12-11-2025 03:49:51 PM

AUTOMATION & PLC | **Course Code : 316334**

Programme Name/s	: Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electronics & Communication Engg./ Electronics Engineering/
Programme Code	: EJ/ EK/ ET/ EX
Semester	: Sixth
Course Title	: AUTOMATION & PLC
Course Code	: 316334

I. RATIONALE

Automation revolutionizes manufacturing by enhancing quality, flexibility, and safety while optimizing costs. To stay ahead, industries are rapidly adopting advanced automation technologies. This course equips learners with the expertise to develop, maintain, and operate sophisticated automation systems, leveraging PLC technology to control diverse industrial processes efficiently.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attain the following industry/employer expected outcome through various teaching learning experiences: "Maintain Automation systems."

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify different components of automation system.
- CO2 - Interface the given I/O device with PLC module.
- CO3 - Develop ladder logic program for various logic gates and Boolean equations.
- CO4 - Develop ladder logic program for given application.
- CO5 - Use the relevant communication protocol for specific automation system.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
				CL	TL	LL					FA-TH	SA-TH	Total		Practical				SLA		
															FA-PR		SA-PR				
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
316334	AUTOMATION & PLC	ATP	DSE	4	-	2	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175

12-11-2025 03:49:51 PM

AUTOMATION & PLC **Course Code : 316334**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :
1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the benefits of Automation TLO 1.2 Describe the function of components of automation system. TLO 1.3 Compare fixed and modular automation. TLO 1.4 Enlist application areas of automation System. TLO 1.5 Compare tools of Automation System.	**Unit - I Basics of Automation** 1.1 Automation: Features and benefits. 1.2 Hierarchy of automation systems (five layer automation) 1.3 Types of automation system: Fixed, Modular. 1.4 Application areas of automation system. 1.5 Introduction of Automation tools : PLC,HMI, SCADA, DCS, Hybrid Control System (Function and brief introduction)	Lecture Using Chalk-Board Educational Videos Presentations Case Study Site/Industry Visit

MSBTE Approval Dt. 04/09/2025 **Semester - 6, K Scheme**

AUTOMATION & PLC | **Course Code : 316334**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Draw block diagram of PLC and explain functions of each block. TLO 2.2 Describe operating modes of CPU. TLO 2.3 Explain redundancy concept in PLC with neat diagram. TLO 2.4 Classify modular PLC. TLO 2.5 Select the appropriate I/O module for specific application and illustrate the wiring diagram for interfacing field I/O devices with the PLC. TLO 2.6 Explain the sinking and sourcing concept of PLC input output module with neat sketches.	**Unit - II PLC Fundamentals and Interfacing** 2.1 Architecture of PLC: Block diagram, function of each block. 2.2 CPU : Function, Scanning cycle, speed of execution, operating modes of CPU (Programing, RUN / STOP Mode), Memory organization of PLC 2.3 Redundancy in PLC system. 2.4 Types of PLC- Based on connection (fixed, modular) , based on size (small, medium, large) , advantages of PLC system over relay based system. 2.5 I/O Modules: Types(Discrete and Analog), Discrete I/O module: Block diagram, function of each block, Specifications, wiring of I/O devices with PLC . Analog I/O module: Block diagram, function of each block, Specifications, wiring of I/O devices with PLC Comparison of AC and DC Discrete PLC Module(Voltage level, speed, noise immunity applications, common output type and safety) 2.6 Sinking and sourcing concept of I/O modules, selection criteria of PLC.	Lecture Using Chalk-Board Educational Videos Presentations Collaborative learning Flipped Classroom
3	TLO 3.1 Compare PLC programming languages. TLO 3.2 Describe significance of various parts of ladder diagram. TLO 3.3 Specify the proper I/O addressing format for PLC. TLO 3.4 Develop ladder program to test logic gates and boolean equations. TLO 3.5 Develop ladder logic for given process using relay instructions . TLO 3.6 Draw and explain Analog scaling instruction used in PLC .	**Unit - III Basic PLC Programming** 3.1 PLC programming languages: Ladder Diagram Programming, Functional Block diagram, Sequential function chart, Structured text, Instruction list (Introduction and features). 3.2 Ladder logic basics: Structure of ladder logic(Power rails, Rungs, Inputs, Outputs, address notation and tag names) 3.3 Ladder programming instructions: Relay based instructions (NO Contact, NC Contact, Output coil, Set output coil, Reset output coil) , bit set /reset instructions: symbols and working. 3.4 PLC I/O Addressing. 3.5 Ladder logic programs for various logic gates and boolean expressions. 3.6 Ladder logic program examples based on bit/relay instruction.(ON/OFF control ,automatic door opening and closing, sequencing operation ,latching/unlatching) 3.7 Analog signal processing Instruction(Scaling and Normalization)	Lecture Using Chalk-Board Educational Videos Demonstration Presentations Case Study Collaborative learning

