I

Name Chirag Rajiv Thakur

Roll No. 23 Year 20 19 20 20

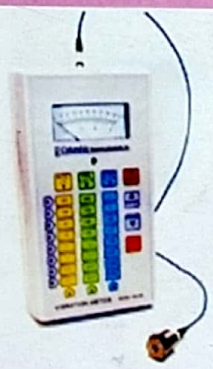
Exam Seat No. 104606

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

A LABORATORY MANUAL

FOR

MECHANICAL ENGINEERING MEASUREMENTS (22443)



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Maharashtra State Board of Technical Education

Certificate

This is to certify that Mr. / Ms ..CHIRAG...RAJIV...THAKUR.....
Roll No.....23.....of Fourth Semester of Diploma in
....MECHANICAL....ENGINEERING.....of Institute
.....V.E.S....POLYTECHNIC.....
(Code...0.0.0.4.....) has completed the term work satisfactorily in course **Mechanical Engineering Measurements (22443)** for the academic year 20.19...to 20.20... as prescribed in the curriculum.

Place .Mumbai..... Enrollment No...1.8.0.0.0.4.0.3.6.2....
Date:..... Exam Seat No. ..1.0.4.6.0.6.....

Course Teacher **Head of the Department** **Principal**

Seal of the Institute

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Content Page

List of Practical 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)
1.	Identify contact and Non-Contact Type Instruments *	1	13/12/19	27/12/19			
2.	Calibration of LVDT transducer for displacementMeasurement	7	27/12/19	03/01/20			
3.	Use Load cell to measure force on given system. *	15	03/01/20	24/01/20			
4.	~~Measure Force Using Eddy Current Dynamometer.~~	20					
5.	Calibration of Bourdon's Tube Pressure gauge	26	24/01/20	24/01/20			
6.	~~Measure Pressure using McLeod Gauge~~	33					
7.	Calibration of Thermocouple *	40	24/01/20	14/02/20			
8.	Measure flow of liquid by Rotameter	46	14/02/20	14/02/20			
9.	~~Measure flow of liquid by Ultrasonic Flow meter~~	52					
10.	Calibration of Stroboscope. *	59	14/02/20	14/02/20			
11.	~~Measure Speed of Rotating Machine using Inductive Pick up~~	65					
12.	Use of Vibration Meter for Measuring Vibration of Machine *	72	21/02/20	28/02/20			
13.	Use of Vibration Meter for Measuring Vibration of Structure	72	28/02/20	6/03/20			
14.	Use Strain gauge To measure Strain induced on member *	78	6/03/20	13/03/20			
15.	Use Psychrometer to measure Air properties	86	13/03/20	19/3/20			
16.	Use Sound Meter to measure sound level of a given system *	93	19/03/20	20/3/20			
	Total						

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

A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

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Practical No. 1 Identify contact and Non-Contact Type Instruments

I Practical Significance

Transducer is a device which converts one form of energy into another form like Electrical to Mechanical, Mechanical to Electrical, Thermal to Electrical and etc. Emphasis in the instrumentation trainers will be directed toward electronic instrumentation systems rather than mechanical systems. In most cases electronic systems provide better data more accurately, completely characterize the design or process being experimentally evaluated. Also the electronic system provides an electrical output signal that can be used for automatic data reduction or for the control of the process.

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 Analogue and digital measuring devices in Mechanical Engineering related applications':

1. Select relevant measuring instrument for measuring various mechanical properties of given machine components.

IV Relevant Course Outcome(s)

- Use relevant instrument for measuring displacement

V Practical Outcome

- Identify contact and Non-Contact Transducers

VI Relative Affective Domain-

- Practice good housekeeping.
- Practice energy conservation.
- Demonstrate working as a leader/a team member.

VII Minimum Theoretical Background

Measuring Instruments are basically classified in to

1. Contact Type- A contact type instruments are those which make a physical contact with object to be measured.

2. Non-Contact Type- Theses instruments are those which do not make any physical contact with object to be measured

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VIII Experimental setup

Fig No 1 Thermometer

Fig No2 Infrared Thermometer

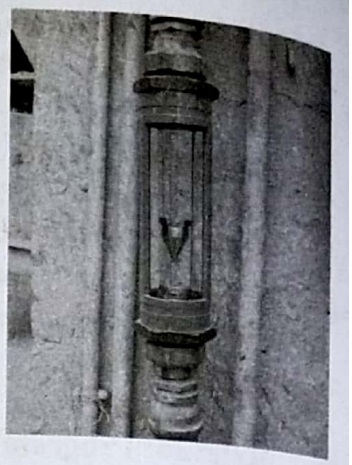

Fig No 3 Rotameter

Fig No 4 Anemometer

Fig No 5 Digital Tachometer

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Thermometer	Alcohol Thermometer Range 0 ^{0}C to 300^{0}C	1
2.	Infra-red Thermometer	Range -30^{0}C to 1500^{0}C	1
3.	Steel Rule	Range 0 to 30 cm	1
4.	Bourdons Tube Pressure gauge	Range 0 to 12 bar	1
5.	Rota meter	0 to 40 Lit/min	1
6.	Anemometer	Max 50 m/sec	1
7.	Tachometer	Speed upto 1000rpm	1
8.	Infra red Tachometer	Speed upto 1000rpm	1

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X Precautions to be Followed

1. Avoid improper handling of Measuring Instruments

XI Procedure

1. Measure displacement by Scale
2. Measure temperature of water using Thermometer
3. Measure temperature of water using Infrared Thermometer
4. Measure pressure of given system with the help of Bourden's Tube pressure gauge.
5. Measure flow rate of water using Rota meter
6. Measure velocity of air stream leaving from split air conditioner using Anamometer
7. Measure speed of electric motor using tachometer
8. Measure speed of electric motor using Infrared tachometer

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Anemometer		Max m/s	1	
2.	Digital		speed upto		
3.	Tachometer		1000 rpm	1	

XIII Actual Procedure Followed

Measure displacement by scale. Measure speed of electric motor using digital tachometer. Measure speed of electric motor using Infra red Tachometer.

XIV Precautions Followed

Avoid improper handling of measuring instruments. Handle the instruments properly while taking readings.

XV Observations and Calculations

S. No	Instruments	Type of Measurement
1	Thermometer	Contact
2	Infra-red Thermometer	Non-Contact
3	Scale	Contact
4	Bourdon's Tube Pressure gauge	Contact
5	Rota meter	Contact

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6	Anemometer	Contact
7	Tachometer	Non-Contact
8	Infra red Tachometer	Non-Contact

XVI Results

We took results on changing the voltage of D.C motor using digital tachometer. They took reading of different air speed using anemometer.

XVII Interpretation of Results

We resulted that digital tachometer is a Non-Contact type of instrument.

XVIII Conclusions

We learned or concluded the difference between contact type and non-contact type of instrument.

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. Identify Contact and Non-contact Measuring devices
2. List different Measuring devices available on I.C Engine test rig in your Power Engineering laboratory.

[Space for Answer]

Range of D.C motor - 0-12.2 volts

Sr. No.	Voltage of D.C motor (in volts)	Speed of D.C motor (in rpm)
1	4.5	18.9
2	6.5	28.5
3	8.5	37
4	9.5	41.6
5	12	53.5

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Anemometer Reading:

Sr.No	Location	Speed of air (in m/s)	Temperature (in °C)
1.	AC Outlet	2.96	38.4
2.	AC Inlet	3.73	26.0
3.	Open space	0.55	24.8
4.	Foyer	1.24	30.2

1) Contact Instruments:

a) Thermometer

b) Scale:

2) Non-Contact Instruments

a) Infra red thermometer

b) Tachometer:

c) Infra red thermometer:

Infra red thermometer reading

Sr. No.	Distance (cm)	Temperature (°C)
1.	0	83.3
2.	4	91.7
3.	6	88.7
4.	8	87.0
5.	10	86.0

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XX References / Suggestions for Further Reading

1. www.youtube.com/watch?reload=9&v=Ck2mfd0n0gE
2. www.youtube.com/watch?v=QItuf6lNvmI
3. www.youtube.com/watch?v=Y1mA50tEmLQ

XXI Assessment Scheme

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

Names of Student Team Members

1. Amey..Rane.....
2. Paiten...Parmar
3. Chirag...Thakur.
4. Sushil...Deshmukh

Marks Obtained			Dated signature of Teacher	
Process Related(10)	**Product Related(15)**	**Total (25)**		13/12/19
				27/12/19

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Practical No.2: Calibration of LVDT Transducer for Displacement Measurement

I Practical Significance

LVDT works under the principle of mutual induction and the displacement which is a non-electrical energy is converted into an electrical energy. LVDT consists of a cylindrical former where it is surrounded by one primary winding in the center of the former and the two secondary windings at the sides. The number of turns in both the secondary windings are equal, but they are opposite to each other i.e., if the left secondary windings is in the clockwise direction, the right secondary windings will be in the anti-clockwise direction, hence the net output voltages will be the difference in voltages between the two secondary coil.

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.

PO2 - **Discipline knowledge:** Apply mechanical engineering knowledge to solve broad-basedmechanical engineering related problems.

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

PO8 -**Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency 'Use Relevant Analogue and digital measuring devices in Mechanical Engineering related applications:

1. Use LVDT transducer for Displacement measurement

IV Relevant Course Outcome(s)

- Use relevant instrument for measuring displacement

V Practical Outcome

- Use inductive transducer to measure displacement

VI Relative Affective Domain-

- Practice energy conservation.
- Demonstrate working as a leader/a team member.

VII Minimum Theoretical Background

Differential transformers works on a variable inductance principle, are also used to measure displacement. The most popular variable inductance transducer for linear displacement measurement is the Linear Variable Differential Transformer (LVDT). The LVDT consists of three symmetrically spaced coils would on to an insulated

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bobbin. A magnetic core moves through the bobbin without contact, provides a path for magnetic flux linkage between coils. The position of the magnetic core controls the mutual inductance between the center or primary coil and with the two outside of secondary coils.

