

**1. Preamble**

This course imparts knowledge for using mechanical and electronic instruments for measurement of dimensions and geometrical concepts of components manufacturing and temperature, pressure, flow and power for automotive applications.

**2. Pre-requisite**

1150GE103	Introduction to Engineering
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**3. Links to other courses**

- Automotive Electrical and Electronics

**4. Course Educational Objectives**

Students undergoing this course are expected to

- Understand the theory of metrology and principles, construction, operation of different mechanical, electronic measuring instruments for measurement of various parameters for automotive applications.

**5. Course Outcomes**

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
C01	Know the principles and method of measurements for geometry and dimensional aspects of automobile components manufacturing.	K2
C02	Understand the selection of measuring instruments for measurement of Pressure, Acceleration and Vibration	K2
C03	Explain the various measuring instruments for measurement of Flow, Density and Viscosity	K2
C04	Demonstrate the various measuring instruments for measurement of Temperature.	K2
C05	Describe the various measuring instruments for measurement of Force, Torque and Speed in engine	K2

(K2-understand, K3-Apply, K4-Analysis)

**6. Correlation of COs with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H		H					L	L		H	H
CO2	H	H	H		H					L	L		M	H
CO3	H	H	H		H					L	L		M	H
CO4	H	H	H		H					L	L		M	H
CO5	H	H	H		H					L	L		H	H

H- High; M-Medium; L-Low

## **7. Course Content**

### **UNIT – I LINEAR MEASUREMENT**

**L-9**

Units and Standards, Precision, Accuracy and Measurement Errors. Linear Measuring Instruments, Dialgauges, Comparators and Linear Measuring Machines. Angular Measuring Instruments- Sine Bar, Bevel Protractor, Measurement of Straightness, Flatness and Surface Finish - Profilographs.

### **UNIT – II PRESSURE, ACCELERATION, & VIBRATION MEASUREMENT**

**L-9**

Bourdon Tube, Diaphragm, Bellows and Pressure Capsules: Potentiometer, Strain Gauges, LVDT, Capacitive and Variable Reluctance Type Transducers. Dynamic Pressure Measurement Piezo Electric and Piezo Resistive Transducers, Farnboro Engine Indicator, Low Pressure Measurement McLeod Gauge, Pirani Gauge, Thermal Conductivity Type Pressure Measurement, Accelerometer- LVDT Strain Gauge and Piezo Electric Type. Vibration Measurement- Mechanical-Seismic Instrument, Vibration Pickups

### **UNIT – III FLOW, DENSITY & VISCOSITY MEASUREMENT**

**L-9**

Obstruction Type Flow Meter- Orifice Plate, Venturimeter, Flow Nozzles, Pitot Tube, Rotameter. Positive Displacement Flow Meters – Turbine Flow Meter, Fluted Tube Flowmeter, Anemometer, Ultrasonic Flow Meter, Magnetic Flow Meters. Viscosity Measurement- Saybolt Viscometer, Rotometer Type Viscometer. Density Measurement– Densitometer, Pressure Head Type, Floats Type & Ultrasonic Type

### **UNIT – IV TEMPERATURE MEASUREMENT**

**L-9**

Temperature Scales – Mechanical Temperature Sensors, Liquid in Glass, Vapor Pressure, Bimetal Temperature Gauges. Resistance Type Temperature Sensors, Thermistors, Thermocouples, Laws of Thermocouple, Types of Thermocouples, Construction and Circuits for Thermocouples. High Temperature Measurement Pyrometers.

### **UNIT – V FORCE, TORQUE AND SPEED MEASUREMENT**

**L-9**

Force Measuring Devices- Balances, Platform Scales, Weigh Bridges, Load Cells, Proving Ring. Torque Measurement – Prony Brake, Rope Brake and Fan Type Brakes. Dynamometers – Hydraulic, Electric Cradle and Eddy Current Dynamometers. Transmission Dynamometers. Chassis Dynamometers. Speed Measurements- Revolution Counter. AC/DC Tachometer-Stroboscopic, Strobotron.

**Total: 45 Periods**

## **8. Text Books**

1. Jain R.K., Engineering metrology, Khanna publishers, New Delhi
2. Alan S Morris, Measurement & Instrumentation Principles, Third Edition, ISBN: 978-0-7506-5081-6

## **9. References**

1. Patranabis D, Principles of industrial instrumentation, TMH Publishing Co. New Delhi
2. Jain R.K., Mechanical & Industrial measurements, Khanna publishers, New Delhi
3. Doebelin, "Measurement System Application & Design" McGraw Hill, New Delhi
4. Gaylor F.W and Shotbolt C.R Metrology for engineers, ELBS.