

COURSE TITLE : ELECTRONICS INSTRUMENTS AND MEASUREMENTS
COURSE CODE : 4041
COURSE CATEGORY : A
PERIODS/WEEK : 4
PERIODS/SEMESTER : 56/4
CREDITS : 4

TIME SCHEDULE

MODULE	TOPIC	PERIODS
1	Analog and digital meters	14
2	Analog and digital oscilloscopes, transducers	14
3	Bridges and signal analysers	14
4	Data recorders and DAS	14
TOTAL		56

Course General Outcome :

Module	GO	On completion of the study of this course the students will be able:
1	1	To understand the performance of various measuring instruments.
	2	To understand working and use of analog and digital multimeters.
2	3	To understand working and use of analog and digital oscilloscope.
	4	To understand different types of transducers, sensors and its applications.
3	5	To understand various AC and DC bridges.
	6	To understand the working of function generators and signal generators.
4	7	To understand various types of data recorders.
	8	To understand the basics of data acquisition system.

GO - General Outcome

On the completion of the study the student will be able :

MODULE I ANALOG AND DIGITAL MULTIMETERS

1.1.0 To understand the performance of various measuring instruments.

- 1.1.1 To define instrument accuracy, precision, sensitivity, resolution and error.
- 1.1.2 To explain the working of galvanometer.
- 1.1.3 To explain the conversion of galvanometer into voltmeter and ammeter.
- 1.1.4 To list the differences between moving coil and moving iron instruments.

1.2.0 To understand working and use of analog and digital multimeters.

- 1.2.1 To explain the block diagram of Analog Multimeter.
- 1.2.2 To explain how Galvanometer is converted into Multimeter.
- 1.2.3 To list the specifications of Analog Multimeter .
- 1.2.4 To explain how the Analog Multimeter to measure different values of resistances.
- 1.2.5 To explain the DC voltage and DC Current Measuring circuit in Analog Multimeter.
- 1.2.6 To explain the AC voltage and AC Current Measuring Circuit in Analog Multimeter.
- 1.2.7 To explain the Block Diagram of Digital Frequency Meter.
- 1.2.8 To list the specifications of Digital Multimeter.
- 1.2.9 To explain Block Diagram Digital Multimeter.
- 1.2.10 To differentiate 3 ½ and 4 ½ digit displays in terms of accuracy.

MODULE II ANALOG AND DIGITAL OSCILLOSCOPES, TRANSDUCERS.

2.1.0 To understand working and use of analog and digital oscilloscope.

- 2.1.1 To list the applications of CRO.
- 2.1.2 To explain the functional block diagram of a CRO.
- 2.1.3 To explain CRT with neat sketch.
- 2.1.4 To explain electrostatic focusing and deflection system used in CRT. .To state the deflection sensitivity.
- 2.1.5 To describe different types of CRO probes.
- 2.1.6 To describe the procedures of measuring voltage (DC and AC), frequency, phase. Angle and time period using CRO.
- 2.1.7 To differentiate between dual beam and dual trace CROs.
- 2.1.8 To explain the working of digital storage oscilloscope.

2.2.0 To understand different types of transducers, sensors and its applications.

- 2.2.1 To list the classification of transducers.
- 2.2.2 To describe different types of resistive transducers - potentiometric, strain gauge and thermistors.
- 2.2.3 To explain the working principle of capacitive transducers.
- 2.2.4 To explain the working principle of microphone type transducer.
- 2.2.5 To explain the working principle of LVDT.
- 2.2.6 To explain the principle of thermocouple, thermopile and opto coupler.
- 2.2.7 To explain the features of photo voltaic cell with application and examples.

- 2.2.8 To describe sensors and actuators, different switches, relays, proximity switches, hall effect sensor and fiber-optic sensor.

MODULE III BRIDGES AND SIGNAL ANALYSERS.

3.1.0 To understand various AC and DC bridges.

- 3.1.1 To explain resistance measurement using Wheatstone bridge.
- 3.1.2 To explain the principle of impedance measurement using Hay's bridge.
- 3.1.3 To explain the principle of impedance measurement using Maxwell's bridge.
- 3.1.4 To explain the principle of impedance measurement using Schering's bridge.
- 3.1.5 To describe the principle of measuring frequency using Wien bridge.

3.2.0 To understand the working of function generators and signal generators.

- 3.2.1 To explain the block diagram of function generator.
- 3.2.2 To explain the principle and block diagram of a spectrum analyzer.
- 3.2.3 To list the applications of spectrum analyzer.
- 3.2.4 To explain the block diagram of logic analyzer.
- 3.2.5 To list the applications of logic analyzer.
- 3.2.6 To explain the principle of Q-meter.

MODULE IV DATA RECORDERS AND DAS

4.1.0 To understand various types of data recorders.

- 4.1.1 To understand the principle of data recorders.
- 4.1.2 To explain the working of potentiometer type recorders.
- 4.1.3 To explain the working of X-Y recorders, and strip chart recorders.
- 4.1.4 To compare different types of data recorders.

4.2.0 To understand the basics of data acquisition system.

- 4.2.1 To explain the block diagram of basic instrumentation systems.
- 4.2.2 To differentiate open loop and closed loop control systems.
- 4.2.3 To list different types of DAS.
- 4.2.4 To explain the block diagram of analog DAS.
- 4.2.5 To explain the block diagram of digital DAS.
- 4.2.6 To describe the role of telemetry in instrumentation system.

CONTENT DETAILS

MODULE I Analog and Digital Multimeters

Terminologies in measurements - accuracy - precision - sensitivity - resolution - error - galvanometer - working - conversion of galvanometer into voltmeter and ammeter - differences between moving coil and moving iron instruments - analog multimeter - block diagram - use of galvanometer as multimeter - measuring circuit for measurement of resistance, dc current, dc voltage, ac current and ac voltage - specifications - digital frequency meter - digital multimeter - block diagram - difference between 3 ½ and 4 ½ digit displays in terms of accuracy.

MODULE II Analog and Digital Oscilloscopes, Transducers

CRO - applications - functional block diagram, CRT - construction - electrostatic focusing and deflection system - deflection sensitivity - types of CRO probes - measurement of voltage (DC and AC), frequency, phase angle and time period with CRO - difference between dual beam and dual trace CROs - digital storage oscilloscope - block diagram - working principle - transducers - classification - primary and secondary - active and passive, types of resistive transducers - potentiometric, strain gauge and thermistors, capacitive transducers, microphone type transducer, LVDT, thermocouple, thermopile, opto coupler - working principle - photo voltaic cell - features - application - examples - sensors - actuators - different switches - relays - proximity switches - hall effect sensor - fiber-optic sensor.

MODULE III Bridges and Signal Analysers

Wheatstone bridge - Hay's bridge - Maxwell's bridge - Schering's bridge - impedance measurement - Wien bridge - frequency measurement - function generator - block diagram - spectrum analyzer - principle - block diagram - applications - logic analyzer - block diagram - applications - Q-meter - working principle

MODULE IV Data Recorders and DAS

Data recorders - potentiometer type recorders - X-Y recorders - strip chart recorders - working principle - comparison - basic instrumentation systems - block diagram - difference between open loop and closed loop control systems - types of DAS - analog DAS - digital DAS - block diagram - role of telemetry in instrumentation system

Text Book

1. Electronic Instrumentation - H S Kalsi - Third edition.
2. Electronics and Electrical Measurements and Instrumentation - J B Gupta - S K Kataria.
3. A Course in Electrical and Electronic Measurements and Instrumentation - A K Sawhney.
4. Industrial Electronics and Control - Biswanath Paul.