

Course Title	Electrical Measurements
Course Code	EE3305
No. of Credit Hrs (Lecture + Tutorial + Lab)	3 (2+0+1)
No. of Contact Hrs (Lecture + Tutorial + Lab)	4 (2+0+2)
Level-Year	6-3
Prerequisite (if any)	EE2401, EE2200

1) Course Objectives:

This course aims to provide the students with fundamental knowledge of the measurement methods, familiarize with various instruments for measuring electrical quantities and the operation of electrical measuring instruments along with their constructional details.

2) Expected Learning Outcomes:

1. Identify and describe the measurement of various electrical quantities such as energy, power, and resistance. **KLO1 [1]**
2. Investigate and explain the operation of modern instruments used in electrical measurements. **KLO3 [6]**
3. Apply suitable methods for accurate measurement of resistance and inductance. **KLO1 [1]**
4. Design and apply techniques for measuring capacitance using different approaches. **KLO2 [2]**
5. Perform and evaluate measurements for various electrical quantities such as voltage, current, power, and energy. **KLO3 [6]**
6. Select appropriate instruments for different scenarios and justify methods to improve their performance. **KLO5 [4]**
7. Conduct experiments on essential measurement concepts, analyze results, and communicate findings through structured reports. **KLO8 [3]**
8. Engage in self-directed learning to explore advanced methods of electrical measurements and adapt strategies for continuous improvement. **KLO9 [7]**

3) Course Contents

1. Concepts of Measurements: Measurement & Measuring Systems, SI system, Methods of Measurement, Definitions – True Value, Accuracy, Error & Error Types, Limiting Errors, Precision, Sensitivity, Resolution, Tolerance.
2. Classification of Measuring Instruments: - Construction and Operation of Moving Coil, Moving Iron Voltmeter and Ammeter, PMMC, Dynamometer Type Instruments, – Expression for The Deflecting Torque and Control Torque, Extension of Range using Shunts and Series Resistance.
3. Measurement of Power & Energy: - Construction and Operation of Wattmeter, Measurement of Power by Two Wattmeter Method. Single Phase Induction Type Energy Meter, Driving and Braking Torques – Errors and Compensations, Testing of Energy Meters.
4. Measurement of Resistance: -Method of Measuring Low, Medium and High Resistance – Sensitivity of Wheatstone's Bridge, Carey Foster's Bridge, Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method, Megger.

5. Measurement of Inductance and Capacitance-Maxwell's Bridge, Hay's Bridge, Anderson's Bridge - Owen's Bridge. Measurement of Capacitance and Loss Angle –Disunity's Bridge, Wien's Bridge, Schering Bridge.
6. Digital Instruments- Digital Voltmeters (DVM), Digital Millimeters, Digital Frequency Meter, Digital Energy Meter.

4) Laboratory Experiments:

1. To understand working of Moving Coil Galvanometer
2. Moving Iron Galvanometer
3. Measure Voltage using Moving Coil Galvanometer
4. Measurement of Currents using Moving Coil Galvanometer
5. Measuring Waveform
6. Measurement of DC & AC Power
7. Measuring Electrical Work (Energy)
8. Wheat-Stone Bridge
9. Measurement of unknown resistance and unknown inductance using Maxwell-Wein Bridge.
10. Measurement of unknown resistance and unknown Capacitance using Wein Bridge

5) Teaching Methods:

- Lectures and Discussion
- Videos
- Self-learning
- Laboratory demonstrations

6) Mode of Evaluation:

Course Assessment Methods

- Quizzes and assignment
- Major Exams
- Final Exam
- Lab Work

Evaluation

• Semester Work

Major Exams	30%
Quizzes	5%
Assignments	5%
Lab/Tutorial	20%

• Final

Paper work	40%
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7) Textbook(s):

- Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, fifth Edition, Wheeler Publishing.
- Lab Manual

8) References:

- Electrical Measurements by Harris, John Wiley & Sons Inc; latest edition.
- Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U,