When an AC carrier excitation is applied to the primary coil, voltages are induced in the two secondary coils that are wires in a series-opposing circuit. When the core is centered between the two secondary coils, the voltage induces between the secondary coils are equal but out of phase by 180^{o}. The voltage in the two coil cancels and the output voltage will be zero. When the core is moves from the center position, an imbalance in mutual inductance between the primary coil and the secondary coil occurs and an output voltage develops. The output voltage is a linear function of the core position as long as the motion of the core is within the operating range of the LVDT

VIII Experimental setup

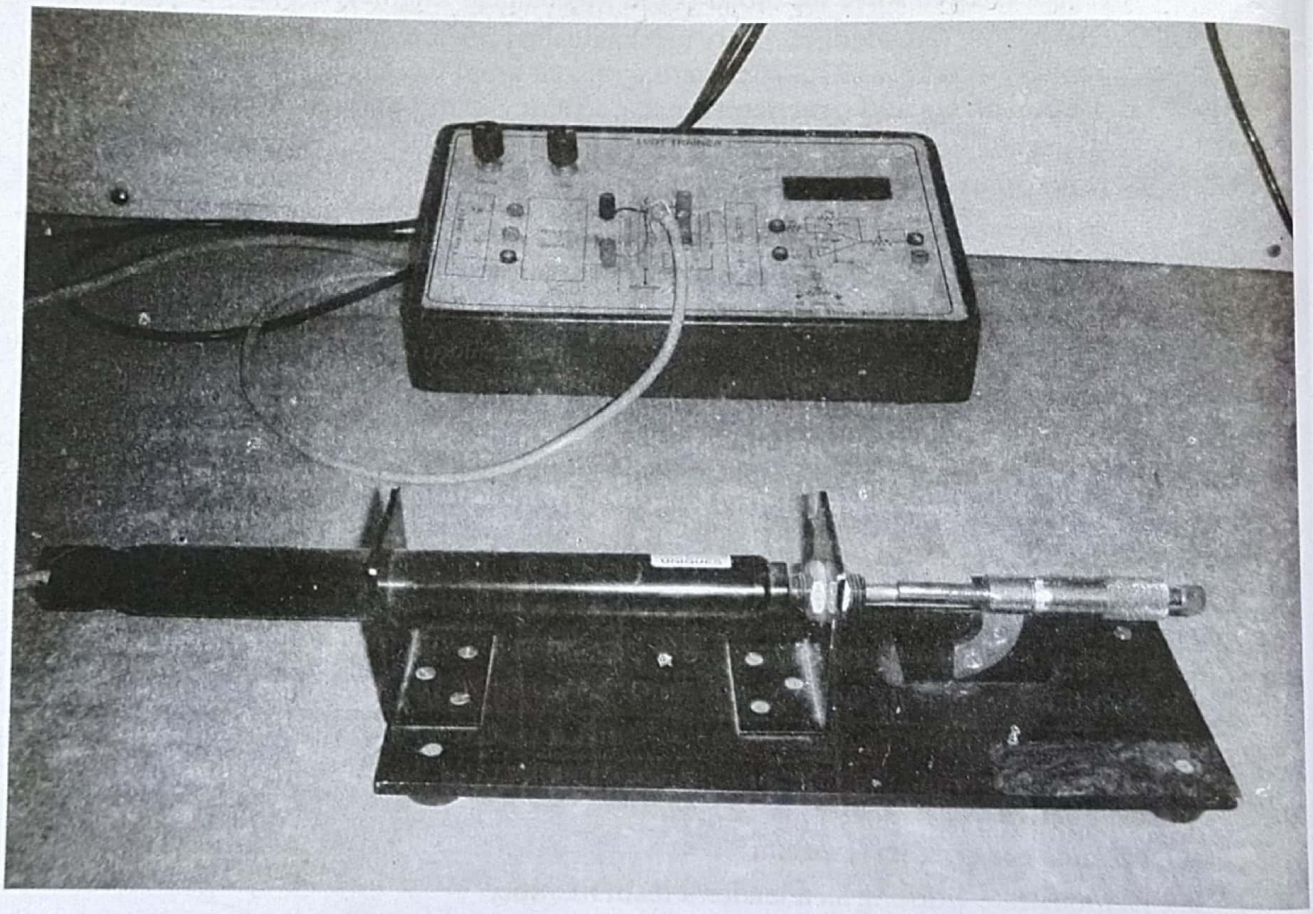

Figure-1

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IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Inductive transducer-	Measurement range -0 to 100 mm -Sensor- inductive (non linear) solenoid type on board with micrometer, micrometer screw gauge assembly for displacement, bridge balance type circuit Display 3.5 digit digital display	1

X Precautions to be Followed

1. Avoid improper handling of Transducer

XI Procedure

1. Connect the power supply chord at the rear panel to the 230V 50Hz supply.
2. Switch ON the instrument by pressing down the toggle switch. The display glows to indicate the instrument is ON.
3. Allow the instrument in ON position for 10 minutes for initial warm-up.
4. Rotate the micrometer till it reads "20.0".
5. Adjust the potentiometer at the front panel so that the display reads "10.0"
6. Rotate the core of micrometer till the micrometer reads "10.0"
7. Adjust the ZERO potentiometer till the display reads "00.0".
8. Rotate back the micrometer core upto 20.0
9. Adjust once again Potentiometer till the display read.
10. As the core of LVDT moves the display reads the displacement in mm.
11. Rotate the core of the micrometer in steps of 1 or 2 mm
12. Tabulate the readings.
13. Tabulate the readings and Plot the graph of Actual V/s indicator readings

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Inductive		Measurement		
2.	Transducer		range-0-100mm Sensar-Inductive	1	
3.					

XIII Actual Procedure Followed

Connect the power supply chord at the rear panel. Switch ON the instrument by pressing down the toggle switch, set the potentiometer at zero reading Now rotate the micrometer core upto 1mm. Record and tabulate reading and plot the graph.

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XIV Precautions Followed

Avoid improper handling of transducer.

XV Observations and Calculations

S N	Actual Micrometer Reading (mm)	Indicator Reading (LVDT)(mm)		Error		% Error
1	1	1.2	1	0.2	0	16.67
2	2	2.3	2.2	0.3	0.2	13.04
3	3	3.3	3.2	0.3	0.2	09.09
4	4	4.3	4.2	0.3	0.2	06.97
5	5	5.2	5	0.2	0	03.85

Error = (Actual Scale Reading- Indicator Scale Reading)

= 1 - 1.2

= -0.2

% Error = (Error/ distance of Step) *100

= (0.2 / 1.2) x100

= 16.67

XVI Results

We took the actual micrometer reading and indicator reading. Thus, calculated % of error.

XVII Interpretation of Results

We learned the use and operation of LVDT for displacement measurement.

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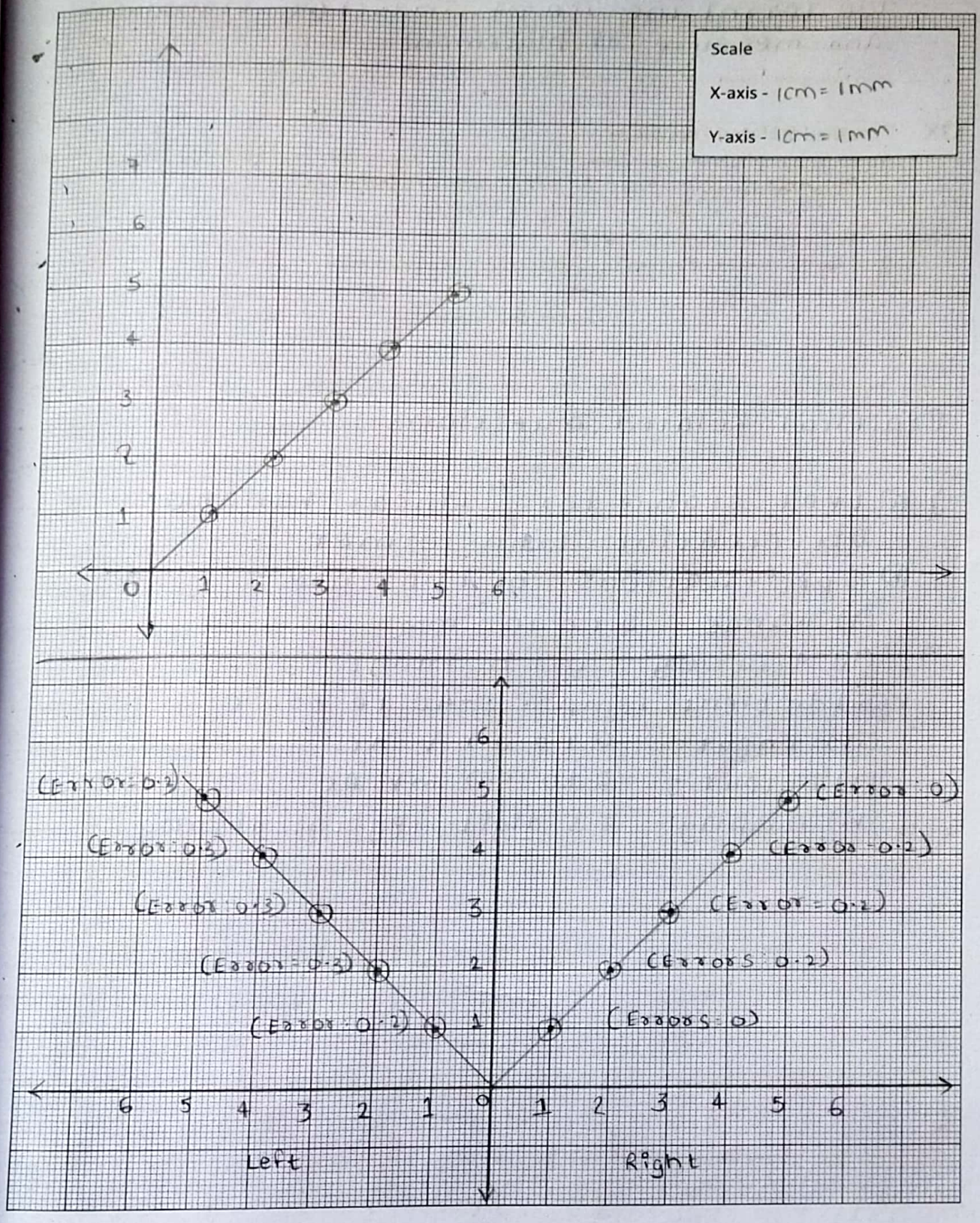

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XVIII Conclusions

We learnt the use of inductive transducer and measure displacement.

XIX Practical Related Questions

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

1. Write specifications of LVDT
2. List the causes of errors in displacement Measurement

[Space for Answer]

Practical Related Questions:-

1) (a) LVDT stands for "Linear Variable Differential Transformer".

(b) Specifications of LVDT are :-

(i) Range - 0 to 100 mm

(ii) Accuracy - 0.1 % range

(iii) Ambient Temp - -40 to +50° C

(iv) Input - 0 to 0.1 V A.C

(v) Output - 0 to 50 mV DC

(vi) Display - 3.5 digit digital display

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XX References / Suggestions for Further Reading

1. www.youtube.com/watch?reload=9&v=Ck2mfd0n0gE
2. www.youtube.com/watch?v=QItuf6lNvmI
3. www.youtube.com/watch?v=Y1mA50tEmLQ

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. .Amey..Rane.....
2. .Pr?ten...Parmar
3. .Ch?rag...Thakur
4. Sush?l..Deshmukh.

Marks Obtained			Dated signature of Teacher	
Process Related(10)	**Product Related(15)**	**Total (25)**		27/12/19
				03/01/20

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Practical No. 3: Use Load Cell to Measure Force On Given System.

I Practical Significance

Load cell is a force Transducer, which can be used to measure force or weight through the deflection. Load cells are available in different types- Mechanical, Hydraulic, Pneumatic and strain Gauge load cells.

