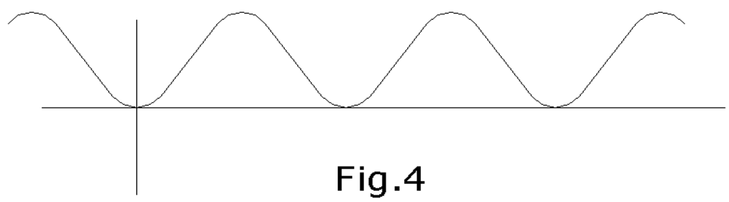

Fig.4

3. Determination of Pitch:

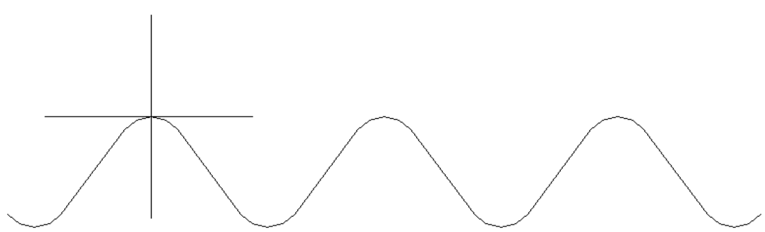

Fig.5

To measure pitch of the thread, align the centre of the cross lines at the peak of the crest as shown in the fig-5. At this position take the micrometer reading. Now move the micrometer in such a way that centre of the cross line align with the peak of the next thread as shown in for-6. Again note-down the reading of the micrometer. Difference of the two readings gives the pitch of the thread.

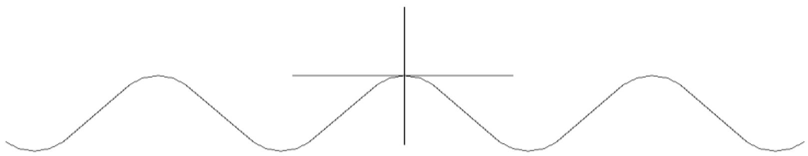

Fig.6

4. <u>Determination of the angle</u>:

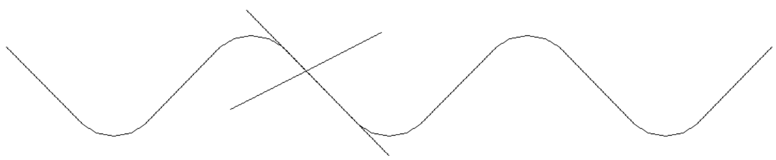

Fig.7

To measure the included angle of the thread coincide one of the lines of the cross lines with the flank of the thread as shown in the fig-7. Note-down the reading of the protractor. Now rotate the protractor in turn the cross lines in such a way that same line coincides with the opposite flank as shown in fig-8. Note-down the reading of the protractor. Difference of the two reading gives the included angle of the thread.

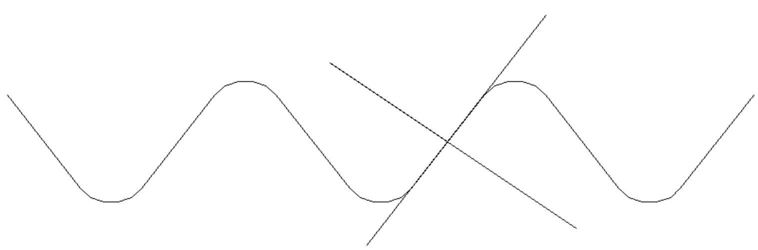

Fig.8

PRECAUTIONS:

1. Students are advised to take readings without any parallax error.
2. Lens must be properly adjusted to get a sharp image.
3. Move the Microscope table by gently holding micrometer thimble.

RESULT: