Mission and vision of the Department

Vision of Mechanical Department

To establish the state of the art learning center in Mechanical Engineering which will impart global competence, enterprising skills, professional attitude and human values in the student.

Mission of Mechanical Department

1. To impart quality technical education to the students.
2. To develop comprehensive competence in the students through various modes of learning.
3. To enable students for higher studies and competitive examinations.
4. To facilitate students and industry professionals for continuous improvement and innovation.

Program Educational Objectives:

[1] Use core competence acquired in various areas of Mechanical Engineering to solve techno-managerial issues for creating innovative products that lead to better livelihoods & economy of resources.

[2] To establish themselves as effective collaborators and innovators to address technical, managerial and social challenges.

[3]To equip students for their professional development through lifelong learning and career advancement along with organizational growth.

[4] Serve as a driving force for proactive change in industry, society and nation.

PROGRAM SPECIFIC OUTCOMES

Student should have

1) An ability to work professionally in mechanical systems including design, analysis, production, measurement and quality control.

2) An ability to work on diverse disciplinary tasks including manufacturing, materials, thermal, automobile, robotics, mechatronics, engineering software tools, automation and computational fluid dynamics.

EXPERIMENT NO: 1

AIM: Study & Demonstration of linear measurement devices.

A] MEASUREMENT WITH VERNIER CALIPER.

Theory: It is a simple arrangement using a fixed scale and sliding scale to obtain measurement. It is based on the difference between the two carefully calibrated scales i.e. the difference between the main scale and one division vernier scale known as least count [L.C]. In this way the length standard can be measured to a greater accuracy.

L.C. = (smallest division on main scale) / (no. of divisions on vernier scale)

= 1/50

= 0.02 mm

Procedure:

(1) Study the scale with its main and vernier divisions.

(2) Study the vernier caliper figure showing the important parts.

(3) Understand the vernier principle and see how the least count (L.C.) is calculated.

(4) Measure the sample pieces, read and record the reading in the format suggested.

(5) Read the instrument for at-least three random vernier positions.

Precautions: (1) The end of the scale must never be set with edge of the part to be measured, because the scale edge is usually worn out after long use.

(2) The scale should not be laid flat on part under measurement because in this way graduations of the scale are not in direct contact with part to be measured.

(3) Check if steel rule ends are worn out.

(4) While measuring the length by above instrument error of parallax or zero error should be avoided.

(5) There should be no play between sliding jaw and main scale.

B] MEASUREMENT WITH MICROMETER.

Instrument Specification:

External micrometer L.C = 0.01mm, 0.001mm (with vernier)

Measuring range = 0 – 25mm.

Theory:

It works on the principle of fixed nut and moving screw .Anvil of micrometer occupies fix position in relation to main nut in which screw moves. Screw is fixed with spindle. Hence spindle moves with movement of screw.Thimble are permanently secured to screw. Spindle is thus moved by rotating thimble. The pitch of screw thread is0.5mm, so that one revolution of the screw moves it axially by 0.5 mm.Main scale on barrel has smallest division of 0.5 mm The thimble has 50 divisions on its circumference .

$\therefore$ One division on thimble = 0.5 / 50

= 0.01 mm

Procedure: (1) Study the main element of external and internal micrometer

- Frame, barrel, thimble, locknut and ratchet.

(2) Calculate the Least count (L.C.).

(3) Read off any three position of the main and circular scale.

(4) Measure sample pieces & note the readings as per the standard format.

Precautions & Care:

The micrometer should be cleaned from oil, dirt and grease. Clean the measuring surfaces of the wheel and spindle for every measurement.

Check for zero error

Ends of anvil & spindle must be flat, parallel & square to axis of the spindle.

CONCLUSION:

Hence we have studied vernier caliper and external micrometer as linear measurement instruments

EXPERIMENT NO: 2

AIM: Study and demonstration of Interferometer.

APPARATUS: (1) Monochromatic light unit.

- 35 W sodium vapor bulb
- Milky white acrylic sheet to get uniform intensity of light.

(2) Optical flat

(3) Test specimen – slip gauge

THEORY: (1) If the optical flat is placed on another flat reflecting surface, it will not form an intimate contact, but will lie at some angle ‘θ’ making an inclined plane.

(2) Optical flat is illuminated by monochromatic source of light.

(3) Now, we can observe number of bands, if viewed from proper angle.

