

Cochin University of Science And Technology
EI 502 : Industrial Instrumentation - I

MODULE I

Measurement of Force – electric balance, different types of load cells (hydrostatic, pneumatic, magneto-elastic, piezoelectric, elastic & strain gauge load cell).

Measurement of Torque – prony brake, strain gauge, based on relative angular twist, differential transformer (RVDT), variable permeability & optical method.

Speed (Velocity) Measurement – revaluation counter, capacitive tacho, drag cup type tacho, DC & AC tachogenerators & stroboscopic method.

MODULE II

Pressure Measurement – units of pressure, manometers (U-tube, well type, enlarged leg, inclined tube, micro manometer, ring-balance), elastic type pressure gauges (bourdon tube, bellows, diaphragms), electrical methods (elastic elements with LVDT & strain gauges, capacitive type pressure gauge, piezoelectric pressure sensor, resonator pressure sensor).

Measurement of Vacuum – McLeod gauge, thermal conductivity gauges, ionization gauge (cold cathode & hot cathode), testing & calibration of pressure gauges (dead weight tester).

MODULE III

Temperature Measurement – definitions & standards, primary & secondary fixed points, calibration of thermometers, filled in system thermometer (different types, sources of errors & their compensation), bimetallic thermometers, electrical methods of temperature measurement – thermistor, RTDs (3-wire & 4-wire, signal conditioning of industrial RTD & their characteristics).

MODULE IV

Thermocouples – law of thermocouple, fabrication of industrial thermocouples, signal conditioning of thermocouple output, thermal block references functions, commercial circuits for cold junction compensation, response of thermocouple, special techniques for measuring high temperature using thermocouples.

Radiation methods for Temperature Measurement – radiation fundamentals, pyrometers (total radiation & selective radiation types), two color radiation pyrometer, optical pyrometer.

Type of Questions for University Exam.

Q.I Eight short answer questions of 5 marks with two questions from each of the four modules.

Q.II – V Two questions A & B of 15 marks from each module with option.

REFERENCES

1. **Norman A Anderson**, Instrumentation for Process Measurement and Control (Third Edition), CRC Press, Florida, 1997.
2. **Béla G Lipták**, Instrument Engineers' Handbook (Fourth Edition), Process Measurement and Analysis, Volume – I, CRC Press, London, 2003.
3. **D Patranabis**, Principles of Industrial Instrumentation (Second Edition), Tata McGraw – Hill Publishing Company Limited, New Delhi, 2004.
4. **R K Jain**, Mechanical and Industrial Measurements (Tenth Edition), Khanna Publishers, New Delhi, 2002.
5. **Ernest O Doebelin**, Measurement Systems – Application and Design (Fifth Edition), Tata McGraw – Hill Publishing Company Limited, New Delhi, 2004.
6. **S K Singh**, Industrial Instrumentation and Control (Second Edition), Tata McGraw – Hill Publishing Company Limited, New Delhi, 2003.
7. **Donald P Eckman**, Industrial Instrumentation, CBS Publishers & Distributors, New Delhi, 2003
8. **C S Rangan, G R Sarma, V S V Mani**, Instrumentation: Devices & Systems (Second Edition), Tata McGraw – Hill Publishing Company Limited, New Delhi.
9. **Dr. D S Kumar**, Mechanical Measurements & Control (Third Revised & Enlarged Edition), Metropolitan Book Co. Private Limited, New Delhi, 2000.

Incomplete list of references