



Shri Vile Parle Kelavani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

(Empowered Autonomous) Affiliated to the University of Mumbai



Department of Electronics & Telecommunication Engineering

Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

DJS23 HONORS Syllabus

Semester VI

w.e.f. AY 2026-27



Shri Vile Parle Kelavani Mandal S

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

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DJS23 Scheme for Third Year for Honor/Minor Degree for Second year Undergraduate Program in Electronics and Telecommunication Engineering(Honors) : Semester VI (Autonomous)
(Academic Year 2026-27)

Sr	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment (B)						Aggregate (A+B)	Credits Earned	
			Theory (Hrs)	Practical (Hrs)	Tutorial (Hrs)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Term Test 3 (TT3)	Term Test Total (TT1 + TT2 + TT3)	Termwork	CA Total (B)			
Honors in Artificial Intelligence and Machine Learning																					
1	DJS23EH1351	Deep Learning	3	--	--	3	2	60	--	--	--	60	15	15	10	40	--	100	100	3	4
2	DJS23EH1351L	Deep Learning Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	--	25	25	50	1	
	Total		3	2	--	4	4	60	25	--	--	85	15	15	10	40	25	125	150	4	

Honors in IoT & NextGen Networks																					
1	DJS23EH2351	Industrial IoT and Industry 4.0	3	--	--	3	2	60	--	--	--	60	15	15	10	40	--	100	100	3	4
2	DJS23EH2351L	Industrial IoT and Industry 4.0 Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	--	25	25	50	1	
Total			3	2	--	4	4	60	25	--	--	85	15	15	10	40	25	125	150	4	

Honors in VLSI Design																					
1	DJS23EH3351	Analog VLSI	3	--	--	3	2	60	--	--	--	60	15	15	10	40	--	100	100	3	4
2	DJS23EH3351L	Analog VLSI Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	--	25	25	50	1	
Total			3	2	--	4	4	60	25	--	--	85	15	15	10	40	25	125	150	4	

Honors in Robotics & Automation																					
1	DJS23EH4351	PLC and Applications	3	--	--	3	2	60	--	--	--	60	15	15	10	40	--	100	100	3	4
2	DJS23EH4351L	PLC and Applications Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	--	25	25	50	1	
Total			3	2	--	4	4	60	25	--	--	85	15	15	10	40	25	125	150	4	

Prepared by:
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Prof Sheeja Nair

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Vice Principal

Dr. Hari Vasudevan
Principal



Honors in Artificial Intelligence & Machine Learning		
Program: Electronics and Telecommunication Engineering		Semester: VI
Course: Deep Learning (DJS23EH1351)		
Course: Deep Learning Laboratory (DJS23EH1351L)		

Pre-requisite:

1. Mathematics for AIML (DJS23EH1201)
2. Artificial Intelligence (DJS23EH1251)
3. Machine Learning (DJS23EH1301)

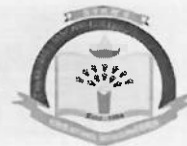
Course Objectives:

1. Understand the concepts, architectures, and mathematics of deep learning.
2. Learn to design, train, and evaluate neural networks for various tasks.
3. Explore deep architectures like CNNs, RNNs, Auto encoders, and GANs.
4. Implement neural networks using Tensor Flow/PyTorch frameworks.
5. Apply deep learning techniques in applications like image, signal, and speech processing.

Outcomes: Upon completion of the course, students will be able to:

1. Explain the working and components of neural networks.
2. Implement and train neural networks using optimization and regularization methods.
3. Design and analyse CNNs for image-based applications.
4. Apply RNNs for sequence and time-series data processing.
5. To design and implement recurrent and auto encoder-based deep learning models for sequential data, speech, and signal processing applications.
6. Employ advanced deep learning frameworks to solve engineering problems.