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.

PO2 - **Discipline knowledge:** Apply mechanical engineering knowledge to solve broad-Based mechanical engineering related 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 Analogue and digital measuring devices in Mechanical Engineering related applications.'

1. Compare different types of load cell
2. Select load cell for relevant application

IV Relevant Course Outcome(s)

- Use relevant instrument for measuring force and torque

V Practical Outcome

- Use Load cell to measure force on given system.

VI Relative Affective Domain-

- Demonstrate working as a leader/a team member.

VII Minimum Theoretical Background

Load cells are force transducers as they convert force in to electrical signals. Strain Gauges are ultra thin heat treated metallic foils and chemically bonded to a thin elastic layer. Load cells consists of steel cylinder which has four identical strain gauges mounted upon it . These four gauges are connected to four limbs of Wheatstone bridge circuit.

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VIII Experimental setup

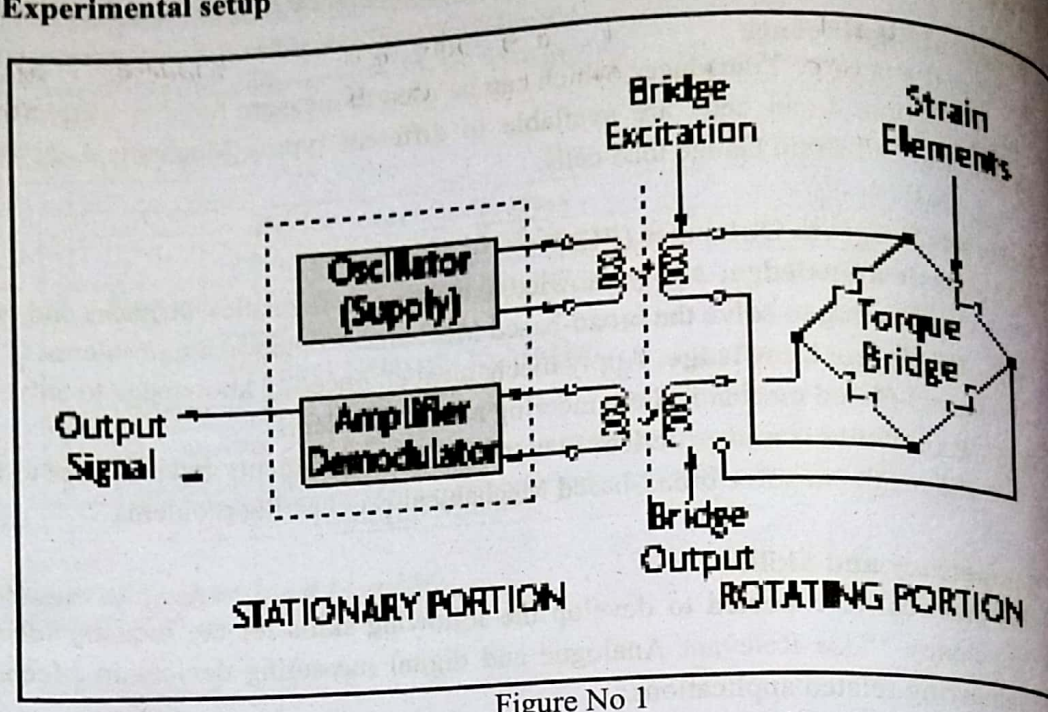

Figure No 1

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Qu
1.	4 arm bridge with strain gauge	Capacity Minimum 2 Kg	
2.	Dead weights	1Kg to 50 kg	
3.	Display	digital	

X Precautions to be Followed

1. Avoid improper handling of instrument

XI Procedure

1. Make connections to load cell
2. Switch 'ON' unit
3. Check initially the output in 'Zero'
4. Put dead weights on platform
5. Note readings
6. Increase load on load cell
7. Take five readings with specific load

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XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Load cell	Mitech	0-2 kg	1	
2.	Dead weight	SHSW	50-500 g	1	
3.	Display		Digital	1	

XIII Actual Procedure Followed

①Make connections to load cell ②Switch ON unit ③Check initially the o/p in zero ④Put dead weight on platform ⑤Note readings ⑥Increase load on load cell ⑦Take 5 readings with specific loads.

XIV Precautions Followed

Avoid improper handling of instrument.

XV Observations and Calculations

S N	Applied Load (kg)	Output Load Cell readings (Kg)	Difference
1			
2			
3			
4			
5			

XVI Results

We took the applied load and output load reading and calculate the difference between them.

XVII Interpretation of Results

We learned the operation of load cell and measured the force on the system.

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XVIII Conclusions

We successfully used load cell to measure force on given system

XIX Practical Related Questions

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

1. Write Specification of Load Cell available in the laboratory
2. State the causes of Errors in Load cell readings during Practical

[Space for Answer]

Practical Related Questions

1) The specification of load cell used are

a) I/p voltage - 230 V, 50 Hz.

b) Weighing range - 0 to 250 gms.

2) Temperature changes can cause weighing errors. Most load cells are temperature compensated to reduce these errors. The temperature effect on the load cell at zero load causes the cells entire output range to shift. overloading can cause errors in the measurement.

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XX References / Suggestions for Further Reading

1. https://www.youtube.com/watch?v=nMaeVfu5_Bw
2. https://www.youtube.com/watch?v=nGUpzwEa4vg&t=96s
3. https://www.youtube.com/watch?v=wk906FPmrgM

XXI Assessment Scheme

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

Names of Student Team Members

1. ..Amey..Rane.....
2. ..Paiten...Parmar
3. ..Chirag..Thakur..
4. Sushil...Deshmukh

Marks Obtained			Dated signature of Teacher	
Process Related(10)	**Product Related(15)**	**Total (25)**		03/01/20
				24/01/20

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Practical No. 5: Calibration of Bourdon's Tube Pressure gauge.

I Practical Significance

Transducers that measure force, torque or pressure usually contains an elastic member that converts the quantity to be measured to a deflection or strain. A deflection sensor or, alternatively, a set of strain gauges can be used to measure the quantity of interest (force, torque or pressure) indirectly. Characteristics of transducers, such as range, linearity and sensitivity are determined by the size and shape of the elastic member, the material used in its fabrication. A wide variety of transducers are commercially available for measuring force, torque and pressure.The different elastic member employed in the design of these transducer include link, columns, rings, beams, cylinders, tubes, washers, diaphragms, shear webs and numerous other shapes of special purpose applications. Strain gauges are usually used as sensors; however linear variable differential transformers (LVDT) and linear potentiometers are sometime used for static or quasistatic measurement.

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.

PO 2 -Discipline knowledge: Apply mechanical engineering knowledge to solve broad-Based mechanical engineering related 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 Analogue and digital measuring devices in Mechanical Engineering related applications':

1. Use of Pressure gauges

IV Relevant Course Outcome(s)

- Use relevant instrument for measuring force and torque

V Practical Outcome

- Use Bourdon's Tube Pressure gauge measure pressure in a given system. .

VI Relative Affective Domain-

- Demonstrate working as a leader/a team member.

VII Minimum Theoretical Background

Pressure cells are divisors that convert pressure into electrical signal through a measurement of either displacement strain or Piezoelectric response. Diaphragm type pressure transducers with strain gauges as sensor is used here for measurement of pressure. This type of pressure transducers uses diaphragm as the elastic element.

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Diaphragms are used for low and middle pressure ranges. Strain gauges are bonded on the diaphragm and the pressure force is applied to the specimen. The material gets elongated or compressed due to the force applied i.e., the material get strained. The strain incurred by the specimen depends on the material used and its elastic module. This strain is transferred to the strain gauges bonded on the material resulting in change in the resistance of the gauge. Since the strain gauges are connected in the form of Whetstones Bridge any change in the resistance will imbalance the bridge. The imbalance in the bridge will inturn gives out the output in mV proportional to the change in the resistance of the strain gauge.

VIII Experimental setup

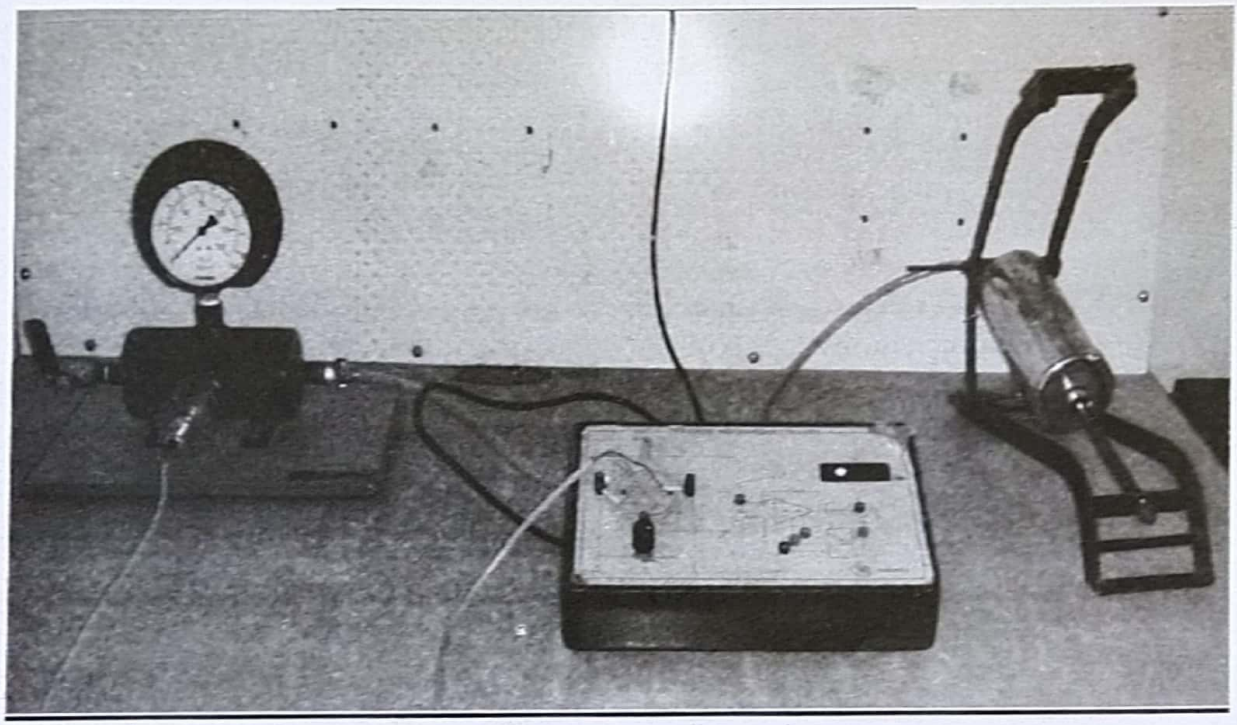

Figure No 1

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Strain gauges bonded on steel diaphragm for pressure measurement	Bourdon's Gauge (Max 10 bar), 3 ½ digit seven segment LED display is used for the indicator of 200mV full scale deflection to read +/- 1999, Front panel zero adjustment through Potentiometer, 230CV D C	01

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X Precautions to be Followed

1. Avoid improper handling of Transducer
2. Don't apply excessive pressure on tips of Transducer.

XI Procedure

1. Switch ON the instrument by rocker switch at the front panel.
2. The display glows to indicate the instrument is ON.
3. Allow the instrument in ON Position for 10 minutes for initial warm-up.
4. Adjust the Potentiometer in the front panel till the display reads "000"
5. Apply pressure on the sensor using the loading arrangement.
6. The instrument reads the pressure Display through LED.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remar (If an
		Make	Details		
1.	Strain gauge		230 c V DC	1	
2.	Air compressor		Pressure range - 0 - 6 bar	1.	

