Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Diploma Engineering College
Semester-3 (Diploma)

Subject: Instrumentation & Measurement - DETEC13202

Type of course: Major

Prerequisite: Basic of Electrical Engineering

Rationale:

Electrical installations ranging from residential consumers to huge industrial estates all are quipped with measuring instruments. In view of this, study of principles of Electrical measurements and measuring instruments becomes mandatory for all electrical engineers. This subject deals with principles of measurements, analog and measuring instruments as well as transducers.

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	
4	0	2	5	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.	**Basics of Instrumentation System** Direct and indirect methods; Types of Instruments: indicating, integrating and recording, absolute and secondary instruments, Terms related to instrumentation system; Types and sources of error: gross error, systematic error, random error.	10	15%

2.	**Potentiometers and Bridges** Construction and working of DC potentiometer, and its applications; Medium resistance by Wheatstone bridge, kelvin's double bridge; Measurement of capacitance and frequency by wine's bridge,Hay's Bridge; Measurement of inductance by maxwell bridge; Measurement of inductance and capacitance by universal impedance bridge.	14	25%
3.	**Electromechanical Instruments** Classification of electromechanical instruments; Deflecting, controlling, and damping torques; Moving iron instruments: ammeter, voltmeter; PMMC instruments: ammeter, voltmeter, vibration galvanometer; Electrodynamometer type meter: ammeter, voltmeter, watt meter, power factor meter; Induction type energy meter-single phase, three phase; Hotwire type instruments, Frequency meter, tri vector meter; Maximum demand meter, phase sequence indicator, instrument transformer.	14	25%
4.	**Calibration** Calibration and its importance; Calibration of ammeter, voltmeter and wattmeter and single-phase energy meter as per IS; Extension of range using shunt, multipliers and derive equation for them; Extension of range of meters using instrument transformer like CT and PT.	8	10%
5	**Transducers** Basic requirements of transducers; Classification based on: transduction phenomenon, type of application, types of input and output signal, electrical principle involved; Resistive transducers, inductive transducers, capacitive transducers, piezoelectric transducers, strain gauge transducers, Thermocouple, RTD, thermistor and semiconductor sensors; Opto-electronic devices: photo emissive cells, photoconductive cells, photodiode, photo transistor, photovoltaic cells, photo optic transducer.	14	25%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Reverse Engineering of Measuring Instruments** Students have to 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 portal.	10

2	**Technical Analysis of Instrument Architecture** Faculty assigns an instrument to each student.The student analyzes the internal architecture of the assigned instrument.. The analysis includes a detailed description of the instrument's components.The student uploads a report of their analysis to the 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	30%	50%	10%	10%	0	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	Comprehend the basics of electrical measurements.
CO2	Explain basic principle, working, characteristics and applications of the various measuring instruments and transducers.
CO3	Apply AC and DC bridges for measurement of electrical parameters like resistance, inductance and capacitance.
CO4	Demonstrate proficiency in calibrating measuring instruments.
CO5	Effectively interpret and understand the functioning of transducers.

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.	Measure linear displacement using LVDT.	4	2
8.	To study the calibration and Testing of a single phase energy meter.	4	2
9.	To study of calibrate voltmeter as per IS.	4	2
10.	To study about opto-electronics devices.	4	2
11.	Test the strain using strain gauge.	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
Totai			**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, A Course in Electrical and Electronic Measurement and Instrumentation, Dhanpat Rai & Co.
[2] J. B. Gupta, Electronics and Electrical Measurements and Instrumentation, S. K. Kataria & Sons.
[3] U. A. Bakshi and A. V. Bakshi, Electrical Instrumentation, Technical Publications, Pune, 2009.
[4] R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers.
[5] A. S. Morris, Principles of Measurement and Instrumentation, PHI Learning, New Delhi, 2011.