Deep Learning (DJS23EH1351)		
Unit	Description	Duration
1	Introduction to Deep Learning and Neural Networks Introduction to AI, ML, and DL; Evolution of Deep Learning, Biological vs Artificial Neural Networks, Structure and working of a Perceptron Activation Functions (Sigmoid, Tanh, ReLU, Leaky ReLU, Softmax) Applications of Deep Learning (Speech, Image, Signal Processing).	06
2	Multilayer Networks and Training Algorithms: Architecture of Multi-Layer Perceptron (MLP), Forward Propagation, Loss Functions (MSE, Cross-Entropy), Gradient Descent and Backpropagation Algorithm, Overfitting and Under fitting.	07
3	Optimization and Regularization: Optimization Algorithms: SGD, Momentum, RMS Prop, Adam, Regularization Techniques: L1, L2, Dropout, Batch Normalization, Early Stopping Hyper parameter Tuning Implementation using Tensor Flow / PyTorch.	06



4	Convolutional Neural Networks (CNNs) Convolution and Pooling Operations, CNN Architecture and Layers, Image Classification and Feature Extraction, Popular CNN Models: LeNet, AlexNet, GG, ResNet, Transfer Learning and Fine-tuning.	07
5	Recurrent Neural Networks and Auto encoders Sequential Modelling Concepts, Recurrent Neural Networks (RNNs), Vanishing Gradient Problem, LSTM and GRU Networks, Auto encoders, Denoising Auto encoders, Sparse Auto encoders, Applications in Speech and Signal Processing.	07
6	Advanced and Emerging Deep Learning Techniques Generative Models: Variational Auto encoders (VAE), Generative Adversarial Networks (GANs), Attention Mechanism and Transformers, Vision Transformers (ViT), Reinforcement Learning Overview, Case Studies and Mini Project Discussion.	06
Total		39

Deep Learning Laboratory (DJS23EH1351L)

Exp.	Suggested Experiment List
1	Implementation of different Activation functions and Cost functions in Neural Network.
2	Implementation of different learning rules in MLP.
3	Implementation of Feed Forward networks in a Multilayer Perceptron.
4	Build a three-layer Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
5	Implementation of Curve Fitting with Deep Neural Networks.
6	Binary Planar data classification with Deep Neural Networks.
7	Handwritten digit—Multiclass classification with Deep Neural Networks.
8	Image Classification with Convolution Neural networks.
9	Audio Classification with Convolution Neural networks.
10	Prediction of a data sequence with simple Recurrent Neural Network.
11	Language Modelling and Generating Text with RNN
12	Handwriting Recognition with LSTM
13	Data Compression with Auto encoders.
14	Data Denoising with Auto encoders.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Self-Learning Plan:

The subject teacher will identify the self-learning topics and ensure that students develop a deeper understanding of their relevance to industry and society. Further, the details of the self-learning activity, assessment methods, and rubrics will be provided in the self-learning plan of the course.



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Books Recommended:

1. Ian Goodfellow, *Yoshua Benjio*, "Deep Learning", Alanna Maldonado Publications, 1st Edition, 2023.
2. Jon Krohn, Grant Beyleveld, "Deep Learning Illustrated", Pearson Education, 1st Edition, 2020.
3. *Neural Networks and Deep Learning* – Charu C. Aggarwal (Springer).

Reference Books:

1. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Recognition", Wiley, 2nd Edition, 2021.
2. Francois Chollet, "Deep Learning with Python", Manning Publications, 2nd Edition, 2022.
3. *Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow* – Aurélien Géron (O'Reilly)
4. Deep Learning by Prof. Prabir Kumar Biswas | IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc20_cs62/preview
5. Deep Learning - IIT Ropar By Prof. Mitesh M. Khapra, Prof. Sudarshan Iyengar | IIT Madras, IIT Ropar
https://onlinecourses.nptel.ac.in/noc25_cs106/preview
6. Neural network and Deep Learning <https://www.coursera.org/learn/neural-networks-deep-learning>

Prepared by

Checked by

Head of the Department

Principal



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Program: Electronics and Telecommunication Engineering Honors in IoT and 5G Technology	T. Y. B. Tech	Semester: VI
Course: Industrial IoT and Industry 4.0	Course Code: DJS23EH2351	
Course: Industrial IoT and Industry 4.0 Laboratory	Course Code: DJS23ELH2351L	

Pre-requisite:

1. IoT System Design (DJS23EH2251)

Objectives:

1. To understand the fundamental concepts, architecture, and applications of Industrial IoT.
2. To explore communication protocols, data acquisition methods, and analytics in IIoT environments.
3. To analyze the implementation of IIoT solutions and the role of edge and cloud computing.
4. To evaluate security and privacy challenges in Industrial IoT applications.

