I

Name _____

Roll No. _____ Year 20____20____

Exam Seat No. _____

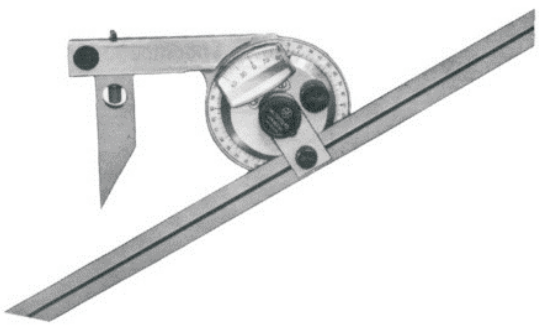
MECHANICAL GROUP | SEMESTER - III | DIPLOMA IN ENGINEERING AND TECHNOLOGY

A LABORATORY MANUAL

FOR

ENGINEERING METROLOGY

(22342)



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

(Autonomous) (ISO 9001 : 2015) (ISO / IEC 27001 : 2013)

VISION

To ensure that the Diploma level Technical Education constantly matches the latest requirements of technology and industry and includes the all-round personal development of students including social concerns and to become globally competitive, technology led organization.

MISSION

To provide high quality technical and managerial manpower, information and consultancy services to the industry and community to enable the industry and community to face the changing technological and environmental challenges.

QUALITY POLICY

We, at MSBTE are committed to offer the best in class academic services to the students and institutes to enhance the delight of industry and society. This will be achieved through continual improvement in management practices adopted in the process of curriculum design, development, implementation, evaluation and monitoring system along with adequate faculty development programmes.

CORE VALUES

MSBTE believes in the followings:

- Education industry produces live products.
- Market requirements do not wait for curriculum changes.
- Question paper is the reflector of academic standards of educational organization.
- Well designed curriculum needs effective implementation too.
- Competency based curriculum is the backbone of need based program.
- Technical skills do need support of life skills.
- Best teachers are the national assets.
- Effective teaching learning process is impossible without learning resources.

A Laboratory Manual

for

Engineering Metrology

(22342)

Semester-III

(ME)

Maharashtra State
Board of Technical Education, Mumbai
(Autonomous) (ISO:9001:2015) (ISO/IEC 27001:2013)

Maharashtra State Board of Technical Education,
(Autonomous) (ISO:9001:2015) (ISO/IEC 27001 : 2013)
4th Floor, Government Polytechnic Building, 49, Kherwadi,
Bandra (East), Mumbai - 400051.
(Printed on June, 2018)

MAHARASHTRA STATE

BOARD OF TECHNICAL EDUCATION

Certificate

This is to certify that Mr. / Ms. ……..…… Roll No. ……..…., of Third Semester of Diploma in ……..…… of Institute, ……..…….……..… (Code: ……...) has completed the term work satisfactorily in course **Engineering Metrology (22342)** for the academic year 20…….. to 20…….. as prescribed in the curriculum.

Place: …… Enrollment No:.……

Date: …… Exam. Seat No: ……

Subject Teacher **Head of the Department** **Principal**

Seal of Institution

Preface

The primary focus of any engineering laboratory/ field work in the technical education system is to develop the much needed industry relevant competencies and skills. With this in view, MSBTE embarked on this innovative 'I' Scheme curricula for engineering diploma programmes with outcome-base education as the focus and accordingly, relatively large amount of time is allotted for the practical work. This displays the great importance of laboratory work making each teacher; instructor and student to realize that every minute of the laboratory time need to be effectively utilized to develop these outcomes, rather than doing other mundane activities. Therefore, for the successful implementation of this outcome-based curriculum, every practical has been designed to serve as a ***'vehicle'*** to develop this industry identified competency in every student. The practical skills are difficult to develop through 'chalk and duster' activity in the classroom situation. Accordingly, the 'I' scheme laboratory manual development team designed the practicals to ***focus*** on the ***outcomes***, rather than the traditional age old practice of conducting practicals to 'verify the theory' (which may become a byproduct along the way).

This Practical manual is designed to help all stakeholders, especially the students, teachers and instructors to develop in the student the pre-determined outcomes. It is expected from each student that at least a day in advance, they have to thoroughly read through the concerned practical procedure that they will do the next day and understand the minimum theoretical background associated with the practical. Every practical in this manual begins by identifying the competency, industry relevant skills, course outcomes and practical outcomes which serve as a key focal point for doing the practical. The students will then become aware about the skills they will achieve through procedure shown there and necessary precautions to be taken, which will help them to apply in solving real-world problems in their professional life.

This manual also provides guidelines to teachers and instructors to effectively facilitate student-centered lab activities through each practical exercise by arranging and managing necessary resources in order that the students follow the procedures and precautions systematically ensuring the achievement of outcomes in the students.

Measurement activities are given prime importance in industry. The diploma technicians often come across measuring different parameters of machined components and the appropriate fitment of interchangeable components in the assemblies. The student has to identify the variables to be measured, decide the accuracy required, select the instrument, investigate reasons for defects and give suggestions, decide whether to accept or reject the jobs, suggest methods of salvaging the defective material manufactured. The different methods and instruments which can be used for linear and angular measurements, geometrical parameters (like surface finish, Squareness, Parallelism, Roundness etc) and the use of gauges and system of limits, fits, tolerances etc. are often required to be dealt in detail by a diploma engineer on the shop floor. Therefore, this course attempts to impart the necessary knowledge and develop the required abilities so that he can perform his job efficiently and effectively in modern industry.

Although best possible care has been taken to check for errors (if any) in this laboratory manual, perfection may elude us as this is the first edition of this manual. Any errors and suggestions for improvement are solicited and highly welcome.

Programme Outcomes (POs) to be achieved through Practical of this Course

Following POs and PSO are expected to be achieved through the practicals of the (Engineering Metrology) course.

PO 1. **Basic knowledge :** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based mechanical engineering problems.

PO 2. **Discipline knowledge:** Apply mechanical engineering knowledge to solve broad-based mechanical engineering related problems.

PO 3. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based mechanical engineering problems.

PO 4. **Engineering tools:** Apply relevant mechanical technologies and tools with an understanding of the limitations

Program Specific Outcomes (PSOs):

PSO 1: Modern Software Usage: Use latest mechanical related softwares for simple design, drafting, manufacturing, maintenance and documentation of mechanical components and proceses.

PSO 2: Maintenance and selection of machines, equipment, instruments: Maintain and select appropriate machine, equipment and instrument in field of Mechanical Engineering.

PSO 3: Manage Mechanical Process: Manage the mechanical process by selection and scheduling right type of machinery, equipment, substrates, quality control techniques, operational parameters and softwares for a particular mechanical process or job for economy of operations.

List of Industry Relevant Skills

The following industry relevant skills of the competency 'Use relevant instruments to measure various parameters of machine components' are expected to be developed in you by undertaking the practicals of this laboratory manual.

1. Use relevant measuring instrument for measuring various parameters of machine components.
2. Select the relevant measuring instrument for measuring various parameters of machine components.
3. Measure the various elements of gear tooth.
4. Measure the angular deviations.
5. Test the parallelism of spindle axis with saddle of Lathe.
6. Test the roundness of given job.

Practical- Course Outcome matrix

Course Outcomes (COs)

a. Select the relevant instrument for measurement.
b. Use different types of comparators.
c. Select gauges, fits and tolerances for machine components.
d. Use relevant instruments to measure different parameters of screw thread and gear.
e. Use linear and angular measuring instruments.
f. Select relevant surface testing methods

S. No.	Practical Outcome	CO a.	CO b.	CO c.	CO d.	CO e.	CO f.
1.	Measure various dimensions of a given components using radius gauge, vernier caliper, vernier height gauge, micrometer (use both mechanical and digital).	√	-	-	-	-	-
2.	Measure bores of a given sample using internal micrometers and dial bore indicators.	-	√	-	-	-	-
3.	Use pneumatic comparator /electronic comparator to Measure the Circularity / Roundness of the given specimen and compare it with the given standard	-	√	-	-	-	-
4.	Use slip gauges combination to set the adjustable snap gauge Go end and No-Go end for a given dimension.	-	-	√	-	-	-
5.	Measure gear tooth elements using gear tooth vernier caliper.	-	-		√	-	-
6.	Measure the effective diameter of the screw thread using Profile Projector / Tool Maker Microscope.	-	-	-	√	-	-
7.	Use floating carriage micrometer to measure minor, major and effective diameter of screw thread.	-	-	-	√	-	-
8.	Measure unknown angle of a given tapered component using sine centre in combination with slip gauges.	-	-	-	-	√	-
9.	Use Bevel Protractor and Clinometers to measure an angle and taper of the given component.	-	-	-	-	√	-

10.	Use angle dekkor / autocollimator to measure the angle and taper of given component.	-	-	-	-	√	-
11.	Measure flatness of the given component by interpreting fringes using monochromatic light source and optical flat.	-	-	-	-	-	√
12.	Measure flatness of a given surface plate using spirit level.	-	-	-	-	-	√
13.	Measure the surface roughness of a given sample using Taylor Hobson's Talysurf / surface roughness tester.	-	-	-	-	-	√
14.	Use dial indicator to check the Lathe machine parameters like parallelism, squareness, trueness, alignment.	-	-	-	-	-	√
15.	Measure run out of cylindrical component using dial indicator.	-	-	-	-	-	√

Guidelines to Teachers -

1. ***Teacher need to ensure that a dated log book*** for the whole semester, apart from the laboratory manual is maintained by every student which s/he has to ***submit for assessment to the teacher*** in the next practical session.
2. There will be two sheets of blank pages after every practical for the student to report other matters (if any), which is not mentioned in the printed practicals.
3. For difficult practicals if required, teacher could provide the demonstration of the practical emphasizing of the skills which the student should achieve.
4. Teachers should give opportunity to students for hands-on after the demonstration.
5. Assess the skill achievement of the students and COs of each unit.
6. One or two questions ought to be added in each practical for different batches. For this teachers can maintain various practical related question bank for each course.
7. If some repetitive information like data sheet, use of software tools etc. has to be provided for effective attainment of practical outcomes, they can be incorporated in Appendix.
8. For effective implementation and attainment of practical outcomes, teacher ought to ensure that in the beginning itself of each practical, students must read through the complete write-up of that practical sheet.
9. During practical, ensure that each student gets chance and takes active part in taking observations/ readings and performing practical.
10. Teacher ought to assess the performance of students continuously according to the MSBTE guidelines.

Instructions for Students

1. For incidental writing on the day of each practical session every student should maintain a ***dated log book*** for the whole semester, apart from this laboratory manual which s/he has to ***submit for assessment to the teacher*** in the next practical session.
2. For effective implementation and attainment of practical outcomes, in the beginning itself of each practical, students need to read through the complete write-up including the practical related questions and assessment scheme of that practical sheet.
3. Student ought to refer the data books, IS codes, Safety norms, Electricity act/rules, technical manuals, etc.
4. Student should not hesitate to ask any difficulties they face during the conduct of practicals.

Content Page

List of Practicals and Progressive Assessment Sheet

S. No	Practical Outcome	Page No.	Date of performance	Date of submission	Assessment marks(25)	Dated sign. of teacher	Remarks (if any)
9.	Use Bevel Protractor and Clinometers to measure an angle and taper of the given component.	41					
10.	Use angle dekkor / autocollimator to measure the angle and taper of given component.	47					
11.	Measure flatness of the given component by interpreting fringes using monochromatic light source and optical flat.	52					
12.	Measure flatness of a given surface plate using spirit level.	59					
13.	Measure the surface roughness of a given sample using Taylor Hobson's Talysurf / surface roughness tester.	64					
14.	Use dial indicator to check the Lathe machine parameters like parallelism, squareness, trueness, alignment.	69					
15.	Measure run out of cylindrical component using dial indicator.	76					
Total							

Note: To be transferred to Proforma of CIAAN-2017.

Practical No. 1: Measure dimensions using Vernier Caliper, Micrometer.

I. Practical Significance

Measurements of various dimensions of a component with utmost accuracy and precision is a prime requirement for Industry. Such kind of measurements is possible using measuring instruments like Vernier Caliper, Micrometer, Vernier Height gauge etc.

II. Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, science and basic Engineering to solve the broad-based Mechanical Engineering problems.

PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Set the Vernier Caliper and micrometer for precise measurement
2. Use relevant measuring instrument for measuring various parameters of machine components.
3. Select the relevant measuring instrument for measuring various parameters of machine components.

IV. Relevant Course Outcome(s)

- Select the relevant instrument for measurement.

V. Practical Outcome

Measure various dimensions of a given components using radius gauge, Vernier caliper, Vernier height gauge, micrometer(use both mechanical and digital)

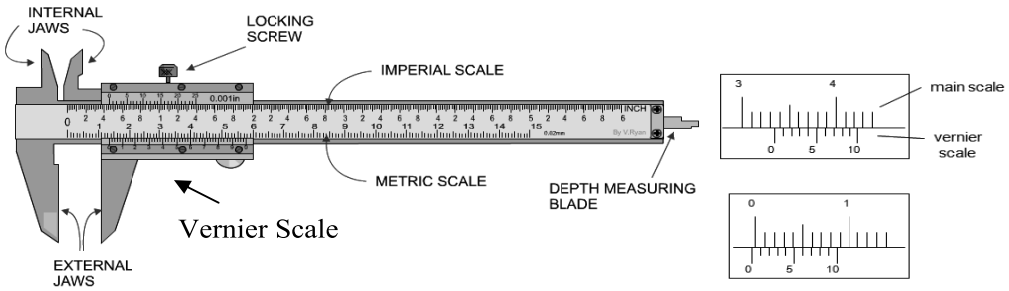
VI. Relevant Affective Domain related Outcomes

1) Follow safe practices
2) Practice good housekeeping
3) Practice energy conservation
4) Demonstrate working as a leader/a team member
5) Maintain tools and equipments
6) Follow ethical practices

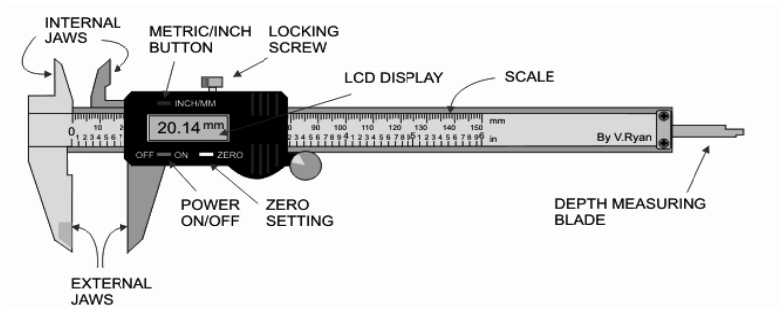
VII. Minimum Theoretical Background

Vernier caliper and Micrometer are the precise instruments used for the linear measurements.

VIII. Experimental setup



Vernier Caliper Details



Digital Vernier Caliper

Micrometer

IX. Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Vernier Caliper-	0-200mm (Manual)	1
2.	Digital Vernier Caliper-	0-200mm	1
3.	Dial Micrometer	(0- 25mm),(25-50mm)	1
4.	Surface Plate-	Granite. (200 x200x 50)	1

X. Precautions to be Followed

1. Avoid improper handling of instrument
2. Don't apply excessive pressure on measuring jaws and anvils.

XI. Procedure

1. Clean the work piece and instrument

2. Check the Vernier caliper and micrometer for errors like play in the measuring jaws
3. If any error ,correct it
4. Calculate the least count of the instrument
5. Hold the workpiece in the jaws/anvils
6. Note down the reading on main scale and Vernier scale
7. Take the reading for 3 components by Vernier caliper/Digital Vernier caliper/Dial Micrometer.
8. Calculate the readings

XII. Resources Used

S. No.	Name of Resource	Broad Specifications		Qty	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII. Actual Procedure Followed

.....
.....
.....
.....

XIV. Precautions Followed

.....
.....
.....
.....
.....
.....

XV. Observations and Calculations

a. Measurement using Vernier Caliper

Name of Work piece	Reading on Main scale (MSR)	Reading on Vernier Scale (VSR)	Final reading MSR + (LC *VSR)

b. Measurement using Digital Vernier Caliper

Name of Work piece	Reading on Main scale (MSR)	Reading on Vernier Scale (VSR)	Final reading MSR + (LC *VSR)

c. Measurement using Micrometer

Name of Work piece	Reading on Main scale (MSR)	Reading on Vernier Scale (VSR)	Final reading MSR + (LC *VSR)

XVI. Results

.....
.....
.....

XVII. Interpretation of Results

.....
.....
.....

XVIII. Conclusions

.....
.....
.....

XIX. Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Choose precise instrument used in the experiment

……..
……..

2. Name the instrument used to measure both external and internal dimension.

……..
……..

XX References / Suggestions for Further Reading

1. https://www.youtube.com/watch?v=sLZeR7RMGFA
2. https://www.youtube.com/watch?v=jjw-PG0cfJU
3. https://www.youtube.com/watch?v=imEqHCW5--o
4. https://www.youtube.com/watch?v=i_jygJkJujE

XXI Assessment Scheme

Performance Indicators		Weightage
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
Total (25 Marks)		**100 %**

Names of Student Team Members

1. ……..
2. ……..…….
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No. 2: Measure Bores of A Give Sample Using Internal Micrometers .

I. Practical Significance

Measurements of Internal dimensions of a bore with utmost accuracy and precision is a prime requirement for Industry. Such kind of measurements is possible using measuring instruments like internal Micrometers, Dial Bore indicators etc.

II. Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.
PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Set the Inside micrometer for precise measurement
2. Use relevant measuring instrument for measuring bores of a machining components
3. Select the relevant measuring instrument for measuring bores of machine components

IV. Relevant Course Outcome(s)

- Select the relevant instrument for measurement.

V. Practical Outcome

- Measure bores of a give sample using internal micrometers and dial bore indicators.

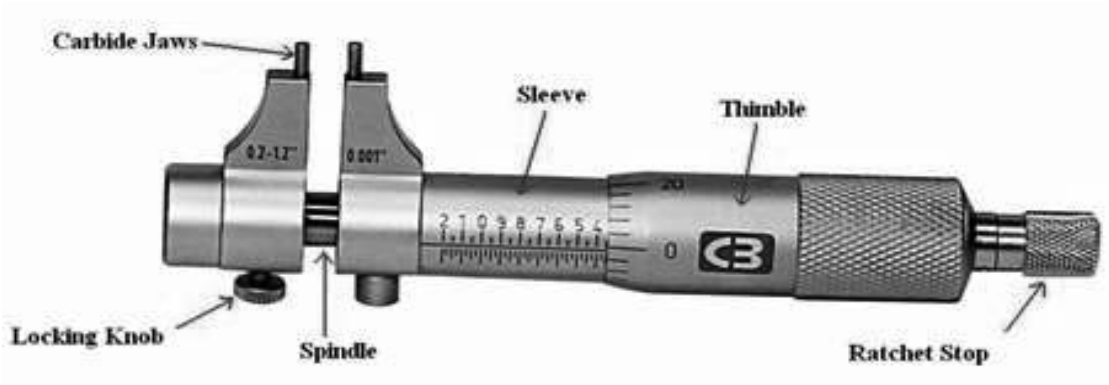
VI. Relevant Affective Domain related Outcomes

1. Follow safe practices
2. Practice good housekeeping
3. Practice energy conservation
4. Demonstrate working as a leader/a team member
5. Maintain tools and equipment

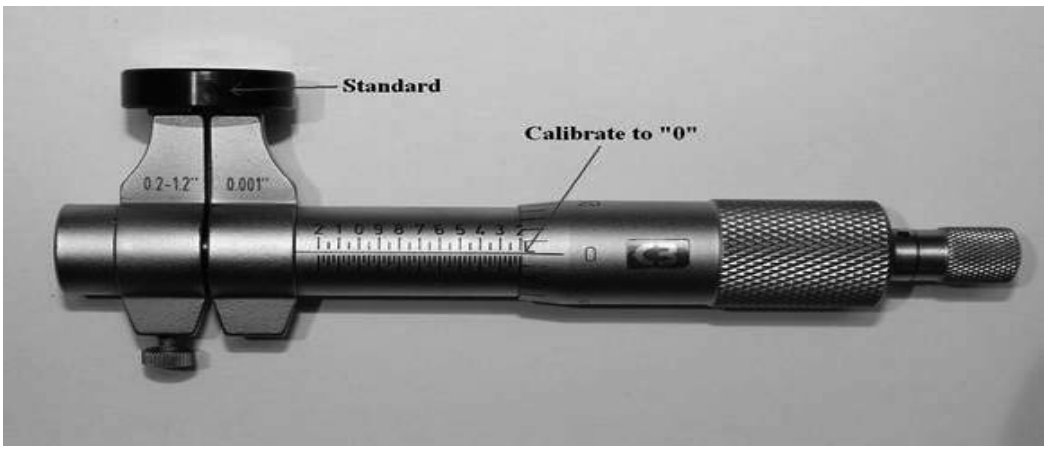
VII. Minimum Theoretical Background

Inside Micrometers are used to measure internal dimensions of through holes, blind holes and registers. It has rigid light weight tubular design and measuring spindle is hardened and ground.

VIII. Experimental setup



Inside Micrometer



Inside Micrometer

Dial Bore Indicator

IX. Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Inside Micrometer	0-200mm (Manual)	1
2.	Dial bore Indicator	0-200mm	1
3.	Surface Plate-	Granite. (200 x200x 50)	1

X. Precautions to be Followed

1. Avoid improper handling of instrument
2. Don't apply excessive pressure on measuring jaws and anvils.

XI. Procedure

1. Clean the work piece and instrument
2. Check the Inside micrometer and Dial bore Indicator for errors like play in the measuring jaws
3. If any error ,correct it
4. Calculate the least count of the instrument
5. Hold the bore/hole of a component in the jaws/anvils
6. Note down the reading on main scale and vernier scale
7. Take the reading for 3 components by Inside micrometer and Dial bore Indicator
8. Calculate the readings

XII. Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		

XIII. Actual Procedure Followed

.....

.....

.....

XIV. Precautions Followed

.....

.....

.....

XV. Observations and Calculations

A Measurement using Inside Micrometer

Name of Work piece	Reading on Main scale (MSR)	Reading on Vernier Scale (VSR)	Final reading MSR + (LC *VSR)
Ring Gauge			

B Measurement using Dial Bore Indicator

Name of Work piece	Reading on Main scale (MSR)	Reading on Vernier Scale (VSR)	Final reading MSR + (LC *VSR)
Cylinder Block			

XVI. Results

.....
.....
.....

XVII. Interpretation of Results

.....
.....
.....

XVIII. Conclusions

.....
.....
.....

XIX. Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

a. State the difference between Micrometer and inside Micrometer

……..
……..
……..

b. Name the instruments used to measure internal dimension.

……..
……..
……..

XX References / Suggestions for Further Reading

a. https://www.youtube.com/watch?v=cXU__cf1Xlk
b. https://www.youtube.com/watch?v=K9LrL-jj2Sg

XXI Assessment Scheme

Performance Indicators		Weight age
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
Total (25 Marks)		**100 %**

Names of Student Team Members

1 ……..

2 …….……

3 ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No. 3: Use of Pneumatic Comparator

I Practical Significance

Comparator is a precision instrument used for comparing dimensions of part under test. Comparators are to compare the work piece with a standard.

II Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.
PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Set the Comparator for comparing with the standard
2. Select specific comparator
3. Compare the dimensional variable with a standard.

IV Relevant Course Outcome(s)

- Use different types of comparators.

V Practical Outcome

- Use pneumatic comparator /electronic comparator to Measure the Circularity / Roundness of the given specimen and compare it with the given standard

VI Relevant Affective Domain related Outcomes

1. Follow safe practices
2. Practice good housekeeping
3. Practice energy conservation
4. Demonstrate working as a leader/a team member
5. Maintain tools and equipment

VII Minimum Theoretical Background

Pneumatic comparator can offer the best of both Mechanical/electronic gauges. Air gauges are virtually always fixed gauges, built to measure a single dimension by directing a controlled jet of air against the work piece. Air gauges may have either analogue or digital display.

