DR.BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO. SU/ Sci & Tech./B.Voc/ NEP/33/2026

It is hereby inform to all concerned that, the Revised syllabi prepared by the Ad-hoc Board and recommended by the Dean, Faculty of Science & Technology **Academic Council at its meeting held on 22 December, 2025 has accepted the following syllabi of Bachelor of Vocation under the Faculty of Science & Technology as per National Education Policy -2020 run at the University Department, Dr. Babasaheb Ambedkar Marathwada University as appended herewith.**

Sr.No	Subject Name	Semester
1.	**B.Voc in Industrial Automation**	**IV**
2.	**B.Voc in Automobile**	**IV**

This is effective from the Academic Year 2025-26 onwards under the Faculty of Science & Technology.

All concerned are requested to note the contents of the circular and bring notice to the students, teachers and staff for their information and necessary action.

University campus,
Chhatrapati Sambhajinagar-431004.
Ref. No. S .U/Sci & Tech/B.Voc./2025-26/ 2584-86
Date: 02/ 01/ 2026

Registrar,

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Copy forwarded and Information to necessary action:-

1] **The Director, Department, of, Deen Dayal Upadhyay Kaushal Kendra Dr. Babasaheb Ambedkar Marathwada University.**

2] **The Director, Board of Examination & Evaluation,**

3] **The Director,** University Network & Information Centre, UNIC, with a **reques to upload this circular on University Website.**
Dr. Babasaheb Ambedkar Marathwada University **Chhatrapati Sambhajinagar.**

Dr. Babasaheb Ambedkar Marathwada University,

Chhatrapati Sambhajinagar – 431 004 (MS), India

Deen Dayal Upadhyay KAUSHAL Kendra (DDUKK)

Dr.Bharti W. Gawali
M.Sc., Ph.D., SET in Computer Science
Director

"NAAC Reaccredited with 'A+' Grade"

Phone No : +91-240-3266 (30)/2403386
Fax No : +91-240-2403113
Cell : +91-9404012032,
Email : director.ddukk@bamu.ac.in

Ref No: DDUKK/2025-26/ 190A **Date: 14/11/2025**

Dr. Babasaheb Ambedkar Marathwada University Inward 295 Syllabus Section 04/11/2025 Aurangabad

To,
The Deputy Registrar,
Syllabus Section,
Dr. Babasaheb Ambedkar Marathwada University,
Chh. Sambhajinagar (MS) – 431004

SUB: Submission of 3rd & 4th semester syllabi of the subjects of Industrial Automation and Automobile (Industry Embedded) and Automobile of Deen Dayal Upadhyay KAUSHAL Kendra (DDUKK) for approval purpose.

Dear Sir,

With reference to above ciated subject, it is hereby submitted that syllabi of the subjects of Industrial Automation and Automobile (Industry Embedded) and Automobile of Deen Dayal Upadhyay KAUSHAL Kendra (DDUKK) for approval have been submitted to the syllabus section.

Hence it is now requested to kindly approve the syllabi and do the needful.

I am looking forward to have your esteemed co-operation,

Thanking you with utter anticipation,

Thanking You,

Best Regards,

Director
Deen Dayal Upadhyay KAUSHAL Kendra (DDUKK)

Director
Deen Dayal Upadhyay Kaushal Kendra,
Dr. Babasaheb Ambedkar
Marathwada University,
Chhatrapati Sambhajinagar(MS)-431004

Encl: as above

Subj - Major Automobile 6 pgs + Major Auto Sem IV - 9 pgs + Autom. (Ind. Embedded 11 pgs + IA Rules 12 pgs = 39 pgs.

Total pgs 39
DD 21858
TD 98909,

Dr. Babasaheb Ambedkar Marathwada University

Chhatrapati Sambhajinagar- 431004

B.VOC. Degree Program

(Three Year)

SEMESTER-IV

DDU KAUSHAL Kendra
Automobile Division

(Revised)

(AS PER NEP-2020)

Subject (Major): Automobile

Effective from 2025-26

B.VOC. Second Year: 4th Semester

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) Mandatory	AU/DSC/T/250	Electric & Hybrid Vehicles	2		2		2+2+2+2 = 08
	AU/DSC/T/251	Automotive HVAC	2		2		
	AU/DSC/P/276	Practical based on AU/DSC/T/250		4		2	
	AU/DSC/P/277	Practical based on AU/DSC/T/251		4		2	
Minor (Choose any two from pool of courses) **It is from different discipline of the same faculty**	AU/Mn/T/250	To be chosen from other discipline of same faculty	4		4		04
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	AU/GE/OE/T/250	Motor Vehicle Act	2		2		02
SEC (Skill Enhancement Courses) (Choose any one from pool of courses)	AU/VSC/T/250	1. Computer Aided Manufacturing	1		1		1+1 =02
	AU/VSC/T/251	2.Automobile Sensors					
	AU/SEC/P/276	Practical based on AU/VSC/T/250		2		1	
	AU/SEC/P/277	Practical based on AU/VSC/T/251					
AEC, VEC, IKS	AEC-4	Modern Indian Language (MIL-2) (Common for all the faculty)	2		2		02
OJT/ FP/CEP/CC/RP	FP-1	Field Project		4		2	2+2= 04
	CC-4	(Fine/ Applied/ Visual/ Performing Arts) (Common for all the faculty)		4		2	
			13	**18**	**13**	**09**	**22**
Exit Option : Award of UG Diploma in major and minor with 88 credits and an additional 4 credits NSQF course (related to major / minor) / Internship during summer vacation OR Continue with Major and Minor							

Minor Courses for other Discipline

AU/Mn/T/250 (Automotive Materials) and AU/Mn/T/251 (Basic Electronics System) are 2 courses of 2 credits each designed for other discipline

Generic /Open Elective Courses for other faculty

AU/GE/OE/250 (Electric and Hybrid Vehicle): 2 credit theory course to be designed for other faculty.

