



SARVAJANIK UNIVERSITY
Sarvajnik College of Engineering and Technology
Bachelor of Technology



B. Tech. Semester V

Subject Name: Industrial Electronics and Automation **Subject Code:** BTEC14504

Type of Course: PEC

Prerequisite: Fundamental Knowledge of Electronics Solid State Devices, Digital Electronics, Electronics measurement

Rationale: Electronics and Automation plays a key role in Industrial sector. It is important for the students to learn and explain the electronics components, devices, instruments, circuits, modules, logic controllers and communication used for industrial Automation. This course will provide an opportunity to learn how Automation system works with Industrial Electronics.

Teaching and Examination Scheme:

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

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 to Industrial Electronics Electronics Requirements in Industry, Electronics Industrial Automation and Classification, Architecture of Industrial Electronics Automation System, Introduction of PLC and DCS Systems, Supervisory Control Systems, Data Acquisition, SCADA, Industrial Communication: Systems, Bus Systems and Protocols.	4	10
2.	Sensing, interface and measurement Systems Sensor Performance Characteristics, Measurement Error Type, Sensor and Sensing Selection Procedure, Sensor for Temperature, pressure, force, displacement, speed, flow, level, humidity and PH measurement. Actuators for Automation. Process Control Valves: Analog and Digital. Elements of Electronics computer aided measurement and control, Electronics computer aided process control hardware, Process related electronics interfaces : Two wire – Three and Four Wire Systems, Conventional – Traditional – Modern Communication System : 4-20 mA, Foundation field bus and Smart Transmitters,	15	30



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	Industrial Communication Systems, Data Transfer Techniques, Computer aided process control software and data acquisition systems, AC and Drives for motor and motion control, P, PI and PID Controller, IoT for plant automation.		
3.	Programmable logic controllers and Distributed Control System: Programmable logic controllers: Architectures, input and output modules, communication and networking, Advantage of PLC for Industrial automation and process control industries. Distributed Control System: Introduction of DCS, Features and Advantage of DCS, PLC and Computer integration with DCS and DCS communication system. Project management and costing – case study	10	22
4.	Industrial Communication and Protocols: Communication hierarchy, Industrial Communication System: management system – MAP / TOP Protocol, Field buses – fieldbus standardization, Smart Transmitter RACK BUS : Bus access method, transmitter, gateway availability, MODBUS – Bus access method, application services, transmission modes, function acceptance, PROFIBUS – Bus access method, data link services, application service acceptance, FIPBUS – Bus access method, International field bus standard.	12	30
5.	Industry 4.0 Introduction of industry 4.0 and core idea, Components of Industry 4.0, state of art, supportive technologies, and proposed framework for Industry 4.0.	4	8

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	10	40	10	10

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	Mechatronics Systems & process Automation	Patrick Kaltjob	CRC Press	2018	1 st



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2	Industrial Instrumentation and Control	S.K. Singh	The McGraw Hill Company	2010	3 rd
3	Industrial Control Handbook	E.A.Parr	News	1998	3 rd
4	Power Electronics	P.S. Bimbhra	Khanna	1999	3 rd
5	A Course in Electrical and Electronics Measurements and Instrumentation	Shawhney A.K.	Dhanpati Rai	1999	11 th

Course Outcome:

Sr. No.	CO Statement After learning this subject students will be able to,	Marks % weightage
CO-1	Identify and Analyze various Automation components and systems.	10
CO-2	Interpret Industrial parameters like temperature, pressure, displacement, flow, speed, level, humidity and PH.	20
CO-3	Use Programmable Logic control for Industrial Automation and Application.	25
CO-4	Relate the use of Electronic Devices, components, circuits, systems, logic controllers in service and maintenance industry.	40
CO-5	Apply the knowledge of data sharing in industry 4.0 in Indian Industry Environment Context.	10

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	3	-	2	-	2	-	2	2	2	2	2	2	-	-
CO-2	3	3	-	2	-	2	-	2	2	2	2	2	-	-	-
CO-3	2	2	3	2	3	2	-	2	-	-	2	2	-	3	-
CO-4	3	3	-	2	-	2	-	2	2	2	2	2	2	-	-
CO-5	2	2	-	2	-	2	-	2	2	2	2	2	-	-	-

List of practical:

1. To explore the various PLCs configuration available and make comparative analysis of specifications.
2. To simulate multiple bit digital logic, I/Os utilization with ladder programming for PLCs operations.



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3. To write and simulate a ladder program for water level controller with given digital I/Os and conditions.
4. To write and simulate a ladder program for the motor control system using latching and Interlocking strategy.
5. To write and simulate ladder programming for the ON - OFF Timer Control, UP-Down counter, motor ON-OFF sequence control System.
6. To Write and simulate Traffic Light Control ladder logic program for a given condition.
7. To Write and simulate elevator system ladder logic program for a given condition.
8. To Write and simulate ladder logic program for analog module for given experiment conditions..
9. A. To simulate RTD as a temperature sensor performance under various experiment condition by using virtual lab simulator.
B. To simulate thermocouple as a temperature sensor performance under various experiment condition by using virtual lab simulator.
10. To mimic the capacitor sensor for level measurement by using virtual lab simulator.
11. Design and write an open loop and closed loop DC motor control system program for open source microcontroller architecture and simulation software.
12. Mini Project, Poster presentation, Active Learning Assignment.

Major Equipment:

- PLCs, Sensor, Actuators, SSR, Valves for demonstration or logic implementation.
- Ladder Logic Simulation Software for specific PLCs.
- AC –DC Motor Drives.
- IoT Boards, Sensor Based Automation Systems.

List of Open Source/learning websites:

- <http://sl-coep.vlabs.ac.in/>
Virtual Lab for Learning of various Sensor Characteristics and Simulation.
- <http://plc-coep.vlabs.ac.in/>
Virtual Lab for PLCs Logic Implementation Simulation Work.
- <https://nptel.ac.in/courses/108/105/108105062/>
Industrial Automation and Control – NPTEL Video Lectures for Sensors, Drives, PID Control and PLCs.
- <https://nptel.ac.in/courses/108/105/108105063/>
Industrial Automation and Control – IIT Kharagpur, Literature for Architecture of electronics Automation and Logic Controller.