Experimental setup

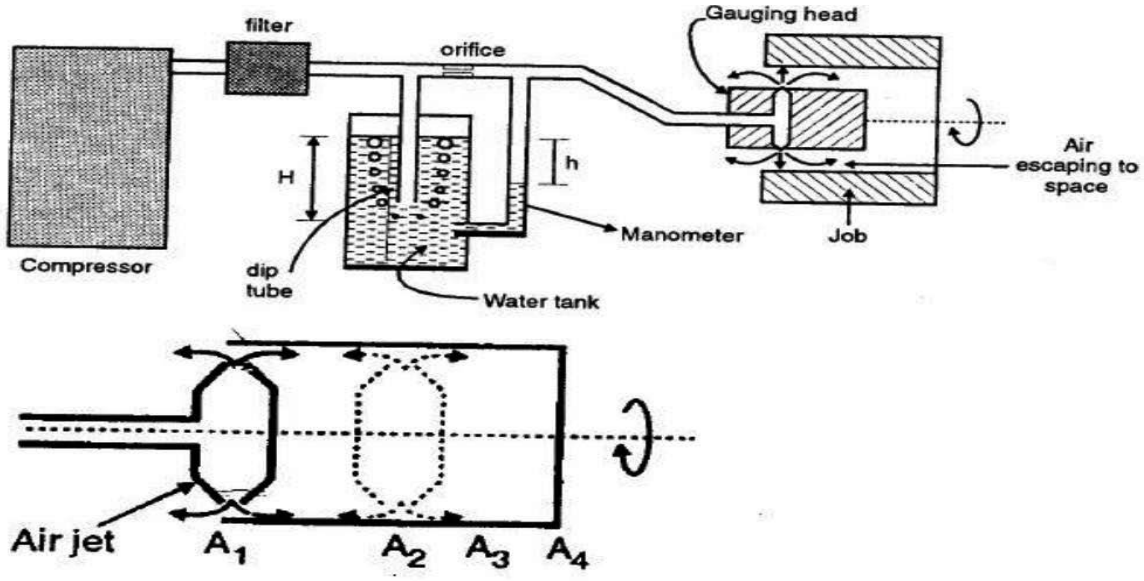


Figure (b)

VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Solex air Gauge	0-200mm (Manual)	1
2.	Go-No Go Plug Gauges	30mm,20mm	1
3.	Go- No GO ring gauges	30mm, 20 mm	1

IX Precautions to be Followed

1. Set Pointer of Gauge to Zero
2. The accuracy of the Instrument must be checked before using..

X Procedure

1. Set the tolerance pointer as per the tolerance given on working drawing
2. Select standard ring gauge /plug gauge
3. Select air ring gauge /plug gauge
4. Use air adjusting Knob while setting air gauge
5. Insert gauge head into the work piece
6. Note the Deviation of pointer
7. Take decision of Acceptance or rejection

XI Resources Used

S. No	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XII Actual Procedure Followed

.....

.....

.....

XIII Precautions Followed

.....

.....

.....

XIV Observations and Calculations

a. Measurement using Pneumatic Comparator

Name of Work piece	Deviation	Actual dimension

XV Results

.....

.....

.....

XVI Interpretation of Results

.....

.....

.....

XVII Conclusion

.....

.....

.....

XVIII Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the application of solex Pneumatic Comparator

---

2. " The Solex comparator is called contactless measuring instrument "State the reason

---

XIX References / Suggestions for Further Reading

a. https://www.youtube.com/watch?v=Msbd8Rty5Dg
b. https://www.youtube.com/watch?v=1q0W6GLsCC8

XX Assessment Scheme

Performance Indicators		Weight age
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
Total(25 Marks)		**100 %**

Names of Student Team Members

1. ……..
2. …….…….
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No. 4 : Use Slip Gauges To Set The Adjustable Snap Gauge Go End And No-Go End.

I Practical Significance

Slip gauges are practical end standard. Slip gauges are rectangular blocks of hardened and high grade cast steel. Snap gauges are used in production setting where specific diametrical or thickness measurement must be repeated frequently with precision and accuracy.

II Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.

PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Select the slip gauges of given dimensions
2. Set the Snap gauge for Go and No go as per given dimensions
3. Wring the slip gauges with proper procedure.

IV Relevant Course Outcome(s)

- Select gauges, fits and tolerances for machine components

V Practical Outcome

- Use slip gauges combination to set the adjustable snap gauge Go end and No-Go end for a given dimension

VI Relevant Affective Domain related Outcomes

1. Follow safe practices
2. Practice good housekeeping
3. Practice energy conservation
4. Demonstrate working as a leader/a team member
5. Maintain tools and equipment

VII Minimum Theoretical Background

Slip gauges are measuring blocks of hardened steel used for measurement, testing and calibration. Various dimensions can be built up by wringing. As per IS2984-1966 ,slip gauges are available in three grades-

Grade 0 for laboratories and standard rooms for checking gauges

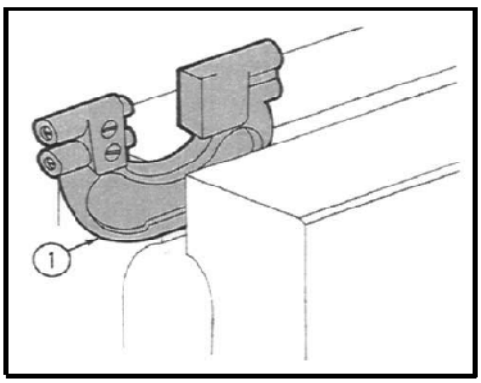
Grade I having lower accuracy and used for inspection department

Grade II to be used for workshop during production

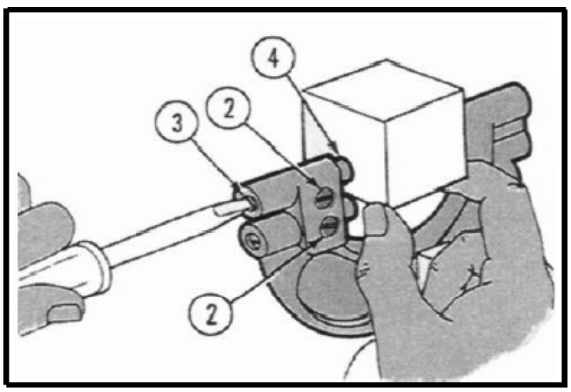
VIII Experimental setup

Adjustable Snap gauge

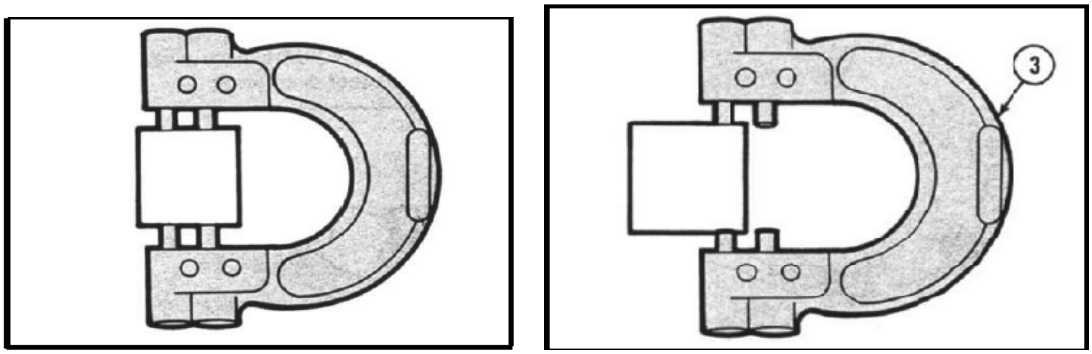
Slip gauge Box



1. Snap gauge



2. Locking Screw
3 Adjusting screw
4 Seting of diemention



Experimental set up

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Slip gauges	Grade 0	1
2.	Adjustable Go-No Go Snap Gauges	Any size	1

X Precautions to be Followed

a. Surface of gauge must be covered with natural petroleum jelly
b. Wringing of gauges should be done without applying undue pressure
c. Never drop slip gauges
d. Use minimum number of slip gauges for building up size combination

XI Procedure

1. Calculate the tolerance
2. Take the Slip gauges for given tolerance from Slip gauge Box
3. Clean all surfaces of slip gauges
4. Place two slip gauges together at right angles to each other to form a cross shape
5. Rotate any one slip gauge through 90 degree by applying small amount of pressure
6. Slip gauge will wrung together
7. Loose the adjustable screw of snap Gauge
8. Set the slip gauges as per tolerance required to adjust the Go and No Go size
9. Tighten the adjustable screw for GO and No go side of snap Gauge.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

.....

.....

.....

XIV Precautions Followed

.....

.....

.....

XV Observations and Calculations

	Tolerance value	Size of snap Gauge to be set	No of pieces of Slip gauges Required	Total
Snap Gauge-Go end				
Snap Gauge-No- Go end				

XVI Results

.....

.....

.....

XVII Interpretation of Results

.....

.....

.....

XVIII Conclusions

.....

.....

.....

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Explain the wringing process of slip gauges
2. State the specification of Slip gauges
3. Select the slip gauges for a given dimension

[Space for Answers]

.....

.....

.....

.....

.....

.....

.....

.....

XX References / Suggestions for Further Reading

a. https://www.youtube.com/watch?v=yQybmZuY1cc

b. https://www.youtube.com/watch?v=tnpgZFbHUqE

XXI Assessment Scheme

Performance Indicators		Weight age
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
Total (25 Marks)		**100 %**

Names of Student Team Members

1. ……..
2. …….
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No. 5 : Measure Gear Tooth elements using Gear Tooth Vernier caliper

I Practical Significance

Gears are Mechanical devices that transmits power and motion in a wide verity of commercial and industrial applications. They are widely used in speed reduction, torque multiplication and accuracy enhancement for positioning system. Transmission efficiency of gear is 99%, efficiency of gear depends upon the dimension of gears .

II Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.
PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Adjust the gear tooth Vernier caliper
2. Measure the various elements of gear tooth.
3. Calculate the chordal thickness of Gear tooth

IV Relevant Course Outcome(s)

- Use relevant instruments to measure different parameters of screw thread and gear

V Practical Outcome

Measure gear tooth elements using gear tooth Vernier

VI Relevant Affective Domain related Outcomes

1) Follow safe practices
2) Practice good housekeeping
3) Practice energy conservation
4) Demonstrate working as a leader/a team member
5) Maintain tools and equipment

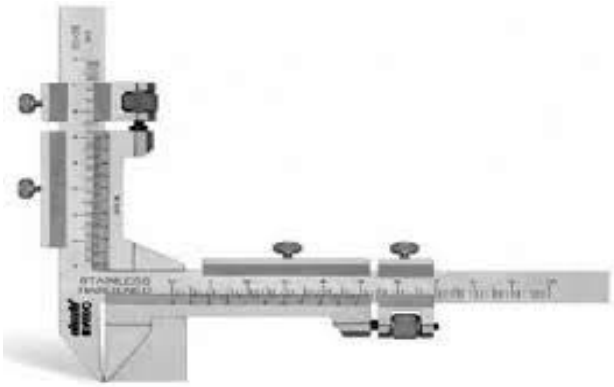
VII Minimum Theoretical Background

Gear Terminology-

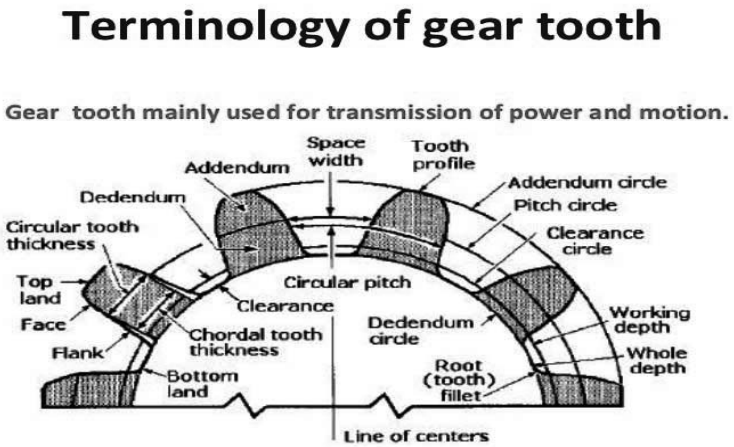
- Pitch Circle diameter (PCD)- It is the diameter of an imaginary circle which produces purely rolling action the same motion as that of the actual gear.
  PCD = (N x OD) /(N+2), N= Number of teeth, OD= Outside diameter
- Module- (m) - It is the ratio of PCD to the number of teeth
  m= PCD/N
- Circular pitch (PC) – It is the distance measured on the circumference of the pitch circle from a point of one tooth to the corresponding point on the next
  PC= II D/N

- Addendum - The radial distance of the tooth from the pitch circle to the top of the tooth
- Dedendum- The radial distance of the tooth from the pitch circle to the bottom of the tooth
  Dedendum = addendum + clearance
  = m + 0.157 m
- Tooth Thickness – It is the arc distance measured along the pitch from the intercepts with one flank to the intercepts with other flank of the same tooth.