XIII Actual Procedure Followed

①.Switch.ON.the.instrument.by.rocker.switch.at.front.panel.②.The.display.glows.to.indicate.the.instrument.is.ON.③.Allow.the.instrument.in.ON.position.for.10.min.④.Instrument.reads.the.pressure

XIV Precautions Followed

①.Avoid.improper.handling.of.transducer.
②.Don't.apply.excessive.pressure.on.tips.of.transducer.

XV Observations and Calculations

SR No	Actual Pressure (bar)	Indicator Pressure (bar)	Error	% Error
1				
2				
3				
4				
5				

% Error = (Error/ Max. Load) *100

Plot Graph- Actual Reading V/S Indicator Reading

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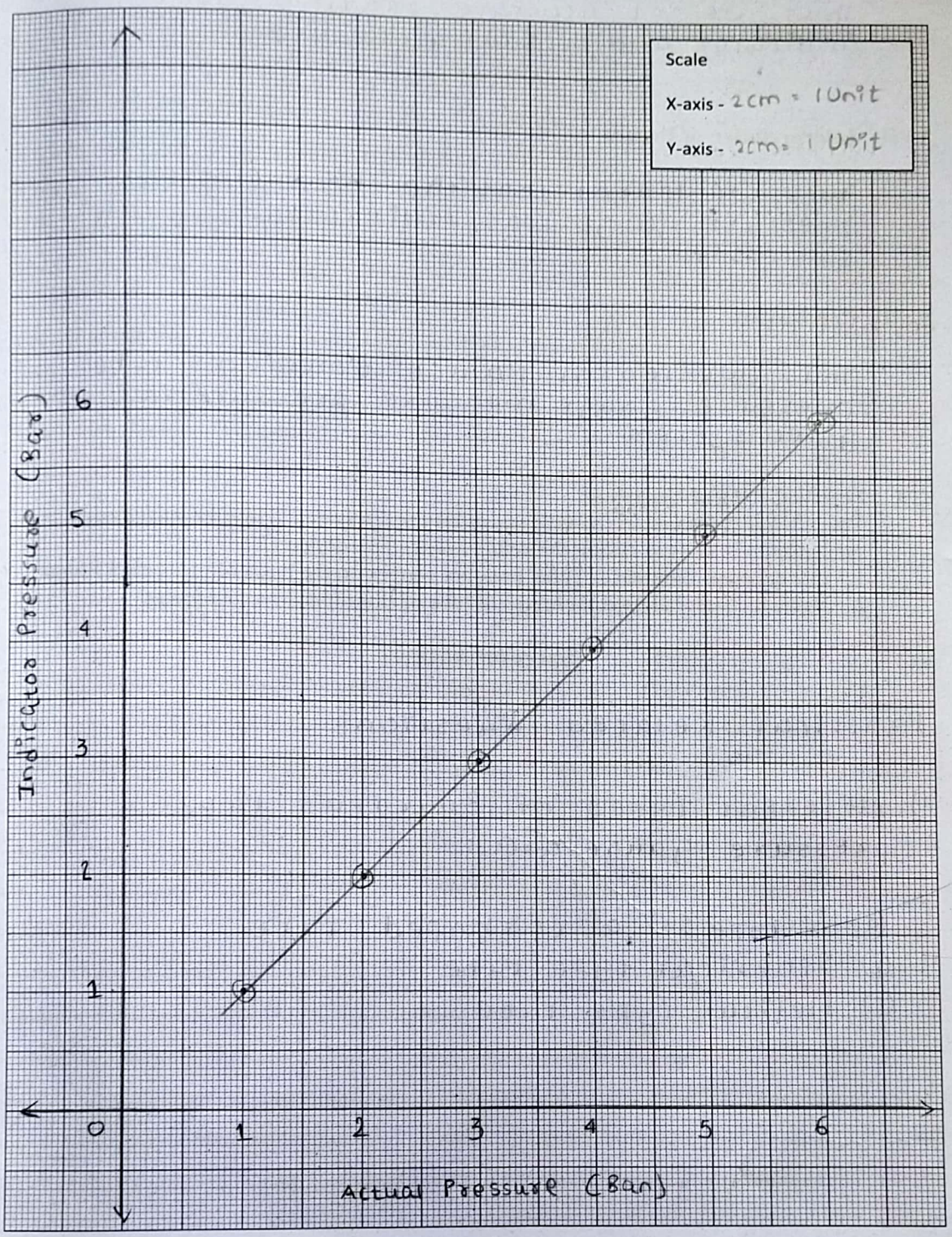

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XVI Results

Thus we get accurate readings in indicator and actual pressure.

XVII Interpretation of Results

Thus we learnt that the Bourden's tube pressure gauge was calibrated successfully.

XVIII Conclusions

Thus, we learnt to use Bourden's tube pressure gauge measure pressure in given system.

XIX Practical Related Questions

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

1. List different Bourden's Tube pressure gauges on the basis of measuring Rang
2. Name the material used for elliptical tube of Bourdons Pressure gauge

[Space for Answer]

Practical Related Questions

1) Different types of Bourden's tube pressure gauge are :-

(a) C-type is a C-shaped tube.
(b) Spherical type tube.
(c) Helical type tube.

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2) The Bourden's tube pressure gauge is almost rectangular or elliptical cross sectional tube made from material such as stainless steel, phosphorous bronze and various metals used are :-

ⓐ Beryllium copper
ⓑ phosphorous bronze
ⓒ stainless steel
ⓓ Alloys of stainless steel

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XX References / Suggestions for Further Reading

1. https://www.youtube.com/watch?v=CSL2B91bjHk
2. https://www.youtube.com/watch?v=Ja_XCJAg_l8

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. ..Amey...Rane.....
2. ..Pritesh...Parmar
3. ..Chirag...Thakur
4. .Sushil....Deshmukh

Marks Obtained			Dated signature of Teacher	
Process Related(10)	**Product Related(15)**	**Total (25)**		24/01/20
				24/01/20

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Practical No. 7: Calibration of Thermocouple.

I Practical Significance

Thermocouple is a active transducer which generates e.m.f. It is simple electrical temperature sensitive device. It provides a reliable method of temperature measurement. It is widely used in industrial applications to monitor temperature of liquid and gaseous in storage and pipes.

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.

PO 2 **-Discipline knowledge:** Apply mechanical engineering knowledge to solve broad-based mechanical engineering related 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 Analogue and digital measuring devices in Mechanical Engineering related applications':

1. Use of Temperature Measuring Instruments

IV Relevant Course Outcome(s)

- Use relevant instrument for measuring Temperature of given system

V Practical Outcome

- Use liquid in glass Thermometer and Thermocouple to measure temperature.

VI Relative Affective Domain-

- Follow safety practices.
- Practice energy conservation.

VII Minimum Theoretical Background

Thermocouple basically consist of two dissimilar metallic wires connected together so as to form two junctions. One junction is kept at constant temperature (cold junction) and other is heated (hot junction).

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VIII Experimental setup

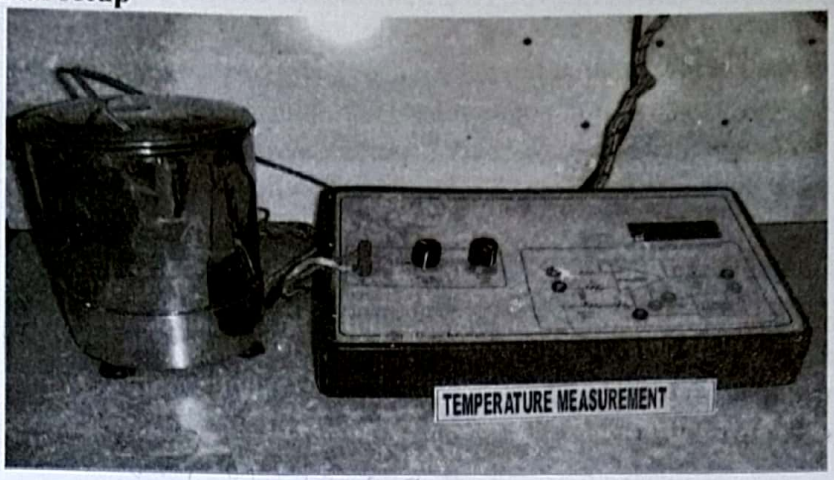

Figure No 1

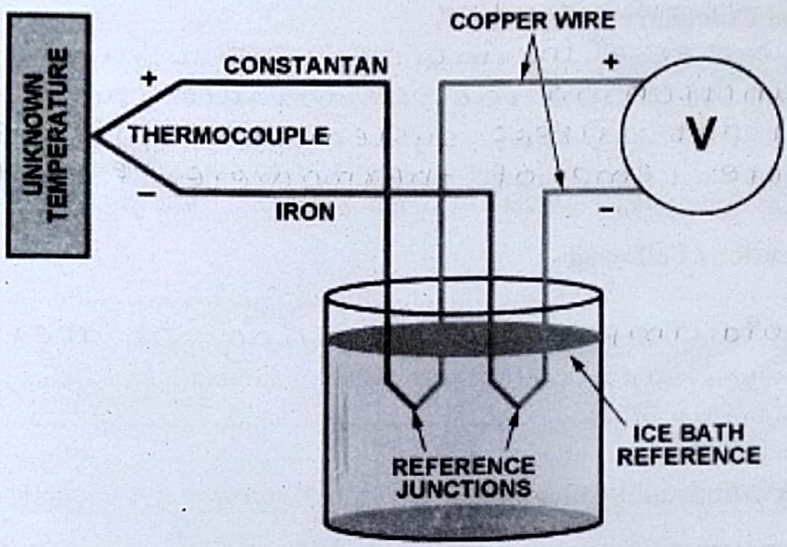

Figure No 2

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Thermocouple Set up assembly with heating arrangement	Thermocouple, Liquid in gas Thermometer, Vessel for hot and cold junction, millimeter. Induction heater.	1
2.	Display	3.5 digital display	1
3.	Power supply	12V, 500 mA to drive A to d converter	1

X Precautions to be Followed

1. Avoid improper handling of Thermocouple

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XI Procedure

1. Immerse Thermocouple hot junction and cold junction in the pan
2. Place Thermometer at hot pot
3. Keep system in 'ON' position for 10 minutes
4. Note down the temperature of Thermometer and indicator
5. Note down the E M F reading with the help of Multi meter

XII Resources Used

S. No	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Thermocouple setup assembly	Hi tech	Thermocouple	1	
2.	Display & power supply		3·5 display, 12 V	1	

XIII Actual Procedure Followed

①...Immerse...thermocouple...hot...junction...& cold.....
....junction...in...the...pan.②...Place...thermometer...at.....
...hot...pot...③...keep...system...in...'ON'...state...for...10...min....
④...Note...temp...of...thermometer...&...indicator.....