(4) Bands are produced by the interference of light rays reflected from

- Lower surface of optical flat &
- Top surface of the specimen through the very thin layer of air between the 2 surfaces.

(5) If the path difference between the two rays is odd multiple of half the wavelength [$\lambda/2$, $3\lambda/2$, $5\lambda/2$ …… etc] then dark band is produced and if the path difference is integer multiple of λ [λ, 2λ, 3λ …… etc] then light band is obtained.

OBSERVATIONS: (1) In case of perfectly flat surface, we will have alternate light and dark patterned straight lines on the surface as shown in figure[C].

(2) Any deviation from this pattern will be a measure of the error in the flatness of the surface being inspected.

(3) If the two surfaces are in perfect contact, no air gap exists and no fringe pattern will be observed.

(4) In figure[b], if

- θ reduced – fringe spacing increases
- θ increased – fringes come closer
- θ very large – fringes are so close that we cannot observe them

(5) In case of convex or concave surface, concentric rings of alternate dark and light band is formed, as shown in figure[c].

CONCLUSION: Light wave interference is accurate and sensitive method to determine the flatness of test specimen.

EXPERIMENT NO:3

AIM: Study and demonstration of surface finish measuring instruments.

THEORY:

Whatever may be the manufacturing process used, it is not possible to produce perfectly smooth surface. The imperfections and irregularities are bound to occur. The irregularities on the surface are in the form of succession of hills and valleys varying in height and spacing. These irregularities are termed as surface roughness, surface finish, surface texture or surface quality.

Factors affecting Surface Roughness:

1. Vibrations
2. Materials of the workpiece.
3. Type of machining.
4. Rigidity of the system consisting of machine tool, fixture cutting tool and work.
5. Cutting conditions, i.e. feed, speed and depth of tool.
6. Type of coolant used.

Types of surface Irregularities:

1. First order: Caused by inaccuracies in the machine tool itself.
2. Second order: The irregularities caused due to vibrations of any kind. These includes-
   Chatter marks on the surface of the parts.
3. Third order: This arises due to the types of process being used.
4. Fourth order: This arises from the rupture of the material during the separation of chip.

Surface irregularities of the above four orders can be classified as:

1. Primary texture (**R**oughness): The surface irregularities of small wavelength are called primary texture or roughness. It includes irregularities of third and fourth order.

2. Secondary texture (**W**aviness): The surface irregularities of considerable wavelength of a periodic character are called secondary texture or waviness. It includes irregularities of first and second order.

Principle, Construction and Working of Stylus Probe type surface texture measuring instruments (SJ 201P-Mitutoyo):

If a finely pointed probe or stylus be moved over the surface of a workpiece, the vertical movement of the stylus caused due to irregularities in the surface texture can be used to assess the surface finish of the workpiece. Stylus which is a fine point made of diamond or any such hard material is drawn over the surface to be tested. The movements of the stylus are used to modulate a high frequency carrier current or to generate a voltage signal. The output is then amplified by suitable means and used to operate a recording or indicating instrument.

Procedure/Working:

1. The detector stylus traces the workpiece surface (measurement surface).
2. The vertical stylus displacement produced during tracing the workpiece surface is converted into electrical signals.
3. The electrical signals are subject to various calculation processes inside the SJ 201P.
4. The calculation results (measurement results) are displayed on the LCD. It is in the form of average roughness value R_a.
5. Measurement result can be saved and later printed with the help of a printer.
6. First check accuracy of instrument by checking roughness of standard specimen supplied with the SJ 201P.
7. Take 3-4 readings using different test surfaces and different values of sampling lengths.

Conclusion:

Thus we have studied surface roughness measurement using electronic surface roughness tester i.e.SJ 201P

EXPERIMENT NO: 4

AIM - Study and demonstration of comparators of different types.

THEORY -

Comparator is a device used to compare and display given dimension with basic dimension. So a comparator has to compare the unknown dimensions of a part with some standard or master setting.

Pick up error → Magnify it → Display.

Classification of comparators -

1. Mechanical comparators.
2. Optical comparators.
3. Electrical / Electronic comparators.
4. Pneumatic comparators

A] Mechanical comparators -

In these comparators magnification is obtained by mechanical linkages and other mechanical devices. These are compact, easy to handle but there are some limitations like sensitivity to vibrations, more friction, parallax error, limited range etc.