VIII Experimental setup



Gear Tooth vernier caliper



IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Gear Tooth Vernier Caliper	0-150 mm	1
2	Vernier Caliper	0- 200 mm	1

X Precautions to be Followed

1. Avoid improper handling of instrument
2. Don't apply excessive pressure on measuring jaws and anvils

XI Procedure

1. Find Blank Diameter by Vernier Caliper

   OD= mm
2. Count Number of Teeth 'N' =
3. Calculate PCD = (N x OD) / (N + 2) =
4. Calculate module m= PCD/ N =
5. Set the Chordal depth (dedendum-'d') on the vertical side of gear tooth Vernier

   d = (N. m/2) [1 + (2/N)- cos(90/N)] = mm
6. Insert the jaws of the caliper on the tooth to be measures
7. Adjust the horizontal Vernier side by the fine adjusting screw so that the jaws just touch the tooth
8. Read the horizontal Vernier side, it gives chordal thickness of the tooth =

   w = mm
9. Find out theoretical value of chordal thickness (w)=N.m.sin(90/N)

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

.....
.....
.....
.....

XIV Precautions Followed

.....
.....
.....
.....

XV Observations

	Practical Chordal Thickness (w)			
Sr No	**Reading 1**	**Reading 2**	**Reading 3**	**Avg. Reading**
Teeth 1				
Teeth 2				
Teeth 3				

XVI Results

.....
.....
.....

XVII Interpretation of Results

.....
.....
.....

XVIII Conclusions

.....
.....
.....

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Define ‘ module’ and Pitch Circle diameter

   ……..
   ……..
   ……..

2. State the relationship between addendum and dedendum

   ……..
   ……..
   ……..

XX References / Suggestions for Further Reading

1. https://www.youtube.com/watch?v=BIE8_IxM2pA
2. https://www.youtube.com/watch?v=V0BsmyGfH_o

XXI Assessment Scheme

Performance Indicators		Weight age
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
Total (25 Marks)		**100 %**

Names of Student Team Members

1. ……..
2. …….
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

ractical No. 6 : Measurement of the Screw Thread Parameter Using Tool Maker's Microscope

I Practical Significance

Tool Maker's Microscope is an optical instrument in which a shadow image of the outline contour of the thread, projected by a beam of light is observed through the eyepiece of optical head.

II Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.
PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.
PO4**- Engineering tools:** Apply relevant mechanical technologies and tools with an understanding of the limitations

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Operate the Tool Maker's Microscope
2. Observe the image of an object
3. Measure the effective diameter of screw thread

IV Relevant Course Outcome(s)

- Use relevant instruments to measure different parameters of screw thread and gear

V Practical Outcome

Measure the effective diameter of the screw thread using profile projector / Tool maker Microscope

VI Relevant Affective Domain Unrelated Outcomes

1) Follow safe practices
2) Practice good housekeeping
3) Practice energy conservation
4) Demonstrate working as a leader/a team member
5) Maintain tools and equipment

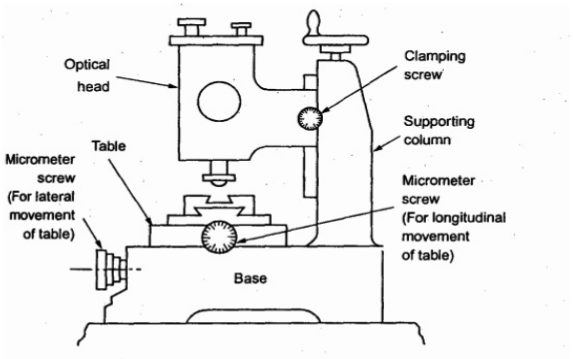
VII Minimum Theoretical Background

1. Major diameter- of thread is the diameter of the imaginary co-axial cylinder that just touches the crest of an external thread
2. Minor Diameter- -is the diameter of the cylinder that just touches the root of an internal thread
3. Crest-it is the prominent part of thread ,whether internal or external

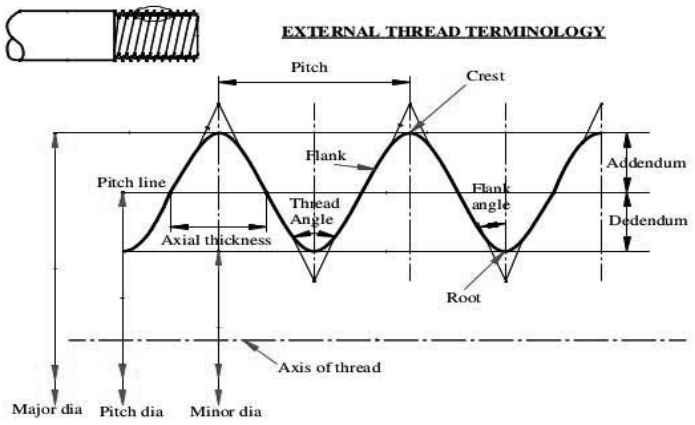
4. Root- It is the bottom of the groove between two flanking surface of the thread
5. Angle of thread-It is the angle between the flanks , measured in axial plane
6. Pitch of Thread- it is the distance measured parallel to its axis between corresponding point on adjacent surface in the same axial plane.
7. Lead- it is the axial movement of point following its helical turn around the thread.

VIII Experimental set up-

Tool makers microscope:



Screw Thread terminology



IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Tool Maker's Microscope	• X.Y Axis Travel: 50x50 mm • Maxi Working Height: 115 mm • Maxi Loading Weight: 5kgs • Measuring Head: Mechanical Measuring Head • Resolution Of Measuring Head: 0.001 mm • Machine Head: Monocular (Aimer Is Adjustable) • Angle Dial: Rotary Angle: 360°; Minimum Angle Reading: 6′ • Eyepiece (176-116): 15x • View Diameter: 13 mm • Objectives (176-138): 2x Working • Diameter: 67 mm • Total Magnification: 30 x • Contour Illumination: 24v/3v Tungsten Bulb With Green Filter Surface Illumination: 24v/3v Tungsten Bulb	1

X Precautions to be Followed

1. Avoid improper handling of instrument
2. Don't apply excessive pressure on Micrometer Screw

XI Procedure

1. Connect Power supply to the Microscope
2. A light source at the base provides a horizontal beam of light and is reflected from a mirror 90 deg. towards the working table
3. Set threaded object between centres on the working table
4. Set threaded object below the optical head by longitudinal and lateral movement of the table
5. Adjust optical head tube in height for focusing purposes till a sharp image of the projected counter is seen on the screen
6. For the measurement of screw thread pitch , the image of the profile is so set that some point of the profile coincides with the cross hair
7. Note the reading of thimble of longitudinal micrometer screw
8. Transverse the object by a micrometer screw until the corresponding point on the profile of next thread coincides with cross hair.
9. For measurement of angle of thread ,rotate the eyepiece until line on the screen coincides with one flank of thread profile.
10. Note the reading on circular scale
11. The difference in two two angular readings give actual angle of thread

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1					
2					
3					

XIII Actual Procedure Followed

.....

.....

.....

.....

XIV Precautions Followed

.....

.....

.....

.....

XV Observations

1. Measurement of Pitch

Sr No	Initial Micrometer Scale reading	Final Micrometer Scale reading	Difference in reading (pitch) mm

2. Measurement of angle of Thread

Sr No	Initial angle in degrees	Final angle in degrees	Difference in reading (angle of thread)

3. Measurement of Major diameter, Minor diameter

Sr No	Reading at Crest'R1'	Reading at Root'R2'	Reading at Root 'R3'	Reading at Crest 'R4'	Major diameter mm	Minor Diameter mm

XVI Results

.....
.....
.....

XVII Interpretation of Results

.....
.....
.....

XVIII Conclusions

.....
.....
.....

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the industrial applications of tool Maker's microscope

---
---

2. List the other jobs that can be measured on Tool maker's Microscope

---

XX References / Suggestions for Further Reading

1. https://www.youtube.com/watch?v=cIuix8O_43o
2. ttps://www.youtube.com/watch?v=A30Wq3nE21Y

XXI Assessment Scheme

Performance Indicators		Weight age
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
Total (25 Marks)		**100 %**

Names of Student Team Members

1. ……..……..
2. ……..…….
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No.7: Measurement of Minor, Major and Effective diameter of Screw Thread using Floating Carriage Micrometer.

I Practical Significance

Floating Carriage micrometer is used for measuring the minor, major and effective diameter of screw thread. It is a high precision instrument with a least count of 0.2 microns. Two wire method is generally used to measure effective, minor and major diameter of screw thread. A large micrometer head and fudicial indicator mounted on a floating carriage constrained to move at right angle to the axis.

II Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.
PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.
PO4- Engineering tools: Apply relevant mechanical technologies and tools with an understanding of the limitations.

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Operate the Floating carriage micrometer
2. Select the wire size
3. Measure the effective diameter of screw thread

IV Relevant Course Outcome(s)

- Use relevant instruments to measure different parameters of screw thread and gear

V Practical Outcome

Use floating carriage micrometer to measure minor, major and effective diameter of screw thread.

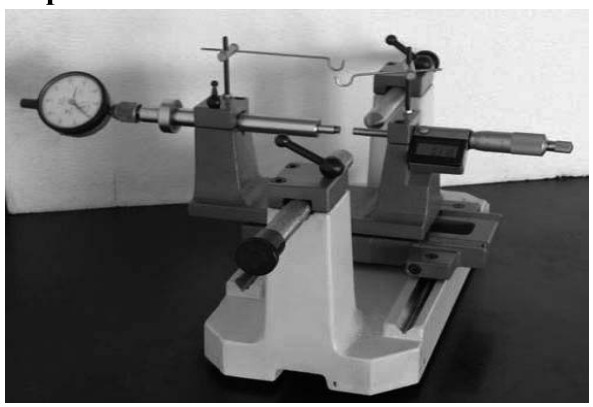
VI Relevant Affective Domain related Outcomes

1) Follow safe practices
2) Practice good housekeeping
3) Practice energy conservation
4) Demonstrate working as a leader/a team member
5) Maintain tools and equipment

VII Minimum Theoretical Background

1. Major diameter- of thread is the diameter of the imaginary co-axial cylinder that just touches the crest of an external thread
2. Minor Diameter- -is the diameter of the cylinder that just touches the root of an internal thread
3. Effective diameter- It is a diameter of the imaginary co-axial cylinder which increases the surface of thread in such a manner that the intercept on a generator of cylinder, between two points where it meets the opposite flanks of a thread groove.

VIII Experimental set up-



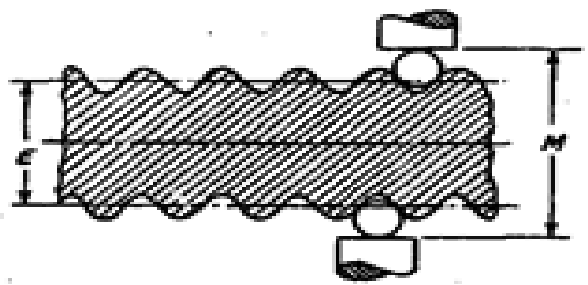
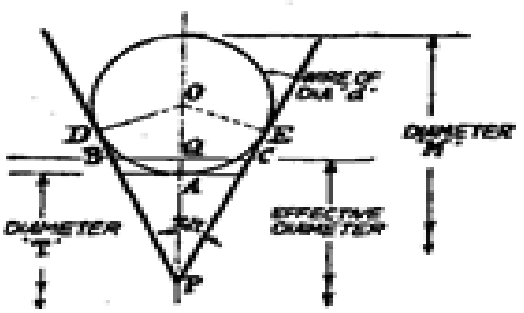


Fig. 13.15 (a)



Floating Carriage Micrometer

Two wire Method set up

Standard Wire Box

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Floating Carriage Micrometer	• **Range:** 0-100mm/0-4" & 0-175mm/0-7". • **Resolution:** 0.0002mm/ 0.0001 mm • **Repeatability:** 0.002 mm/0.0002 mm • **Accuracy:** 0.004mm/ 0.002mm with P10 probe • Accessories**:** Thread Measuring wires, Prisms, Cylindrical masters & Taper thread plug attachment.	1

X Precautions to be followed

1. Avoid improper handling of instrument
2. Don't apply excessive pressure on Micrometer anvils

XI Procedure

1. Select the set of standard wire/V-pieces and setting cylinder of assize nearer to size of workpiece
2. Hold setting cylinder between centers
3. Hang the standard wire on stands provided with floating carriage micrometer
4. Apply the pressure over anvil until fudicial indicators shows zero reading
5. Note the reading on thimble as initial reading 'R_c"
6. Replace a setting cylinder by a screw thread/thread plug gauge
7. Insert the standard wire in root of the thread
8. Apply the pressure over anvil until fudicial indicators shows zero reading
9. Note the reading on thimble as final reading 'R_t"
10. Calculate the diameter over wire 'Do"
    Do = Ds + (Rt - Rc)
    Ds= Diameter of setting cylinder
11. Effective Diameter = D_E = Do – 2d + P
    P = 0.866p – d (metric Thread)
    d= diameter of wire
    p = Screw thread pitch

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

.....

