

COURSE TITLE : INDUSTRIAL INSTRUMENTS II
COURSE CODE : 5211
COURSE CATEGORY : A
PERIODS/WEEK : 4
PERIODS/SEMESTER: 52
CREDITS : 4

TIME SCHEDULE

Module	Topics	Periods
1	Flow measurement.	14
2	Special type Flow meters.	14
3	Viscosity, Specific gravity, Humidity and Moisture measurement.	14
4	Force, Speed, Torque, Acceleration Measurement.	10
TOTAL		52

COURSE GENERAL OUTCOME

Module	G.O.	On completion of the study of this module the student will be able
1	1	To understand Principles of Flow measurements.
	2	To understand Principles of Flow measurements.
	3	To comprehend Variable head Flowmeters.
2	1	To know special type flow meters.
	2	To understand positive displacement flow meters.
	3	To understand open channel flow meters.
3	1	To understand the principle of viscosity measurement.
	2	To comprehend the principle of specific gravity measurement.
	3	To understand the principle of moisture and Humidity measurement.
4	1	To understand the various methods of force measurement.
	2	To understand the various methods of speed measurement
	3	To understand different types of Torque measurement
	4	To comprehend Acceleration measurement

On Completion of the study the student will be able

MODULE I FLOW MEASUREMENT

1.1.0 To understand Principles of Flow measurements

- 1.1.1 Introduction to flow measurement
- 1.1.2 To State Bernoulli's theorem
- 1.1.3 To Define Reynolds Number
- 1.1.4 To Define laminar and turbulent flow.
- 1.1.5 To derive Continuity equation

1.2.0 To comprehend Variable area Flowmeters

- 1.2.1 To explain the principle of operation of variable area flow meter
- 1.2.2 To explain the construction and working of Rota meter

1.3.0 To comprehend Variable head Flowmeters

- 1.3.1 To explain the Principle of operation of variable head flow meter
- 1.3.2 To explain the different types of orifice plates
- 1.3.3 To describe the construction & working of orifice plate flowmeter.
- 1.3.4 To describe the construction & working of Venturi meter
- 1.3.5 To explain the construction & working of Flow Nozzle
- 1.3.6 To explain the construction & working of Dähler tube
- 1.3.7 To explain the construction & working of Pitot tube

MODULE II SPECIAL TYPE FLOW METERS

2.1.0 To know special type flow meters

- 2.1.1 To explain the working principle & Construction of Electromagnetic flow meters.
- 2.1.2 To describe the working principle & Construction of Turbine flow meters
- 2.1.3 To explain the working principle & Construction of Mass flow meters. (Coriolis principle)
- 2.1.4 To describe the working principle & Construction of Ultrasonic flow meters.
- 2.1.5 To explain the working principle & Construction of Hot wire anemometer
- 2.1.6 To illustrate the working of vortex shedding flow meters

2.2.0 To understand positive displacement flow meters.

- 2.2.1 To explain the working principle & Construction of Nutating disc type flow meters.
- 2.2.2 To describe the working principle & Construction of Reciprocating piston type flow meters
- 2.2.3 To illustrate the working principle & Construction of oval gear type flow meters.

2.3.0 To understand open channel flow meters

- 2.3.1 To explain the working principle & Construction of V- notch
- 2.3.2 To describe the working principle & Construction of Rectangular notch
- 2.3.3 To illustrate the working principle & Construction of Weirs
- 2.3.4 To explain the methods of calibration of flow meters

MODULE III VISCOSITY, SPECIFIC GRAVITY, HUMIDITY AND MOISTURE MEASUREMENT

3.1.0 To understand the principle of viscosity measurement

- 3.1.1 To define absolute viscosity, Kinematic viscosity and relative viscosity.

- 3.1.2 To explain the different Units of viscosity
- 3.1.3 To describe the principle and working of Say bolt's viscometer.
- 3.1.4 To explain the principle and working of Redwood viscometer.

