

# INSTRUMENTATION & MEASUREMENT (THEORY) EE304

Pre-requisite: Circuit Analysis-I  
Credit Hours 03  
Contact Hours 48

## RECOMMENDED BOOKS

- Electronic Instrumentation and Measurements, 3<sup>rd</sup> edition by David A. Bell

## REFERENCE BOOKS

- Modern Electronic Instrumentation and Measurement Techniques, 2nd edition by Albert D. Helfrick and William D. Cooper
- Elements of Electronic Instrumentation and Measurements, 3rd Edition by Joseph J. Carr

## OBJECTIVE OF COURSE

This course aims to expose the students to the general electronic measurement principles and instrumentation techniques. Understand the concepts of accuracy and precision. To familiarize students to many varieties of meters, scopes, transducers available, their operating principles, strengths and weaknesses. To give students enough applications information that they can select optimum meters, transducer, amplifier, recording and readout devices to assemble a system for routine measurements.

S.NO	CLO/PLOs MAPPING	DOMAIN	PLO
01	<b>Describe</b> mathematically and physically the designed measuring instruments and their use for measurements.	C1	01
02	<b>Express</b> the integration of transducers with analog and digital hardware and use of software to achieve required output for measurement system	C2	01
03	<b>Analyze</b> the design of instruments and measurement of parameters using instruments.	C4	02
04	<b>Design</b> a variety of electronic instruments and measuring systems used in different fields.	C5	03

## COURSE CONTENTS

**Introduction to Electronic Instrumentation and Measurements**

- Course objectives and outcomes, course contents, grading policy, general rules and regulations.
- Basic block Diagram of a measurement system, quick review of units, scientific notation and dimensions.

### **Some Basic Measurement Theory**

- Measurement Categories, factors in making measurement: Error, validity, Reliability and Repeatability, accuracy and Precision, Resolution,
- Measurement Errors: absolute errors and relative errors , systematic errors, Gross errors, random errors, probability of errors, probable error, limiting errors, measurement standards.

### **Electro Mechanical Instruments**

- Permanent magnet moving coil instruments, Galvano meter, DC ammeter, DC volt meter, Rectified volt meter, rectified Ammeter, Deflection Instruments errors.
- Series Ohmmeter, shunt Ohmmeter, Volt- ohm- Milliammeter, Electro dynamic instruments, Wattmeter, Measurement of Small and high voltage measurement

### **Analog Electronic VOLT-OHM-Milliammeters**

- Transistor voltmeter circuits, OP-Amps, Ohmmeter func,
- AC electronic voltmeters, current measurement with Electronic instruments

### **Resistance Measurements**

- Low, high and Precise Resistance Measurements
- Volt meter and ammeter method, substitution method, Low resistance measuring instruments, High resistance measuring instruments

### **Bridge Measurements**

- DC Wheatstone bridges, Kelvin Bridge
- Guarded Wheatstone Bridge, Ac Bridges and Their applications
- Maxwell bridge, Hay Bridge

### **Digital Voltmeters and Frequency Meters**

- Digital Instrument Basics, Digital Displays,
- ADC and DAC, Digital Counting, Digital Voltmeters, Digital Multimeters,
- Digital Frequency Meter system

### **Inductance and Capacitance Measurements**

- RC and RL equivalent CKTs
- Inductance bridges, measuring small LC and R quantities, Q meter.

### **The Oscilloscopes**

- Oscilloscope Block Diagram, Cathode Ray Tube, CRT Circuits, Deflection Systems,
- Oscilloscope Probes, Oscilloscope Controls, Making Measurements on the Oscilloscope, Digital Storage Oscilloscopes, Medical Oscilloscopes
- Signal Generators
- Audio Generators, Function Generators, RF Generators,
- Pulse Generators

### **Sensors and Transducers**

- Position, motion sensors
- Temperature, Gas sensors
- Pressure, Humidity sensors
- Rotary, Photo sensors