.....

.....

XIV Precautions Followed

.....

.....

.....

XV Observations

1. Measurement of Pitch

Sr No	Diameter of Setting Cylinder mm	Reading on Threaded Object mm	Reading on Setting Cylinder mm	Diameter over the wire mm
	Ds	Rt	Rc	Do = Ds + (Rt - Rc)
1				
2				
3				

XVI Results

.....

.....

.....

XVII Interpretation of Results

.....

.....

.....

XVIII Conclusions

.....

.....

.....

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the function of Fudicial Indicator

……..
……..
……..

2. Explain Two wire method for the measurement of Effective diameter.

……..
……..
……..

XX References / Suggestions for Further Reading

1. https://www.youtube.com/watch?v=Jd5Kx4hMgiQ

XXI Assessment Scheme

Performance Indicators		Weightage
Process Related (10 Marks)		**40 %**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
	Total (25 Marks)	**100 %**

Names of Student Team Members

1. ……..
2. …….
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No. 8 : To Find Unknown Angle of A Given Component Using Sine Centre.

I Practical Significance

A sine Bar is a high precision and most accurate angle measuring instrument, it is used in conjunction with set of slip gauges. This bar is made up of high carbon high chromium Steel. It is kept on two hardened rollers of accurately equal diameter at a fixed distance. They are available in 100mm,200mm, 300mm.

II Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.

PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Select the slip gauges of given dimensions
2. Set the component on sine Centre
3. Adjust the dial indicator to Zero.

IV Relevant Course Outcome(s)

- Select gauges, fits and tolerances for machine components

V Practical Outcome

Measure unknown angle of a given tapered component using sine centre in Combination with slip gauges

VI Relevant Affective Domain related Outcomes

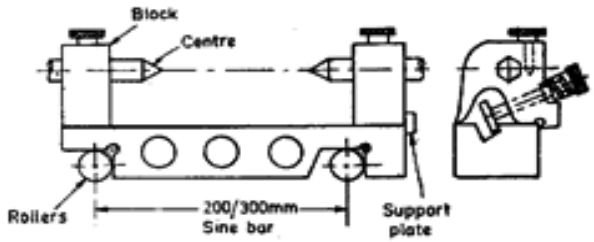
1) Follow safe practices
2) Practice good housekeeping
3) Practice energy conservation
4) Demonstrate working as a leader/a team member
5) Maintain tools and equipment

VII Minimum Theoretical Background

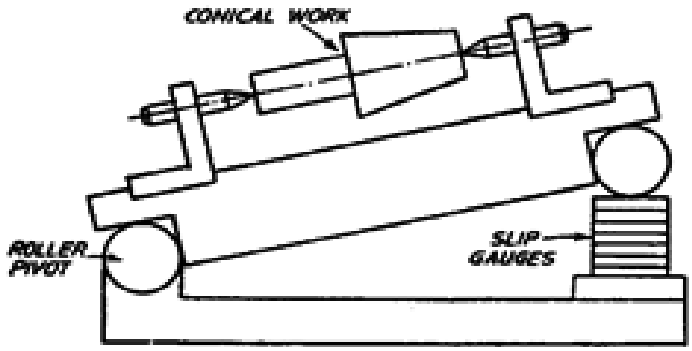
Sine centers are used in situations where it is difficult to mount component on sine bar. It consist of sine bar. Two blocks are mounted on the top surface of the sine bar ,which carry two centers and can be clamped at any position on Sine bar. These Two centers can be adjusted depending upon the length of component.

VIII Experimental setup

Slip gauge Box



Sine Centre



Experimental set Up

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Slip gauges	Grade 0	1
2	Sine centre	100mm or 200 mm size	1
3	Surface plate	Granite plate 200mm x 200mm	1
4	Dial Indicator	0-25mm size	1
5	Dial Indicator Stand		1
6	Bevel Protractor		1

X Precautions to be Followed

a. Surface of slip gauge must be covered with natural petroleum jelly
b. Wringing of gauges should be done without applying undue pressure
c. Never drop slip gauges
d. Use minimum number of slip gauges for building up size combination
e. Sine bars should not be used for the angles more than 45 degree

XI Procedure

1. Note the length of Sine Bar L= mm
2. Find the approximate angle using Bevel protractor θ = degree
3. Calculate Height of slip gauge (h) , sin θ = h/L =
4. Select the Slip gauge pieces
5. Wring the slip gauge pieces for dimension of 'h'
6. Place the workpiece on Sine centre
7. Dial indicator is to clamped to the stand and place plunger over workpiece with slight pressure
8. To check the parallelism of upper surface of workpiece, a dial indicator along with stand is moved from one end to another end
9. Note the deviation δθ = degree
10. Calculate δh, tan δθ = δh/L , δh=
11. Add or Remove slip gauges of height δh as per dial indicator deviation
12. Now move dial indicator over the workpiece, There is no deviation
13. Unknown angle Sin θ_1 = [(h+ δh)/L] =

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

.....
.....
.....

XIV Precautions Followed

.....
.....
.....

XV Observations and Calculations

- Length of Sine Bar L = mm
- Angle θ =
- Sinθ = h / L =
- Height of Slip gauges 'h' = mm
- Deviation angle δθ =

- tan δθ = δh/L =
- Unknown angle Sin θ_1 = [(h+ δh)/L] =

XVI Results

.....
.....
.....

XVII Interpretation of Results

.....
.....
.....

XVIII Conclusions

.....
.....
.....

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Explain the use of sine bar

……..
……..
……..

2. State the function of Sine centre

……..
……..
……..

XX References / Suggestions for Further Reading

a. **https://www.youtube.com/watch?v=bN4cKPZwFlc**

XXI Assessment Scheme

Performance Indicators		Weightage
Process Related (15 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (30 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
Total (25 Marks)		**100 %**

Names of Student Team Members

1. ……
2. ……
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No.9 : Angular Measurement Using Bevel Protractor And Clinometer.

I Practical Significance

Angular Bevel protector is a simplest instrument used for measuring the angle between the two faces of a component. it consists of a base plate attached to the main body and an adjustable blade attached, which in turn attached to a circular plate containing the Vernier scale. Clinometer is a special case of the application of spirit level. The clinometer is mainly used to measure the included angle between two adjacent faces of the workpieces.

II. Relevant Program Outcomes (POs)

PO1- **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.

PO3- **Experiments and practice:**Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.

PO4- Engineering tools: Apply relevant mechanical technologies and tools with an understanding of the limitations

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Measure the angles of a given job using Vernier Bevel protractor
2. Measure the angles of a given job using Clinometers.

IV Relevant Course Outcome(s)

Use linear and angular measuring instruments

V Practical Outcome

Use Universal Bevel Protractor and Clinometer for measuring angles of a given job.

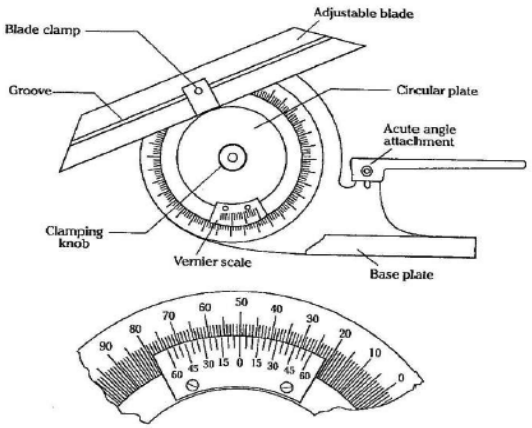
VI Relevant Affective Domain related Outcomes

1) Follow safe practices
2) Practice good housekeeping
3) Practice energy conservation
4) Demonstrate working as a leader/a team member
5) Maintain tools and equipment

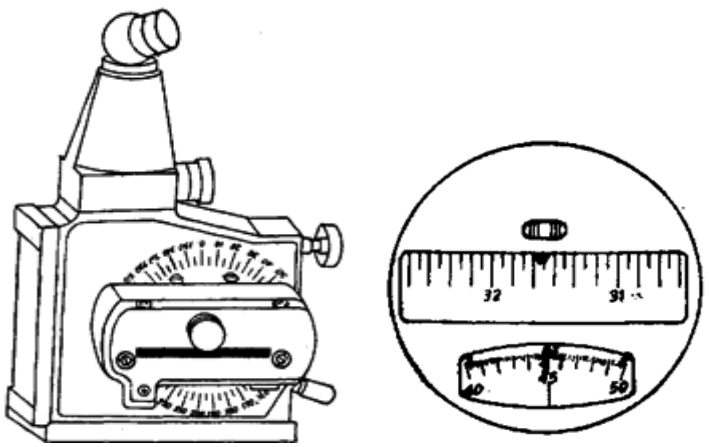
VII Minimum Theoretical Background

- Angle is defined as the opening between the two lines meet at a point.
- If one line moved around a point in an arc, a complete circle can be formed.
- The basic unit of angular measurement is the right angle, which is defined as the angle between two lines which intersect so as to make the adjacent angle equal.
- If a angle is divided into 360 parts, each part is called as **degree (0)**
- Each degree is divided into 60 parts and each that part is called **minute (').**
- Each second have 60 parts and each that part is called **second (").**

VIII Experimental set up-



Universal Bevel Protractor



Clinometer

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Universal Bevel Protractor	• Graduation:5min.(0º- 90º- 0º) Accuracy Vernier:±5' Straightness [.00016"+(.00005xL/2)]" Parallelism [.00016"+(.00005xL/2)]" L = Length in inch Diameter: 2.56" / 70mm	1
2.	Clinometer	• Measuring range: 4 x 90°. • Graduation: 1°. • Dimensions: 100 x 15 x 100 mm	1

X Precautions to be Followed

1. Avoid improper handling of instrument
2. Don't apply excessive pressure on Micrometer Knobs

XI Procedure

A. Bevel Protractor-

1. The fixed blade of the bevel protractor is made to coincide with the reference surface of work piece.
2. Move the movable blade of protractor to coincide with outer surface.
3. The angle between the blades is taken from protractor after noting main scale and vernier scale reading.

   Angle between the faces is given by

   A= main scale reading + L.C. x (Vernier scale reading)

   Least Count of the Protractor= 5 minute

B. Clinometer

a. Place the base of Clinometer on a angular surface

b. Rotate the knob of clinometers until the bubble of spirit level reaches at the middle

c. Note down the reading

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

……..
……..
……..

XIV Precautions Followed

……..
……..
……..

XV Observations

A. Bevel Protractor

Nature of angle measurement	Sl. No.	Main Scale Reading (degree)	Vernier Scale Reading including zero error correction	Observed Reading (degree & minute)	Best Estimate (mean) (mm)	Design values of the angles	Error in manufacturing process
Acute angle in a metal plate between largest & smallest side	**1**						
	2						
	3						
Acute angle in a metal plate between largest & intermediate side	**1**						
	2						
	3						
Obtuse angle opposite to the largest side	**1**						
	2						
	3						

B. Clinometer

Component No	Angular reading	Average	Remark
1			

2			
3			

XVI Results

……..
……..
……..

XVII Interpretation of Results

……..
……..
……..