Outcomes: At the end of course, student will be able to:

1. Explain the fundamental concepts, architecture, and applications of Industrial IoT.
2. Describe communication protocols, data acquisition techniques, and data analytics in IIoT
3. Implement IIoT solutions using edge and cloud computing frameworks
4. Assess the security challenges and mitigation strategies in Industrial IoT environments.

Industrial IoT and Industry 4.0 (DJS23EH2351)

Unit	Description	Duration
1	Introduction to Industrial IoT: Overview of IoT and Industrial IoT: Definition of IoT and IIoT, IIoT vs. Traditional IoT, Evolution of Industrial IoT. Scalability and Interoperability Key Technologies and Applications: Smart Manufacturing, Predictive Maintenance, Digital Twins, Asset Tracking and Monitoring Industrial IoT Reference Architecture: Layered Architecture (Edge, Fog, Cloud), Business models of IIoT, IIoT Devices and Sensors, Data Processing and Analytics Layer, Benefits and Challenges of IIoT, Improved Operational Efficiency, Cost Reduction, Data Management and Security Issues.	10
2	IIoT Protocols and Standards: Communication Protocols for IIoT: MQTT (Message Queuing Telemetry Transport), CoAP (Constrained Application Protocol), OPC-UA (Open Platform Communications – Unified Architecture), DDS (Data Distribution Service), Data Acquisition Techniques, Sensor Integration and Data Collection, Signal Conditioning and Calibration, Real-Time Data Acquisition Systems, Edge and Cloud Data Processing, Data Filtering and Aggregation, Edge Analytics for Low Latency, Cloud-Based Data Management, Protocol and Data Mapping, Matching Protocols to Industrial Scenarios, Real-World Examples and Case Studies.	08



3	Data Analytics in IIoT: Role of Data Analytics in IIoT: Necessity of analytics, IIoT analytics, Challenges in Analytics, usefulness of IIoT analytics, Deployment of analytics. Machine Learning and Data Science in Industries: Machine Learning and categorization, Application of ML in Industries, Data science and deep learning, Application of Deep learning in Industries.	08
4	Implementing IIoT Solutions: Healthcare Applications in Industries, Manufacturing Industry, Automotive Industries, Mining Industry Inventory Management and Quality Control.	08
5	Security and Privacy in IIoT: Security Challenges in IIoT Environments: Plant safety and Security: Software Security, Network Security and Mobile Device Security. Best Practices for Secure IIoT Deployment: Regular Security Audits, Secure Firmware and Software Updates, Role-Based Access Control (RBAC).	08
Total		42

Industrial IoT and Industry 4.0 Laboratory (DJS23ELH2351L)

Exp.	Suggested Experiment List
1	Understand IoT fundamentals by setting up a simple IoT device using an Arduino or Raspberry Pi. Implement a simple blink an LED Program, basic functionality.
2	Set up a basic IoT device using a Raspberry Pi or Arduino, and monitor sensor readings like temperature or humidity
3	Interface a DHT11/DHT22 sensor with Arduino/Raspberry Pi, display data on a screen, and control an actuator based on threshold values.
4	Use an Arduino with a temperature sensor to log temperature readings into a CSV file, storing it for later analysis or use in cloud storage.
5	Use a button to turn an LED on and off, simulating basic IoT control through a user interface.
6	Use the Blynk app to control and monitor IoT devices.
7	Set up an MQTT broker and use an Arduino to send temperature readings to the broker. On the cloud side, a simple application can display these readings.
8	Send temperature and humidity data from Arduino or Raspberry Pi to ThingSpeak and visualize it on a live dashboard.
9	Collect temperature data using an IoT device (Arduino/Raspberry Pi), then use Python to calculate the average temperature and plot the data using Matplotlib.
10	Soil moisture monitor and SD card logger
11	Internet/ Intranet based motor speed control
12	Case studies on Manufacturing Industry, Automotive Industry and Mining Industry.
13	Detect a presence of an intruder within a specified area of home and get sound alarm and logging measurement to ThingsSpeak.
14	Control electrical equipment like small pumps, bulb, fan over Intranet and Internet.



