SARVAJANIK UNIVERSITY
SarvajanikCollege of Engineering and Technology
Bachelor of Technology

B.Tech. III Semester VI

Subject Name: Industrial Instrumentation and Automation **Subject Code: BTEL14623**

Type of course: **Professional Elective Course**
Prerequisite: Electrical Measurements & Instruments
Rationale: Automation is playing a key role in Industries. Industries rely heavily on automation for economic viability and mass production. Measurement of different physical quantities is the first step of industrial automation. This course will provide opportunity to learn- concepts of different transducers used for measurement of different physical quantities like temperature, displacement, force, strain etc. and basic of automation. Also students will learn about PLC.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	% Module Weightage
1.	**Introduction:** Static and Dynamic characteristics of Instruments, Definition, different types of transducers, criteria for selection, Measurement of Displacement using Resistive, inductive and capacitive transducers, Hall-effect sensors and proximity gauges.	07	16
2.	**Measurement of Pressure, strain Force & Torque:** Elastic transducers (Bourdon Gauge, Bellows and Diaphragm Gauge). Low pressure measurement, Strain Gauge, Gauge factor, types of electrical strain gauge, strain gauge circuits, Load cell, Torque measurement, Piezo-electric sensors.	10	22
3.	**Measurement of Temperature, Flow and Level:** Thermocouple, thermoelectric laws, Resistance Temperature Detector (RTD), 3 lead and 4 lead method, Thermistor, Radiation Pyrometer, Differential Pressure flow-meter,	10	22

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	Variable area flow- meter, Variable reluctance transducer, Turbine flow-meter, Ultrasonic flow-meter (Both transit time and Doppler Shift), electromagnetic flow-meter, Resistive, inductive and capacitive transducer for level measurement, air purge method for level measurement.		
4.	**Data transmission, Recorders and data loggers:** Introduction to industrial data transmission techniques, distinction between recorders and data loggers, strip chart recorder, X-Y recorders, data logger.	04	**09**
5.	**Automation:** Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Industrial bus systems: modbus & profibus. Control elements:-Actuators, driving units and control valves - classification and working principle of pneumatic and electrical types, overview of Industry 4.0	04	**09**
6.	**Programmable Automation:** Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, Timers and counters, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries, Introduction of DCS and Supervisory Control And Data Acquisition (SCADA).	10	**22**

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
05	**15**	**25**	**10**	**10**	**05**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

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.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Electrical and	A.K.Sawhney	DHANPAT RAI &	2015	

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	Electronic Measurements and Instrumentation		CO		
2	Fundamentals of Industrial Instrumentation	Alok Barua	Wiley India Pvt Ltd	2011	
3	Process Control Instrumentation Technology	C.D. Johnson	PHI		
4	Industrial Instrumentation and Control	S.K. Singh	The McGraw Hill Companies		
5	Programmable logic controller	Dunning,	Delmar		

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Apply the concepts of transducers for measurement of physical quantities	40
CO-2	Explain data transmission, recorders and data loggers in instrumentation system.	15
CO-3	Describe the technology of Industrial Automation	15
CO-4	Identify the role of PLCs to Automation problems in industries	30

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO-1	3	3	3	3	1	1	1		2		1		3		1
CO-2	3	2	2	2	1				2		1		3		
CO-3	3	2	2	2	2				3		1		3		
CO-4	3	2	2	3	2				3		1		3	2	
Rationale*															

Rationale*: Explaining why it is matching this particular program outcome

LIST OF PRACTICALS: (Minimum 8 performed.)

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1. To study the measurement of weight using Strain gauge.
2. To study the measurement of linear displacement using Linear Variable Differential Transformer (LVDT).
3. To Study the measurement and control of temperature using Resistance Temperature Detector (RTD).
4. To Study the measurement and control of temperature using Thermocouple.
5. To Study the measurement and control of temperature using Thermistor.
6. To study the measurement of level using Air purge method.
7. To implement/simulate ladder diagram for logic gates
8. To implement/simulate ladder diagram based on timers
9. To implement/simulate ladder diagram based on counters
10. To implement/simulate ladder diagram for given application.
11. To implement/simulate logic gates (DCS)

Major Equipment:

1. LVDT
2. RTD
3. Strain Gauge
4. Thermocouple

List of Open Source/learning website:

- https://vlab.co.in
- https://nptel.ac.in

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