

Module Name (Instrumentation & Control Engineering)	Total Hours
Maintenance, Calibration and testing of industrial instruments (Pressure and Flow)	36

Unit	Learning Outcomes	Topic	Sub-Topic	Activity
1. Introduction to Pressure and Flow	A. Able to understand basic physics terminology, law, required theorem used in pressure and flow transducer	Pressure	Definition of Pressure Unit of Pressure Type of Pressure Pascal Law Hooks Law	<ol style="list-style-type: none"> 1. Demonstrate pascal law by inflating balloon 2. Demonstrate toy of bourdon tube. 3. Demonstrate hooks law using simple spring. 4. Demonstrate flow measurement using bucket and stop watch with different types of liquids. 5. Demonstrate turbulence and laminar flow using obstruction. 6. Demonstrate continuity equation and Bernoulli's theorem Using garden pipe.
		Flow	Definition of flow Unit of flow Type of flow Reynolds Number Bernoulli's theorem Equation of continuity	
	B. Able to understand basic electricity terminology, law, required theorem used in pressure and flow transducer	Electricity	Voltage Current Resistance Ohm's Law Wheatstone bridge equation,	<ol style="list-style-type: none"> 1. Demonstrate electricity analogy using hydraulic system. 2. Measure voltage, current(ac and d.c) and resistance using multi meter. 3. Verify ohm's Law. 4. Calculate Wheatstone bridge formulae.
	C. Able to understand basic electromagnetism terminology, law, required theorem used in pressure and flow transducer	Electromagnetism	Magnets Magnetism and Electro-Magnetism Faraday's and Lenz's law of Electromagnetism	Demonstrate magnetism(flux line,magnetic pole,attraction and repulsion,) using toy. Demonstrate electro magnetism using toy.(Farady's and Lenz's Law)
D. Able to understand Basic measurement concepts like Area, Volume, Mass, Density.	Basic measurement concepts	Area, Volume, Density. Viscosity Velocity Acceleration Mass and Weight Force	Measure class room area using measure tape. Measure tank volume using cubic tank. Demonstrate Density dropping metal ball in various liquids. Demonstrate velocity and acceleration by running. Demonstrate mass using weighing scale. Demonstrate weight by dropping various objects in air. Demonstrate force by moving different weight object.	

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2. Pressure Gauge	A. Able to understand working operation of bourdon tube type pressure gauge.	bourdon tube type pressure gauge.	Types Basic Components Working	Identify different types of gauge. Identify components. Identify dial size, connection and fluid service for given pressure gauge.
	B. Able to understand maintenance flow chart of bourdon tube type pressure gauge.	maintenance flow chart	maintenance flow chart Documentation	Nil
	C. Able to test bourdon tube type pressure gauge.	Test	Working/not working	Prepare flow chart for a given device.
	D. Able to calibrate bourdon tube type pressure gauge.	Calibration	Types of Calibration(3,5,7 point) Calibration procedure using standard gauge and using dead weight tester.	Carry out the calibration procedure using given resources.
	E. Able to perform preventive maintenance of bourdon tube type pressure gauge.	preventive maintenance	Check thickness Check pointer movement And firmness. Check mechanical link connection. Check teeth on sector and pinion. Check hair spring Check Glass.	Carry out preventive maintenance for given device by observation.
	F. Able to perform breakdown maintenance of bourdon tube type pressure gauge.		Identify the problem of break down. Verify repairable or not. Follow the standard procedure of repairing.	Repair faulty gauge.
3. Strain Gauge	A. Able to understand working operation of Strain Gauge type pressure transducer.	Strain Gauge type pressure transducer.	Types Basic Construction Working Resistance measurement	Identify different types of Strain gauge. Identify input and output connections. Demonstrate change in resistance due to change in pressure.

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			using Wheatstone bridge.	
	B. Able to understand maintenance flow chart of Strain Gauge.	maintenance flow chart	maintenance flow chart Documentation	Nil
	Able to test Strain Gauge.	Test	Working/not working	Prepare flow chart for a given device.
	C. Able to calibrate Strain Gauge.	Calibration	Types of Calibration(3,5,7 point) Calibration procedure using Shunt Calibration of Strain Gauge Instrumentation.	Carry out the calibration procedure using given resources.
	D. Able to perform preventive maintenance of Strain Gauge.	preventive maintenance	Check solder at base. Check continuity of grid. Check condition of isolating base. Check uniformity of foil. Check isolation between input and output side.	Carry out preventive maintenance for given device by observation.
	E. Able to perform breakdown maintenance of Strain Gauge.		Identify the problem of break down. Verify repairable or not. Follow the standard procedure of repairing.	Repair faulty Strain Gauge.
4. Orifice Flow Transducer	A. Able to understand working operation of orifice flow transducer .	orifice flow transducer	Types Basic Construction. Working Explain relation between flow and differential pressure using mathematical formulae. Types of tapping	Identify different types of orifice flow transducer. Identify different tapping and measure corresponding ΔP . Calculate the flow rate using given theorem and verify using calibrated bucket.
	B. Able to understand maintenance flow chart of orifice flow transducer.	maintenance flow chart	maintenance flow chart Documentation	Nil
	C. Able to test orifice flow	Test	Working/not working	Prepare flow chart for a given device.

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	transducer . .			
	D. Able to calibrate orifice flow transducer.	Calibration	Types of Calibration(3,5,7 point) Calibration procedure using standard techniques.	Carry out the calibration procedure using given resources. Measure discharge coefficient.
	E. Able to perform preventive maintenance of orifice flow transducer.	preventive maintenance.	Check flange, tapping connections. Check gaskets. Check pipe line, tapping for choke up.	Carry out preventive maintenance for given device by observation.
	F. Able to perform breakdown maintenance of orifice flow transducer .		Identify the problem of break down. Verify repairable or not. Follow the standard procedure of repairing.	Repair faulty orifice flow transducer .
5. Electro-magnetic Flow Meter	A. Able to understand working operation of electro-magnetic flow meter.	electro-magnetic flow meter	Types Basic Construction. Working. Explain relation between flow and voltage using mathematical formulae.	Identify different types of electro-magnetic flow meter Identify components. Calculate the flow rate using given theorem and verify using calibrated bucket.
	B. Able to understand maintenance flow chart of electro-magnetic flow meter.	maintenance flow chart	maintenance flow chart Documentation	Nil
	C. Able to test electro-magnetic flow meter.	Test	Working/not working	Prepare flow chart for a given device.
	D. Able to calibrate electro-magnetic flow meter.	Calibration	Types of Calibration(3,5,7 point) Calibration procedure using standard techniques.	Carry out the calibration procedure using given resources.
	E. Able to perform preventive maintenance of electro-magnetic flow meter.	preventive maintenance.	Check flange connections. Check gaskets. Check coil. Check inside lining.	Carry out preventive maintenance for given device by observation.

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	F. Able to perform breakdown maintenance of electro-magnetic flow meter .		Identify the problem of break down. Verify repairable or not. Follow the standard procedure of repairing.	Repair faulty electro-magnetic flow meter.
6. Smart Instruments	A. Able to understand features of advance industrial smart instrument.	Smart transmitter (flow with hart protocol)	Comparison between traditional and smart instruments.	Demonstration of smart instrument.
	B. Explore job opportunities in industry.	Job opportunities	Types and List of Process Industries. How to prepare resume. How to face interview. List of web site to find job.	Prepare List of Industries. Prepare List of web sites. Prepare Resume. Attend mock Interview.