INSTITUTE OF AERONAUTICAL ENGINEERING



(Autonomous) Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LABORATORY								
V Semester: EEE								
Course Code	Category	Hours /WEEK			Credits	Maximum Marks		
AEED24	Core	L	Т	Р	С	CIA	SEE	Total
		0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 45				Total Classes: 45		
Prerequisite: There are no prerequisites to take this course.								

I. COURSE OVERVIEW:

The objective of this laboratory course is to learn about the electrical measurement methods, operational principles with suitable software and hardware. The lab emphasizes on the practical skills to design and realize the use of instruments for different electrical applications.

II. COURSES OBJECTIVES:

The students will try to learn

- I. The characteristics of sensors, signal conditioning circuits and display devices.
- II. The different waveforms using Lab VIEW software to measure various parameters.
- III. The use of transducers in electrical and nonelectrical measurements.
- IV. The virtual instruments in measurement of analysis of electrical parameters.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

- **CO 1** Make use of transducers like thermocouple, thermistor and resistance temperature detector for measuring temperature.
- CO 2 Choose appropriate transducers for the measurement of strain, pressure, position and level.
- **CO 3** Examine the errors in measuring instrument by calibrating voltmeter, ammeter, LPF wattmeter, single phase energy meter, dynamometer power factor meter.
- CO 4 Develop Lab view programs for displaying electrical waveforms and Lissajous patterns.
- **CO 5** Build simulation models in digital environment for the measurement of passive parameters like inductance, capacitance and resistance.
- **CO 6** Analyze the quantities like turns ratio, reactive power, errors associated with current transformer for reducing the errors in measuring instruments.

IV. COURSE CONTENT:

WEEK-1: SENSING OF TEMPERATURE AND SPEED

Measurement of temperature using transducers like thermocouple, thermistors, and resistance temperature detector with signal conditioning; speed measurement using proximity sensor using Hardware.

WEEK - 2: MEASUREMENT OF RESISTANCE

Measurement of low resistance using Kelvin's double bridge Hardware.

WEEK - 3: MEASUREMENT OF STRAIN AND PRESSURE

Measurement of strain using strain gauge and measurement of pressure using differential pressure transducer.

WEEK - 4: MEASUREMENT OF POSITION AND LEVEL

Measurement of position using encoders and measurement of level using capacitive transducer.

WEEK - 5: PHANTOM LOADING ON LPF WATTMETER

Calibration of electrodynamometer type LPF wattmeter using phantom loading.

WEEK - 6: CALIBRATION OF SINGLE-PHASE ENERGY METER AND POWER FACTOR METER

Calibration of single-phase energy meter using resistive load and dynamometer power factor meter.

WEEK - 7: MEASUREMENT OF TURNS RATIO AND APPLICATIONS OF CTs

Measurement of turns ratio using AC bridge; the extension of range of wattmeter to measure three phase power using two CTs and one single phase wattmeter.

WEEK - 8: MEASUREMENT OF REACTIVE POWER

Measurement of reactive power using one single phase wattmeter.

WEEK - 9: MEASUREMENT OF CAPACITANCE

Measurement of unknown capacitance using Schering bridge.

WEEK - 10: CROMPTON DC POTENTIOMETER

Calibration of PMMC ammeter and PMMC voltmeter.

WEEK-11: ANALYSIS OF WAVE FORMS, FREQUENCY AND THD USING DIGITAL SIMULATION

Measurement and display of voltage, current wave forms, frequency Lissajeous patterns and THD using Lab VIEW.

WEEK - 12: MEASUREMENT OF THREE PHASE POWER

Measurement of three phase power with single wattmeter and two numbers of current transformer.

WEEK - 13: WORKING OF STATIC ENERGY METER USING DIGITAL SIMULATION

Measurement of energy using static energy meter and verification with Lab VIEW.

WEEK - 14: MEASUREMENT OF PASSIVE PARAMETERS USING DIGITAL SIMULATION

Inductance measurement using Anderson bridge and capacitance measurement using Schering bridge and verification with Lab VIEW.

V. REFERENCE BOOKS:

- 1. G. K. Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016.
- 2. R. K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd., 2007
- 3. E.W. Golding and F. C. Widdis, "Electrical Measurements and measuring Instruments", 5th Edition, Wheeler Publishing, 2011.
- 4. Reissland, M. U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition, 2010.

VI. WEB REFERENCES:

1. https://www.gnindia.dronacharya.info/EEEDept/Downloads/Labmanuals/EMI_Lab.pdf

2. https://www.scribd.com/doc/25086994/electrical-measurements-lab

VII. ELECTRONIC RESOURCES:

- 1. https://www.allaboutelectricalmeasureements.com/textbook/
- 2. https://onlinecourses.nptel.ac.in/noc22_ee93/preview
- 3. https://www.iare.ac.in

VIII. MATERIALS ONLINE:

- 1. Course Content
- 2. Lab manual