AU/DSC/T/250 Electric & Hybrid Vehicles

Total Credits: 02 Total Contact Hours: 30
Maximum Marks: 50

Course Objectives:

- To understand general aspects of Electric and Hybrid Vehicles.
- To select the suitable electric propulsion systems
- To select required energy storage and charging devices

Course Outcomes (CO):

1. Summarize the general aspects of Electric and Hybrid Vehicles (EHV).
2. Identify the various types of motors used in electric vehicles
3. Select the required energy storage and charging devices for Electric and Hybrid vehicles.

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7		PSO 1	PSO 2	PSO 3
CO1	H	M							H		
CO2	M	H	M		M				M	M	
CO3		M		M					M	H	M

Module No.	Topics / actual contents of the syllabus	Contact Hours
Unit - I **Introduction to Electric Vehicle**	History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, Classification of EV. Architecture of HEV: Series HEV, Parallel HEV and Series-Parallel HEV, Government Schemes and Progress: FAME-1, FAME-2	**10 Hours**
Unit- II **Motor drive Technologies:**	Electric propulsion unit - Classification of EV Motors, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switched reluctance motor dives	**10 Hours**
Unit- III **Energy storage requirements**	Definition of various Battery Parameters. Different types of batteries – Lead Acid, Nickel-based, Sodium based, Lithium based, Metal Air based. Battery charging, Quick Charging devices. Battery Management System, Battery charging technologies: Methods of battery charging –Onboard and offboard charging	**10 Hours**

References:

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC, 2004. ISBN 0-8493-3154-4
3. Iqbal Hussein, "Electric and Hybrid Vehicles Design Fundamentals", CRC Press. , 2003 ISBN 0203009398, 9780203009390
4. Jack Erjavec, Jeff Arias, "Hybrid, Electric and Fuel-cell Vehicles", Cengage Learning India Pvt Ltd. New Delhi.

Web Resources:

https://nptel.ac.in/courses/108/103/108103009/
https://nptel.ac.in/courses/108/106/108106170

AU/DSC/T/251 Automotive HVAC

Total Credits : 02 Total Contact Hours: 30 Hrs

Maximum Marks : 50

Course Objectives:

- To provide fundamental knowledge of automotive heating, ventilation, and air conditioning systems.
- To understand refrigerants, HVAC components, and automatic climate control.
- To develop ability for inspection, troubleshooting, and safe servicing of automotive HVAC systems.

Course Outcomes (CO):

CO No.	Course Outcome Description
CO1	Understand basic principles and elements of automotive HVAC systems.
CO2	Identify, analyze and troubleshoot automotive cooling & heating system components
CO3	Apply maintenance and servicing procedures with safety in automotive HVAC.

CO-PO Attainment Matrix for Course (L = Low, M = Medium, H = High)

Course Outcomes	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO2	PSO3
CO1	M	L	L	L	L	L	L	L	L	M
CO2	L	L	L	M	L	L	M	—	M	L
CO3	M	M	M	L	M	L	M	—	L	M

Module No.	Topics / actual contents of the syllabus	Contact Hours
Unit I: Fundamentals of Automotive Air Conditioning Systems	• Requirement of A/C in vehicles • Refrigeration load, cooling capacity & ton of refrigeration • DBT, WBT, Dew point, humidity and RH • Latent heat of condensation & evaporation • Heat transfer modes • Moist / saturated / unsaturated air • Refrigerants & oils: types, properties • Environmental effects & eco-friendly refrigerants • Basic HVAC terminology	**10 Hrs**
Unit II: Cooling, Heating & Ventilation Systems	• Automotive cooling cycle • Components: Magnetic clutch, Compressors, Condenser, Receiver drier, Accumulator, Expansion valve, Orifice tube,	**10 Hrs**

	Evaporator • Troubleshooting of cooling system • Heating system working cycle • Heating system construction & components • Electric heating system • Ventilation system components & functions • Types of automotive A/C units • Troubleshooting of heating system	
Unit: -III HVAC Controls, Climate Control & Servicing	• Manual / automatic HVAC controls • Semi-automatic temperature controls & sensors • Automatic climate control systems • Safe handling practices • HVAC inspections & testing • Leak detection techniques • Refrigerant charging / discharging • Servicing of compressor, evaporator, condenser, heater core & hoses	**10 Hrs**

Reference Books:

1. Automotive Air Conditioning and Climate control Systems. Steven Daly Butterworth-Heinemann publications.
2. Automobile Engineering (Volume – VI) Anil Chhikara Satya Prakashan.
3. Automotive Airconditioning William H. Carouse & Donald L. Anglin Tata McGraw-Hill Co., Ltd., New Delhi.
4. Automotive heating and air conditioning Mark Schnubel Cengage Publication.

List of Open-Source Software/learning website:

1. https://www.howacarworks.com
2. https://swayam.gov.in
3. http://nptel.ac.in/courses/112105129/pdf/R&AC
4. https://tinyurl.com/57mv2hct for video link
5. https://tinyurl.com/yysu44b6 for web link

AU/DSC/P/277 Practical based on Automotive HVAC

Total Credits : 02 Total Contact Hours : 60 Hrs

Maximum Marks : 50

Course Objectives:

- To provide hands-on learning about automotive HVAC components and systems
- To develop competency in troubleshooting and servicing HVAC systems
- To ensure students practice safe handling of refrigerants and HVAC equipment

Course Outcomes (CO):

CO No.	Course Outcome Description
CO1	Identify and explain components of automotive HVAC systems.
CO2	Perform basic servicing, leak testing, and charging operations with safety.
CO3	Demonstrate troubleshooting skills for cooling, heating, and ventilation systems.