XIV Precautions Followed

.....
...Avoid...improper...handling...of...thermocouple.....
.....
.....

XV Observations and Calculations

Sr No	Indicator Reading using Thermocouple	EMF generated Millivolt	Actual Temperature by Thermometer°C
1			
2			
3			
4			
5			

XVI Results

.....
...We...calculated...the...readings...by...using...glass.....
...temperature...sensing...thermometer...and.....
...thermocouple...for...various...temperature.....

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XVII Interpretation of Results

We found the temperature increases & thus, the emf generated also increases, Thus, use of thermo couple as temperature sensing device is successful.

XVIII Conclusions

We used glass thermometer and thermo-couple to measure temperature.

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 material used for thermocouple
2. List different temperature measuring devices available in the laboratory with their specifications

[Space for Answer]

Practical Related Questions

1) Thermocouple basically consist of two dissimilar metallic wires connected together so as to form two junctions. One junction is kept at constant temperature (cold junction) and other is kept at heating temperature (hot junction). It is mostly made up of Nickel - chromium / Nickel - Aluminium Iron or copper made is also common.

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2) Different temperature measuring devices are-

(a) Thermocouples
(b) Resistor Temperature Detectors (RTD)
(c) Thermistors
(d) Infrared sensors (IR)
(e) semi-conductors
(f) Thermo-meters
(g) Thermostat

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XX References / Suggestions for Further Reading

1. www.youtube.com/watch?v=Xp7ZNAc9Fis
2. www.youtube.com/watch?v=ODdzZLkQL98
3. www.youtube.com/watch?v=xaxGZZR21sc

XXI Assessment Scheme

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

Names of Student Team Members

1. ..Amey..Rane.....
2. .Priten...Parmar
3. .Chirag..Thakur
4. Sushil...Deshmukh

Marks Obtained			Dated signature of Teacher	
Process Related(10)	**Product Related(15)**	**Total (25)**		24/01/20
				14/02/20

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Practical No. 8: Measure flow of liquid by Rotameter.

I Practical Significance

In variable flow meters, the flow restrictions are of fixed size and the differential pressure across it changes with the flow rate. Rotameters are most commonly used form of variable area flow meters. The basic principles, The pressure differential across the orifice is proportional to the square of its flow area and square of the flow rate.

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 Analogue and digital measuring devices in Mechanical Engineering applications.

1. Use of flow Measuring Instruments

IV Relevant Course Outcome(s)

- Use relevant instrument for measurement of Flow

V Practical Outcome

- Use Rotameter to measure flow

VI Relative Affective Domain-

- Follow safety practices.
- Practice good housekeeping.

VII Minimum Theoretical Background

Rota meter is a device that measures the flow rate of liquid in a closed tube. It is the variable area flow meter where pressure drop at the inlet and outlet is kept constant by changing the annular area. It is always installed vertically as flow measurement is done from lower level to upper level

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VIII Experimental setup

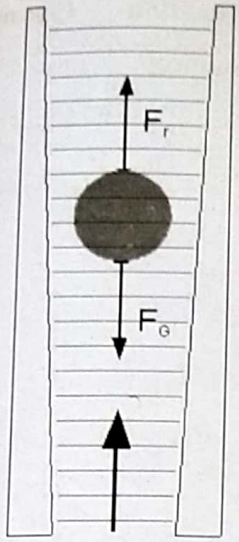

Figure .1 Principle of Rotameter

Figure .2 Rotameter

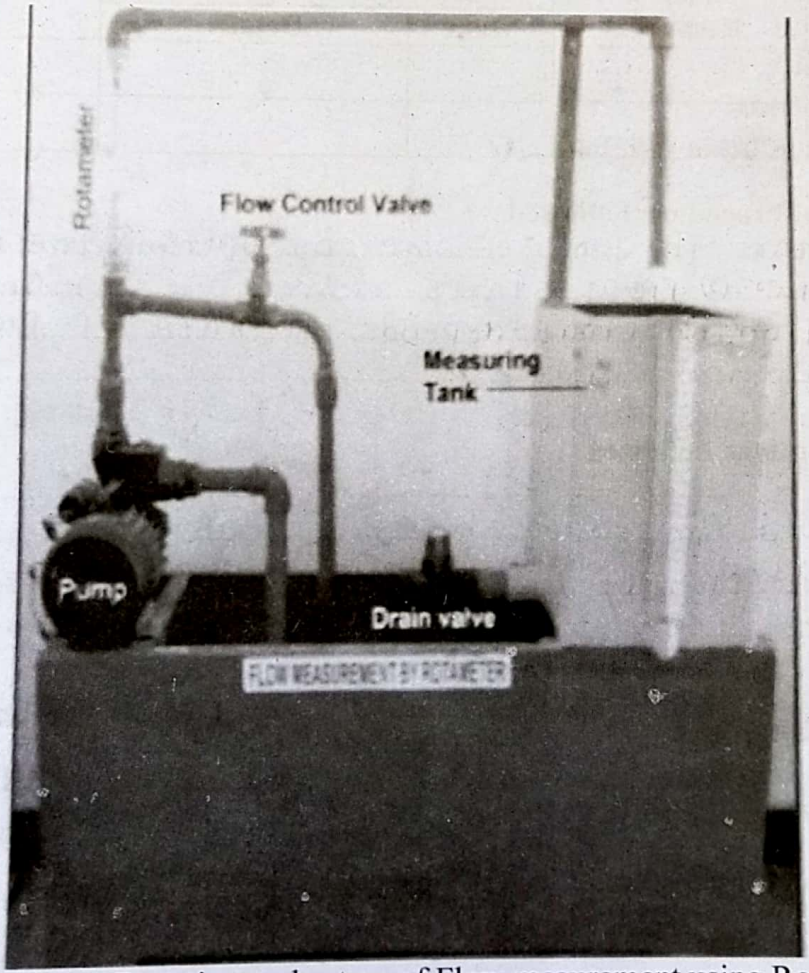

Figure 3- Experimental set up of Flow meaurement using Rotameter

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IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Hydraulic Bench with Rotameter	Measuring Tank, Flow control Valve	1

X Precautions to be Followed

1. Avoid improper handling of flow control valve

XI Procedure

- Start the flow of water by opening the flow control valve
- Float starts rising
- Rising and Falling action of float depends on rate of flow
- Note down the readings
- Note down the flow in the Discharge tank

XII Resources Used

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

XIII Actual Procedure Followed

① Start the flow of water by opening the flow control value ② Float starts rising ③ Rising and falling action of float depends on rate of flow ④ Note down the readings.

XIV Precautions Followed

Avoid improper handling of flow control valve

XV Observations and Calculations

Sr No	Rotameter Reading Lit/Min(LPM)	Actual Flow in the discharge tank LPM	Difference
1	50	50	0
2	100	100	0
3	200	200	0
4	300	300	0
5	400	400	0

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XVI Results

We calculated the readings using rota-meter & actual flow discharge was measured.

XVII Interpretation of Results

We found that the difference between the rotameter reading and actual flow reading was zero. Thus the instrument was calibrated.

XVIII Conclusions

Thus, we used rotameter and measured the flow & discharge of tank.

XIX Practical Related Questions

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

1. State the working principle of rotameter
2. Write the specification of Rotameter used in practical

[Space for Answer]

1] Working principle of rota-meter is operation is based on variable principe, fluid flow raises a float on tappered tube, increasing area for fluid of passage.

2] Maximum pressure to be measured 8 bar with maximum temperature : 60°C

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XX References / Suggestions for Further Reading

1. www.youtube.com/watch?v=ELJoieQDe6w
2. www.youtube.com/watch?v=peQdiWlfFUg

XXI Assessment Scheme

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

Names of Student Team Members

1. ...Amey...Rane.....
2. ...Paiten...Parmar....
3. ....Chirag...Thakur....
4. ...Sushil...Deshmukh

Marks Obtained			Dated signature of Teacher	
Process Related(10)	**Product Related(15)**	**Total (25)**		14/02/20
				14/02/20

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Practical No. 10: Calibration of Stroboscope.

I Practical Significance

Speed of an object is the magnitude of its velocity. Speed is either measured for linear movements or for rotational movement. Stroboscope utilizes the phenomenon of vision when the object is viewed intermittently.

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.

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

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

PO4 -Discipline knowledge: Apply mechanical engineering knowledge to solve broad-based mechanical engineering related problems

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency 'Use Relevant Analogue and digital measuring devices in Mechanical Engineering related applications':

1. Use of Speed Measuring Instruments

IV Relevant Course Outcome(s)

- Use relevant instrument for measurement of speed

V Practical Outcome

- Use of Stroboscope to measure speed of Rotating shaft

VI Relative Affective Domain-

- Follow safety practices.

VII Minimum Theoretical Background

Stroboscope consist of whirling disc attached to a motor whose speed can be varied and measured. A reference mark on the rotating shaft is observed through an opening in the rotating disc. The speed of disc is adjusted until the mark on the shaft appears to be stationary.

