

INDUSTRIAL INSTRUMENTATION

Code : EI 501

Contacts : 3L+1T

Credits : 4

(All periods will be of at least 50 minutes duration)

Module I [6]

Measurement of Pressure and Vacuum:

Pressure:

Manometers – U tube, Inclined Tube and Well type Manometers

Elastic Pressure Sensor Instruments – Bourdon Tube Pressure Gauge, Capsule Gauge, Differential Pressure Gauge, Pressure

Switch

Electronic Pr / DP transmitters : capacitive, piezo - resistive and resonating wire type

Vacuum:

McLeod Gauge, thermal conductivity gauge, ionization gauge

Module II [11]

Flow rate Measurement:

General concepts - Laminar flow, Reynolds's number, Effect of temperature and pressure on flow rate measurement,

Calibration of flow meters.

Head type flow measurement – analysis and calculation, and head producing devices - orifice, venturi, pitot tube, multiport averaging pitot

Variable Area Flowmeters – Glass and metal tube rotameters

Electromagnetic type, Ultrasonic type, Vortex type, Positive displacement type

Mass flow meters : Coriolis, Thermal, Impeller type

Weirs, Flumes and open channel flow measurement.

Module III [6]

Level Measurement :

Gauge glass, Bi-Colour, Magnetic and Reflex Level Gauge

Float and displacers type instruments – Gauge and Switch

D/P type sensors and their installation arrangements

Capacitive type level instrument

Ultrasonic and Microwave type level instruments

Module IV [8]

Temperature Measurement:

Temperature scale, ITS 90, fixed points and interpolation equations

Filled in systems: liquid, gas and vapour, ranges, media, errors, construction details and comparison, classification

Bimetal elements, Thermostats

RTD: review of materials, construction, types; measuring circuits, ranges, errors and minimization of errors

Thermocouples including MI thermocouples: types, thermoelectric power, circuits, ranges, errors, cold junction compensation, compensating cables

Radiation Thermometer sensors used, spectral and other characteristics, Optical Pyrometers

Module V

Installation Requirements

Installation of pressure measuring instruments with accessories like seals, snubbers, 2 valve manifolds

Installation of DP measuring instruments with head producing devices – pressure tapplings, isolation valves, 3 valve manifolds, etc.

Straight run requirements for flowmeters

Installation of Temp elements – Thermowells [3]

Pneumatic Instrumentation

Flapper nozzle system - pneumatic force balance and motion balance system

Pneumatic Transmitter [2]

Hazardous Area Instrumentation

Basic Concepts

Classification based on site, material and temperature – IEC and North American system

Methods of Protection – Explosion proof, Intrinsic safety, Purging and Pressurization, Non-Incendiary ; IEC

Equipment Protection Level (EPL)

NEMA and IP codes [4]

Books:

1. D. Patranabis, Principles of industrial Instrumentation, TMH, New Delhi, 2nd Ed.
2. B. G. Liptak, Instrument Engineers Handbook, vol-I and vol-II, Chilton Book Co. Philadelphia
3. D. M. Considine and G. D. Considine (Eds.) Process Instruments and controls Handbook, Mc Graw Hill, New York
4. Ernest O. Doebelin, Measurement Systems – Application and Design, Tata-McGraw Hill
5. A. Barua, Fundamentals of Industrial Instrumentation, Wiley India
6. M.M.S. Anand, Electronic Instruments and Instrumentation Technology, PHI, Delhi