CO-PO Attainment Matrix for Course (L = Low, M = Medium, H = High)

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M	L	L	L	L	L	L	M	L	M
CO2	L	L	M	M	L	M	M	L	M	L
CO3	M	M	M	M	M	M	M	M	L	M

Practical No.	Practical Title
1	Study of different HVAC refrigerants — characteristics & properties
2	Identification of automotive cooling system components
3	Identification of automotive heating system components
4	Study of automotive ventilation system components
5	Interpretation of automatic climate control system in a vehicle
6	Lubrication & refrigerant recharging operations with safety
7	Servicing of A/C components with safety practices

AU/DSC/P/226 Practical Based on Electric and Hybrid Vehicles

Total Credits: 02 Total Contact Hours: 60
Maximum Marks: 50

Course Outcomes (COs):

After completion of the course, students will be able to -

I. Identify the motors used in EV applications

II. Determine the Ampere-Hour capacity of given battery with a given load.

CO-PO Attainment Matrix for Course
(L = Low, M = Medium, H = High)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7		PSO 1	PSO 2	PSO 3
CO1			H							M	
CO2			H						M		

List of Experiments (Any 6)

1. Study of Testing of Battery in Electrical vehicle (Hub Motor) Training system
2. Study of Key switch testing in Electrical Vehicle (Hub Motor) Training system.
3. Study of Display Meter in Electric Vehicle (Hub Motor) Training System.
4. Study of Controller is testing in Electrical Vehicle (Hub Motor) Training system
5. Study of Convertor tests in Electrical Vehicle (Hub Motor) Training system.
6. Study of Indicator test on Electric Vehicle (Hub Motor) Training System.
7. Study of Headlight and Tail light test in Electric Vehicle (Hub Motor) Training System.
8. Study of Charging & Discharging of Battery in Electric Vehicle (Hub Motor) Training System.
9. Study the N-T (Speed –Torque) characteristic, Input Power, Output Power & Efficiency.
10. Study of running Hub (BLDC) Motor in Forward & Reverse direction

DSC–XX : Computer Aided Manufacturing (CAM)

Total Credit: 01 Total Contact Hours: 15 Hrs

Maximum Marks: 50

Course Objectives:

- To impart understanding of CNC machine tools and control systems
- To introduce part programming using G & M codes
- To enable components machining using CNC Turning and Milling
- To familiarize students with CAM software and manufacturing automation

Course Outcomes (CO):

CO No.	Course Outcome Description
CO1	Understand CNC machine structure, working, and control systems.
CO2	Develop CNC part programs using G/M codes for turning and milling.
CO3	Apply CAM tools for toolpath generation and machining simulations.

CO-PO Attainment Matrix for Course (L = Low, M = Medium, H = High)

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	M	L	—	—	L	—	H	M	—
CO2	M	H	M	M	M	L	—	H	H	—
CO3	L	M	H	H	H	M	—	M	H	M

Module No.	Topics / actual contents of the syllabus	Contact Hours
Unit 1: CNC Machine Tools & Control Systems	• Introduction to CAD–CAM integration • Construction & working of CNC turning and machining centers • Axes convention, drives and feedback systems • CNC controller functions and interfacing • Tooling systems and work holding devices • Advantages of CNC in modern manufacturing	**10 Hrs**
Unit 2: CNC Programming for Turning & Milling	• Overview of part programming • Coordinate systems & preparatory (G) & miscellaneous (M) codes • Programming for: – CNC turning operations (facing, turning, threading, taper, grooving) – CNC milling operations (pocketing, contouring, drilling cycles) • Canned cycles and subprograms	**10 Hrs**

	• Tool offset and tool radius compensation	
Unit 3: CAM Software & Process Automation	• Introduction to CAM environment & tool libraries • 2D and 3D toolpath generation concepts • CNC simulation and post-processing • Flexible Manufacturing Systems (FMS) • Introduction to Robotics & AGV in manufacturing • Industry 4.0 and smart manufacturing overview	**10 Hrs**

Reference Books:

1. Mikell P. Groover — Automation, Production Systems & CIM
2. P.N. Rao — CAD/CAM
3. James Madison — CNC Machining Handbook
4. Y. Koren — Computer Control of Manufacturing Systems
5. Kundra & Rao — Numerical Control and CAM

AU/SEC/P/276: Practical Based on Computer Aided Manufacturing (CAM)

Total Credit : 01 Total Contact Hours : 30 Hrs

Maximum Marks : 50

Course Objectives:

- To impart understanding of CNC machine tools and control systems
- To introduce part programming using G & M codes
- To enable components machining using CNC Turning and Milling
- To familiarize students with CAM software and manufacturing automation

Course Outcomes (CO):

CO No.	Course Outcome Description
CO1	Understand CNC machine structure, working, and control systems.
CO2	Develop CNC part programs using G/M codes for turning and milling.
CO3	Apply CAM tools for toolpath generation and machining simulations.

CO-PO Attainment Matrix for Course (L = Low, M = Medium, H = High)

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	M	L	—	—	L	—	H	M	—
CO2	M	H	M	M	M	L	—	H	H	—
CO3	L	M	H	H	H	M	—	M	H	M

Practical No.	Practical Title
1	Study of CNC machine components and control panel
2	Introduction to G & M codes — manual programming practice
3	CNC Turning program for facing and straight turning
4	CNC Turning program for taper and threading
5	CNC Milling program for contouring and pocket milling
6	Toolpath generation using CAM software
7	CNC simulation, post-processing & job execution

AU/VSC/T/250 Automobile Sensors

Total Credit: 01 Total Contact Hours: 30
Maximum Marks: 50

Course Objectives:

- To provide an over view of the concepts involved automotive sensors technology.