MSBTE Approval Dt. 04/09/2025 | **Semester - 6, K Scheme**

AUTOMATION & PLC   **Course Code : 316334**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Use appropriate timer instruction to develop ladder program for the given application. TLO 4.2 Use appropriate counter instruction to develop ladder program for the given application. TLO 4.3 Use Logical, Comparison, Data handling instructions to develop ladder program for given application. TLO 4.4 Develop ladder program for the given industrial application. TLO 4.5 Develop PLC sequential function chart for the given industrial application.	**Unit - IV Advanced PLC Programming** 4.1 Timer instruction : ON delay, OFF delay ,Retentive, (Symbol, Status bits, Control word format, timing diagram, working). 4.2 Counter Instruction: Up, Down, Up/Down (symbol, control word format and timing diagram, working). 4.3 Logical, Comparison, arithmetic(mathematical), and Data Handling instructions. 4.4 Ladder logic for industrial application: Automatic Tank Level Control, Sequential motor control, Automatic Bottle filling plant ,Process control, Automatic Car parking, Automatic Traffic light control, Home automation, Objects counter (System design, I/O Listing, Ladder logic) 4.5 Sequential function chart (SFC) programming : Introduction, Structure of SFC, Transition representation ,Types of SFC: (Selection branch ,Simultaneous branch), Sequential functional chart design for object sorting, pick up and place.	Lecture Using Chalk-Board Educational Video Demonstration Presentations Case Study Site/Industry Visit Collaborative learning
5	TLO 5.1 Describe SCADA system architecture in automation system. TLO 5.2 Describe communication protocols used for automation system. TLO 5.3 State benefits of AI in PLC systems. TLO 5.4 Describe steps to share data from PLC to cloud.	**Unit - V Basics of Communication protocols, SCADA and Advancements in PLC** 5.1 Supervisory Control and Data Acquisition (SCADA)- Basic function, Generalized block diagram, function of each block, Interfacing of SCADA with PLC, applications of SCADA. 5.2 Basic communication protocols used in industrial automation: Types of Communication interface , Protocols: PROFINET , MODBUS (RTU and TCP/IP), Profibus DP, Ethernet / IP. Foundation Field Bus, HART (wire and Wireless) 5.3 AI Tools for PLC programming: Introduction ,Benefits ,Applications ,Challenges of AI in PLC systems. 5.4 Cloud PLC: Introduction ,cloud-PLC interconnection , Benefits ,Steps to send data from PLC to cloud.	Lecture Using Chalk-Board Presentations Educational Video Collaborative learning

VI.   LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify the components of automation system available in laboratory.	1	*Identification of components of automation trainer kit available in the laboratory.	2	CO1
LLO 2.1 Interface input output devices with PLC and test the output for various inputs .	2	*Interface given I/O devices with PLC.	2	CO1 CO2