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VIII Experimental setup

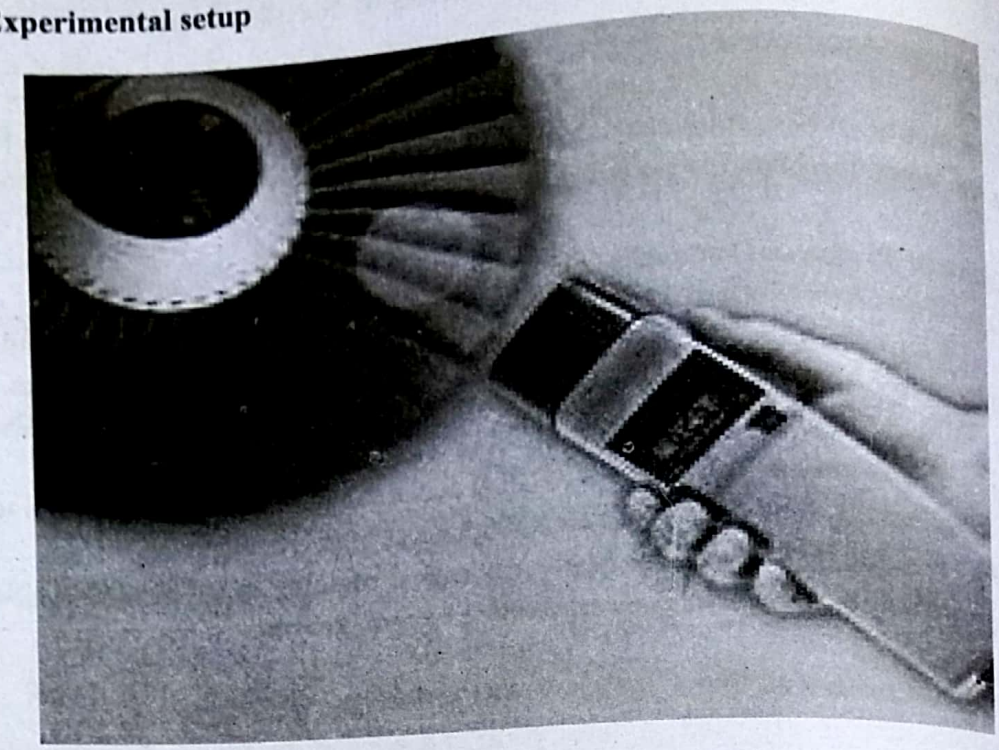

Figure 1 Stroboscope

IX Resources Required

S. No	Name of Resource	Suggested Broad Specification	Quantity
1.	Stroboscope	• Course and fine flash rate adjustments to freeze and analyze rotating objects • Battery operation brings motion analysis to any location • Unique display features characters that reverse direction depending on measurement mode • Large 0.4" (10mm) 5 digit LCD display • Microprocessor based with quartz crystal oscillator to maintain high accuracy • Tachometer memory stores last, max, and min readings	1
2.	Tachometer	Range 0 to 4000 RPM	01

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X Precautions to be Followed

1. Avoid improper handling of flow control valve

XI Procedure

- Make a dark mark on the end section of rotating element
- Switch on Stroboscope
- Allow circular disc to attain constant speed by varying the rpm
- Switch 'ON' the stroboscope
- Flash frequency is gradually increased from Zero until the rotating member appears to be stationary.
- Note down the reading
- Note down reading of rotating member with help of Tachometer
- Take five different readings

XII Resources Used

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

XIII Actual Procedure Followed

① Make a dark mark on the end section of rotating element ② Switch ON stroboscope ③ Allow circular disc to attain constant speed by varying the rpm ④ Note the reading

XIV Precautions Followed

Avoid improper handling of flow control valve.

XV Observations and Calculations

Sr No	Actual Speed using Tachometer (rpm)	Stroboscope Reading (rpm)	Error
1	20	20.1	0.1
2	25	25.08	0.08
3	30	29.71	0.29
4	35	34.96	0.04
5	40	40.01	0.01

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XVI Results

Thus, the tachometer and stroboscope were calculated & noted down

XVII Interpretation of Results

We found that there was some error present between these two reading.

XVIII Conclusions

Thus, we learnt to use stroboscope & measured the speed of rotating shaft

XIX Practical Related Questions

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

1. Justify, is it possible to use Stroboscope for speed measurement of 100 to 200 rpm
2. Write Technical Specification of Stroboscope used in practical

[Space for Answer]

1] yes, we can use stroboscope for speed measurement of 100 to 200 rpm here device are high speed diagnosis

2] Range :- 1000 - 1500 rpm / FFM

Accuracy :- ± [0.05% + 1 digit]

I/P :- 5V to 30V

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XX References / Suggestions for Further Reading

1. www.youtube.com/watch?v=ngFZN3llqnU
2. www.youtube.com/watch?v=OBRu3Vx1H68

XXI Assessment Scheme

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

Names of Student Team Members

1. Amey Rane
2. Priten Parmar
3. Chirag Thakur
4. Sushil Deshmukh

Marks Obtained			Dated signature of Teacher	
Process Related(10)	**Product Related(15)**	**Total (25)**		14/02/20
				14/02/20

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Practical No. 12 and 13: Use of Vibration Meter for Measuring Vibration of Machine and Structure.

I Practical Significance

Vibration analysis is used to detect early precursors to machine failure, allowing machinery to be repaired or replaced before expensive failure occurs. All machines vibrate and have a 'signature' which changes as operating conditions change. Vibration analysis can help detect a wide variety of fault conditions. When a disruption in the vibration signature is detected, data is collected that allows workers to detect and assess the severity of fault conditions such as imbalance, misalignment, looseness, and bearing faults. It is most effective on high-speed rotating equipment. Vibration sensors can be the most expensive component of a Predictive Monitoring program to get set up and running, but it allows the user to evaluate the condition of equipment and avoid failures.

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 Measurement and control of Relevant Equipment'***:

1. Use relevant measuring instrument for measuring various mechanical properties of machine complements
2. Use of Vibration Measuring Instruments

IV Relevant Course Outcome(s)

- Use relevant instrument for measurement of vibration and strain

V Practical Outcome

- Use of FFT analyzer/Vibration meter to measure vibrations of a given structure.
- Use of FFT analyze/ Vibration Meter to measure vibrations of a given Machine

VI Relative Affective Domain-

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

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VII Minimum Theoretical Background

Vibration is the back and forth or repetitive motion of an object from its point of rest. When a force is applied to the mass, it stretches the spring and moves the weight to the lower limit. When the force is removed, the stored energy in the spring causes the weight to move upward through the position of rest to its upper limit. Here, the mass stops and reverses direction traveling back through the position of rest to the lower limit. In a friction-free system the mass would continue this motion indefinitely. All real systems are damped, that is they will gradually come to their rest position after several cycles of motion, unless acted upon by an external force. The characteristics of this vibratory motion are period, frequency, displacement, velocity, acceleration, amplitude and phase. Continued vibration of this spring mass system would only repeat the characteristics shown in this single cycle.

VIII Experimental setup

Figure No 1Vibration Meter

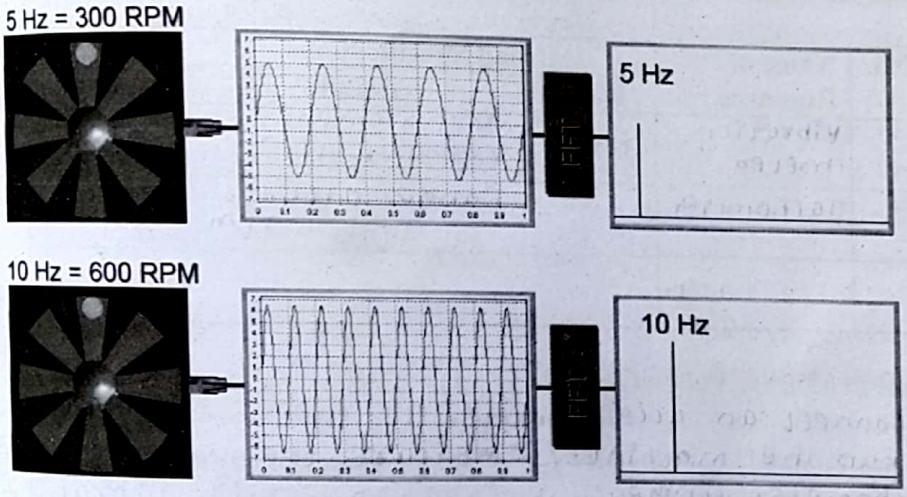

Figure No 2 Spectrum Analysis

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IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Vibration Meter	• Displacement : 0.1-199.9 µm peak-peak • Velocity : 0.1-199.9 mm/s true RMS • Acceleration : 0.1-199.9 m/s^{2}peak • Overall Accuracy : ±5% of display ±2 digits • Temperature Range : 5-50 deg C • Frequency Response : 10-1000Hz (Outside accelerometer) • Battery : 9V 6F22, 25 hours of continuous operation. • Pickup : Accelerometer with hand-held probe and magnetic base	1
2.	Tachometer	Range 0 to 4000 rpm	

X Precautions to be Followed

1. Avoid improper handling of flow control valve
2. Don't apply excessive pressure on tips of Transducer .

XI Procedure

- Connect an accelerometer to the machine/structure properly
- Run the machine
- Measure the speed with the help of Tachometer
- Measure the frequency and Vibrational Amplitudes with the help of Vibration meter
- Take at least five readings of different Machine/Structure

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Vibration meter	MTC	Displacement, velocity, Acc^n	01	
2.	Tachometer		Range - 0 to 4000 rpm	01	
3.					

XIII Actual Procedure Followed

(1) Connect an accelerometer to the m/c properly (2) Run the machine (3) Measure the speed with help of Tachometer (4) Measure frequency with vibration meter (5) Take at least five readings of different machine

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XIV Precautions Followed

1. Avoid improper handling of flow control valve
2. Don't apply excessive pressure on tips of Transducer

XV Observations and Calculations

Sr No	Machine/Structure	Speed RPM	Frequency recorded Hz	Vibration measured
1	Bearing of Machine			
2	Shaft of machine			
3	Pump rotor			
4	Gear Drive			
5	Shaft of Motor			
6	Crank shaft of I C engine			

XVI Results

We found the vibration of the compressor using vibration methods

XVII Interpretation of Results

we found different errors of the compressor. the frequency was different

XVIII Conclusions

Thus, we learnt how to use vibration meter for measuring vibration of machine and structure

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 Necessity of Vibration Measurement.
2. List the applications of FFT analyzer.

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[Space for Answer]

Ans - 1

Vibration measurement is an important factor in productive maintainance. It is used for maintaining the condition of different types of production machining. Vibration measurement is used on equipment that has rotating parts.

Ans - 2]

The applications of FFT analysis are:

a) Data collection and analysis for vibration & shock test.
b) Collection of vibration of shock data at more locations.
c) Creation of instrument to demonstrative maden analysis technique.

SR NO	Structure vibration	Motor vibration	RPM
1	906.1	1086	679
2	2239	891.3	508.1
3	1415	6541	1489
4	998.5	238.1	780.6
5	1190	1355	

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XX References / Suggestions for Further Reading

1. www.youtube.com/watch?v=dQY6kLcFMQ4
2. www.youtube.com/watch?v=8Bq74FklKVI
3. www.youtube.com/watch?v=LXBsg5w6T2A

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. ..Amey....Rane..
2. ..Praiten...Parmar
3. ..Chirag...Thakur...
4. ..Sushil...Deshmukh

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	21/02/20
			28/02/20

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Practical No. 14: Use Strain gauge to measure Strain induced on member

I Practical Significance

Strain Gauge is a device used to measure strain on an object. It is passive resistive transducer which converts mechanical elongation to change in resistance.