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Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Self -Learning Plan:

The subject teacher will identify the self-learning topics and ensure that students develop a deeper understanding of their relevance to industry and society. Further, the details of the self-learning activity, assessment methods, and rubrics will be provided in the self-learning plan of the course.

Books Recommended:

Text books:

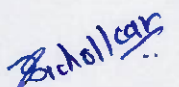
1. Sudip Mishra, Chandana Roy and Anandarup Mukherjee "Introduction to Industrial Internet of Things and Industry 4.0 ", CRC Press, Taylor & Francis Group, 2023.
2. Raj Kamal, " Internet of Things Architecture and Design Principles", Mc Graw Hill Publications, 2nd Edition, 2023.
3. Ismail Butun, "Industrial IoT: Challenges, Design Principles, Applications, and Security", Springer Cham, 2020 Edition.
4. Yashavant Kanetkar, Shrirang Korde, "21 Experiments on Internet of Things(IoT), BPB Publications, 1st Edition, 2018.

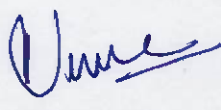
Reference Books:

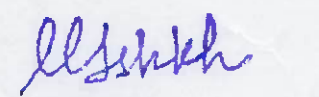
1. Monique J. Morrow, "Next Generation Networks", CISCO Press, 2007.
2. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, "Industrial Internet of Things: Cybermanufacturing Systems", Springer 2016.
3. Arshdeep Bagha, Vijay Madishetti, "Internet of Things- A Hands on Approach", Universities Press, 2015.

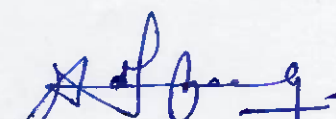
NPTEL courses:

1. nptel.ac.in/courses/106105195.


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Program: Electronics and Telecommunication Engineering Honors in VLSI Design	T. Y. B. Tech	Semester: VI
Course: Analog VLSI	Course Code: DJS23EH3351	
Course: Analog VLSI Laboratory	Course Code: DJS23EH3351L	

Pre-requisite:

1. Electronic Devices & Circuits (DJS23EPC202)
2. Microelectronics (DJS23EH3201)
3. Digital VLSI (DJS23EH3301)

Objectives:

1. To understand CMOS analog circuit design and MOS device modeling.
2. To design and analyze current mirrors and amplifier configurations.
3. To study CMOS operational amplifiers and data converters.

Outcomes: On completion of the course, the learner will be able to:

1. Design and Analyze CMOS current mirror circuits.
2. Design single stage amplifiers based on MOSFET.
3. Design the MOSFET-based differential amplifier and Operational amplifiers.
4. Explain working principles of Data Converters.

Analog VLSI (DJS23EH3351)		
Unit	Description	Duration
1	CMOS Amplifiers building blocks: MOS Models: Necessity of CMOS analog design, Review of characteristics of MOS device, MOS Device capacitances, MOS small signal model, Impact of scaling of MOSFET on analog circuits, MOS SPICE models. Passive and Active Current Mirrors: Current sources, Current mirrors, Cascode current mirrors.	05
2	Single Stage Amplifiers: Amplifier Configurations: Basic concepts, Common source amplifier, Common source stage with resistive load, CS Stage with current source load, CS stage with triode load, CS stage with source degeneration, Source follower, Common gate stage, Cascode Amplifier.	10

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	Current-Mirror Circuits with Improved Performance: Cascode MOS Mirrors, The Wilson Current Mirror, The Wilson MOS Mirror, The Widlar Current Source.	
3	Differential Amplifiers: MOS Differential Pair: Single ended and differential operation, Operation with a Common-Mode Input Voltage, Operation with a Differential Input Voltage, Large-Signal Operation, Small-Signal Operation, Differential Amplifier with Current-Source Loads, Cascode Differential Amplifier, Input Offset Voltage of the MOS Differential Amplifier. The Differential Amplifier with a Current-Mirror Load: Differential to Single-Ended Conversion, Current-Mirror-Loaded MOS Differential Pair, Differential Gain of the Current-Mirror-Loaded MOS Pair, Common-Mode Gain and CMRR.	09
4	MOS Operational Amplifiers: Op-amp Design: The Two-Stage CMOS Op Amp, The Circuit, Input Common-Mode Range and Output Swing, Voltage Gain, Common-Mode Rejection Ratio (CMRR), Frequency Response, Slew Rate, Power-Supply Rejection Ratio (PSRR), Bias Circuit for the Two-Stage CMOS Op Amp. Folded-Cascode CMOS Op Amp: The Circuit, Input Common-Mode Range and Output Swing, Voltage Gain, Frequency Response, Slew Rate.	09
5	Data converters: Sampling of Analog Signals, Signal Quantization, The A/D and D/A Converters as Functional Blocks. D/A Converter Circuits: Basic Circuit Using Binary-Weighted Resistors, R-2R Ladders. A/D Converter Circuits: The Feedback-Type Converter, The Dual-Slope A/D Converter, The Parallel or Flash Converter.	09
	Total	42