1. Dial indicator-

   This is one of the most commonly used mechanical comparator. Its complete setup consists of robust base, whose surface is perfectly flat and a pillar carrying a bracket. In this bracket dial indicator is attached. Dial indicator has one movable spindle. The linear movement of spindle is magnified by means of a gear and pinion train into a sizable rotation of the pointer on dial scale. The indicator is set to zero by the use of slip gauges representing the correct basic size of the part. Then plunger is moved over part to be checked. Deflection of pointer indicates error in dimension of part. This is generally used for small machined parts. This type of comparators can be used with various attachments so that it may be suitable for large number of works.

B] Pneumatic comparators-

In these, magnification is obtained by use of pressurized air. It gives very high amplification. As there is no physical contact between part and measuring head, there is no loss of accuracy. Internal dimensions can be easily measured. But it has some problems like- apparatus is not easily portable and different gauging heads are required for different dimensions.

1. Solex pneumatic comparator-

   This instrument is produced by commercially by Solex Air Gauges Ltd. This is generally used for internal measurement, but with suitable measuring head it can be used for external gauging also. In pneumatic comparators constant pressure is required. In Solex comparator it is obtained by using water tank and dip tube. There is a tank in which water is filled up to a certain level and a dip tube is immersed into it up to a certain depth corresponding to air pressure required. P_A is pressure just before control orifice (see diagram). It is observed that $P_A > P_B$. Pressure difference $(P_A – P_B)$ is proportional to height of air column in a manometer tube i.e. 'h'. If there is lot of clearance between work-piece and measuring jet, then 'P_B' will be very less, then 'h' will be small. Thus height of water column 'h' acts as indicator of size of part to be measured.

CONCLUSION:-

Thus we have studied various types of comparators & working of dial gauge and Solex pneumatic comparator

EXPERIMENT NO: 5

AIM: Study and demonstration of sine bar.

THEORY:

Sine bars are used for precise measurements of angles. Sine bars are also used for locating any part to a given angle within very close limits. The ratio of two sides of a right angled triangle is used in deriving a given angle.

$$\text{Sin } \theta = \frac{\text{Opposite side}}{\text{Hypoteneous}}$$

Measurement is usually limited to angles less than 45°, because at higher angles sine bar has less accuracy. The sine bar itself is not complete measuring instrument. Following instruments are used with sine bar.

i. Datum surface e.g. Surface plate.
ii. Slip gauges.
iii. Indicating device e.g. Dial gauge.

Sine bars are made from high carbon, high chromium, corrosion resistant steel, hardened, ground and stabilized. Two cylinders of equal diameter are attached at the ends. (Fig. A).The axes of these two cylinders are mutually parallel to and at equal distance from the upper surface of the sine bar. The distance between the axes of the two cylinders is exactly 100mm, 200mm or 300mm. Some holes are drilled in the body of the bar to reduce the weight and to facilitate handling.

Applications Of Sine Bar-

A. Locating any work to a given angle

One of the rollers of sine bar is placed on the surface plate and other roller is placed on the slip gauges of height ‘h’. Then angle made by top surface of sine bar with surface plate ‘θ’ is given by, $\text{Sin } \theta = h/l$. Thus knowing θ, ‘h’ can be found out and any work could be set at this angle.

B. **Checking of unknown angles-**

First find the angle approximately with the help of a bevel protractor. Let the angle be ‘θ’. Then the bar set at this angle ‘θ’. Next, the work is placed on sine bar and clamped to angle plate as shown in fig. [c]. Then a dial indicator is set at one end of the work and moved to the other, and deviation is noted. Again slip gauges are so adjusted that dial indicator reads zero across the work surface. Now we can get accurate value of ‘θ’ as $\sin^{-1}$ (h/l).

C. **Checking unknown angles of heavy components-**

In such cases sine bar is mounted on the components as shown in Fig. [D]. The height over the rollers can then be measured by a vernier height gauge. The difference of the two readings of height gauge divided by the center distance of sine bar gives the ‘sine’ of the angle of the component to be measured.

LIMITATIONS OF SINE BAR-

i. Difficult to achieve exact center distance between two rollers.
ii. Devices operating on the sine principle are reliable at angles less than 15°, but become increasingly in-accurate as the angle increases.
iii. Temperature variations affect the reading.

PRECAUTIONS IN USE OF SINE BAR-

i. Sine bar should not be used for angle greater than 60°.
ii. Accuracy of sine bar should be ensured.
iii. As far as possible longer sine bar should be used, since many errors are reduced by using longer sine bars.

CONCLUSION:

Sine bar can be used for angular measurement of different types of components.