Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Degree Engineering College
Semester-6

Subject: Electrical Measurement and Instrumentation- BETEE16325

Type of course: Professional Core

Prerequisite: Basic knowledge of Electrical Engineering and Electronics.

Rationale:

This course provides a comprehensive understanding of measurement techniques and the principles of various electrical and electronic instruments. It equips students with the essential skills to use, calibrate, and test instruments critical in modern electrical and electronic systems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
2	0	2	3	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No.	Course content	Hrs	% Weightage
1.	**Fundamentals of Measurement & Instrumentation** Methods of measurement -Direct and indirect methods, Types of Instruments - Indicating, integrating and recording, absolute and secondary instrument, Range, true value, indicated value, correction, sensitivity, repeatability, reproducibility, precision, Accuracy, significant figure, etc., Types and sources of error : gross error, systematic error , random error	06	20%

2.	**Measurement of R, L and C** Construction and working of DC potentiometer, and its applications, Low, medium, and high resistance, Kelvin's double bridge, medium resistance by Wheatstone bridge, Ammeter-voltmeter method, Ohmmeter., High resistance by Megger, Earth resistance by Earth tester., Measurement of inductance and capacitance by Universal impedance bridge, A.C. bridge - Maxwell, Anderson, Hays, De-Sauty's and Wien's bridge. (no phasor diagram)	12	40%
3.	**Electromechanical Instruments** Common errors in electromechanical instruments, moving iron instruments: Ammeter, voltmeter, PMMC instruments: ammeter, voltmeter, Electrodynamometer type meter: ammeter, voltmeter, wattmeter, Compare CT and PT	06	30%
4.	**Calibration and Testing** Calibration and its importance, Calibration of ammeter, voltmeter and wattmeter and single-phase energy meter(along with adjustments) as per IS.	06	10%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Reverse Engineering of Measuring Instruments:** Students will disassemble a basic measuring instrument (e.g., an analog voltmeter or ammeter) and identify its components. They will then explain the working principle, internal construction, and role of each part through a report or presentation. Upload report or presentation on GMIU Web portal.	10
2	**Field Visit and Report on Industrial Instrumentation:** Students will visit a power plant, factory, or research lab where electrical and electronic instrumentation is used. They will interact with professionals, document their learnings, and prepare a report on the types of instruments used and their importance. Upload report on GMIU Web portal.	10
3	**DIY Sensor-based Measurement System:** Students will build a simple sensor-based system (e.g., temperature sensor using a thermistor, strain gauge experiment) and collect real-time data. They will interpret the readings, compare with theoretical values, and analyze errors. Upload video on GMIU Web portal. (No. of students per group-03)	10
Total		30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	35%	35%	10%	10%	10%	0

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand the fundamentals of measurement and instrumentation.
CO2	Apply various methods of measurement and use different instruments for testing.
CO3	Use electromechanical and electronic instruments.
CO4	Calibrate electrical measuring instruments according to standard protocols.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs
1.	Study about types of error and sources of error.	1	2
2.	Measure the resistance using a wheatstone bridge.	2	2
3.	Measurement of capacitance and frequency by wein's bridge.	2	2
4.	Measurement of resistance using Hay's bridge.	2	2
5.	Connection of electrical meters.	3	2
6.	Measure electrical parameters using a clamp meter.	3	2
7.	To study the calibration and Testing of a single phase energy meter.	4	2
8.	To study the calibrated voltmeter as per IS.	4	2
9.	To study about opto-electronics devices.	4	2
10.	Test the strain using strain gauge.	5	2

11.	Measure linear displacement using LVDT.	5	2
12.	Control of temperature using thermocouple.	5	2
13.	Study & Measurement of temperature using RTD.	5	2
14.	To study different types of transducers.	5	4
	Total		30

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] A.K. Sawhney, *Electrical & Electronic Measurements*, Dhanpat Rai & Co., 2005.
[2] J. J. Carr, *Elements of Electronic Instrumentation and Measurement*. New Delhi, India: Pearson.
[3] A. D. Helfrick, *Modern Electronic Instrumentation and Measurement Techniques*. New Delhi, India: PHI Learning.
[4] S. K. Sen, *Measurement Techniques in Industrial Instrumentation*, Wiley-IEEE Press, 2015.
[5] F.C. Widdis and E.W. Golding, *Electrical Measurements and Measuring Instruments*, Wheeler Publishing, 2005.