SEMESTER S4

ELECTRONIC INSTRUMENTATION

Course Code	PEEET411	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	PCEET205	Course Type	Theory

Course Objectives:

1. The objective of this course is to impart comprehensive understanding in the field of electronic instrumentation, industrial instrumentation and communication systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Functional elements of electronic instrumentation system – Calibration methods: Static, Dynamic, Field, Traceable, Master. Transducers- Classification-Criteria for selection- Static and dynamic characteristics- Zeroth and first order instruments and time responses. Resistive transducers for liquid level and humidity Inductive transducers- types and basic principles- LVDT- synchro Capacitive transducers- types and basic principles- Thickness measurement Piezoelectric transducers- Hall effect transducers-Basic principle and applications Electronic IC for sensor applications, Micro Electromechanical system (MEMS) Advantages and Applications, MEMS micro sensors and actuators, MEMS accelerometers	10

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2	Signal conditioning for instrumentation systems: Voltage to Current Converter, Transducer bridges: null type and deflection bridges, AC bridges using push pull transducers Amplifiers: Instrumentation amplifiers- charge amplifiers- isolation amplifier Role of filters: Low pass, high pass, band pass and band rejection filters, Introduction to digital filters Data Transmission- Types of Telemetry System- Modulation methods: Pulse modulation, Pulse amplitude modulation, Pulse code modulation General telemetry systems- Cable transmission of analog and digital data- Fibre optic data transmission Principles of time division and frequency division multiplexing- Radio-wireless communication, WLAN architecture. Protocols: Field Bus, Profibus , HART	**10**
3	Display methods and devices: Different types of display –display system building blocks. Data Presentation Element: Recorders-Strip Chart Recorder, Potentiometric Recorder, X-Y Recorder. Magnetic recorder, Digital recorders- Data logger Experiments and statistical analysis: Performance of experiment-characteristics of experimental data- description of dispensed data- type of probability distribution-probability error	**9**

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4	Introduction to Process Control - Block diagram of the process control loop. Analog and Digital DAS: Programmable logic controllers (PLC), Organization- Hardware details- I/O- Power supply- CPU- Standards Programming aspects- Ladder programming- realization of AND, OR, NAND, NOR and XOR logic, the concept of latching, Introduction to Timer/Counters, Numerical Exercises based on Timers and Counters. SCADA and DCS systems: SCADA: Introduction, SCADA Architecture, Common System Components, Supervision and Control, HMI, RTU and Supervisory Stations, Protocols-IEC 60870-5-101 and DNP3. Distributed Control System: Introduction, DCS Architecture, Control modes.	**10**

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Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

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

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Identify the sensors/transducers suitable for industrial applications.	**K3**
CO2	Design the signal conditioning circuits for industrial instrumentation and automation.	**K3**
CO3	Understand the concepts of data transmission methods applicable to electronic instrumentation systems.	**K2**
CO4	Develop the logic for the process control applications using PLC programming	**K3**
CO5	Analyze the performance of measurement systems using statistical methods	**K4**
CO6	Describe the fundamental concepts of DCS and SCADA systems	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

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CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	3	-	-	-	2	-	-	-	-	-	2
CO3	3	3	-	-	-	-	-	-	-	-	-	2
CO4	3	2	-	-	2	-	-	-	-	-	-	2
CO5	3	2	-	-	2	-	-	-	-	-	-	2
CO6	3	2	3	-	3	2	-	-	-	-	-	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	A course in Electrical and Electronic Measurements & Instrumentation	A. K. Sawhney	Dhanpat Rai & Co.	2011
2	A course in Electrical & Electronic Measurement & Instrumentation	J. B. Gupta	S K Kataria & Sons	14th Ed., 2014
3	Electrical Measurements & Measuring Instruments	Golding E.W and Widdis	Wheeler Pub.	
4	Electronic Instrumentation	H. S. Kalsi	McGraw Hill, New Delhi	4th Ed., 2019
5	Principles of Electrical Measurement	S Tumanski	Taylor & Francis.	
6	Electronic Instrumentation and Measurements	David A Bel	Oxford	
7	Programmable Logic Controllers	William Bolton	Elsevier India Pvt. Ltd	5th edition,
8	SCADA: Supervisory Control and Data Acquisition	Stuart A. Boyer,	International Society of Automation,	4th edition, 2010

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Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Modern Electronics Instrumentation	Cooper W.D	Prentice Hall of India	
2	Basic Electrical Measurements	Stout M.B	Prentice Hall	
3	Electronic Measurements & Instrumentation	Oliver & Cage	McGraw Hill	
4	Doebelin's Measurements Systems	E.O Doebelin and D.N Manik	McGraw Hill Education (India) Pvt. Ltd.	6th Ed.
5	Electrical and Electronics Measurements and Instrumentation	P.Purkait, B.Biswas, S.Das and C. Koley	McGraw Hill Education (India) Pvt. Ltd.,	2013

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Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/108/105/108105153/ https://archive.nptel.ac.in/courses/108/108/108108147/
2	https://archive.nptel.ac.in/courses/108/105/108105153/
3	https://archive.nptel.ac.in/courses/108/105/108105153/
4	https://archive.nptel.ac.in/courses/108/108/108108147/ https://archive.nptel.ac.in/courses/106/105/106105166/