Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ Practical	Tutorial	Total
EXC 305	Electronic Instruments and Measurements	04	--	--	04	--	--	04

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXC305	Electronic Instruments and Measurements	20	20	20	80	--	-	--	100

Prerequisite Topics*:*
System of units, Measuring Instrument.

Course Objective:
Objectives of this course are:

1. In depth knowledge of measurement methods and instruments of electrical quantities.
2. Understanding design aspects and performance criterion for measuring instruments.
3. Implementation of the different signal generators and its analysis techniques.
4. To understand the working principle of the transducers.
5. To aware the students about the advances in Instrumentation.

Course Outcomes:
The outcomes of this course are**:**

1. An ability to apply knowledge of electronic instrumentation for measurement of electrical quantities.
2. Ability to apply the principles and practices for instrument design and development to real world problems.
3. Ability to select and use latest hardware for measurements and instrumentation.
4. An ability to design and conduct experiments for measurement and ability to analyze and interprets data.

Module No	Topics	Hrs.
1.	**Principles 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 etc.	
	1.2 Errors in Measurement: Errors in Measurement, Classification of Errors, Remedies to Eliminate/Reduce Errors.	
2	**Test and Measuring Instruments**	10
	2.1 Analog Multi-meters: Multi-range, Multi-parameter Measurement, Electronics Voltmeter using Transistors, FETs and Opamps. Specifications of a multi-meter.	
	2.2 RLC and Q-meter: Measurement of Low, Medium and High Resistance using Wheatstone bridge, Kelvin's Double Bridge and Mega ohm Bridge; Measurement of Inductance using Maxwell Bridge and Hey Bridge; Measurement of Capacitance using Schering Bridge; Operating Principle and Applications of Q-Meter.	
	2.3 Digital Multi-meters: DMM; Automation, Auto Ranging and Auto Zero Adjustments in Digital Instruments.	
3	**Oscilloscopes**	10
	3.1 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.	
	3.2 Measurement using Oscilloscope: Measurement of Voltage, Frequency, Rise Time, Fall Time and Phase Difference. Lissajous Figures in Detection of Frequency and Phase.	
	3.3 Digital Storage Oscilloscope (DSO): Features like Roll, Refresh, Storage Mode and Sampling Rate; Applications of DSO.	
4	**Transducers for Displacement and Temperature Measurement**	08
	4.1 Basics of Transducers/Sensors : Characteristics of Transducers; Requirement of Transducers; Classification of transducers; Selection Criteria of Transducers.	
	4.2 Displacement: Potentiometers; Linear Variable Differential Transformer, Resistance Strain Gauges, Capacitance Sensors.	
	4.3 Temperature: RTD, Thermisters, Thermocouples- Their Ranges, and Applications.	
5	**Transducers for Pressure, Level and Flow Measurement**	10
	5.1 Pressure: Pressure gauges; Elastic Pressure Transducers; Dead Weight Tester; Vacuum Pressure Measurement- McLeod Gauge and Pirani Gauge.	
	5.2 Level: Side glass tube method; Float type methods; Capacitance type method; Ultrasonic type transducer.	
	5.3 Flow: Restriction type Flow meters-Orifice and Venturi; Rotameter; Magnetic Flow meter; Turbine Flow meter.	
6	**Data Acquisition and advances in Instrumentation Systems**	08
	6.1 Monitoring Instruments : Indicators, Alarm, Recorders.	
	6.2 Data Acquisition and Converters: Data logger; Data acquisition system (DAS)- Single channel, Multichannel.	
	6.3 PC based Instrumentation: PC based Instrumentation System; Introduction to Programmable Logic Controller.	
	Total	**52**

Rcommended Books:

1. H. Oliver and J. M. Cage, Electronic Measurement and Instrumentation, McGraw Hill, 3rd edition.
2. W. Cooper, A. Helfric, Electronic Instrumentation and Measurement Techniques, PHI, 4th edition.
3. C. S. Rangan, G.R. Sarma, V.S.V. Mani, Instrumentation Devices and Systems, Tata McGraw Hill, 9th edition.
4. A. K. Sawhney, Electrical & Electronic Instruments & Measurement, Dhanpat Rai and Sons, Eleventh ed., 2000.
5. Dally, William F. Riley and Kenneth G, Instrumentation for Engineering Measurements, James John Wiley and Sons. Inc., 2nd Edition 1993.
6. A.J. Bowens, Digital Instrumentation, McGraw-Hill, latest addition.
7. J.J.Carr, Elements of Electronic Instrumentation and Control, Prentice Hall, 3rd edition.

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 as final IA marks

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 set from all the modules. 5:
Weightage of marks will be as per Blueprint.