

B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VII

SUBJECT: Instrumentation Systems

Lectures: 3 Hrs per week
Practical: 2 Hrs per week

Theory: 100 Marks
Term Work: 25 Marks

***Rationale:** The art of measurement plays an important role in all branches of engineering & science. With the advancement of technology measurement techniques have taken rapid strides during recent year with the introduction of different types of instrumentation devices. The aim is to bring these developments together.*

DETAILED SYLLABUS

Fundamental Concept Of Measurement & Performance Characteristics of An Instrumentation System

System Configuration-Block diagram of a generalized measurement system,
*Generalized measurements- Transfer function representation & sinusoidal Transfer function.
*Zero order system
*First order system- Response of a system to Step, Ramp, Impulse input & Frequency response.
*Second order system - Response of the system to Step, Ramp input & Frequency response of. Second order system.
*Dead time element.
*Dynamic response of measurement systems.

Transducers

* Classification and Requirements.
*Displacement - principle of transducers, potentiometric displacement transducer, L.V.D.T., Variable capacitance transducer, Hall effect- angular displacement transducer, Digital transducer.
*Strain- Types of Strain gauge, theory of operation of resistance strain gauge, types of electrical strain gauge, Materials for strain gauge, Gauging techniques, Strain gauge circuits, Temperature compensation, Application.
*Vibration- Vibration sensing Devices- Velocity transducer, Bonded Strain Gauge Accelerometer, Piezoelectric Accelerometer, servo Accelerometer, Digital Accelerometer. *Signal conditioners for vibration transducer output. -voltage amplifier, Charge amplifier. *Application. Temperature-
*Classification of temperature sensors
*Resistance type temperature sensor, Platinum resistance thermometer.
*Thermister.
*Thermocouples- Properties, Material used for construction, Reference junction compensation, Thermocouple output linearizing circuits.
*Temperature measurement by radiation method - Optical pyrometer.

* Solid state transducer.

Pressure- Diphagrams, capsule, Bourdon tube, Bellows, Variable reluctance type, Variable capacitance type, Thin film pressure transducer, Digital pressure transducer, Piezo electric transducer.

Force And Torque- Different types of load cell configuration, Effect of temp. Variation, Dynamic response of elastic transducer, Digital force transducer.

Torque Measurement- Absorption type, Transmission type, Stress type, and Deflection type.

Flow- Classification of flow meter, Head type flow meter, Electromagnetic type, Rotameter, Anemometer, Ultrasonic flow meter.

Photo Electric Transducer- The photo multiplier tube, Photo conductive cell, Photo-Voltaic cell, Semiconductor photo diode, Photo transducer.

Data Acquisition

Generalized data acquisition system, Multi-channel DAS, Data logger, PC based data acquisition System, Concept of Virtual Instrumentation.

BOOKS

Text Books:

Rangan, Sharma & Mani, Instrumentation Devices and Systems, Tata McGraw Hill, second edition.

Additional Reading:

1. Doebelin E .O., Measurement systems - Applications and Design, fourth edition, , Tata McGraw Hill, fourth edition, 1990.
2. Jones and Chin, Electronic Instruments and Measurements, John Willey and Sons, 1987.
3. Nakra and Chaudhary, Instrumentation, Measurement and Analysis, Tata McGraw Hill, second edition, 2003
4. Neubert H. K., Instrument Transducers, Oxford University Press, Second edition.

TERM WORK

1. Term work shall consist of at least eight practicals covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.