Course Outcomes (CO):

1. Discuss the basics of various Power train sensors and chassis management associated systems for proper vehicle dynamics and stability in automotive systems.
2. Comprehend various sensors for vehicle body management

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	H	M						H		
CO2	M	H	M		M			M	M	
CO3		M		M				M	H	M

Module No.	Topics / actual contents of the syllabus	Contact Hours
Unit - I **Powertrain Sensors and Chassis Management**	Engine combustion sensing, exhaust temperature sensor, NOx sensor, fuel quality sensor, level sensor, torque sensor, mass flow sensor, manifold absolute pressure sensor. Wheel speed sensors/direction sensors, steering position sensor, acceleration sensor, brake pneumatic pressure sensor, ABS sensor, electronic stability sensor	**5 Hours**
Unit- II Sensors for vehicle body & Convenience	Adaptive cruise Control, air bag sensor, key less entering sensor. Tire pressure monitoring systems, Two wheeler and Four wheeler security systems, parking guide systems, anti-lock braking system, Safety and Reliability, Traction Control, skidding& anti-collision	**5 Hours**
Unit- III Passenger convenience systems	Principal Sensor Functions, Distributed Front Air Bag sensing systems, Single-Point Sensing systems, Side-Impact Sensing. Electromechanical Seat, Steering Wheel, and Mirror Adjustments, Central Locking Systems.	**5 Hours**

Reference Books:

1. Automotive Electrics, Automotive Electronics: Systems & Components, 2014,5th Edition, BOSCH.
2. John Turner, Automotive Sensors,2010,1st Edition, Momentum Press, New York.
3. William B. Ribbens, "Understanding Automotive Electronics", Sixth Edition, Newnes, Elsevier Science, ISBN 0-7506-7599-3.
4. J. Marek, H.-P. Trah, Y. Suzuki, I. Yokomori, "Sensors for Automotive Applications", Volume-4,WILEY-VCHVerlagGmbH&Co.KGaA,Weinheim ISBN:3- 527-29553-4.
5. Vipul Jain, Payam Heydari, "Automotive Radar Sensors in Silicon Technologies", Springer New York Heidelberg Dordrecht London, ISBN 978-1-4419-6774-9

AU/VSC/P/276 Practical Based on Automobile Sensors

Total Credits: 01 Total Contact Hours: 30
Maximum Marks: 50

Course Outcomes (COs):

After completion of the course, students will be able to -

I. Identify the Sensors and their locations in Automobiles.
II. Explain the wiring diagram of various sensors.

CO-PO Attainment Matrix for Course
(L = Low, M = Medium, H = High)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7		PSO 1	PSO 2	PSO 3
CO1			H							M	
CO2			H						M		

List of Experiments (Any 6)

1. Study and Diagnosis of Manifold Absolute Pressure Sensor (MAP)
2. Study and Diagnosis of Crankshaft Position Sensor (CKP).
3. Study and Diagnosis of Camshaft Position Sensor (CMP).
4. Study and Diagnosis of Lamda/Oxygen Sensor.
5. Study and Diagnosis of Intake Air Temperature (IAT) and Mass Airflow Sensor (MAF).
6. Study and Diagnosis of Throttle Position Sensor (TPS).
7. Study and Diagnosis of Knock Sensor.
8. Study of Adaptive Cruise Control System.

Dr. Babasaheb Ambedkar Marathwada University

Chhatrapati Sambhajinagar- 431001

Deen Dayal Upadhyay KAUSHAL Kendra

Three Year
B.VOC. Degree Program

Syllabus Semester IV

(Revised)

(AS PER NEP-2020)

Subject (Major): INDUSTRIAL AUTOMATION

(Pattern 2024)

Effective from 2025-26

Syllabus for Semester – IV

B.VOC Industrial Automation

Major (Core)
Mandatory

IA/DSC/T/250 : Fundamentals of Flexible Manufacturing System

Total Credits : 02 **Total Contact Hours : 30 Hrs**

Maximum Marks : 50

Learning Objectives of the Course:

To provide students with:

1. Basic understanding of manufacturing concepts, processes, and materials.
2. Knowledge of components and classification of manufacturing systems.
3. Understanding of FMS and CIM concepts, layouts, and applications.
4. Awareness of automation principles, safety practices, and modern manufacturing innovations.

Course Outcomes (COs) :

On completion of the course, students should be able to -

1. Describe key manufacturing processes, production systems, and safety measures.
2. Identify major components and classifications of manufacturing systems.
3. Explain the structure, operation, and benefits of FMS.
4. Analyze automation strategies and evaluate flexibility and technological improvements in manufacturing.

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H
CO4	H	H	H	H	H								H	H	H	H

Module No.	Course Content	Contact Hours
I	Foundations of Manufacturing and Production Systems Introduction to Manufacturing, Materials in Manufacturing, Manufacturing Processes, Production Systems, Manufacturing Economics, Basic Safety measures; Manufacturing Processes; Production systems, automation in production systems, automation principle and strategies, manufacturing industries and products, manufacturing operations, production facilities;	10 Hrs
II	Components and Classification of Manufacturing Systems Components of manufacturing systems: production machines, material handling systems, computer handling system, human resources; Classification Scheme for Manufacturing Systems	10 Hrs
III	Flexible Manufacturing Systems (FMS) and Computer-Integrated Manufacturing (CIM) Introduction and definition of FMS; Basic components of FMS; Types of FMS and FMS layouts; Factors influencing FMS layouts; Benefits of flexibility; Objectives and aims of FMS; Advantages and disadvantages of FMS implementation; Industrial applications of FMS; Equipment required for FMS and their functions; Innovations advancing manufacturing;	10 Hrs

Text Books:

1. Mikell P Groover, 'Automated Production Systems, and computer integrated manufacturing', Third Edition, Pearson Education, Inc. 2016, ISBN-978-93-325-4981-4.
2. Fundamentals of Modern Manufacturing - Materials, Processes, and Systems: Mikell P.Groover; Wiley; ISBN: 9781118231463

Reference Books:

1. Mikell P Groover, 'Fundamentals of Modern Manufacturing: Materials, processes and systems', Fifth Edition, Wiley. 2012, ISBN-978-11-183-9367-3
2. K.K. Shivanand, M.M.Benal,V.Koti, 'Flexible Manufacturing System', New age Publishers, ISBN-10 : 8122418708, ISBN-13 : 978-8122418705
3. S. Kant Vajpayee, ' Principles of Computer-Integrated Manufacturing', PHI Learning Private Limited, 2015, ISBN-978-81-203-1476-4

Online Reference:

1. https://nptel.ac.in/courses/110105155
2. https://nptel.ac.in/courses/110106044
3. https://nptel.ac.in/courses/112104289

IADSCP276: Fundamentals of Flexible Manufacturing Systems Lab

Total Credits : 02 **Total Contact Hours : 60 Hrs**

Maximum Marks : 50

Learning Objectives of the Course:

1. To provide students hands-on experience with flexible color-sorting and material-sorting stations.
2. To train students in operating linear transport stations for controlled movement of parts.
3. To enable students to perform multi-parameter sorting (shape, material, color) at varying difficulty levels.

