Elements of Industrial Automation

(Elective)

(Code - 22526)

Maharashtra State Board of Technical Education (MSBTE)

Semester V - Electrical Engineering Group (EE/EP/EU)

Strictly as per new revised 'I' Scheme w.e.f. academic year 2019-2020

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We dedicate this Publication soulfully and wholeheartedly, in loving memory of our beloved founder director,

Late Shri. Pradeepji Lalchandji Lunawat, who will always be an inspiration, a positive force and strong support behind us.

"My work is my prayer to God"

-Lt. Shri. Pradeepji L. Lunawat

Soulful Tribute and Gratitude for all Your Sacrifices, Hardwork and 40 years of Strong Vision…

Preface

Dear Students,

We are extremely happy to come out with this book on **"Elements of Industrial Automation"** for you. The topics within the chapters have been arranged in a proper sequence to ensure smooth flow of the subject.

A large number of university questions have been included. So, We are sure that this book will cater all your needs for this subject.

We present this book in the loving memory of **Late Shri Pradeepji Lunawat,** our source of inspiration and a strong foundation of **"TechKnowledge Publications"**. He will always be remembered in our heart and motivate us to achieve our new milestone.

We are thankful to Shri. Shital Bhandari, Shri. Arunoday Kumar and Shri. Chandroday Kumar for the encouragement and support that they have extended. We are also thankful to Jeevan Tergaonkar and other staff members of TechKnowledge Publications for their efforts to make this book as good as it is. We have jointly made every possible effort to eliminate all the errors in this book. However if you find any, please let us know, because that will help us to improve further.

We are also thankful to my family members and friends for patience and encouragement.

- Authors

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Syllabus

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit - I **Industrial Control Circuits** **Refer chapter 1**	1a. Identify a specified symbols along with their functions in the given industrial control diagram. 1b. Explain with sketches the control and power circuit for the given motor control application. 1c. Develop control and power circuits for the specified process control application(s). 1d. Describe the method to troubleshoot the given industrial control circuit.	1.1 Need and benefit of automation Different input devices such as push button, selector switch, limit switch, proximity switch and pressure switch. 1.2 Different output devices such as relay, contactor, solenoid valve, solid state relay (SSR) 1.3 Different symbols used in industrial control circuits. Concept of control and power circuit diagram. 1.4 Commonly used motor control circuits such as (a) DOL starting (b) Star-delta starter (c) FWD-STOP-REV control and random reversing of induction motor. (d) Soft Starters 1.5 Typical control and power circuit diagrams of hoist control, conveyer control, lifting magnet and Mill and Extruders.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit - II **PLC Fundamentals** **Refer chapter 2**	2a. Describe with sketches the function of a given part of PLC. 2b. Describe the function of the specified part of the given discrete IO module. 2c. Describe the function of the specified part of the given analog IO module 2d. Describe the functions of the specified part of the given special IO modules. 2e. Compare the salient features of the given two PLCs using block diagrams.	2.1 Function of different parts of PLC such as CPU, memory, power supply and IO modules. 2.2 Digital IO module of PLC, Block diagram and specification 2.3 Analog IO module of PLC, Block diagram and specification 2.4 Special modules of PLC : Communication module PID controller module stepper motor control module. 2.5 PLCs in market based on CPU type, on of IOs, speed and memory 2.6 Micro PLCs
Unit - III **PLC Programming basics** **Refer chapter 3**	3a. Identify the given parts of the ladder diagram along with the description their functions. 3b. Develop the PLC ladder programs for the given situations. 3c. Describe program scan process for the given type of PLC 3d. Modify the given relay instructions for proper implementation of the given ladder diagram.	3.1 Binary system, bit, byte, word logic gates 3.2 Programming PLC using ladder diagram, Components of ladder diagram, Program scan process applied to single rung. 3.3 Ladder diagram for different logic gates. 3.4 Relay type instructions IF-CLOSED, IF-OPEN Output Energize instructions. Internal relay instructions Internal relay instruction.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	3e. Describe the method to troubleshoot the given simple PLC ladder program.	3.7 Timer/counter module : types of timers and counters
Unit - IV **PLC Wiring diagrams and Ladder logic** **Refer chapter 4**	4a. Develop ladder diagrams for the given situation(s). 4b. Select the relevant Input / Output devices required for the given application(s) with justification. 4c. Prepare the relevant wiring diagram for connecting the given type of PLC. 4d. Describe the method to troubleshoot the given PLC ladder diagram and wiring diagram.	4.1 Seal in circuits using PLC 4.2 Ladder and wiring diagram of DOL starter with OLR 4.3 Latching Relay using PLC 4.4 PLC based water level controller, 4.5 Forward reverse control of 3-phase IM using PLC 4.6 Temperature control ON/OFF 4.7 Stepper motor control 4.8 Bottle filling system, 4.9 Traffic light control
Unit - V **SCADA and DCS** **Refer chapter 5**	5a. Identify the specified components of the given SCADA System. 5b. Prepare a block diagram of the given architecture of SCADA. 5c. Identify the specified components in the given DCS diagram. 5d. Compare the salient features of given types of SCADA and DCS systems using block diagrams.	5.1 SCADA (Supervisory Control and Data Acquisition) overview. 5.2 Use of HMI 5.3 SCADA architecture : Monolithic, distributed and networked. 5.4 Concept of DCS (Distributed Control System)

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