

B.E. Semester: 4
Electronics & Communication Engineering
Subject Name: Electronics Measurements & Measuring Instruments
Sub Code: EC-405

A. Course Objective :

The educational objectives of this course are

- The objective of the course is to introduce the fundamentals of Electronics Instruments and Measurement providing an in-depth understanding of Measurement errors, Bridge measurements, Digital Storage Oscilloscope, Function Generator and Analyzer, Display devices, Data acquisition systems and transducers.
- To address the underlying concepts and methods behind Electronics measurements.

B. Teaching/ Experiments Scheme :

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
CODE	NAME	L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
		Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
EC-405	Electronics Measurements & Measuring Instruments	3	0	2	5	4	3	70	30	20	30	150

C. Detailed Syllabus :

1. **Measurement Errors:** Introduction to Subject, Definitions Accuracy and Precision, Significant Figures, Types of Error Statistical Analysis, Probability of Errors, Limiting Errors.
2. **Bridge Measurements:** wheatstone bridge, Kelvin Bridge AC Bridge And Their Applications, Maxwell Bridge, Hay's Bridge AC Bridge And Their Applications, Maxwell Bridge, Hay's Bridge Unbalance Conditions, Wein Bridge.
3. **Digital Instruments :** Digital Frequency Meter, Circuit For Measurement of Frequency, Simplified Composite Circuit For Digital Frequency Meter High Frequency Measurements Period Measurement, Ratio And Multiple Ratio Measurements, Time Interval Measurements, Resolution in Digital Meter Sensitivity of Digital Meters, Accuracy Specification of Digital Multimeters, Digital L, C And R Measurements, Digital LCR Meter and Q Meter
4. **Digital Storage Oscilloscope :** Introduction, Oscilloscope Block Diagram, Cathode Ray Tube Block Diagram Of DSO , Its Principle and Working, Advantages And Applications Special Oscilloscope.
5. **Function Generator And Analyzer :** Introduction, The Sine Wave Generator, Frequency Synthesized Signal Generator, Frequency Divider Generator, Vector Signal Generator, Sweep

Frequency Generator, Pulse And Square Wave Generator, Function Generator Wave Analyzer, Harmonic Distortion Analyzer, Spectrum Analyzer, Logic Analyzer.

6. **Display Devices :** Digital Display Methods, Digital Display Units, Segmental Displays
Dot Matrices, Rear Projection Display, Light Emitting Diode, Liquid Crystal Diodes, Segmental Gas Discharge Displays, Decade Counting Assembly's, Display Systems, Decimal Decoders, BCD To 7-Segment Converter, BCD To Dot Matrix Converter, Sensitivity Of Digital Meters, Accuracy Specification of Digital Multi meters.
7. **Data Acquisition Systems And Transducers:**
Objective of DAS, signal conditioning of the inputs, single channel DAS, Electrical transducer, selecting a transducer, resistive transducer, Strain gauges, resistance thermometer, thermistor, inductive transducer, Differential output transducer, LVDT, pressure inductive transducer, capacitive transducer, load cell, Piezo electric transducer, photo electric transducer, photo voltaic cell.

D. Lesson Planning :

Sr. No	Lectures (Hours)	% Weightage in Exam	Topics
1.	3	6	Measurement Errors : Introduction to Subject, Definitions, Accuracy and Precision, Significant Figures, Types of Error, Statistical Analysis, Probability of Errors, Limiting Errors.
2.	7	15	Bridge Measurements : Wheatstone Bridge, Kelvin Bridge, AC Bridge And Their Applications, Maxwell Bridge, Hay's Bridge AC Bridge And Their Applications, Maxwell Bridge, Hay's Bridge, Unbalance Conditions, Wein Bridge, Anderson's Bridge, De Sautys Bridge, Schering Bridge
3.	8	18	Digital Instruments : Digital Frequency Meter, Circuit For Measurement of Frequency, Simplified Composite Circuit For Digital Frequency Meter High Frequency Measurements Period Measurement, Ratio And Multiple Ratio Measurements, Time Interval Measurements, Resolution in Digital Meter Sensitivity of Digital Meters, Accuracy Specification of Digital Multimeters, Digital L, C And R Measurements, Digital LCR Meter and Q Meter
4.	4	9	Digital Storage Oscilloscope : Introduction, Oscilloscope Block Diagram, Cathode Ray Tube Block Diagram Of DSO , Its Principle and Working, Advantages And Applications Special Oscilloscope
5	7	16	Function Generator And Analyzer : Introduction, The Sine Wave Generator, Frequency Synthesized Signal Generator, Frequency Divider Generator, Vector Signal Generator, Sweep Frequency Generator, Pulse And Square Wave Generator, Function Generator Wave Analyzer, Harmonic Distortion Analyzer, Spectrum Analyzer, Logic Analyzer
6	9	20	Display Devices Digital Display Methods, Digital Display Units, Segmental

			Displays, Dot Matrices, Rear Projection Display, Light Emitting Diode, Liquid Crystal Diodes, Segmental Gas Discharge Displays, Decade Counting Assembly's, Display Systems, Decimal Decoders, BCD To 7-Segment Converter, BCD To Dot Matrix Converter, Sensitivity Of Digital Meters, Accuracy Specification of Digital Multi meters.
7	7	16	Data Acquisition Systems And Transducers Objective of DAS, signal conditioning of the inputs, single channel DAS, Electrical transducer, selecting a transducer, resistive transducer, Strain gauges, resistance thermometer, thermistor, inductive transducer, Differential output transducer, LVDT, pressure inductive transducer, capacitive transducer, load cell, Piezo electric transducer, photo electric transducer, photo voltaic cell.
Total	45	100	

E. Instructional Method & Pedagogy :

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- Experiments shall be performed in the laboratory related to course contents.

F. Suggested list of Experiments :

1. To find the value of unknown resistor using Wheatstone bridge.
2. To find the value of unknown capacitance and inductance using Maxwell's bridge.
3. To find the value of unknown capacitance using Wein's series and parallel bridge.
4. To extend the range of given voltmeter and ammeter.

5. Measurement of frequency using Lissajous method.
6. To study and verify characteristic of variable resistor transducer (strain gauge).
7. To study and verify characteristic of LVDT.
8. To study and verify characteristic of Thermocouple/RTD.
9. To study the front panel controls of storage CRO.
10. To analyze analog and digital multi meter for various measurements.
11. To verify the performance characteristics of compensated attenuator.
12. To demonstrate the functionality of function generator and its use as a test and Measurement equipment.
13. Measurement of LCRQ meter.
14. To demonstrate the functionality of IC tester and test various ICs.
15. Fourier series analysis of a square wave using spectrum analyzer.
16. To study and simulate any two measurement system using LAB VIEW.
17. To generate various signals using arbitrary waveform generator.
18. To demonstrate the functionality of distortion meter.

G. Students Learning Outcomes :

On successful completion of the course student can learn about detailed aspects of Electronics and measurements including error as well as in the field of Digital Instruments which all the areas in day to day life. Can also learn about **Bridge Measurements**, DSO, Function Generator & Data acquisition systems.

H. Recommended Study Materials :

TEXT & REFERENCE BOOKS :

1. Modern electronics Instrumentation and measurement techniques by Albert D. Helfrick And William D. Cooper
2. Electronic Instruments and Measurements by David Bell
3. A course in Electrical and electronics measurement and instrumentation by A.K.Sawhney, 2nd Edition by Dhanpatrai.
4. Electronic instrumentation by H.S. Kalsi, 2nd Edition ,Tata McGraw Hill Publications