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 Measurement and control of Relevant Equipment'***:

1. Use relevant measuring instrument for measuring various mechanical properties of machine complements
2. Use of Vibration Measuring Instruments

IV Relevant Course Outcome(s)

- Use relevant instrument for measurement of vibration and strain

V Practical Outcome

- Use Strain to measure strain induced on member

VI Relative Affective Domain-

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

VII Minimum Theoretical Background

The principle of the electrical resistance strain gauge was discovered by Lord Kelvin, when he observed that a stress applied to a metal wire, besides changing its length and diameter, also changes its electrical resistance. Metallic electrical strain gauges are made in to two basic forms, bonded wire and bonded foil. Wire gauges are sandwiched between two sheets thin paper and foil gauges are sandwiched between two thin sheets of epoxy. The resistance **R** of a metal depends on its electrical resistivity **r**, its area **a** and the length according to the equation. $R = r\, l / a$. Thus to obtain a high resistance gauge occupying a small area the metal chosen has a high resistivity, a large number of grid loops and a very small cross sectional area. The most common material for strain gauges is a copper- nickel alloy known as advance.

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The strain gauge is connected to the material in which it is required to measure the strain, with a thin coat of adhesive. Most common adhesive used is Eastman, duco cement,etc. As the test specimen extends are contracts under stress in the direction of windings, the length and cross sectional area of the conductor alter, resulting in a corresponding increase or decrease in electrical resistance.

VIII Experimental setup

Figure No. 1 Experimental Set Up

Half-bridge strain gauge circuit

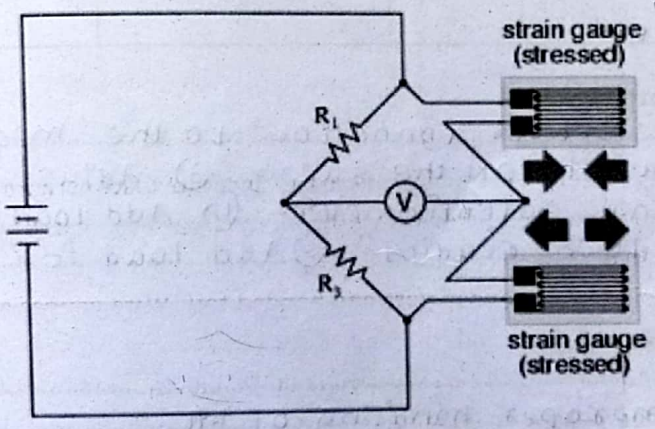

Figure No 2 Half wave Strain Gauge Circuit

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IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Strain measurement Trainer	Type : Strain gauge based., Range : 10 Kg. ,Gauge Resistance : 350 ohms., Max Excitation : 12 Volt DC., Insulation Resistance : 1000 mega ohms @ 25 degrees, measured at 30 volt DC., Combined Error : + or – 0.5 % of the F.5.,Operating Temperature: 0 degree to 50 degree., Safe overload : 10 % of the rated load	1

X Precautions to be Followed

1. Avoid improper handling of kit

XI Procedure

- Connect sensor connector to the measuring unit
- Switch 'ON' the supply
- Adjust zero load using potentiometer
- Add load over pan
- Note down readings
- Add load for 5 readings
- Note down the reading for loading and unloading

XII Resources Used

S. No	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Strain				
2.	measurement			01	
3.	Trainer				

XIII Actual Procedure Followed

①..Connect.....sensor.....connector.....to.the.....measuring.....
unit..②....Switch.....ON.the.supply.....③....Adjust.....zero.....
..load....using.....potentiometer.....④...Add.load.over.pan.....
⑤...Note.....down.....readings.....⑥Add.load.for.....5.....readings

XIV Precautions Followed

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Avoid improper handling of kit

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XV Observations and Calculations

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Sr No	Loading			Unloading		
	Weight applied (grams)	Measured Strain (mV)	Strain Gauge Reading (Kg)	Weight applied (grams)	Measured Strain (mV)	Strain Gauge Reading (Kg)
1	50		0.05	250		0.25
2	100		0.1	200		0.2
3	150		0.15	150		0.15
4	200		0.2	100		0.1
5	250		0.25	50		0.05

XVI Results

Reading were calculated by strain gauge while loading and unloading.

XVII Interpretation of Results

Strain gauge valve was found for weight applied gradually i.e loading then unloading gradually.

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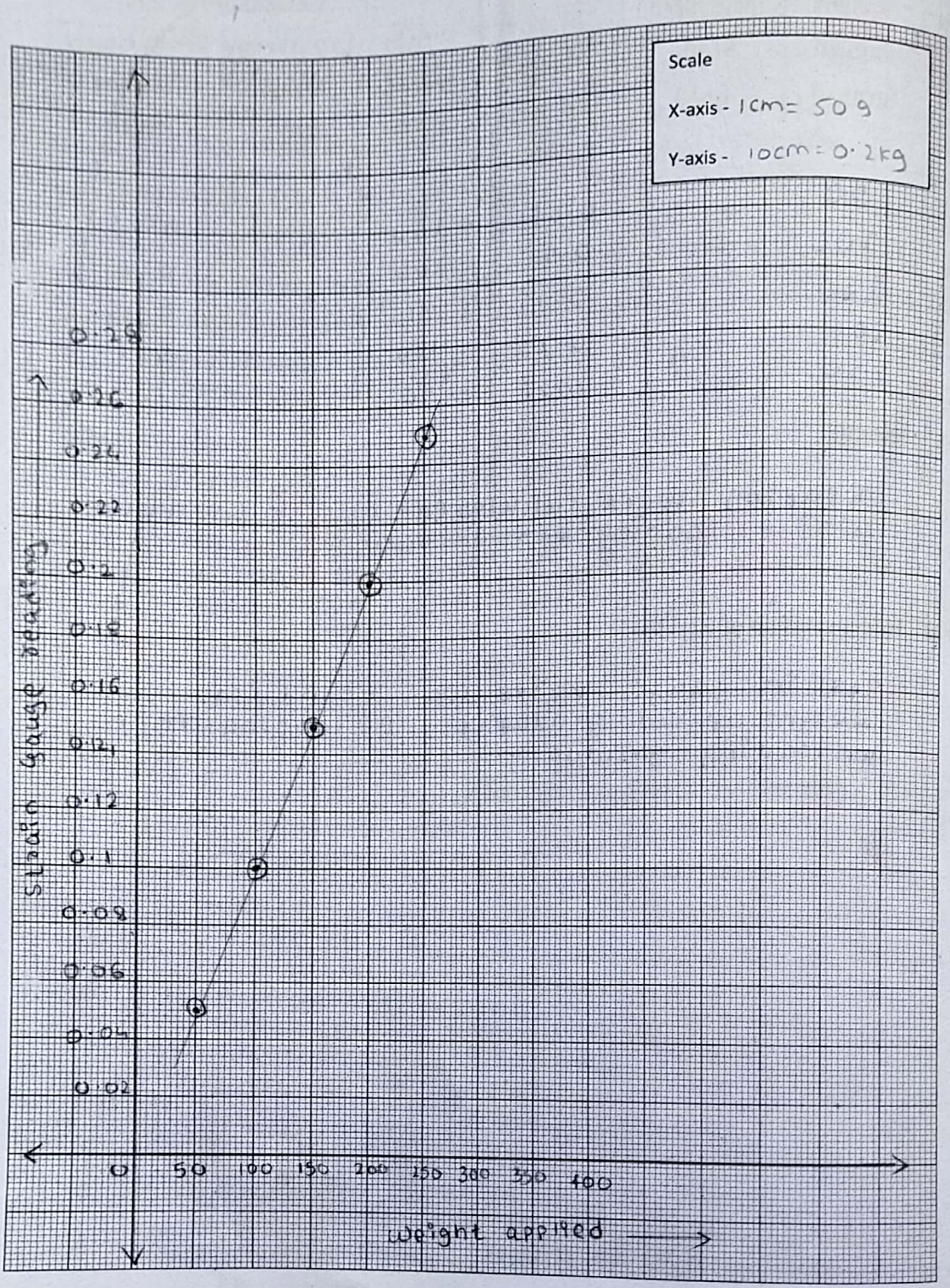
Plot graph of Measured Strain V/S weight applied



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VIII Conclusions

Thus we learnt the use of strain gauge load cell to measure strain induced on a member.

IX 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 Necessity of Strain Measurement.
2. Enlist main requirements for of strain gauge.

[Space for Answer]

Ans- 1] Strain is a measure of the amount of stretch on compression along a material on the amount of distance associated with sliding of layers within a material Strain measurement is a key element of material disting strain measurement also plays a role in low cycle fatigue testing that us used in determining the durability of measurements subjected to alternating strain.

Ans- 2] The main requirement of strain gauge are

a) High resistance.
b) High Elastic limit.
c) Insensitive to temp.
d) High Gauge factor.
e) High electrical stability.
f) Low hysteresis.
g) Good soldability.
h) Good weldability.

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XX References / Suggestions for Further Reading

1. www.youtube.com/watch?v=o0LLV5GP6Ow
2. https://www.youtube.com/watch?v=nkCeEM1H2gA
3. www.youtube.com/watch?v=3xB2wZTNn_I

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. ..Amey...Rane....
2. ...Patel...Parmar
3. ...Chirag...Thakur
4. ..Sushil....Deshmukh

Marks Obtained			Dated signature of Teacher	
Process Related(10)	**Product Related(15)**	**Total (25)**		6/03/20
				13/03/20

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Practical No. 15: Use Psychrometer to measure Air properties

I **Practical Significance**

A psychrometer is a type of hygrometer and is used exclusively to determine the relative humidity or moisture content in the air. Psychrometer represent an older humidity measurement form and electronic sensors that depend on changes in electrical resistance and capacitance rather than condensation temperature have widely replaced them. However, psychrometer are still found in many industrial environments and are available in both stationary and mobile versions.

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 Measurement and control of Relevant Equipment'***:

1. Use relevant measuring instrument for measuring various mechanical properties of machine complements

IV **Relevant Course Outcome(s)**

- Use relevant instrument for humidity measurement

V **Practical Outcome**

- Use Sling Psychrometer to measure air properties

VI **Relative Affective Domain-**

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

VII **Minimum Theoretical Background**

Psychrometer consists of two thermometers, one dry and one wet. The wet thermometer is encased in a sock or cloth that has been saturated with distilled water. The idea is that the wet thermometer is always slightly colder than the dry thermometer due to evaporation. The two thermometers' temperature readings are compared and the difference between them is used to calculate the relative humidity in the air.

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Psychrometer measure the humidity in a general environment's or specific area's (such as a chamber or structure) air. Psychrometer is generally used in laboratory settings in order to determine precise measurements for experiments and chemical reactions. A stationary psychrometer is the most common and is used in some forms of industrial equipment, while a mobile psychrometer, known as a sling psychrometer, consists of two thermometers attached to a handle and is spun in the air for several minutes in order to calculate the relative humidity in the field.

Experimental setup

Figure No. 1

Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Digital r	1. Humidity Sensor & Air Temperature Sensor 2. Triple LCD Display 3. ON/OFF button 4. T1-T2/Dew Point/T1 button 5. °F/°C select 6. MIN/MAX/RESET button 7. T2-DP/Wet Bulb/T2 button 8. HOLD button 9. T2 Probe Jack	1

Precautions to be Followed

1. Avoid improper handling of flow control valve
2. Don't apply excessive pressure on tips of Transducer .

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XI Procedure

- Switch 'ON' Psychrometer
- Hold it in the air
- Note down the Dry bulb temperature and relative Humidity
- Take five more reading at different locations
- Locate the readings on 'Psychometric Chart

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Sling Psychometer	JRM	Range -10°C to +50°C	02	
2.	Digital Psychometer	HTC	RH & DBT-1	01	
3.					

