

Subject Code	Subject Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW	Tutorial	Total
ETC 305	Electronic Instruments and Measurements	04	--	--	04	--	--	04

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical and oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. Of Test 1 and Test 2					
ETC 305	Electronic Instruments and Measurements	20	20	20	80	--	--	--	100

Pre-requisites:

- Students are expected to have basic knowledge of analog and digital electronics

Course objectives:

- To understand basic functions and principle of working of sensors and components used in Electronic Measurement
- To understand principles of advanced electronic instruments and application in measurement of electronics parameters

Course outcomes:

- Students will learn measurement of physical parameters using various transducers and working of sensors.
- They will become familiar with basics of instruments and details of operation of measuring instruments and their applications.

Module No.	Unit No.	Topics	Hrs.
1.0		Principals of measurement	06
	1.1	Introduction to basic instruments: Components of generalized measurement system, applications of instrument systems, static and dynamic characteristics of instruments, concepts of accuracy, precision, linearity, sensitivity, resolution, hysteresis, calibration	
	1.2	Errors in measurement: Errors in measurement, classification of errors, remedies to eliminate errors	
2.0		Sensors and transducers	12
	2.1	Basics of sensors and transducers: Active and passive transducers, characteristics and selection criteria of transducers, working principle of Eddy-current sensors, Pizeoelectric transducers, photoelectric and photo voltaic sensors, capacitive sensors	
	2.2	Displacement and pressure: Potentiometers, pressure gauges, Linear Variable Differential Transformers (LVDT) for measurement of pressure and displacement, strain gauges	
	2.3	Temperature transducers: Resistance Temperature Detectors (RTD), thermistors, and thermocouples, their ranges and applications	
3.0		Testing and measuring Instruments	10
	3.1	Analog multi-meter: Multi-range measurement of voltage, current and resistance, specifications	
	3.2	Measurement of resistance: Kellvin's double bridge, Wheatstone bridge, and Megaohm bridge Measurement of inductance: Maxwell bridge and Hey bridge; Measurement of capacitance: Schering bridge Q-Meter: Operating principle and applications	
	3.3	Energy and power meters: Working of energy and power meter	
4.0		Data Acquisition and Digital Instruments	10
	4.1	Data acquisition and converters: single channel, multichannel and PC based DAS A/D and D/A converters: Types and specifications of A/D and D/A converters, Significance of X½ digit display	
	4.2	Digital multi-meter: Block diagram, multi range measurement of voltage, current and resistance, specifications	
5.0		Oscilloscopes	08
	5.1	Cathode ray oscilloscope: Block diagram based Study of CRO, specifications, controls, sweep modes, role of delay line, single- and dual-beam dual-trace CROs, chop and alternate modes	
	5.2	Measurement using oscilloscope: measurement of voltage, frequency, rise time, fall time and phase difference. Lissajous figures in detection of frequency and phase	
	5.3	Digital storage oscilloscope (DSO): Block diagram based study of DSO, study of features like roll, refresh, storage mode and sampling rate; applications of DSO	
6.0		Signal analyzers	06
	6.1	Wave analyzers: Introduction to harmonic, total harmonic distortion analyzer; block diagram and applications of wave analyzers	
	6.2	Spectrum and network analyzers: Block diagram and applications	
		Total	52

Text Books:

1. H. Oliver and J. M. Cage, "*Electronic Measurement and Instrumentation*", McGraw Hill, 3rd edition, 2008
2. C. S. Rangan, G.R. Sarma, and V.S.V. Mani, "*Instrumentation Devices and Systems*", Tata McGraw Hill, 9th edition, 2007

Reference Books:

1. T. S. Rathore, "*Digital Measurement Techniques*", Narosa Publishing House, New Delhi, 2nd Edition, 2003
2. W. Cooper and A. Helfric, "*Electronic Instrumentation and Measurement Techniques*", PHI, 4th edition, 2009
3. H. S. Kalsi, "*Electronics Instrumentation*", Tata Mcgraw Hill, 2nd Edition, 2009

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered for final Internal Assessment.

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
- 3: Question No.1 will be compulsory and based on entire syllabus.
- 4: Remaining question (Q.2 to Q.6) will be selected from all the modules.