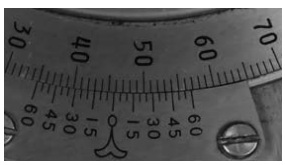
XVIII Conclusions

……..
……..
……..

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions as to ensure the achievement of identified CO.

1. Note down the reading of following case



2. State the function of Clinometers

……..
……..
……..

XX References / Suggestions for Further Reading

1. https://www.youtube.com/watch?v=oJFUI_FHlio
2. https://www.youtube.com/watch?v=pX-cnBBg2ww

XXI Assessment Scheme

Performance Indicators		Weightage
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
	Total (25 Marks)	**100 %**

Names of Student Team Members

1. ……
2. ……
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No. 10 : Use Angle Dekkor / Autocollimator To Measure The Angle And Taper Of Given Component.

I Practical Significance

Angle Dekkor is a type of autocollimator used to find out deviation in angle by comparing the reading obtained from a standard.

II Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.
PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.
PO4- Engineering tools: Apply relevant mechanical technologies and tools with an understanding of the limitations

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Set the angle dekkor with respect to base/slip gauges
2. Operate the angle dekkor
3. Measure the angular deviations

IV Relevant Course Outcome(s)

- Use linear and angular measuring instruments.

V Practical Outcome

Use angle dekkor for measuring angular deviation of a given job..

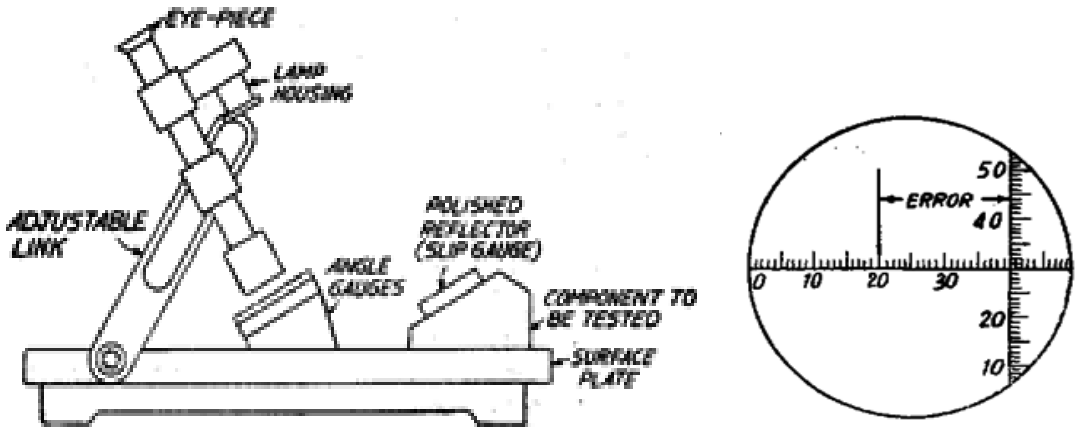
VI Relevant Affective Domain related Outcomes

1) Follow safe practices
2) Practice good housekeeping
3) Practice energy conservation
4) Demonstrate working as a leader/a team member
5) Maintain tools and equipment

VII Minimum Theoretical Background

It consist of a small illuminated scale in the focal plane of objective lens. The illuminated scale is projected as a parallel beam of a light by a collimating lens. In the field view ,there is another datum scale fixed across the centre of the screen and the reflected image of illuminated scale is received at right angle to the fixed scale. These two scales intersects with each other The reading of illuminated scale measures the angular deviation in one axis at 90 degree to optical axis changes in angular position in two plane are indicated by changes in points of intersection of two scales An angular deviation of 1' can be measured with the help of angle dekkor.

VIII Experimental set up-



Angle Dekkor Set up

IX Resources Required

S. No	Name of Resource	Suggested Broad Specification	Quantity
1.	Angle Dekkor	• Focal Length of Objective lense : 220mm • Clear Aperture of Objective lense : 40mm • Magnification : 11X • Measuring Range : 60-0-60 minute in X-Y axis. • Least Division on Reticle : 1 minute of arc • Least Division with Micrometer Drum : 2 second of arc .	1
2.	Set of angle Gauges	1 set	1
3.	Set of slip Gauges	1 set	1

X Precautions to be Followed

1. Avoid improper handling of instrument
2. Handle eyepiece with care
3. Handle Gauges with care

XI Procedure

1. Mount the angle dekkor on adjustable bracket
2. Select the set of angle gauge
3. Set the angle dekkor in such a way that the axis of optical system is normal to the surface of reflector
4. Set the zero reading on illuminated scale
5. Remove the angle gauge and replace it by component
6. Note down the reading of new position of reflected scale

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

……..
……..
……..

XIV Precautions Followed

……..
……..
……..

XV Observation

Sr No	Basic size angle	Angle gauge	Reading on reflected scale	Angular deviation from Basic Size
	α	β	θ	α +/- θ
1				
2				
3				

XVI Results

……..
……..
……..

XVII Interpretation of Results

……..
……..
……..

XVIII Conclusions

……..
……..
……..

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State difference between auto collimator and angle dekkor

……..
……..
……..
……..
……..
……..

2. State the procedure of angle dekkor calibration

……..
……..
……..
……..
……..
……..

XX References / Suggestions for Further Reading

1. https://www.youtube.com/watch?v=Vt6OWKZA3V4

XXI Assessment Scheme

Performance Indicators		Weightage
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
Total (25 Marks)		**100 %**

Names of Student Team Members

1. …….
2. ……
3. ……..

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No. 11: Measure Flatness Of The Given Component By Interpreting Fringes Using Monochromatic Light Source And Optical Flat.

I Practical Significance

Flatness testing of a workpiece is done by observing the fringe pattern by interface of two monochromatic light rays reflected from lower surface of top face of top optical flat and upper surface of lower flat surface through very fine air gap between two flats.

II. Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.
PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.
PO4- Engineering tools: Apply relevant mechanical technologies and tools with an understanding of the limitations

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Set the optical flat
2. Observe the fringe pattern
3. Interpret the fringe pattern

IV Relevant Course Outcome(s)

- Select relevant surface testing methods.

V Practical Outcome

Use optical flat for measuring the flatness of given job.

VI Relevant Affective Domain Unrelated Outcomes

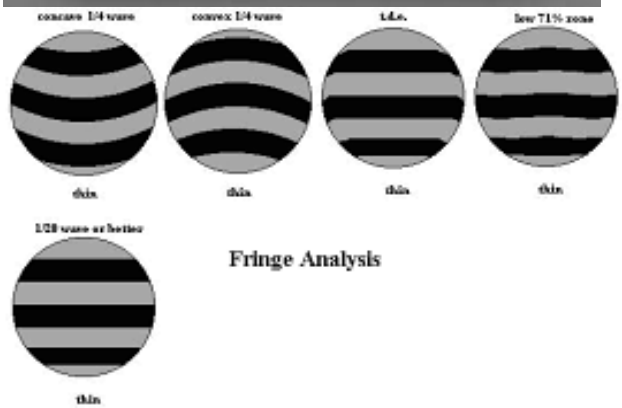
1) Follow safe practices
2) Practice good housekeeping
3) Practice energy conservation
4) Demonstrate working as a leader/a team member
5) Maintain tools and equipment

VII Minimum Theoretical Background

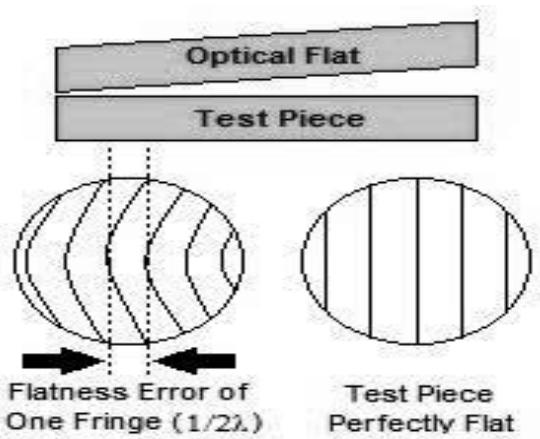
The essential equipment by a light wave interference is a monochromatic light source and a set of optical flat. An optical flat is a circular piece of optical glass or fused quartz having its two plane faces flat and parallel .The surfaces are finished to an optical degree of flatness. If the optical flat form an intimate contact and placed in monochromatic light source then the bands are visible.

VIII Experimental set up-

Optical Flat



Fringe pattern



IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Monochromatic Light Source	Sodium vapour light	1
2.	Optical flat Set	Convex, Concave, flat, Cylindrical, Turf type optical flat	1 set

X Precautions to be Followed

1. Avoid improper handling of optical flat
2. Don't apply pressure on optical flat

XI Procedure

1. Keep Optical flat on, master piece
2. Apply pressure by two fingers so that there should not be any air gap
3. Observe the fringe pattern
4. Keep optical flat once again on same surface and apply pressure gently so that some air gap exist
5. Observe the fringe pattern
6. When fringes are perfectly straight and same fringe width for dark and bright band we conclude that the surface is perfectly flat
7. Keep optical flat on convex surface
8. Apply pressure gently so that some air gap exist
9. For convex surface the fringes curve around the point of contact
10. Keep optical flat on concave surface
11. Apply pressure gently so that some air gap exist
12. For concave surface the fringes curve away from the point of contact

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

……..
……..
……..

XIV Precautions Followed

……..
……..
……..

XV Observation

Sample No	Fringe Pattern Observed	Nature of surface.
1		
2		
3		

XVI Results

……..
……..
……..

XVII Interpretation of Results

……..
……..
……..

XVIII Conclusions

……..
……..
……..

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Name the commonly used monochromatic light sources

……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……
…..……..

2. State the uses of optical flats

……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..

XX References / Suggestions for Further Reading

- https://www.youtube.com/watch?v=ZJLTVuo9FJo

XXI Assessment Scheme

Performance Indicators		Weight age
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
Total (25 Marks)		**100 %**

Names of Student Team Members

1. ……..
2. …….
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No. 12 : Measure Flatness Using Spirit Level.

I Practical Significance

The simplest form of flatness testing is possible by comparing the surface with an accurate surface. The least count of precision spirit level is 0.01 mm.

II. Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.
PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.
PO4- Engineering tools: Apply relevant mechanical technologies and tools with an understanding of the limitations

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Set the spirit level
2. Observe the bubble of spirit level

IV Relevant Course Outcome(s)

- Select relevant surface testing methods.

V Practical Outcome

Use spirit level for measuring the flatness of given job.

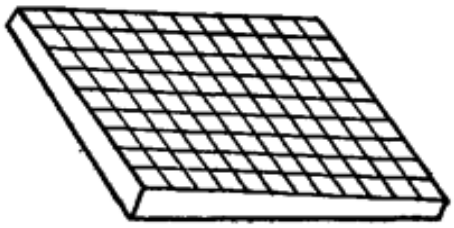
VI Relevant Affective Domain Unrelated Outcomes

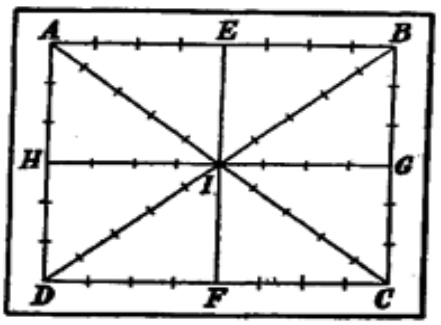
1) Follow safe practices
2) Practice good housekeeping
3) Practice energy conservation
4) Demonstrate working as a leader/a team member
5) Maintain tools and equipment

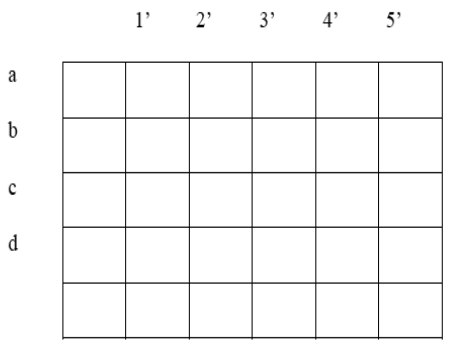
VII Minimum Theoretical Background

Spirit level is used in special cases and called Clinometers, precision micro-optic clinometers utilizes bubble unit with a prismatic coincidence reader which presents both ends of the bubble an adjacent images in a spirit field. Levelling helps in the coincidence of the 2 images, making it very easy to sec when the bubble is exactly centered without reference to any graduations. The special features to precision micro-optic clinometers arc direct reading over range 0-360°, optically reading system, main coarse setting, slow motion screw to fine setting. The least count of precision spirit level is 0.01 mm.

