

25UEET415	ELECTRONIC INSTRUMENTATION	Category	L	T	P	R	Credit	Year of Introduction
		PEC	3	0	0	0	3	2025

Preamble: This course introduces the fundamentals of electronic instrumentation used for measurement, monitoring, and control in electrical and industrial systems. It covers sensors and transducers, signal conditioning, data acquisition, and signal transmission techniques. The course also provides an overview of PLC and industrial automation systems, enabling students to apply instrumentation concepts in electrical and industrial applications.

Prerequisite: IEE104 Introduction to Electrical & Electronics Engineering

Course Outcomes: After the completion of the course, the student will be able to:

CO	Course Outcomes	Knowledge Level
CO1	Explain the principles and characteristics of sensors, transducers, and electronic measurement systems.	K2 Understand
CO2	Apply signal conditioning techniques and instrumentation circuits for sensor interfacing.	K3 Apply
CO3	Apply data acquisition and signal transmission methods in electronic instrumentation systems.	K3 Apply
CO4	Apply PLC and industrial instrumentation concepts in monitoring and control applications.	K3 Apply

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	1	1	1
CO2	3	3	2	-	-	-	-	-	-	-	1	2	2
CO3	3	2	2	-	-	-	-	-	1	-	1	2	3
CO4	3	2	2	-	1	-	-	-	1	1	2	3	3
Avg	3	2.25	2	-	1	-	-	-	1	1	1.25	2	2

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	-	-	-	*	-
CO2	*	*	*	*	*	-	-	*	-
CO3	*	*	*	*	*	-	-	*	-
CO4	*	*	*	*	*	*	-	*	-

Wks Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*	*	-	*	-

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance	: 5 marks
Continuous Assessment Test	: 20 marks
Continuous Assessment Assignment	: 15 marks

SYLLABUS**Module 1 (11 Hours)**

Introduction to electronic instrumentation systems and measurement concepts. Classification of sensors and transducers. Static and dynamic characteristics such as accuracy, sensitivity, linearity, and response time. Resistive transducers including potentiometer, strain gauge, RTD, and thermistor. Inductive transducers including LVDT and proximity sensors. Capacitive transducers for displacement measurement. Piezoelectric and Hall effect sensors. Introduction to MEMS sensors, accelerometers, and intelligent sensors used in electrical and industrial applications.

Module 2 (10 Hours)

Need for signal conditioning in instrumentation systems. Wheatstone bridge and differential measurement techniques. Signal conversion circuits including voltage-to-current and current-to-voltage converters. Instrumentation amplifiers and isolation amplifiers. Analog filters including low-pass, high-pass, and band-pass filters. Introduction to signal interfacing and noise reduction techniques.

Module 3 (11 Hours)

Basic elements of data acquisition systems. Analog-to-digital conversion and digital measurement concepts. Signal transmission methods including analog and digital techniques. Introduction to telemetry systems. Multiplexing techniques including TDM and FDM. Digital display, recording, and data logging systems.

Module 4 (10 Hours)

Introduction to process instrumentation systems. Programmable Logic Controller (PLC) architecture, input-output modules, and basic control functions.

Introduction to ladder logic, timers, and counters. Overview of SCADA and distributed control systems (DCS). Applications in industrial automation and electrical engineering systems.

Text Books

1. Kalsi, H. S. (2010). *Electronic instrumentation* (3rd ed.). McGraw-Hill Education.
2. Sawhney, A. K. (2012). *Electrical and electronic measurements and instrumentation*. Dhanpat Rai Publications.
3. Patranabis, D. (2003). *Sensors and transducers* (2nd ed.). PHI Learning.

Reference Books

1. Doebelin, E. O., & Manik, D. N. (2011). *Measurement systems: Application and design* (6th ed.). McGraw-Hill Education.
2. Pallas-Areny, R., & Webster, J. G. (2001). *Sensors and signal conditioning* (2nd ed.). Wiley India.
3. Bolton, W. (2015). *Programmable logic controllers* (6th ed.). Elsevier.
4. Bentley, J. P. (2005). *Principles of measurement systems* (4th ed.). Pearson Education.
5. Liptak, B. G. (2003). *Instrument engineers' handbook*. CRC Press.

END SEMESTER EXAMINATION – MODEL QUESTION PAPER (STC 2025 SCHEME)

Course Code	25UEET415
Course Name	ELECTRONIC INSTRUMENTATION
Max. Marks: 60	Duration: 2.5 Hours

Part A				
(Answer all questions. Each question carries 3 marks)				
Qn No.	Question	Marks	CO	BL
1	Differentiate sensors and transducers with suitable examples.	3	1	L2
2	Compare static and dynamic characteristics of measuring instruments.	3	1	L2
3	Determine the output voltage of a Wheatstone bridge having $R_1=100\Omega, R_2=100\Omega, R_3=120\Omega, R_4=100\Omega$ with a supply voltage of 10 V.	3	2	L3

4	Compare instrumentation amplifiers and isolation amplifiers.	3	2	L2
5	Distinguish TDM and FDM multiplexing techniques.	3	3	L2
6	A telemetry system transmits data at 1200 bps. Determine the number of bits transmitted in 10 seconds	3	3	L3
7	Compare SCADA and DCS used in industrial automation.	3	4	L2
8	Develop a ladder logic program using a counter to count five objects.	3	4	L3
Part B (Answer any one full question from each Module. Each carry 9 marks)				
Module I				
Qn No.	Question	Marks	CO	BL
9.a.	Compare potentiometer, strain gauge, RTD, and thermistor with respect to construction, principle, and applications.	5	1	L2
9.b.	Explain the static and dynamic characteristics of transducers such as accuracy, sensitivity, linearity, and response time	4	1	L2
OR				
10.a	Explain the concept of intelligent sensors and their applications in modern industrial systems.	5	1	L2
10.b	Describe the construction and working principle of capacitive transducers used for displacement measurement.	4	1	L2
Module II				
Qn No.	Question	Marks	CO	BL
11.a	A band-pass filter has $f_L=500$ Hz and $f_H=5$ kHz. Determine: a) Bandwidth. b) Center frequency.	5	2	L3
11.b	Explain the construction and operation of Wheatstone bridge circuits used for measurement	4	2	L2
OR				
12.a	A current-to-voltage converter uses $R_f=5k\Omega$ Determine the output voltage for an input current of: a) 1 mA	5	2	L3

	b) 2 mA c) 5 mA			
12.b	Explain the construction, operation, and applications of isolation amplifiers.	4	2	L2
Module III				
Qn No.	Question	Marks	CO	BL
13. a	Explain the basic elements and operation of a data acquisition system.	3	3	L2
13.b	An 8-bit ADC has a full-scale voltage of 5 V.Determine: a)Resolution. b) Quantization level corresponding to 3.2 V. c) Quantization error.	6	3	L3
OR				
14. a	Explain the principles of telemetry and its industrial applications.	3	3	L2
14.b	A telemetry system transmits data at 2400 bps continuously for 15 minutes. Determine: a) Total bits transmitted. b) Total bytes transmitted. c) Data transmitted in kilobytes.	6	3	L3
Module IV				
Qn No.	Question	Marks	CO	BL
15. a	Explain the features and applications of distributed control systems (DCS).	3	4	L2
15.b	Develop a ladder logic diagram for the START-STOP control of a motor using push buttons.	6	4	L3
OR				
16. a	Explain the role of SCADA in industrial monitoring and supervisory control.	3	4	L2
16.b	Develop a ladder logic program to operate two lamps	6	4	L3

	simultaneously using a single switch			
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