AUTOMATION & PLC   Course Code : 316334

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 3.1 Interface input output devices with PLC and test the output for various inputs in virtual lab.	3	Interface I/O devices with PLC in virtual lab	2	CO1 CO2
LLO 4.1 Test sinking and sourcing concept in discrete I/O module.	4	Sourcing and sinking connection of I/O devices with descrete I/O module.	2	CO2
LLO 5.1 Test functionality of logic gates using ladder diagram.	5	*Test functionality of various logic gates using ladder diagram.	2	CO3
LLO 6.1 Design 4:1 multiplexer using ladder diagram.	6	*Develop ladder program for 4:1 Multiplexer.	2	CO3
LLO 7.1 Test relay type instructions(NO,NC,output coil etc) using ladder diagram.	7	* Test the functionality of latching using basic relay type instructions in ladder diagram.	2	CO3
LLO 8.1 Test ladder program for sequential ON-OFF control of lamps/ motors.	8	Develop a ladder program for sequential ON-OFF control of lamps/motors.	2	CO3
LLO 9.1 Test ladder program to monitor the temperature of a given liquid using RTD/Thermocouple and PLC (use Analog scaling instruction)	9	*Develop a ladder program to process analog signal.	2	CO3
LLO 10.1 Control the direction of stepper motor using ladder diagram.	10	Develop ladder program to control the direction (Clockwise and Anticlockwise)of stepper motor .	2	CO3 CO4
LLO 11.1 Test ladder program for automatic traffic control using virtual lab.	11	Develop ladder program for traffic light control system using virtual lab simulator	2	CO3 CO4
LLO 12.1 Test ladder program to identify metallic and non-metallic objects.	12	Develop ladder program to sort metalic and non-metalic objects .	2	CO3 CO4
LLO 13.1 Test SFC to identify metallic and non-metallic objects.	13	Develop Sequencial Function Chart (SFC) to sort metalic and non-metalic objects .	2	CO3 CO4
LLO 14.1 Test ladder program for automatic car parking system.	14	*Develop ladder program for automatic car parking system.	2	CO3 CO4
LLO 15.1 Test and compare profibus and profinet network protocol .	15	Interface and test PLC with profibus and profinet network protocol.	2	CO5
LLO 16.1 Develop SCADA graphic screen integrate it with PLC to perform the sequential ON-OFF control of Lamps/motors.	16	*Develop SCADA graphic screen and integrate with PLC to perform the sequential ON-OFF control of Lamps/motors.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

MSBTE Approval Dt. 04/09/2025   **Semester - 6, K Scheme**

AUTOMATION & PLC | **Course Code : 316334**

Assignment

- Prepare a report on analog I/O module and Digital I/O module.
- Give selection criteria's of I/O modules in automation system.

Industrial Visit

- Visit nearby PLC/SCADA/DCS based process / packaging industry, observe the industrial automation and prepare a report

Micro project

- Automatic Water Level Monitoring and Control
1)Develop ladder program to monitor and maintain the water level in a tank.
2) Prepare I/O list with tags.
3)Draw wiring diagram.
4) Describe Network protocol used
5)SCADA Integration: Display real-time tank levels and control pump operations remotely
- Automatic bottle filling plant
1)Develop ladder program to monitor and maintain the water level in a tank.
2) Prepare I/O list with tags.
3)Draw wiring diagram.
4) Describe Network protocol used
5)SCADA Integration: Display real-time process of automatic bottle filling plant

---

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Nano PLC, Mini PLC, Micro PLC with analog and Digital I/O, memory, peripheral interfaces, Profinet and Profibus network.	1,2,4,7,5,6,8,10,12,14,13,15,16
2	Input and Output devices for PLC: like Lamp, DC Motor, Proximity sensors, Thermocouple/RTD, Red, green, yellow LEDs, Stepper Motor, limit switches, push button.	1,2,4,7,5,6,8,10,12,14,13,15,16,9
3	Ladder logic simulator : Such as TIA portal/RS Logix/CODESYS/Pico soft Simulator/ EDA tools.	1,2,4,7,5,6,8,10,12,14,13,15,16,9
4	PLC with programming Software and interfacing hardware, user manual, (complete PLC Trainer system)	1,2,4,7,5,6,8,10,12,14,13,15,9