Course Outcomes (COs) :

On completion of this course, students should be able to –

1. Identify and operate key components of a flexible color-sorting station.
2. Perform linear transport operations for organized part handling.
3. Sort products based on shape, material, and color, including combined complex sorting tasks.

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H									H	M	M	
CO2	H	H	H	H									H	M	M	
CO3	H	H	H	H									H	M	M	

At least six experiments have to be performed

1. Study of different parts of a flexible color sorting station
2. Experiment with retrieval of modular workpieces from cartridge assembly
3. Experiment with linear transport station
4. Sorting of finished products on basis of their shape/ contour.
5. Sorting of finished products on basis of their material of construction
6. Sorting of finished products on basis of their colour
7. Experiments with combining 2 to 6 at different difficulty levels
8. Logic implementation for Bottle Filling Application
9. Study with Linear transport and material station (Linear movement of Object and sequential/batch wise placing)
10. Study pick and place Robot on Rotating station.
11. Programming of Robot as in for pick and place operation
12. Study of Cartesian robot customized for AS/RS.
13. Programming of a Cartesian robot for AS Operation.
14. Programming of a Cartesian robot for Retrieval Operation.
15. Study of Virtual Simulation Software's for FMS.

Virtual Simulation Software like FlexSim, Visual Components etc can be used for experimentation purpose and experiments can be performed

IA/DSC/T/251 : Fundamentals of Industrial Robotics

Total Credits : 02 **Total Contact Hours : 30 Hrs**
Maximum Marks : 50

Learning Objectives of the Course:

To provide students with:

5. Basic knowledge of industrial manipulators and work-cell components.
6. Understanding of coordinate frames and simple kinematics for positioning.
7. Familiarity with robot programming principles and teach pendant operation.
8. Awareness of safety measures and industrial applications of robots.

Course Outcomes (COs) :

On completion of the course, students should be able to -

5. Describe basic attributes of industrial manipulators.
6. Apply coordinate transformations and basic forward kinematics to determine the end-effector position.
7. Demonstrate understanding of robot programming and safe operation.
8. Identify key industrial applications and perform basic preventive maintenance checks.

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H
CO4	H	H	H	H	H								H	H	H	H

Module No.	Course Content	Contact Hours
I	**Introduction to Robotics and Robot Anatomy** Evolution and Classification of Robots; Industrial Manipulator Components; Joints, Links, DOF, Work Cell and Work Volume; Sensors and Actuators – overview; Safety protocols while operating manipulators; Applications overview.	**10 Hrs**
II	**Robot Kinematics and Coordinate Systems** Robot Coordinate Frames; Homogeneous Transformations; Simple 2–3 DOF Forward Kinematics; Inverse Kinematics Concept (qualitative); Specifications of Robots; Basic Robot Motions and Path Concept.	**10 Hrs**
III	**Robot Programming and Industrial Applications** Teach Pendant Operation, Motion Commands, Speed Control, Wait/Loop Functions; Safety Interlocks; Maintenance Practices; Industrial Use Cases – Pick & Place, Welding, Assembly; Case Discussions.	**10 Hrs**

Text Books:

3. M.P. Groover, M. Weiss, R. N. Nagel, N. G. Odrey, 'Industrial Robotics: Technology. Programming and Applications', Second Edition; Tata McGraw Hill Education, 2012

4. S. K. Saha, 'Introduction to Robotics', Third Edition;Tata McGraw Hill Education, 2024

Reference Books:

4. R. K.Mittal, I. J. Nagrath,' Robotics and Control', First Indian Edition; Tata McGraw Hill Education, 2012
5. M. R. Miller & R. Miller,' Robots and Robotics: Principles, Systems, and Industrial Applications' First Edition; McGraw Hill Education, 2017
6. K. M. Lynch & F. C. Park,' Modern Robotics: Mechanics, Planning, and Control' First Edition; Cambridge University Press, 2017.

Online Reference:

4. https://nptel.ac.in/courses/122106025
5. ABB RobotStudio: https://new.abb.com/products/robotics/robotstudio/downloads
6. https://robodk.com/

IA/DSC/P/277: Fundamentals of Industrial Robotics Lab

Total Credits : 02 **Total Contact Hours : 60 Hrs**
Maximum Marks : 50

Learning Objectives of the Course:

1. To provide students with an understanding of the fundamentals of position, speed, and servo control in robotics.
2. Operating and programming industrial six-axis articulated robots safely for basic operations.
3. Performing simple automated motion programs.

Course Outcomes (COs) :

On completion of this course, students should be able to –

1. Demonstrate position and speed control of DC, stepper, and servo systems.
2. Operate a six-axis industrial robot safely using teach pendant and coordinate modes.
3. Develop and execute robot programs for joint, linear, and circular motion paths.

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H									H	M	M	
CO2	H	H	H	H									H	M	M	
CO3	H	H	H	H									H	M	M	

At least six experiments have to be performed

1. Study of position control for different angular position commands.
2. Study of effect of forward gain on position control performance.
3. Study of speed and load characteristics of a DC motor in open-loop and closed-loop configuration.
4. Study of operation and control of a stepper motor.
5. Study and programming of an AC servo motor for controlled operation.
6. Familiarization with teach pendant of an industrial six-axis articulated robot.
7. Zeroing and jogging of industrial six-axis articulated robot (Axis and World Coordinate Modes).
8. Programming of robot for Joint and Linear motion.
9. Programming of robot for Circular motion and Tool Centre Point (TCP) calibration.
10. Programming of robot I/O channels and execution of a simple sequence task.