XIII Actual Procedure Followed

①Switch 'ON' psychometer ②Hold it in the air ③Note down the dry bulb temp and relative Humidity ④Take five more reading at diff locations.

XIV Precautions Followed

①Avoid improper handling of flow control valve.
②Don't apply excessive pressure on tip of transducer.

XV Observations and Calculations

S. No.	Name of Location	Dry Bulb Temperature (DBT)	Relative Humidity (%)	Wet Bulb Temp (^{0}C)	Specific Humidity Kg/Kg of dry air	Sp. Volume m^3/Kg
1	M/c Lab	28	46	20		
2	Auto CAD	27	48	18		
3	Canteen	31	49	20		
4	Welding	27	45	18		
5	M/c Shop	29	49	19.5		

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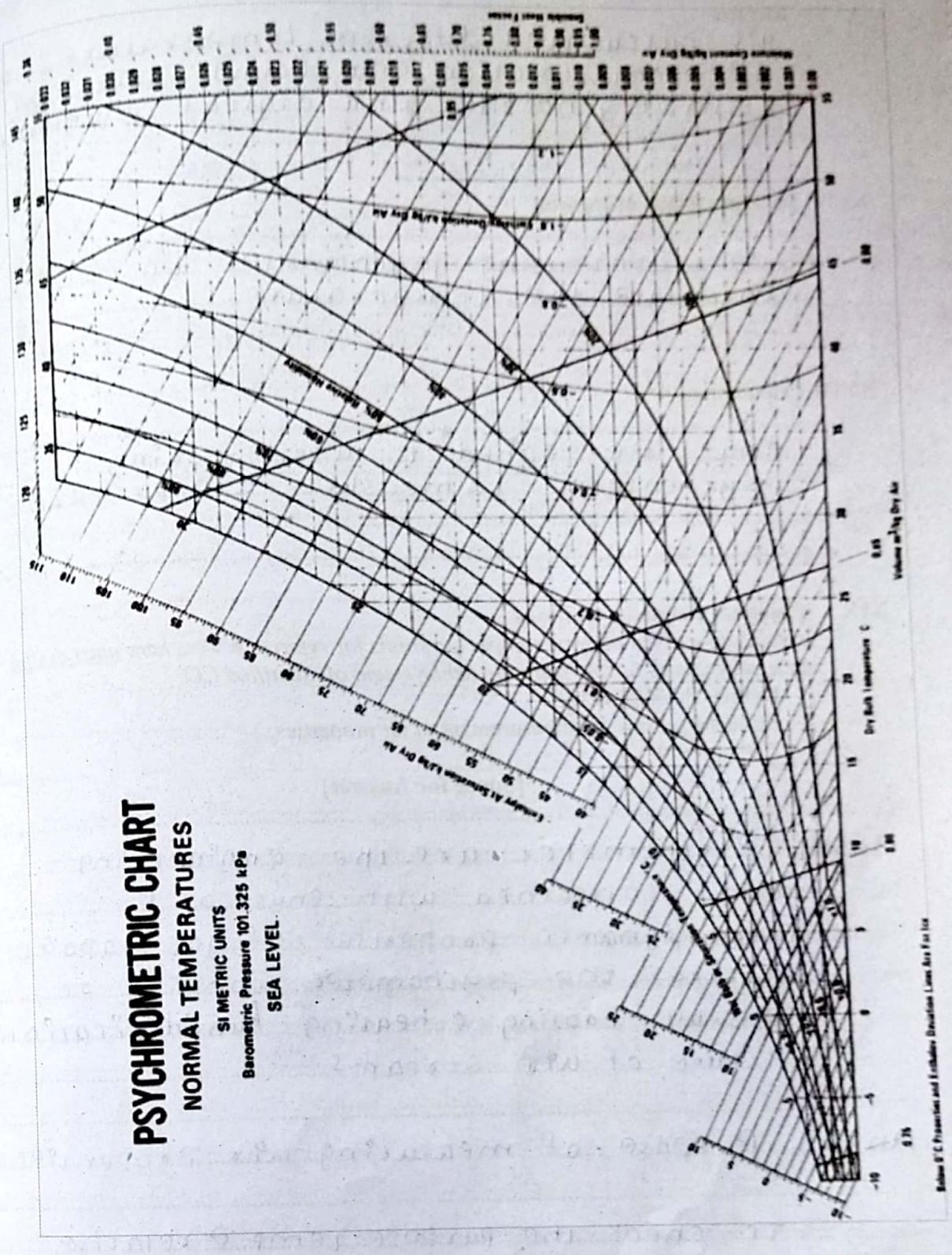

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XVI Results

We calculated different temperature at different location and found variations using Psychometer and digital psychometer

XVII Interpretation of Results

We learnt using psychometer to calculate the temperature

XVIII Conclusions

Thus we learned to used Spring psychometer to measure air properties

XIX Practical Related Questions

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

1. Define 'Psychrometry'.
2. State the purpose of measurement of air properties..

[Space for Answer]

Ans-1] Psychometer are the engineering terms concerned with physical & Thermodynamic properties of gas-vapor mixtures the psychometer consist of sensible cooling & heating humidification, mixture of air streams

Ans-2] Purpose of measuring air properties To check the purpose temp & relative humidity & calculated the density of air

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Thus, we traced graphs of different climate conditions. Hence it helps us to keep a track of climate condition of a particular region giving us geographical condition.

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XX References / Suggestions for Further Reading

1. www.youtube.com/watch?v=D66uqsKURs4
2. www.youtube.com/watch?v=mB9VTmQ5V4o
3. www.youtube.com/watch?v=TGWoRG4Rx80
4. www.youtube.com/watch?v=PECbPxQ1cF0
5. www.youtube.com/watch?v=2265UNflXT4

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. Amey...Rane..
2. .Pritan..Parmar
3. .Chirag...Thakur.

Marks Obtained			Dated signature of Teacher	
Process Related(10)	**Product Related(15)**	**Total (25)**		13/03/20
				19/03/20

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Practical No.16: Use Sound Meter to measure sound level of a given system

I **Practical Significance**

A sound level meter is a measuring device that measures the strength of sound in decibels. There are different types of these meters, but all of them contain 3 main parts; the microphone, which is used to capture the sound. Then there is the processing section which is self-explanatory; the area where the sound is processed. Last but not least we have the unit that contains the read out, which is digital and lets you know the outcome.

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 Measurement and control of Relevant Equipment'***:

1. Use relevant measuring instrument for measuring various mechanical properties of machine complements
2. Use of Sound Measuring Instruments

IV **Relevant Course Outcome(s)**

- Use relevant instrument for sound level measurement

V **Practical Outcome**

- Use sound meter to measure sound level

VI **Relative Affective Domain-**

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

VII **Minimum Theoretical Background**

Sound level meter is used for acoustic (sound that travels through air) measurements. It is commonly a hand-held instrument with a microphone. The diaphragm of the microphone responds to changes in air pressure caused by sound waves. That is why the instrument is sometimes referred to as a Sound Pressure Level (SPL) Meter. This movement of the diaphragm, i.e. the sound pressure deviation (pascal Pa), is converted into an electrical signal (volts V).A microphone is distinguishable by the voltage value

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produced when a known, constant sound pressure is applied. This is known as the microphone sensitivity. The instrument needs to know the sensitivity of the particular microphone being used. Using this information, the instrument is able to accurately convert the electrical signal back to a sound pressure, and display the resulting sound pressure level (decibels dB SPL).Sound level meters are commonly used in noise pollution studies for the quantification of different kinds of noise, especially for industrial, environmental and aircraft noise. The current international standard that specifies sound level meter functionality and performances is the IEC 61672-1:2013.

VIII Experimental setup

Figure No.1

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Sound level Meter	• Standard applied- IEC 651 type 2, ANSI 1.4 type 2 • Dynamic Range- 50 dB • Resolution-0.1 dB • Time Weighting- FAST (125mS), SLOW (1 sec) • Frequency range-31.5 Hz ~ 4kHz • Measuring level range- 40 ~ 130db (40 ~ 80dB, 50-90dB, 60-100dB, 70-110dB, 90 ~ 130db)	1

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Precautions to be Followed

X
1. Avoid improper handling of flow control valve
2. Don't apply excessive pressure on tips of Transducer .

XI Procedure

- Switch 'ON' Sound level Meter
- Take the probe nearer to the machine whose sound is to be measured (distance should not less than 25 mm)
- Note down the reading
- Compare reading with standard value
- Take five different readings

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Sound		Dynamic range	01	
2.	Level	HTC	50dB / Freq		
3.	meter		31.5 - 4KHz		

XIII Actual Procedure Followed

① Switch on sound lever meter. ② Take the probe nearer to the machine whose sound is to measured. ③ Note down the reading. ④ Compare reading with standard valves ⑤ Take 5 diff readings.

XIV Precautions Followed

① Avoid improper handling of flow control valve.
② Don't apply excessive pressure on tips of transducer.

XV Observations and Calculations

S. No.	Name of System	API Standard Value (dB)	Noise meter Reading (dB)	Remark
1	Electric Motor	65	65.6	
2	Automobile Car	85		
3	Window air conditioner	68	68.5	
4	Lathe Machine	100		
5	Ceiling fan	35	58	

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6	Air compressor	78	86	
7	Air conditioning		87	
8	Compressor		67	
9	water chilling plant		77.5	

XVI Results

We studied about sound level meter & application thoroughly

XVII Interpretation of Results

The noise meter was taken at various place to understand work.

XVIII Conclusions

Effect of sounds were studied with the help of sound level meter.

XIX Practical Related Questions

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

1. State the effect of sound on Human being.
2. As per API, list sound level limit of maximum ten machinery..

[Space for Answer]

Ans:-] The effects of sound on Human beings are

① Noise leads to behavioural and Emotional stress

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② It may permanently damage hearing.

③ It increases the chances of occurance of sudden noise can cause disease such as headache, blood pressure heart failure, etc.

④ It can affect physically mentally & psychologically

Ans-2] For refrigeration, it is 40 dB for vehicle it is 85 decible, for firearms it is 120 decible. The exposure limit for noise that is average of 90 dB & action level of 85 dB

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XX References / Suggestions for Further Reading

1. www.youtube.com/watch?v=j3hFRNyHZW8
2. www.youtube.com/watch?v=6DPdVsFboQM
3. www.youtube.com/watch?v=dyvAg6XKNB4

XXI Assessment Scheme

	Performance Indicators	Weightage
	Process Related (10 Marks)	**(40%)**
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3. .Chirag...Thakur.

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	19/03/20
			20/03/20

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