MSBTE Approval Dt. 04/09/2025 | **Semester - 6, K Scheme**

AUTOMATION & PLC   **Course Code : 316334**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
5	SCADA software: Such as Wincc/Eclipse/Factory I/O/Wonder ware /InTouch/Visualization	16
6	Virtual lab simulator.	3,11

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basics of Automation	CO1	6	2	2	4	8
2	II	PLC Fundamentals and Interfacing	CO2	14	4	6	6	16
3	III	Basic PLC Programming	CO3	16	4	6	8	18
4	IV	Advanced PLC Programming	CO4	16	4	6	8	18
5	V	Basics of Communication protocols, SCADA and Advancements in PLC	CO5	8	2	4	4	10
		Grand Total		**60**	**16**	**24**	**30**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

• For formative assessment of laboratory learning 25 marks. Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
• Two offline unit tests are of 30 marks and average of two unit test marks will be consider for out of 30 marks.

Summative Assessment (Assessment of Learning)

• End semester assessment is of 70 marks.
• End semester summative assessment is of 25 marks for laboratory learning.

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	2	1	2	-	2			
CO2	3	1	2	1	2	1	2			
CO3	3	2	2	2	3	1	3			
CO4	2	3	3	3	3	1	3			
CO5	2	3	3	3	2	3	3			

MSBTE Approval Dt. 04/09/2025   **Semester - 6, K Scheme**

AUTOMATION & PLC   **Course Code : 316334**

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	John W. Webb & Ronald A. Reis	Programmable Logic Controllers-Principles and Applications	Fifth Edition, Pearson Education India.,Noida ISBN-13- 9789-33-255-512-9
2	Frank D. Petruzella	Programmable Logic Controllers	Fifth Edition, McGraw Hill ,New Delhi ISBN-13 978-9353167271
3	Garry Dunning	Introduction to Programmable Logic Controllers	Edition3 Delmar Cengage Learning , ISBN-13978-1401884260
4	Madhuchhand A Mitra, Samarjit Sen Gupta	Programmable logic controllers and industrial automation an introduction.	Penram international publication, New Delhi, 2015, ISBN: 978-8187972174
5	Rajesh Mehra & Vikrant Vij	PLC & SCADA-Theory and Practice	First Edition University science press ISBN 978-93-81159-11-8

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/tw-79FiRYKA?feature=shared	Introduction to Automation system.
2	https://youtu.be/IAhxYsMi4e8?feature=shared	Introduction of Automation Triangle.
3	https://youtu.be/IAhxYsMi4e8?feature=shared	Automation Pyramid.
4	https://youtu.be/E2WNPXJf-Kw?feature=shared	PLC Introduction.PLC Basics.Components of PLC. Modular PLC. Modules,Input Output.Backplane
5	https://youtu.be/t2rq0lTi8xo?feature=shared	Input Output Modules PLC ?, What is input and output module of PLC?
6	https://youtu.be/zsajTNtxfAE?feature=shared	PLC Ladder programming-1
7	https://youtu.be/mDl46055UN8?feature=shared	PLC Ladder programming - 2
8	https://youtu.be/IRm_tB-irx8?feature=shared	Timers & Counters.
9	https://youtu.be/93PtehIiWKM?feature=shared	Communicating Protocols in automation system
10	https://youtu.be/ShaAt45iMhc?feature=shared	Automation Communication Protocols
11	https://plc-coep.vlabs.ac.in/	Virtual Lab for PLC programming for basic and industrial applications.

AUTOMATION & PLC **Course Code : 316334**

Sr.No	Link / Portal	Description
12	https://www.ixon.cloud/knowledge-hub/how-to-get-data-from-plc	PLC to Cloud communication

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 04/09/2025 **Semester - 6, K Scheme**