Mini Project (Mandatory):

Title: Development of a Robotic Pick-and-Place System (Physical or Simulated)

Objective: To integrate motion, I/O, and safety knowledge by designing a small automation task using either an actual industrial robot/ miniature servo platform/a simulation environment such as ABB RobotStudio, RoboDK, Fanuc ROBOGUIDE, or CoppeliaSim.

Expected Deliverables: Project report, Demonstration of motion and logic

Minor Course
in
Industrial Automation

Offered by DDUKK
(Industrial Automation Division)

IA/Mn/T/250 : Applied Fluidics

Total Credits : 02

Total Contact Hours : 30 Hrs **Maximum Marks : 50**

Learning Objectives of the Course:

1. To acquaint students with the basic tools of pneumatic control
2. To equip students with fundamental tools for basic pneumatic circuit design

Course Outcomes (COs) :

On completion of the course, students should be able to –

1. Recognize basic pneumatic elements in a standard circuit
2. Describe operation of basic pneumatic actuators/ control elements
3. Construct circuit diagram for basic pneumatic circuits according to application demand

CO-PO-PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H

Module No.	Course Content	Contact Hours
I	Pneumatic System- Concepts, Components and Design Basics Introduction; Comparison of Pneumatic/Hydraulic/and Electrical System; Air compression system- Types of Compressor, Compressor specifications; Air preparation elements; Arrangement of a complete pneumatic system; compressed air behaviours. Understanding pneumatic components- Pneumatic Actuators, Direction Control Valves. Design of pneumatic circuits- fluid power circuit design; switching valve position; control air/s signal air; Notation/ Numbering of Valves Building of pneumatic circuits; Application of Logic valves-AND, OR; Speed control circuit; Application of time delay valve.	10 Hrs
II	Design of Pneumatic Circuits Position sensing in Pneumatic Cylinders, Position Sensing in Pneumatic Cylinders- Signal flow in pneumatic circuits for pressure sensing; Roller lever valve circuits- Notation of roller lever valve and roller lever valve with idle return in pneumatic circuits, Pressure Sensing in Pneumatic Circuits, Pressure Sequence Valve	10 Hrs
III	Multicylinder Pneumatic Circuits Two Cylinder Movement, Overlapping of Signals, Displacement Diagrams, Displacement Diagrams of Multicylinder operations, Cascade method of Sequential Circuit Design, Stepper Sequencer or Counter Method of Drawing Pneumatic Circuits	10 Hrs

Text Books:

1. S. Ilango, V. Soundararajan, "Introduction to Hydraulics and Pneumatics", Second Edition, Prentice Hall of India, 2012
2. Anthony Esposito, "Fluid Power with Application", Seventh Edition, Pearson Publication, 2009

Reference Books:

1. S R Majumdar, " Pneumatic Systems (Principal and maintenance)", First Edition, McGraw Hill, 2017
2. Joji P.," Pneumatic Controls", First Edition, Wiley India Edition, 2008

Online Reference:

1. https://archive.nptel.ac.in/courses/112/106/112106300/
2. https://nptel.ac.in/courses/108105088

IA/Mn/T/251 :Discrete State Process Controllers

Total Credits : 02

Total Contact Hours : 30 Hrs **Maximum Marks : 50**

Learning Objectives of the Course:

1. To introduce students to general hardware specifications of Programmable Logic Controllers and I/O devices
2. To develop concepts for creating ladder diagram from process control description
3. To equip students with basic level software tools for application of PLC in real-time operating conditions

Course Outcomes (COs) :

On completion of the course, students should be able to-

1. Recognize Relays and PLCs as building block of Industrial Automation
2. Identify I/O terminals/ connections of a PLC in generic control circuits
3. Develop PLC wiring diagrams and Ladder Diagrams for basic control applications
4. Develop PLC program using Timers and Counters

CO-PO-PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H
CO4	H	H	H	H	H								H	H	H	H

Module No.	Course Content	Contact Hours
I	Foundation of Industrial Logics Industrial Logic overview, Relay Logic, Typical logic circuits, Relay ladder logic, Solid State Relays (SSRs); Programmable Logic Controllers (PLCs)- Parts of a PLC, Principles of Operation, Modifying the Operation, PLC Size and Application; PLC Hardware Components; Logic Fundamentals: The Binary Concept, AND, OR, and NOT Functions, The AND Function, The OR Function, The NOT Function, The Exclusive-OR (XOR) Function, Boolean Algebra, Developing Logic Gate Circuits from Boolean Expressions, Producing the Boolean Equation for a Given Logic Gate Circuit, Hardwired Logic versus Programmed Logic	10 Hrs
II	PLC Programming Basics and Tools Programming Basics: Processor Memory Organization (Program Files, Data Files), Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of Operation; Timers: Industrial Timers, Types of Timing Operations, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers; Counters: Counter Instructions, Up-Counter, Down-Counter, Up/Down Counter, Cascading Counters	10 Hrs
III	Basic I/O Devices, Wiring and Applications Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors (Proximity Sensor, Magnetic Reed Switch, Light Sensors, Ultrasonic Sensors, Strain/Weight Sensors, Temperature Sensors, Flow Measurement, Velocity and Position Sensors), Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description; Program examples	10 Hrs

Text Books:

1. F. Petruzella," Programmable Logic Controllers" Mc Graw Hill Publishing Company
2. W. Bolton," Programmable Logic Controllers", Newnes (Elsevier) ;
3. J. R. Hackworth, F. D. Hackworth Jr., "Programmable Logic Controllers: Programming Methods and Applications-" Pearson India Education

Reference Books:

1. J.W. Webb, R. A. Reiss, " Programmable Logic Controllers: Principles and Applications", Prentice Hall of India
2. L. A. Bryan, E. A. Bryan, "Programmable Controllers: Theory and Implementation" An Industrial Text Company Publication
3. J. A. Rehg, G. J. Sartori," Programmable Logic Controllers", Pearson

Online Reference:

www.instrumentationtools.com

Generic / Open Elective (GE/OE) Offered by DDUKK (Industrial Automation Division)

IA/GE/OE/T/250: Fundamentals of Industrial Robotics

Total Credits : 02 **Total Contact Hours : 30 Hrs**
Maximum Marks : 50

Learning Objectives of the Course:

To provide students with:

1. Basic knowledge of industrial manipulators and work-cell components.
2. Understanding of coordinate frames and simple kinematics for positioning.
3. Familiarity with robot programming principles and teach pendant operation.
4. Awareness of safety measures and industrial applications of robots.

