



SILVER OAK UNIVERSITY
College of Technology (01)
Diploma in Mechanical Engineering
Subject Name: Metrology and Instrumentation
Subject Code:1010122219
Semester: 3rd

Prerequisite: Zeal to Learn Subject.

Objective: Metrology and Instrumentation plays very vital role in the manufacturing Industries. This Course is prepared to understand the usage of various measuring Instruments to make a product very effective. It also incorporates the instrumentation along with IOT, which includes the application of the various devices such as the PLC, SCADA and many more and also application of IOT for manipulating various devices in the Industries. This Course will provide the opportunity to learn about Metrology, Instrumentation along with IOT.

Teaching and Examination Scheme:

Teaching Scheme					Evaluation Scheme				Total Marks
L	T	P	Contact Hours	Credits	Theoretical		Practical		
					CIE (TH)	ESE (TH)	CIE (PR)	ESE (PR)	
3	0	2	5	4	40	60	20	30	150

Content:

Unit No.	Course Contents	Teaching Hours	Weightage %
1	Metrology and Instrumentation: Basic of Metrology, Definition of Measurement, Measurement system model, methods of measurements, static and dynamic characteristics of an instrument, classification of instruments, Errors in measurement, Calibration process, Measurement of pressure, temperature, velocity, Acceleration, force and torque. Basic of Instrumentation, Introduction to coordinate measuring machines, constructional features, applications. Basic concepts of lasers, types, advantages & applications of lasers, laser interferometers.	12	27%
2	Linear and Angular Measurements: Standards of measurement, Line standards, end standards, sources of error in measurement. Various Linear measuring instruments like Calipers, surface plates, vernier height gauge, vernier depth gauges, micrometers, slip gauges. Comparators: classification and Characteristics of comparators, uses,	10	22%

	working principal, advantages and disadvantages of various types of comparators. Angular measurements: Bevel protector, sine principle and sine bars, angle gauges, clinometers, optical instrument for angle measurements		
3	Limits, Fits, Tolerance and Gauging: Definition of Tolerance, interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919-1963), geometric tolerance, position-tolerances. Classification of gauges, brief concept of design of gauges (Taylor's principles), Application of various types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.	6	13%
4	Industrial Instrumentation & Devices: Concept of the Industrial Instrumentation, Basics of PLC, SCADA, DCS and smart instrumentations. I to P and P to I Converter, Various types of transmitter such as Pneumatic Electronic, Smart transmitter, Control Valve, Actuators and Positioners, Control valve parameters, Application of control valves in industries, Basic Parts of Control Valve, Flow characteristics of control valve, Calibration procedure of different valves, Basic of valve actuators, Type of actuators, Calibration of Actuators.	12	27%
5	Incorporation of IOT in Instrumentations & Instrumentation Documentations: Introduction of different documentations, Need of documentations, Overview of ISA standards documentations, History of IOT, Definition, Architecture. Industry revolutions, Industry Revolution 4.0–technology, opportunities and challenges, Hardware required: Sensors, Actuators, Routers, Switches, platforms for IOT.	5	11%

Course Outcome:

Sr. No.	CO statement	Unit No
CO-1	To relate engineering aspects of metrology and Instrumentation and also learn about measurements of various mechanical quantities like Force, Temperature, Pressure, Velocity, Acceleration, Torque.	1, 2
CO-2	To understand the Significance of various Limits, Fits, Gauges in Manufacturing field to make effective and specified size Components.	3
CO-3	To illustrate the fundamental principles of Industrial instruments, actuators, Control valves used in industry	4
CO-4	To incorporate the Internet of Things in Industrial Instrumentation and also learn about the Industrial Instrumentation Documentation Process.	5

Teaching & Learning Methodology:

1. Kinesthetic learning
2. Direct instruction
3. PPT and Video Animations
4. Flipped classroom
5. Case Study / Open Ended Problem
6. Industrial Visit

List of Experiments/Tutorials:

1. Basic understanding of metrology and Instrumentation: concepts, application, advantage and future aspects.
2. Performance on linear and angular measurements and check different characteristics of measurements.
3. Performance on temperature measurements and check different characteristics of measurements.
4. Performance on pressure measurements and check different characteristics of measurements.
5. Performance on Speed/Velocity, acceleration measurements.
6. Basic Understanding of the PLC, DCS, SCDA.

Major Equipment:

1. Temperature and pressure Measurements Equipment/Devices/Sensors.
2. Linear/Angular Measurements Equipment/Devices/Sensors
3. Resistive Potentiometer, Tachometers, Piezoelectric Accelerometer
4. Miscellaneous measurements Equipment.
5. PLC with software
6. IOT Models

Books Recommended:

1. Galyer J.F.W. and Shot bolt, Metrology for Engineers, Thomson Learning
2. Mahajan M., A Text Book of Engineering Metrology, Dhanpat Rai & Sons Manufacturing Processes, O. P. Khanna.
3. Juran J.M. and Gryna Frank M, Quality planning and analysis, Tata McGraw Hill Education. Processes and Materials of Manufacture; Lindberg Roy A.; Prentice-HallIndia.
4. Industrial Instrumentation & Control by S K Singh, Mc Graw Hill
5. M. D. Desai, Control System Components, PHI Publication

List of Open Source Software/learning website:

1. <https://nptel.ac.in/courses/112/106/112106138/>
2. <https://nptel.ac.in/courses/108/105/108105064/>
3. <https://nptel.ac.in/courses/108/108/108108179/>