Analog VLSI Laboratory (DJS23EH3351L)

Exp.	Suggested Experiment List
1	To study trans-conductance plots of MOSFET device (voltage bias, current bias and technology bias).
2	To design of single stage amplifier.
3	To design of cascode amplifier.
4	To design of basic current sink.
5	To design current sink by using negative feedback resistor.
6	To design of cascode current sink.
7	To design of positive feedback boot strap current sink.



8	To design of regulated cascode current sink.
9	To design of simple current mirror.
10	To design of Wilson current mirror.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Self -Learning Plan:

The subject teacher will identify the self-learning topics and ensure that students develop a deeper understanding of their relevance to industry and society. Further, the details of the self-learning activity, assessment methods, and rubrics will be provided in the self-learning plan of the course.

Books Recommended:

Text books:

1. P. E. Allen and D. R. Holberg, "*CMOS Analog Circuit Design*", Oxford University Press, 3rd Edition, 2011.
2. Sedra Smith, "*Microelectronic Circuits*", Oxford university press, 5th Edition, 2011.
3. B Razavi, "*Design of Analog CMOS Integrated Circuits*", Tata McGraw Hill, 2nd Edition, 2017.

Reference Books:

1. D. Neamen, D. Biswas, "*Semiconductor Physics and Devices*", McGraw-Hill Education, 4th Edition, 2017.
2. N. Weste and D. Harris, "*CMOS VLSI Design. A Circuits and Systems Perspective*", Pearson Education India, 4th Edition, 2015.
3. Gray, Meyer, Lewis, Hurst, "*Analysis and design of Analog Integrated Circuits*", Willey, 5th Edition, 2009.
4. Mohammed Ismail and Terri Faiz, "*Analog VLSI Signal and Information Process*", McGraw-Hill Book company, 1st Edition, 1994.

NPTEL Courses Suggested:

<https://nptel.ac.in/courses/117101105>

https://www.cdeep.iitb.ac.in/vod/vodCloud/course_intra.php?ccode=296&referSrc=57dc9eb7be985a0e14aaa07846b0b9b4

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Program: Electronics and Telecommunication Engineering	T. Y. B. Tech	Semester: VI
Course: PLC and Applications	Course Code: DJS23EH4351	
Course: PLC and Applications Laboratory	Course Code: DJS23EH4351L	

Pre-requisite:

1. Sensors & Instrumentation (DJS23EH4201)
2. Basics of Control Systems (DJS23EH4251)
3. Microcontroller and Applications (DJS23EPC253)
4. Digital System Design (DJS23EPC203)

Objectives:

1. To understand the fundamentals of industrial automation systems, automation hierarchy, and various industrial automation components.
2. To study the architecture, hardware components, memory organization, input/output interfacing, and industrial applications of PLC systems.
3. To develop ladder logic programs using PLC programming for industrial control applications.
4. To implement PLC-based industrial automation applications such as motor control, traffic light systems, through practical laboratory experiments.
5. To design and interface Human Machine Interface (HMI) systems with PLCs for industrial monitoring, visualization, troubleshooting, and communication.

Outcomes: At the end of course, student will be able to:

1. Understand industrial automation systems and PLC fundamentals.
2. Configure PLC hardware, I/O modules, and communication interfaces.
3. Develop ladder logic programs using PLC instructions.
4. Implement PLC-based industrial automation applications.
5. Design and interface HMI systems with PLC for monitoring and control.