VIII Experimental set up-







Experimental set up

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Spirit Level		01

X Precautions to be Followed

1. Avoid improper handling of optical flat
2. Don't apply pressure on optical flat

XI Procedure

1. Let a plane passing through the points A, B and D be assumed to be an arbitrary plane, relative to which the heights of all other points may be determined. For it, the ends of lines AB, AD and BD are corrected to zero and thus the height of points A, B and D are zero.
2. The height of point / is determined relative to the arbitrary plane ABD = 000. As I is the mid-point of line AC also, all the points on AC can be fixed relative to the arbitrary plane by assuming A = 0 and correcting / on AC to coincide with the mid-point J on BD. In this way, all points on AC are corrected by amounts proportionate to the movement of its mid-point. A hint could be taken here that C is twice as far from A as the mid-point, the correction for C will be double that oil.
3. Point C is now fixed relative to the arbitrary plane and points B and D are set at zero, all intermediate points on BC and DC can be corrected accordingly.
4. The positions of H and G, E and F are known, so it is now possible to fit in lines HG and EF. This also provides a check on previous evaluation since the mid-point of these lines should coincide with the known position of mid-point I.
5. Thus a number of readings w.r.t to surface plate reference is found.
6. A plot is done on the performance

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

……..
……..
……..

XIV Precautions Followed

……..
……..
……..

XV Observation

Square Name	reading	Square Name	reading	Square Name	reading
A-1		**B-1**		**C-1**	
A-2		**B-2**		**C-2**	
A-3		**B-3**		**c-3**	
A-4		**B-4**		**C-4**	
A-5		**B-5**		**C-5**	

Calculate Ra Value

XVI Results

……..
……..
……..

XVII Interpretation of Results

……..
……..
……..

XVIII Conclusions

……..
……..
……..

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Define RMS value

……..
……
…..……..

2. State the unit of flatness.

……..
……..
……..

XX References / Suggestions for Further Reading

- https://www.youtube.com/watch?v=ZJLTVuo9FJo

XXI Assessment Scheme

Performance Indicators		Weight age
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(40%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
Total (25 Marks)		**100 %**

Names of Student Team Members

1. ……..
2. …….
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No. 13 : Measure The Surface Roughness Of A Given Sample Using Taylor Hobson's Talysurf / Surface Roughness Tester

I **Practical Significance -**Taylor Hobson Talysurf is a device used for measurement of surface finish with a high accuracy. The device is initially calibrated with a standard work piece.

II **Relevant Program Outcomes (POs)**

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.
PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.
PO4- Engineering tools: Apply relevant mechanical technologies and tools with an understanding of the limitations

III **Competency and Skills**

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Operate Taylor Hobson Talysurf
2. Measure surface roughness of given work piece
3. Compare the surface roughness of a given surface with standard workpiece.

IV **Relevant Course Outcome(s)**

- Select relevant surface testing methods.

V **Practical Outcome**

Use Talysurf for surface roughness of a given surface.

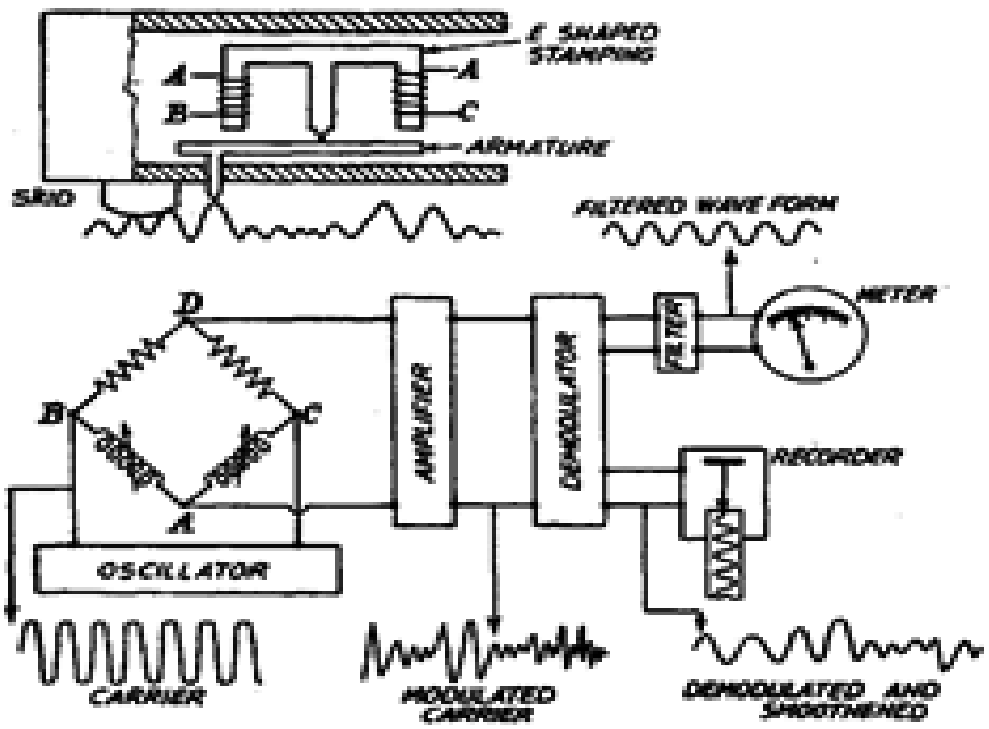
VI **Relevant Affective Domain related Outcomes**

1) Follow safe practices
2) Practice good housekeeping
3) Practice energy conservation
4) Demonstrate working as a leader/a team member
5) Maintain tools and equipment

VII Minimum Theoretical Background

The Talysurf is an electronic instrument working on carrier modulating principle.The measuring head of the instrument consist of a diamond stylus of about 0.002mm tip radios skid is drawn across the surface by means of motorised driving unit .It provides three motorized speeds giving 20X,100X magnification and speed suitable for average reading.

VIII Experimental set up-



Layout of Talysurf

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Taylor Hobson talysurf	• Span length – 0.8mm, • Diamond stylus, • Digital Reading • Sample workpiece for all machining process • Samples showing all surface roughness value	01

X Precautions to be Followed

1. Avoid improper handling of Talysurf
2. Don't apply pressure on stylus of the instrument

XI Procedure

1. Calibrate the talysurf using standard piece
2. Clean the surface under test
3. Place the probe on the surface which is to be tasted
4. ON the talysurf
5. Observe the display of 'Ra' value
6. Note the "Ra" value reading displayed
7. Repeat the procedure for various components

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					

XIII Actual Procedure Followed

……..
……..
……..

XIV Precautions Followed

……..
……..
……..

XV Observation

Component No	Manufacturing Process used	'Ra' Value	Average 'Ra'
1			
2			
3			

XVI Results

……..
……..
……..

XVII Interpretation of Results

……..
……..
……..

XVIII Conclusions

……
…..……..
……..

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Define Ra value

……..
……..
……..

2. State the principle of Talysurf.

……..
……..
……..

XX References / Suggestions for Further Reading

- https://www.youtube.com/watch?v=9zk7aKYbCYM

XXI Assessment Scheme

Performance Indicators		Weightage
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
	Total (25 Marks)	**100 %**

Names of Student Team Members

1. ……..
2. …….
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No. 14 : Use Dial Indicator To Check The Lathe Machine Parameters Like Parallelism, Trueness and Alignment.

I Practical Significance –

Parallelism- Two lines or planes are said to be parallel , when their distance from each other is measured anywhere on the surface and maximum error over a specified length does not exceed that agreed value.

II. Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.

PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.

PO4- Engineering tools: Apply relevant mechanical technologies and tools with an understanding of the limitations

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Test the flatness of lathe bed
2. Test the parallelism of spindle axis with saddle of Lathe
3. Test the alignment of axis between chuck and tailstock
4. Test the trueness of chuck

IV Relevant Course Outcome(s)

- Select relevant surface testing methods.

V Practical Outcome

- Test the parallelism, Trueness and alignment of Lathe component using dial indicator

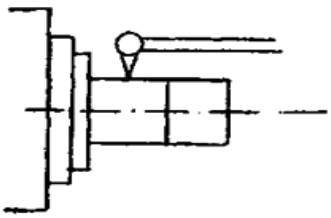
VI Relevant Affective Domain Unrelated Outcomes

1) Follow safe practices
2) Practice good housekeeping
3) Practice energy conservation
4) Demonstrate working as a leader/a team member
5) Maintain tools and equipment

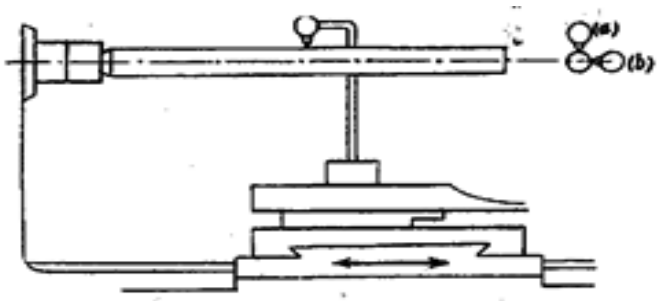
VII Minimum Theoretical Background

Two lines or planes are said to be aligned when their distance apart at several points over a given length is measured and this distance does not exceed than a standard tolerance. The dimension, surface finish, geometry and accurate production of component depends upon then quality and accuracy of machine tool. Therefore maintaining the accuracy of component the machine should be properly aligned.

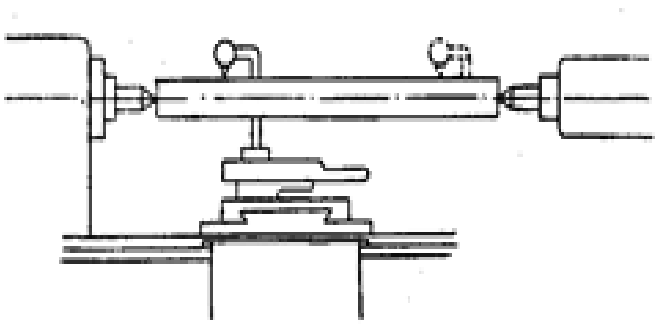
VIII Experimental set up-



Trueness of Spindle



Parallelism of spindle axis with saddle



Alignment of both centers

IX Resources Required

S. No	Name of Resource	Suggested Broad Specification	Quantity
1.	Dial Indicator	Range 0- 25mm	1
2.	Magnetic stand		1

X Precautions to be Followed

1. Avoid improper handling of Dial Indicator
2. Don't apply pressure on tipoff Dial Indicator

XI Procedure

A. **Parallelism of Main spindle to saddle movement-**

1. It is carried out on both vertical and horizontal plane
2. For this test mandrel is fitted in the spindle
3. Fix the dial indicator on magnetic stand on the saddle
4. Place the plunger of dial indicator on the mandrel
5. Move the saddle slowly
6. Note down the reading (amount of error)
7. Compare with standard value (allowable deviation)

B. **Trueness of Spindle**

1. For this test mandrel is fitted in the spindle
2. Fix the dial indicator on magnetic stand on the saddle
3. Place the plunger of dial indicator on magnetic stand on the saddle
4. Move the spindle slowly
5. Note down Reading of dial indicator (amount of error)
6. Compare with standard value (allowable deviation)

C. **Alignment of both Centers**

1. Hold the mandrel between two centers of lathe
2. Fix dial indicator with magnetic stand on the carriage
3. Press the plunger of dial indicator against the mandrel
4. Move the carriage
5. Note down the reading (amount of error)
6. Compare the reading with standard value (allowable deviation)

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					

XIII Actual Procedure Followed

……..
……..
……..

XIV Precautions Followed

……..
……..
……..

XV Observation

A. Parallelism of Main spindle to saddle movement-

Sr No	Type of test conducted	Allowable deviation	Dial Indicator Reading	Remarks
1				
2				
3				
4				

B. Trueness of Spindle

Sr No	Type of test conducted	Allowable deviation	Dial Indicator Reading	Remarks
1				
2				
3				
4				

C. - Alignment of both Centers

Sr No	Type of test conducted	Allowable deviation	Dial Indicator Reading	Remarks
1				
2				
3				
4				

XVI Results

……..
……..
……..

