09AE212 INSTRUMENTATION & CONTROL SYSTEMS

Credits: 4:0:0

Course Objectives:

1. To provide knowledge on the fundamentals of measurement science and measuring instruments
2. To provide a knowledge on the basics of control system theory

Course Outcomes:

1. Students will be conversant with measurement techniques and the use of measuring instruments
2. Students will have working knowledge for dealing with problems involving control system fundamentals

Unit I

General concepts of Mechanical Instrumentation generalized measurement system. Classification of instruments as indicators, recorders and integrators- their working principles, Precision and accuracy: measurement error and calibration.

Unit II

Measurement of displacement, time, speed, frequency, acceleration - vibrometer, accelerometer etc. Pressure measurement: gravitational, Bourdon, elastic transducers, strain gauge, pressure cells, and measurement of high and low pressure. Temperature measurement: bi-metallic, resistance thermometer, thermocouples, pyrometer, thermistors. Hot-wire anemometer, magnetic flow meter , ultrasonic flow meter.

Unit III

Viscosity: Capillary tube viscometer, efflux viscometer, Humidity: absorption hydrometer, Dew point meter. Strain: strain gauges, types, gauge rosettes calibration. Force measurement: scales and torque measurement: Mechanical torsion meter, electrical torsion meter, fibre optic & piezo electric transducer.

Unit IV

Control systems: Wheatstone bridge circuits. Open and closed systems, servomechanisms, transfer functions, signal flow graphs, block diagram algebra and hydraulic and pneumatic control systems. Two –way control, proportional control, differential and integral control. Simple problems.

Unit V

Time response of first order and second order systems, concept of stability, necessary condition for stability, routh stability criterion, Polar and Bode plots, Nyquist stability criterion. Simple Problems.

Text Books:

1. Sawheny, A.K. “Electrical and Electronics Measurements & Instrumentation”, Dhanpat Rai & Co., 1993
2. Nagoor Kani. A., ‘Control Systems’, RBA Publications, 1998 (for units IV & V)

Reference Books:

1. Thomas G. Beckwith, Lewis buck N. Ray D. Maragoni, ‘Mechanical Measurements, Narosa Publishing House new Delhi, 1989.
2. Collet. C. V. and Hope. A.D. ‘Engineering Measurements’ 2nd Edition ELBS
3. Nagrath. M. and Gopal. I.J. Control systems Engineering, Wiley eastern Ltd., 1991.