CEPE3010 PROCESS INSTRUMENTATION (3-0-0)

Overall course Objective:
The main objective of the course is to teach students about various instruments measuring temperature, pressure, and flow. Introduce students to various concepts of variable measurement. Instrumentation is to measure, monitor, control and optimize industrial processes so they operate safely, efficiently and consistently.

Module I: (13 Hrs)
Basic concepts and qualities of measurement, Level measurement: Methods of liquid level measurement, Direct methods, Hook-type level indicator, sight glass, Float-type level indicator, Displacer level detectors, Indirect methods, Hydrostatic pressure type, Pressure gauge method, Air bellows, Air purge system, Liquid purge system, Electrical methods.

Module II: (15 Hrs)
Flow Measurement: Methods of flow measurement, Inferential flow measurement, Quantity flowmeters, Mass flowmeters, Calibration of flowmeters, Selection of flowmeters. Pressure measurement: Pressure, Methods of pressure measurement, Manometers, Elastic pressure transducers, Measurement of vacuum, Force-balance pressure gauges, Electrical pressure transducers, Pressure switches, Calibration of pressure measuring instruments, Maintenance and repair of pressure measuring instruments, Troubleshooting.

Module III: (12 Hrs)
Temperature measurement: Temperature, Temperature scales, Methods of temperature measurement, Expansion temperature, Filled-system thermometers, Electrical temperature instruments. Pyrometers: Radiation and optical. Methods of composition analysis: Absorption spectroscopy, Emission spectroscopy, Mass spectroscopy.

Course Outcomes:
On completion of the course, the student can;
CO1: Characterize instruments, evaluate responses and estimate errors.
CO2: Understand working of various transducers and evaluate associated parameters.
CO3: Understand measurement techniques for pressure and temperature and select appropriate instruments.
CO4: Understand measurement techniques for level, flow and flow related properties and select appropriate instruments.
CO5: Understand the measurement techniques for composition, humidity and turbidity and select appropriate instruments.

Text Books:
1. Industrial Instrumentation by D P Eckman, CBS.
2. Instrumentation: Devices and Systems, 2nd ed. by C Rangan, G Sarma, and V S V Mani, McGraw-Hill.

Reference Books:
1. Principles of Measurement Systems, 3rd ed. by J P Bentley, PHI.
2. Industrial Instrumentation and Control, 3rd ed. by S K Singh, McGraw-Hill.

Digital Learning Resources:
1. Chemical Process Instrumentation by Prof. Debasis Sarkar, Department of Chemical Engineering, IIT Kharagpur, Link: https://nptel.ac.in/courses/103/105/103105130/