

# GUJARAT TECHNOLOGICAL UNIVERSITY

## Diploma in Mechanical Engineering

Semester: 4

**Subject Name     METROLOGY AND INSTRUMENTATION**

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

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

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| 12. | <b>FLOW MEASUREMENT</b><br>12.1 Classification of flow measuring devices.<br>12.2 Use of various volumetric meters.<br>12.3 Application of obstruction meters.<br>12.4 Special methods of flow measurements.<br>12.5 Given a situation, select proper flow measuring device and justify it.                |
| 13. | <b>AUTOMATIC CONTROLS</b><br>13.1 Meaning, general aspects and application of automatic control.<br>13.2 Automatic control system such as open loop control, feed back control, on-off control and proportional control.<br>13.3 Control responses such as pneumatic, hydraulic, electric and electronics. |
| 14. | <b>CALIBRATION OF INSTRUMENTS</b><br>14.1 Need of calibration.<br>14.2 Standards.<br>14.3 Various standard procedures for calibration of instruments.<br>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)                |