XVII Interpretation of Results

……..
……..
……..

XVIII Conclusions

……..
……..
……..

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

a. State the meaning of trueness of spindle of lathe

……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..

b. State the reason, The lathe machine is to tasted for its alignment during errection.

……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..

……..
……..

XX References / Suggestions for Further Reading

- https://www.youtube.com/watch?v=q5AslPQLQpw
- https://www.youtube.com/watch?v=aShIV48-fQ

XXI Assessment Scheme

Performance Indicators		Weight age
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
Total (25 Marks)		**100 %**

Names of Student Team Members

1. ……..
2. …….
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

Practical No. 15: Measure Run Out Of Cylindrical Component Using Dial Indicator

I Practical Significance –

A dial indicator mounted on a magnetic base is being used to measure shaft runout as the shaft is being turned slowly . The runout measurement is reported in terms of the total movement of the indicator needle. Runout measurements in actual operating conditions may be impractical to measure, and are likely to be far greater than measurements taken while rotating the shaft slowly, without actual operational loads.

II. Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic Engineering to solve the broad-based Mechanical Engineering problems.

PO3 **- Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Mechanical Engineering problems.

PO4- Engineering tools: Apply relevant mechanical technologies and tools with an understanding of the limitations

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use relevant instruments to measure various parameters of machine components'***:

1. Test the roundness of given job
2. Judge the ovality of a round job

IV Relevant Course Outcome(s)

- Select relevant surface testing methods.

V Practical Outcome

- Carry the roundness testing of a given job

VI Relevant Affective Domain related Outcomes

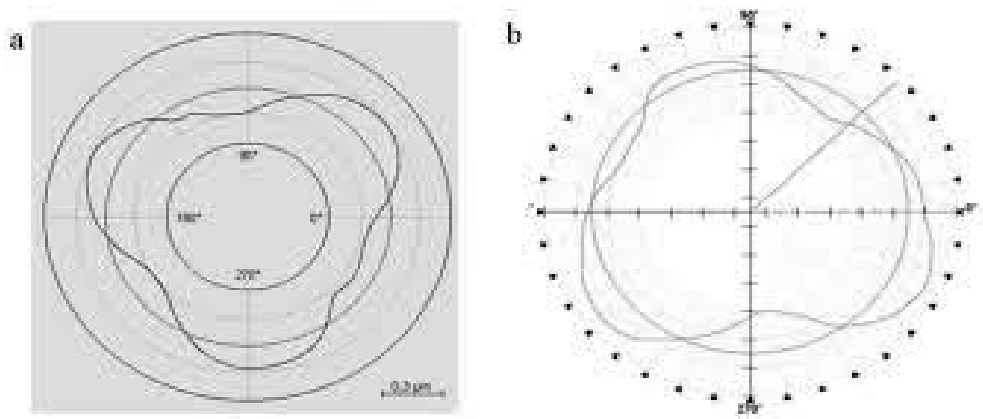
1) Follow safe practices
2) Practice good housekeeping
3) Practice energy conservation
4) Demonstrate working as a leader/a team member
5) Maintain tools and equipment

VII Minimum Theoretical Background

Roundness is generally assessed by rotational technique by measuring radial deviations from a datum axis. The polar profile graph can be drawn on a graph paper .To measure out of roundness, it is necessary to compare the part profile to an ideal circle or datum. The most commonly used devices for measurement of roundness are

a. Diametral.
b. Circumferential confining gauge—a shaft is confined in a ring gauge and rotated against a set indicator probe.
c. Rotating on centres.
d. V-Block. Piece rotating against a set probe (a) of fixed angle, (b) of adjustable angle.
e. Three-point probe (120° spacing).
f. Accurate spindle.

VIII Experimental set up-



Profile Graph of Roundness testing

IX Resources Required

S. No	Name of Resource	Suggested Broad Specification	Quantity
1.	Dial Indicator	Range 0- 25mm	1
2.	Magnetic stand		1
3.	V- Block		1
4.	Surface plate		1

X Precautions to be Followed

1. Avoid improper handling of Dial Indicator
2. Don't apply pressure on tipoff Dial Indicator

XI Procedure

1. Measure the diameter of job with the help of Vernier caliper
2. Place the round job over V Block
3. Mark measuring points (at least 36) on the circumference of a job
4. Place the plunger of dial indicator on job over a marking .
5. Rotate the job until plunger place over another marking point
6. Repeat the procedure until one complete revolution
7. Note down the readings at each marking point
8. Plot a graph taking base value of job equal to diameter of job

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					

XIII Actual Procedure Followed

……..
……..
……..

XIV Precautions Followed

……..
……..
……..

XV Observation

Diameter of job = mm

Position	Deviation in Dial Indicator	Position	Deviation in Dial Indicator	Position	Deviation in Dial Indicator	Position	Deviation in Dial Indicator
1		**10**		**19**		**28**	
2		**11**		**20**		**29**	
3		**12**		**21**		**30**	
4		**13**		**22**		**31**	
5		**14**		**23**		**32**	
6		**15**		**24**		**33**	
7		**16**		**25**		**34**	
8		**17**		**26**		**35**	
9		**18**		**27**		**36**	

XVI Results

……..
……..
……..

XVII Interpretation of Results

……..
……..
……..

XVIII Conclusion

……..
……..
……..

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Define term Roundness

   ……..
   ……..
   ……..

2. List different types of reference circles, consider to check the quality of circular job
   ……..
   ……..
   ……..

XX References / Suggestions for Further Reading

https://www.yo_utube.com/watch?v=gn4m8V8Q4f8

XXI Assessment Scheme

Performance Indicators		Weight age
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
Total (25 Marks)		**100 %**

Names of Student Team Members

1. ……..
2. …….
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	

List Of Laboratory Manuals Developed by MSBTE

First Semester:

1	Fundamentals of ICT	22001
2	English	22101
3	English Work Book	22101
4	Basic Science (Chemistry)	22102
5	Basic Science (Physics)	22102

Second Semester:

1	Bussiness Communication Using Computers	22009
2	Computer Peripherals & Hardware Maintenace	22013
3	Web Page Design with HTML	22014
4	Applied Science (Chemistry)	22202
5	Applied Science (Physics)	22202
6	Applied Machines	22203
7	Basic Surveying	22205
8	Applied Science (Chemistry)	22211
9	Applied Science (Physics)	22211
10	Fundamental of Electrical Engineering	22212
11	Elements of Electronics	22213
12	Elements of Electrical Engineering	22215
13	Basic Electronics	22216
14	'C' programming Language	22218
15	Basic Electronics	22225
16	Programming in "C"	22226
17	Fundamentals of Chemical Engineering	22231

Third Semester:

1	Applied Multimedia Techniques	22024
2	Advanced Serveying	22301
3	Highway Engineering	22302
4	Mechanics of Structures	22303
5	Building Construction	22304
6	Concrete Technology	22305
7	Strength Of Materials	22306
8	Automobile Engines	22308
9	Automobile Transmission System	22309
10	Mechanical Operations	22313
11	Technology Of Inorganic Chemicals	22314
12	Object Oriented Programming Using C++	22316
13	Data Structure Using 'C'	22317
14	Computer Graphics	22318
15	Database Management System	22319
16	Digital Techniques	22320
17	Principles Of Database	22321
18	Digital Techniques & Microprocessor	22323
19	Electrical Circuits	22324
20	Electrical & Electronic Measurment	22325
21	Fundamental Of Power Electronics	22326
22	Electrical Materials & Wiring Practice	22328
23	Applied Electronics	22329
24	Electrical Circuits & Networks	22330
25	Electronic Measurments & Instrumentation	22333
26	Principles Of Electronics Communication	22334
27	Thermal Engineering	22337
28	Engineering Matrology	22342
29	Mechanical Engineering Materials	22343
30	Theory Of Machines	22344

Fourth Semester:

1	Hydraulics	22401
2	Geo Technical Engineering	22404
3	Chemical Process Instrumentation & Control	22407
4	Fluid Flow Operation	22409
5	Technology Of Organic Chemicals	22410
6	Java Programming	22412
7	GUI Application Development Using VB.net	22034
8	Microprocessor	22415
9	Database Managment	22416
10	Electric Motors And Transformers	22418
11	Industrial Measurements	22420
12	Digital Electronics And Microcontroller Applications	22421
13	Linear Integrated Circuits	22423
14	Microcontroller & Applications	22426
15	Basic Power Electronics	22427
16	Digital Communication Systems	22428
17	Mechanical Engineering Measurments	22443
18	Fluid Mechanics and Machinery	22445
19	Fundamentals Of Mechatronics	22048

Fifth Semester:

1	Design of Steel and RCC Structures	22502
2	Public Health Engineering	22504
3	Heat Transfer Operation	22510
4	Environmental Technology	22511
5	Operating Systems	22516
6	Advanced Java Programming	22517
7	Software Testing	22518
8	Control Systems and PLC's	22531
9	Embedded Systems	22532
10	Mobile and Wireless Communication	22533
11	Industrial Machines	22523
12	Switchgear and Protection	22524
13	Energy Conservation and Audit	22525
14	Power Engineering and Refrigeration	22562
15	Solid Modeling and Additive Manufacturing	22053
16	Guidelines & Assessment Manual for Micro Projects & Industrial Training	22057

Sixth Semester:

1	Solid Modeling	17063
2	Highway Engineering	17602
3	Contracts & Accounts	17603
4	Design of R.C.C. Structures	17604
5	Industrial Fluid Power	17608
6	Design of Machine Elements	17610
7	Automotive Electrical and Electronic Systems	17617
8	Vehicle Systems Maintenance	17618
9	Software Testing	17624
10	Advanced Java Programming	17625
11	Mobile Computing	17632
12	System Programing	17634
13	Testing & Maintenance of Electrical Equipments	17637
14	Power Electronics	17638
15	Illumination Engineering	17639
16	Power System Operation & Control	17643
17	Environmental Technology	17646
18	Mass Transfer Operation	17648
19	Advanced Communication System	17656
20	Mobile Communication	17657
21	Embedded System	17658
22	Process Control System	17663
23	Industrial Automation	17664
24	Industrial Drives	17667
25	Video Engineering	17668
26	Optical Fiber & Mobile Communication	17669
27	Therapeutic Equipment	17671
28	Intensive Care Equipment	17672
29	Medical Imaging Equipment	17673

Pharmacy Lab Manual

First Year:

1	Pharmaceutics - I	0805
2	Pharmaceutical Chemistry - I	0806
3	Pharmacognosy	0807
4	Biochemistry and Clinical Pathology	0808
5	Human Anatomy and Physiology	0809

Second Year:

1	Pharmaceutics - II	0811
2	Pharmaceutical Chemistry - II	0812
3	Pharmacology & Toxicology	0813
4	Hospital and Clinical Pharmacy	0816

HEAD OFFICE

Secretary,
Maharashtra State Board of Technical Education
49, Kherwadi, Bandra (East), Mumbai - 400 051
Maharashtra (INDIA)
Tel: (022)26471255 (5 -lines)
Fax: 022 - 26473980
Email: -secretary@msbte.com
Web -www.msbte.org.in

REGIONAL OFFICES:

MUMBAI

Deputy Secretary (T),
Mumbai Sub-region,
2nd Floor, Govt. Polytechnic Building,
49, Kherwadi, Bandra (East)
Mumbai - 400 051
Phone: 022-26473253 / 54
Fax: 022-26478795
Email: rbtemumbai@msbte.com

PUNE

Deputy Secretary (T),
M.S. Board of Technical Education,
Regional Office,
412-E, Bahirat Patil Chowk,
Shivaji Nagar, Pune
Phone: 020-25656994 / 25660319
Fax: 020-25656994
Email: rbtepn@msbte.com

NAGPUR

Deputy Secretary (T),
M.S. Board of Technical Education
Regional Office,
Mangalwari Bazar, Sadar, Nagpur - 440 001
Phone: 0712-2564836 / 2562223
Fax: 0712-2560350
Email: rbteng@msbte.com

AURANGABAD

Deputy Secretary (T),
M.S. Board of Technical Education,
Regional Office,
Osmanpura, Aurangabad -431 001.
Phone: 0240-2334025 / 2331273
Fax: 0240-2349669
Email: rbteau@msbte.com