INDUSTRIAL AUTOMATION AND CONTROL

V Semester: EEE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AEE511	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:
The course should enable the students to:

I.   Illustrate the functioning of programmable logic controllers and implementation in automation of industry.
II. Analyze working of hardware related to programmable logic controllers.
III. Analyze working of hardware related to programmable logic controllers.
IV. Apply sequential logic to industrial applications and control systems.

COURSE OBJECTIVES (COs):
The course should enable the students to:

CO 1: Learn the fundamental concepts about introduction to industrial automation and control and devices.
CO 2: Study the performance of each system in detail along with practical case studies.
CO 3: Develop various types of industrial automation and control and devices.
CO 4: Understand the process control of PLC automation.

COURSE LEARNING OUTCOMES (CLOs):

1. Describe the various elements of an Industrial Automation Systems and how they are organized hierarchically in levels.
2. Define the different terms used for characterizing the performance of an instrument/ measurement system.
3. Name the different methods of measuring temperature, pressure, force, displacement and speed.
4. Study the signal conditioning circuits, different types of errors.
5. Write the input-output relationship of a P-I-D controller
6. Justify the use of feed forward and ratio control schemes.
7. Explain the two schemes for predictive control suggest a suitable compensation scheme for control of a process with inverse response.
8. Define Sequence and Logic Control and Name the major functions performed by a PLC.
9. Describe the hardware structure of a PLC Program and the execution of a PLC Program.
10. Describe motivations for formal modeling in the design of sequence control programs for an industrial control problem.
11. Describe the physical organization of hardware in the PLC.
12. Define Numerical Control and describe its advantages and disadvantages.
13. Name the types of control valves and sketch their ideal flow characteristics.
14. Describe the principles of operation of hydraulic systems and understand its advantages.
15. Describe pressure switches, as well as pressure and flow gauges used in hydraulic systems.

16. Demonstrate energy saving with variable speed drive method of flow control compared to throttling.
17. Explain with schematic diagrams, open loop and closed loop control schemes used for step motors.
18. Describe the operational features of dc motor drives, Induction motor drives, BLDC motor drives for Electrical actuators

Unit-I	INTRODUCTION TO INDUSTRIAL AUTOMATION AND CONTROL	Classes: 08

Introduction to Industrial Automation and Control: Introduction to industrial automation and control architecture of industrial automation system, measurement systems specifications, temperature measurement, pressure and force measurement, displacement and speed measurement, signal conditioning circuits, errors and calibration.

Unit-II	PROCESS CONTROL	Classes: 10

Process control: Introduction to process control, PID control, controller tuning, implementation of PID controllers, special control structures, feed forward and ratio control special control structures: predictive control, control of systems with inverse response.

Unit-III	PROGRAMMABLE LOGIC CONTROL SYSTEMS	Classes: 09

Programmable logic control systems: introduction to sequence or logic control and programmable logic controllers, the software environment and programming of PLCs, formal modeling of sequence control specifications. Programming, programming of PLCs: sequential function charts, the PLC hardware environment.

Unit-IV	CNC MACHINES AND ACTUATORS	Classes: 10

CNC machines and actuators: Introduction to computer numerically controlled machines, control valves, hydraulic actuation systems, principle and components, directional control valves, switches and gauges, industrial hydraulic circuits.

Unit-V	ELECTRICAL MACHINE DRIVES	Classes: 08

Electrical machine drives: Energy savings with variable speed drives, step motors: principles, construction and drives, electrical actuators, DC motor drives, electrical actuators: induction motor drives, electrical actuators, BLDC motor drives.

Text Books:

1. Stamatios Manesis, George Nikolakopoulos, "Introduction to Industrial Automation", CRC press, 2018.
2. Kok Kiong Tan, Andi Sudjana Putra, "Drives and Control for Industrial Automation", springer-verlag Londoan limited, 2011.
3. S.K. Bhattacharya & S. Bhattacharya, "Electrical Measurement and Control (WBSCTE)", Vikas Publishing House Pvt Ltd, 2015

Reference Books:

1. Madhu Chanda Mitra, Samarjit Sen Gupta, "Programmable Logic Controllers and Industrial Automation: An Introduction", Penram International Publishing (India) Pvt. Ltd., 1 st Edition, 2008.
2. K Krishnaswamy, S Vijayachitra, "Industrial Instrumentation", New Age Publications, 1 st Edition, 2010.
3. Rajesh Mehra, Vikrant Vij, "PLCs & SCADA: Theory and Practice", Laxmi publications, 2nd Edition, 2016.

Web References:

1. https://www.google.co.in/search?q=introduction+to+industrial+automation+and+control&ie=utf-8&oe=utf-8&client=firefox-b-ab&gfe_rd=cr&ei=puocwoxvl67v8wekwzngaw

2. https://www.noorropidah.files.wordpress.com/2012/01/plc-1-3.pdf
3. https://www.radix.co.in/families/automation?gclid=cjfw24pbjtacfuyeaaodicqghq

e-text books:

1. https://www.plc-scada-dcs.blogspot.com/p/downloads.html
2. https://www.megawatt.com.gr/files/uploads/katalogos%20plc%20abb.pdf