Course Outcomes (COs) :

On completion of the course, students should be able to -

1. Describe basic attributes of industrial manipulators.
2. Apply coordinate transformations and basic forward kinematics to determine the end-effector position.
3. Demonstrate understanding of robot programming and safe operation.
4. Identify key industrial applications and perform basic preventive maintenance checks.

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H
CO4	H	H	H	H	H								H	H	H	H

Module No.	Course Content	Contact Hours
I	**Introduction to Robotics and Robot Anatomy** Evolution and Classification of Robots; Industrial Manipulator Components; Joints, Links, DOF, Work Cell and Work Volume; Sensors and Actuators – overview; Safety protocols while operating manipulators; Applications overview.	10 Hrs
II	**Robot Kinematics and Coordinate Systems** Robot Coordinate Frames; Homogeneous Transformations; Simple 2–3 DOF Forward Kinematics; Inverse Kinematics Concept (qualitative); Specifications of Robots; Basic Robot Motions and Path Concept.	10 Hrs
III	**Robot Programming and Industrial Applications** Teach Pendant Operation, Motion Commands, Speed Control, Wait/Loop Functions; Safety Interlocks; Maintenance Practices; Industrial Use Cases – Pick & Place, Welding, Assembly; Case Discussions.	10 Hrs

Text Books:

5. M.P. Groover, M. Weiss, R. N. Nagel, N. G. Odrey, 'Industrial Robotics: Technology. Programming and Applications', Second Edition; Tata McGraw Hill Education, 2012
6. S. K. Saha, 'Introduction to Robotics', Third Edition;Tata McGraw Hill Education, 2024

Reference Books:

7. R. K.Mittal, I. J. Nagrath,' Robotics and Control', First Indian Edition; Tata McGraw Hill Education, 2012
8. M. R. Miller & R. Miller,' Robots and Robotics: Principles, Systems, and Industrial Applications' First Edition; McGraw Hill Education, 2017
9. K. M. Lynch & F. C. Park,' Modern Robotics: Mechanics, Planning, and Control' First Edition; Cambridge University Press, 2017.

Online Reference:

7. https://nptel.ac.in/courses/122106025
8. ABB RobotStudio: https://new.abb.com/products/robotics/robotstudio/downloads
9. https://robodk.com/

Skill Enhancement Courses (SEC)

IA/SEC/T/250: Internet Of Things

Total Credits : 01 **Total Contact Hours : 15 Hrs**
Maximum Marks : 50

Learning Objectives of the Course:

To provide students with:

1.To introduce students with building blocks of Internet of Things (IoT) and their characteristics.
2. To provide students with basic knowledge of connectivity technologies employed across IOT domain
3. To acquaint students with basic traits of IOT based system design

Course Outcomes (COs) :

On completion of the course, students should be able to -

1.Describe the basic connectivity technologies in IOT
2. Compare physical and logical design of IOT, IOT model specifications
3. Explain role of IOT in industry, agriculture and other sectors

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H

Module No.	Course Content	Contact Hours
I	**Foundation of IOT** Origin of terminology, IOT market share, evolution of connected devices, modern day IOT applications, baseline technologies. IOT resulting in address crunch, connectivity terminologies, IOT network configurations; Sensors- features, classes, types, Sensorial Deviations; Actuators- types-hydraulic, pneumatic, thermal, electrical and mechanical; Basics of IOT networking: IoT Components, IoT Interdependencies	05 Hrs
II	**Connectivity Technologies** 6LoWPANs, RPL routings, RFID, MQTT, SMQTT, CoAP, XMPP, AMQP; Communication Protocols: IEEE 802. 15.4, Zigbee, 6LoWPAN, Wireless HART, Z-Wave, ISA 100, Bluetooth, NFC, RFID	05 Hrs
III	**IOT Platforms and Design Methodology** Purpose and requirement specification, process specification, domain model specification, information model specification, service specification, IoT level specification, functional view specification, operational view specification, device and component integration, application developments; Case studies	05 Hrs

Text Books:

1. A. Bahga, V. Madisetti, *Internet of Things: A Hands-On Approach*, 1st Edition, Universities Press, 2014.
2. M. Milenkovic, *Internet of Things: Concepts and System Design*, 1st Edition, Springer, 2020.

Reference Books:

1. D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, J. Henry, *IoT Fundamentals: Networking Technologies, Protocols, and Use Cases*, 1st Edition, Cisco Press, 2017.
2. S. Ziegler, R. Radócz, A. Q. Rodriguez, S. N. M. Garcia (Eds.), *Springer Handbook of Internet of Things*, 1st Edition, Springer, 2023.
3. M. Alam, K. A. Shakil, S. Khan (Eds.), *Internet of Things: Concepts and Applications*, 1st Edition, Springer, 2020.

Online Reference:

1. https://nptel.ac.in/courses/106105166

IA/SEC/P/276: Internet of Things Lab

Total Credits : 01 **Total Contact Hours : 30 Hrs**
Maximum Marks : 50

Learning Objectives of the Course:

1. To provide students with an understanding of the fundamentals of IOT.
2. Operating and programming industrial IOT basic operations with ESP8266.

