

# GUJARAT TECHNOLOGICAL UNIVERSITY

## Diploma in Mechatronics Engineering

Semester: 4

**Subject Name     METROLOGY AND INSTRUMENTATION**

<b>Sr. No.</b>	<b>Course content</b>
1.	<b>INTRODUCTION</b> 1.1    Need, Scope & importance of metrology and instrumentation in industries. 1.2    List of major mechanical industries in GUJARAT having their metrology and instrumentation lab . 1.3    Need of attitude, knowledge & skill required for using metrology and instrumentation aids in industries. 1.4    Inspection –types as for variables and attributes, need in industry, need for mass production. 1.5    Classification and functions of inspection including centralized and decentralized inspection. 1.6    Relationship between inspection and metrology. 1.7    Elements of measurement and factors affecting it. 1.8    Concept, need and importance of standard and specification.  1.6    Relationship between interchangeability and selective assembly. 1.7    Understand the fundamental linear measuring unit. 1.8    Concepts of computer aided inspection, working system and applications, coordinate measuring machine.
2.	<b>LINEAR MEASUREMENT</b> 2.1    Least count, accuracy, precision, error. 2.2    Direct and indirect measuring instruments including digital type measuring instruments (All types of instruments must be included)-Construction, elements and their functions, methods for setting, least count, method to use , precautions to be taken in handling, and applications. 2.3    Errors in measurements. 2.4    Working and use of dial indicator. 2.5    Selection of instrument for given situation.
3.	<b>ANGULAR MEASUREMENT</b> 3.1    Universal Bevel protectors, angle gauges, sine bar, spirit level. 3.2    Electronic level, clinometers, auto collimator, photo electric auto collimation. 3.3    Angle decker and taper gauges.
4.	<b>TESTING OF STRAIGHTNESS, FLATNESS AND SQUARENESS</b> 4.1    Concept of straightness, flatness, squareness and roundness 4.2    Testing of straightness, flatness, squareness and roundness.

5.	<b>ASSESSMENT OF SURFACE ROUGHNESS</b> 5.1 Terminology associated with surface roughness. 5.2 Surface roughness testing systems and direct and indirect measuring instruments for the same. 5.3 Measurement of surface roughness, computation of typical profile. 5.4 Relationship of machining processes and surface texture.
6.	<b>SCREW THREAD MEASUREMENT</b> 6.1 Terminology associated with screw thread measurement. 6.2 Measurement methods of external and internal thread elements. 6.3 Study of all type of thread measuring instruments.
7.	<b>GEAR MEASUREMENT</b> 7.1 Terminology associated with gear measurements. 7.2 Various methods of measuring and deriving gear elements. 7.3 Gear tooth vernier caliper, Parkinson's gear tester, David Brown gear tooth form testing. 7.4 Tool room microscope as projection method for small gear. 7.5 Involute curve checking.
8.	<b>LIMITS GAUGES</b> 8.1 Concept of gauging types and uses of gauges. 8.2 Use of various gauges . 8.3 Given a situation to be gauged, suggest the suitable type of gauges.
9.	<b>SENSORS AND TRANSDUCERS</b> 9.1 Definitions and concept. 9.2 Static and dynamic characteristics. 9.3 Potentiometer sensor, electrical resistance strain gauge, optical encoder, proximity switch, piezoelectric sensors and light sensors.
10.	<b>TEMPERATURE MEASUREMENT</b> 10.1 Principles of temp. measuring devices. 10.2 Bimetal thermometer, pressure spring thermometer, resistance thermometer, thermister, thermocouple, pyrometer. 10.3 Errors in temperature measurement. 10.4 Given a situation , suggest suitable temperature measuring device, stating reasons for selection.
11.	<b>11 PRESSURE MEASUREMENT</b> 11.1 Pressure measuring devices - types, applications, and its constructional details including vacuum. 11.2 Use of manometers, elastic gauges, tactile sensor and pressure transducers.
12.	<b>FLOW MEASUREMENT</b> 12.1 Classification of flow measuring devices.

	12.2 Use of various volumetric meters. 12.3 Application of obstruction meters. 12.4 Special methods of flow measurements. 12.5 Given a situation, select proper flow measuring device and justify it.
13.	<b>AUTOMATIC CONTROLS</b> 13.1 Meaning, general aspects and application of automatic control. 13.2 Automatic control system such as open loop control, feed back control, on-off control and proportional control. 13.3 Control responses such as pneumatic, hydraulic, electric and electronics.
14.	<b>CALIBRATION OF INSTRUMENTS</b> 14.1 Need of calibration. 14.2 Standards. 14.3 Various standard procedures for calibration of instruments. 14.4 Calibration procedure of the given instrument.

## REFERENCES

- |   |                                  |
|---|----------------------------------|
| 1. Engineering Metrology                        | R.K.Jain                         |
| 2. Mechanical and Industrial Measurement        | R.K.Jain                         |
| 3. Metrology and Instrumentation                | Tahir                            |
| 4. Metrology and Instrumentation                | Gupta                            |
| 5. Mechanical Measurement                       | R.S.Sirohi<br>& H.C.Radhakrishna |
| 6. Handbook of Dimensional Measurement          | Francis T. Fargo                 |
| 7. Gear Metrology                               | C.A.Scoks                        |
| 8. Practical Engineering Metrology              | K.W.B.Sdarp, Pitman              |
| 9. Industrial Instrumentation                   | Donald A. Eckman                 |
| 10. Instrumentation - Pressure & Liquid level   | F.E. Doyle.                      |
| 11. Mechanical measurements and instrumentation | R.K.Rajput (KATSON)              |
| 12. Mechatronics                                | W.Bolten (PEARSON)               |
| 13. Mechatronics                                | HMT                              |
| 14. Fundamentals of Fluid Mechanics             | Dr.D.S.Kumar (KATSON)            |
| 15. Fluid Mechanics                             | Douglas (PEARSON)                |