- 3.2.0 To comprehend the principle of specific gravity measurement.**
 - 3.2.1 To define specific gravity.
 - 3.2.2 To explain the principle and working of specific gravity measurement
 - 3.2.3 To describe the Static pressure operated mechanism.
 - 3.2.4 To illustrate the principle and working of Weighing tube method.
 - 3.2.5 To explain the principle and working of Hydrometer

- 3.3.0 To understand the principle of Humidity and moisture measurement**
 - 3.3.1 To define Humidity, relative humidity, absolute humidity and dew point.
 - 3.3.2 To explain the operation of wet and dry bulb psychrometer.
 - 3.3.3 To describe the principle of Hygrometers.
 - 3.3.4 To describe the construction and working of Hygrometers (Hair & Resistive).
 - 3.3.5 To explain the operation of dew cell.
 - 3.3.6 To define moisture.
 - 3.3.6 To explain capacitance hygrometer method used for moisture measurement.

MODULE IV FORCE, SPEED, TORQUE, ACCELERATION MEASUREMENT

- 4.1.0 To understand the various methods of force measurement.**
 - 4.1.1 To list different types of load cells.
 - 4.1.2 To describe hydraulic load cell.
 - 4.1.3 To explain pneumatic load cell.
 - 4.1.4 To describe strain gauge load cell.

- 4.2.0 To understand the various methods of speed measurement.**
 - 4.2.1 To classify the different types of tachometers.
 - 4.2.2 To explain the construction & working of mechanical tachometer.
 - 4.2.3 To describe the method of measurement of speed by stroboscope.
 - 4.2.4 To describe the method of measurement of speed by non contact type instruments.

- 4.3.0 To understand different types of Torque measurement**
 - 4.3.1 To explain the technique of torque measurement using strain gauges

- 4.4.0 To comprehend Acceleration measurement**
 - 4.4.1 To study the principle of accelerometer
 - 4.4.2 To explain the construction & working of seismic accelerometer
 - 4.4.3 To explain the construction & working of LVDT accelerometer
 - 4.4.4 To explain the construction & working of Piezoelectric accelerometer

CONTENT DETAILS

Module I

Principles of Flow measurements-laminar and turbulent flow – Reynolds's number -Continuity equation- Bernoulli's equation for ideal fluid –Variable area flow meters- Rota meter – Variable Head flow meter- Different types of orifice plate and tapings. Orifice plate flow meter - Venturi meter - Flow Nozzle – Dahl tube - Pitot tube-Differential Pressure flow transmitter

MODULE II

Special type Flow meters- Electromagnetic flow meters.- Turbine flow meter.- Mass flow meters.- Ultrasonic flow meters - Vortex flow meter - Hot wire anemometer-Positive displacement flow meters- Oval gear- Nutating disc type- Reciprocating piston type-Open channel flow meters- Weirs - V notch- Rectangular notch

MODULE III

Viscosity measurement- Absolute viscosity - Kinematic viscosity - relative viscosity – units-Saybolt Viscometer - Redwood Viscometer-Specific gravity measurement- Definition - Static pressure operated mechanism-Weighing tube type – Hydrometer-Humidity measurement-Definition - humidity- relative humidity –Absolute humidity - Dew point-Measurement methods - Wet and dry bulb method- Sling psychrometer.- Hair hygrometer – resistive hygrometer - Dew cell - cold mirror method-Moisture measurement-Definition - capacitive hygrometer method

MODULE IV

Force measurement-Load cells – hydraulic – pneumatic – strain gauge load cells-Speed measurement Classifications - Mechanical tachometer – Stroboscope – non- contact method-Torque measurement- technique using strain gauge-Acceleration measurement-Seismic accelerometer - LVDT accelerometer - Piezoelectric accelerometer

REFERENCES

1. A K Sawney–Mechanical Measurements and Instrumentation Dhanpathrai and sons
2. S.K.Singh – Industrial Instrumentation and Control-TMH
3. Liptak– Instrument Engineers Handbook Vol. I
4. Austin.E.Fribance– Industrial Instrumentation Fundamentals
5. Donald .P. Eckman– Industrial Instrumentation
6. D.S. Kumar – Mechanical Measurements and Control
7. Patranabis – Industrial Instrumentation