PLC and Applications (DJS23EH4351)		
Unit	Description	Duration
1	Introduction to Industrial Automation: Needs and Benefits, Automation Hierarchy, Basic Components of Automation System, Types of Automation System, Fixed, Programmable, Flexible. Strategies of Automation, Factory Process Automation, Systems for Industrial Automations, PLC, HMI, SCADA, DCS.	08
2	Programmable Logic Controller: PLC Fundamentals, Introduction, Block Diagram, PLC Components, CPU, Memory Organization, I/O Modules (Discrete and Analog), Power Supply, Fixed and Modular PLC and their types, I/O Module Selection Criteria, Interfacing different I/O devices with appropriate I/O modules, Various Industrial PLCs, Allen-Bradley, MicroLogix 1400 series B, Siemen PLC, Delta PLC etc.	10



3	PLC Programming: PLC Programming Language, Functional Block Diagram(FBD), Instruction List, Structured Text, Sequential Function Chart (SFC), Ladder Programming. Programming Software, Bootp, RS Linux, RS Logics for Allen-Bradley and TIA for Siemens PLC. PLC Programming Instructions, I/O Addressing, Relay Type Instructions, Timer Instructions, Counter Instructions, Logical and Arithmetic Instructions, Comparison and Data Handling Instructions. Ladder Logic Programming based on relay, timer, counter, logical, comparison, arithmetic.	10
4	PLC-based applications: Motor sequence control, traffic light control, tank level control, conveyor system, elevator control, stepper motor control, and reactor control. Case study: Electric power transmission and distribution, EV manufacturing process, Gas pipeline transmission control and monitoring.	06
5	Human-Machine Interface (HMI): Introduction, Basic block diagram, Communication to PLC, Wecom HMI, Tags, Alarms, Trends, Data log, Screen animation, Download Upload the programs. HMI software: Introduction to PI Studio, Fault finding troubleshooting. Communication standard, DF1, Ethernet, DH45, RS485, Profibus, MODBUS, RTU.	08
Total		42

PLC and Applications Laboratory (DJS23EH4351L)

Exp.	Suggested Experiment List
1	Identify various parts and front panel status indicators of the given PLC.
2	Establish communication between PLC and Server for controlling and monitoring.
3	To study LCD and keypad of the programmable logic controller.
4	To study PLC input/output modules and its components.
5	To study PLC instructions used for ladder programming.
6	To verify set and reset operation of LAMP.
7	Implementation of ladder logic program for PLC.
8	Implementation of ladder logic diagram using timer.
9	Basic Ladder Logic Programming using NO and NC Contacts
10	Motor ON/OFF Control using PLC
11	To study human machine interface (HMI) used in Industrial Automation
12	Traffic Light Control System using PLC
13	Staircase Lighting Control using PLC
14	Water Tank Level Control System
15	Conveyor Belt Control using PLC
16	PLC Based Industrial Alarm System



17	Creation of Basic HMI Screens
18	PLC and HMI Communication Setup

Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Self -Learning Plan:

The subject teacher will identify the self-learning topics and ensure that students develop a deeper understanding of their relevance to industry and society. Further, the details of the self-learning activity, assessment methods, and rubrics will be provided in the self-learning plan of the course.

Books Recommended:*Textbooks:*

1. Frank D. Petruzella, "*Programmable Logic Controllers*", McGraw-Hill, 5th Edition, 2016.
2. John W. Webb & Ronald A. Reis, "*Programmable Logic Controllers: Principles and Applications*", Pearson Education, 5th Edition, 2013.
3. Madhuchhanda Mitra & Samarjit Sen Gupta, "*Programmable Logic Controllers and Industrial Automation*", Penram International Publishing, 1th Edition, 2005.
4. WECON Technology, "*HMI programming and visualization practice, software manuals*", Wecon Tech, 5th Edition, 2020.

Reference Books:

1. Samuel M. Herb, "*Understanding Programmable Logic Controllers*", Delmar Publishers, 5th Edition, 2018.
2. Rockwell Automation, "*MicroLogix 1400 Programmable Controllers User Manual*", Rockwell Automation, 9th Edition, 2020.
3. Thomas A. Hughes, "*Programmable Controllers, HMI and SCADA*", ISA Publications, 1st Edition, 2007.
4. Richard Zurawski, "*Industrial Communication Technology*", CRC Press, 2nd Edition, 2014.

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