Course Outcomes (COs) :

On completion of this course, students should be able to –

1. Configure and program IoT boards (NodeMCU/ESP32) for basic input–output operations.
2. Interface sensors and actuators using Arduino IDE and perform real-time data acquisition.
3. Implement IoT communication using MQTT and cloud dashboards for real-time data publishing and monitoring.

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H										H	M	M	
CO2	H	H	H										H	M	M	
CO3	H	H	H										H	M	M	

At least six experiments have to be performed.

1. Study of NodeMCU / ESP32 Development Board Pin configuration,Power supply,GPIO, ADC, PWM
2. Installation and Setup of Arduino IDE Library installation, Board manager setup
3. Blink LED using IoT Board (NodeMCU/ESP32): Digital output control
4. Interface Temperature Sensor (LM35/DHT11/DHT22): Displaying temperature & humidity on Serial Monitor
5. Interfacing LDR Sensor for Light Measurement: ADC reading and LED control
6. Interfacing Ultrasonic Sensor (HC-SR04),Distance measurement
7. Interfacing Gas Sensor (MQ-2/MQ-135),Smoke / pollution detection
8. Interfacing Relay Module for AC/DC Load Control using IoT board
9. Interfacing DC Motor or Servo Motor: PWM speed control (DC) / angle control (Servo)
10. Interfacing Buzzer for Alert Notification
11. MQTT-based IOT experiment using MQTT Dashboard ,Publishing sensor data
12. IOT Virtual Labs: https://iot-amrt.vlabs.ac.in/List%20of%20experiments.html

IA/SEC/T/251 : SCADA

Total Credits : 01 **Total Contact Hours : 15 Hrs**
Maximum Marks : 50

Learning Objectives of the Course:

To provide students with:

1. fundamentals and evolution of SCADA systems and their industrial role.
2. introductory explanation of SCADA hardware, software, and communication architectures.
3. Concepts of SCADA protocols, LAN integration, and application case studies.

Course Outcomes (COs) :

On completion of the course, students should be able to -

1. Explain the evolution, structure, and essential components of SCADA systems.
2. Describe SCADA communication principles, hardware configuration, and data flow.
3. Illustrate the functions of SCADA software, protocols, and typical industry applications.

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	H								H	H	H	H
CO2	H	H	H	H	H								H	H	H	H
CO3	H	H	H	H	H								H	H	H	H

Module No.	Course Content	Contact Hours
I	**Introduction to SCADA Systems** Definition, Purpose and Evolution of SCADA; Concept of Telemetry and Data Acquisition; Hierarchical Structure and Components — Field Devices, RTUs, Master Stations; Comparison: SCADA vs DCS vs PLC; Smart Instruments and IEDs; Benefits of SCADA in Automation.	05 Hrs
II	**SCADA Hardware, Communication and Protocols** SCADA Architecture; RTU and Master Station Design; Communication Media (Landlines, Modem, Fiber, Radio, Ethernet); LAN and Internet-based SCADA; Overview of Communication Protocols — Modbus, DNP3, IEC 60870-5, CSMA/CD; Noise, Interference and Shielding Concepts.	05 Hrs
III	**SCADA Software, Human–Machine Interface and Applications** SCADA Software Components — I/O Server, Database, Alarm & Trend System, Reporting; HMI Design, Alarming and Display Concepts; Data Acquisition Cycle and Redundancy; Case Studies — Power Distribution, Process Industries, and Water Systems; Web-based and IoT-enabled SCADA Trends.	05 Hrs

Text Books:

1. David Bailey & Edwin Wright, Practical SCADA for Industry, First Edition, Elsevier / IDC Technologies, 2003.
2. Stuart A. Boyer, SCADA: Supervisory Control and Data Acquisition, Fourth Edition, ISA / Toaz Publications, 2023.

Reference Books:

10. Gordon Clarke & Deon Reynders, 'Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems', First Edition, Newnes / Elsevier, 2004.
11. Frank Lamb, Industrial Automation: Hands-On Approach, McGraw-Hill Education, First Edition, 2013.

Online Reference:

10. Ignition, Siemens, and Schneider Electric SCADA Documentation.
11. https://nptel.ac.in/courses/108106022

IA/SEC/P/277- SCADA LAB

Total Credits : 01 **Total Contact Hours : 30 Hrs**
Maximum Marks : 50

Learning Objectives of the Course:

1. To provide students hands-on experience with SCADA installation, setup and configuration.
2. To provide students with first-hand experience on interfacing of SCADA to PLCs/devices, create tags, monitor/control data.
3. To equip students with basic concepts of designing HMI screens, create alarms/trends/reports, and interface I/O.

Course Outcomes (COs) :

On completion of this course, students should be able to –

4. Install and configure standard SCADA and link with PLCs/devices.
5. Create tags, HMI screens, I/O channels and real-time monitoring using Ignition.
6. Implement alarms, trends, and data logging in SCADA environment.

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H									H	M	M	
CO2	H	H	H	H									H	M	M	
CO3	H	H	H	H									H	M	M	

At least six experiments have to be performed

1. Installation of Ignition SCADA, setup project workspace.
2. Connection of Ignition to a PLC (e.g., Siemens S7-1200 or Micrologix) and tag creation.
3. Create HMI screens: start/stop controls, status indicators, analog value display.
4. Configure alarms and event handling in Ignition SCADA.
5. Configure trend logging and historical data display.
6. Configure report generation and dashboard export.
7. Interface SCADA with digital I/O channels: read/write from PLC.
8. Interface SCADA with analog I/O and display values with graphics.
9. Develop data analytics: simple dashboards, graphs, KPI indicators in Ignition.
10. Simulated industrial control scenario: conveyor sort system or water tank system — integrate PLC, SCADA screens, alarms, I/O and logging.

Mini Project (Mandatory):

Title: Design and Implement a SCADA Monitoring & Control System for a Simulated Process
Objective: Integrate PLC (real or simulated) with Ignition SCADA; create tags, HMI screens, alarms/trends, I/O control, logging & dashboard; document the implementation and present a demo.

Deliverables: Project report, SCADA project file/screenshots, demo session.