

Approval: 1st Convocation Adhoc Meeting

Course Name: Theory of Measurement
Course No.: EE 307
Credits: 3-0-0-3
Prerequisites: Basic electrical circuits, Understanding of basic probability and statistics.
Students intended for: B.Tech.
Elective or Compulsory:
Semester: Odd/Even

Preamble: Advancement in science and technology are directly related to the sophistications in the measurement techniques. New discoveries in science in technology must be backed by actual measurements. Measurements not only help us to validate a new hypothesis but also aid us in the better understanding of the problem. Measurements play a very important role in the design, development, and maintenance of an industrial process. Engineers involved in the design and development of new equipments and processes must have a good understanding of the measurement techniques that may be used to validate their design. This course will emphasize on accepted procedures for analyzing a measurement problem. The course will also address some of the important measurement techniques used in the industry. Students taking this course will be able to address the following fundamental questions related to measurement theory:

- How to establish a relationship between the real value of a variable and that actually measured?
- How can a measurement plan be devised so that the measurement provides the unambiguous information sought?
- How can a measurement system be used so that the engineer can easily interpret the measured data and be confident in their meaning?

Course contents

Module 1: Characterization of Measurement Systems

Significance of Measurements, Units and Standards, Instruments and Measurements, Examples of Measurement System, Instrument Characteristics (Accuracy, Range, Linearity, Sensitivity, Calibration), Dynamic Characteristics (Zero, First and Second Order Systems).

Module 2: Error and Noise Analysis

Errors, Classification of Errors, Review of Probability and Statistics, Statistical Treatment of Data, Regression Analysis (Least Squares), Uncertainty Analysis.

Module 3:Primary Sensing Elements

Strain Gauges, Load Cells, Linear Variable Displacement Transformers (LVDT), Potentiometers, Capacitive Transducers, Thermistors, Thermocouple, Pressure Sensors, Flow Sensors, Piezoelectric transducers.

Module 4:Signal Conditioning Circuits

Analog Signal Conditioning: Amplifiers, Voltage Comparator and Filters. Sampling, Quantization, A/D Converter, D/A Converter, Digital Voltmeter, Data Acquisition, Smart Sensors.

Text Books:

1. Ernest Doebelin, "Measurement System: Application and Design", McGraw-Hill Science/Engineering/Math, 5th edition.
2. Richard S. Figliola and Donald E. Beasley, "Theory and Design for Mechanical Measurements", Wiley&Sons, 5th edition.
3. D. Patranabis, "Principal of Industrial Instrumentation", McGraw-Hill, 3rd edition.