Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY, BANGALORE – 560056

(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi)

Department of Electrical and Electronics Engineering

Aided By Govt. of Karnataka

Skill Laboratory Report

"programmable Logic controller and its applications".

First-Year Students (Batch: 2025)

Date: 06/04/2026 to 11/04/2026

Venue: Electrical Machines Laboratory, Logic Design Laboratory and A-214

Company: Harvesters Desk Bengaluru

Resource Persons: 1. Mr. Arunkumar V, Project Engineer 2. Mr. Jayanth Narendra Project Engineer 3. Mr. Chandrashekara.N Project Engineer

Faculty: 1. Dr.Umadevi.D Assistant Professor 2. Mrs. Dhanyavathi.A Assistant Professor

Instructor: Prabhu Swamy.J

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Coordinator(s):	HOP	HOS
Dr. Mukundaswamy. MS	Dr.Arpitharaju B	Dr. Govindaraju HV

AY 2026

Brief Overview

The Skill Lab on *Programmable Logic Controller (PLC) and its Applications* is designed to provide 2nd semester EEE students with fundamental knowledge and practical exposure to industrial automation. This training introduces the basic concepts of PLC, its architecture, working principles, and programming techniques. Students will gain hands-on experience in wiring, configuring, and programming PLCs to control real-time systems such as motors, lights, and simple automation processes. The lab emphasizes bridging theoretical knowledge with industrial practices, preparing students for modern automation environments.

Objectives

- To understand the basic structure and working of a PLC system.
- To learn different PLC programming methods, especially ladder logic.
- To develop skills in wiring input/output devices with PLC hardware.
- To implement simple control circuits using PLC programs.
- To gain hands-on experience in troubleshooting and debugging PLC systems.
- To understand real-time industrial applications of PLC in automation.
- To enhance practical knowledge and prepare for industry-oriented skills in electrical engineering.

Impacts of the Skill Lab – PLC and Its Application

The Skill Lab on PLC and its applications has significantly enhanced students' practical understanding of industrial automation systems. It helped bridge the gap between theoretical concepts and real-world applications by providing hands-on experience in PLC programming, wiring, and troubleshooting.

Students developed problem-solving skills by designing and implementing basic control circuits using ladder logic. The training improved their confidence in handling automation equipment and understanding industrial processes such as motor control and sequential operations.

The lab also increased awareness of modern automation technologies used in industries, thereby improving employability and technical readiness. Additionally, it strengthened teamwork, analytical thinking, and safety practices while working with electrical systems.

Overall, the Skill Lab contributed to building a strong foundation in PLC-based automation and prepared students for future advanced learning and industry requirements.

Day 1 – Activity

Session 1:

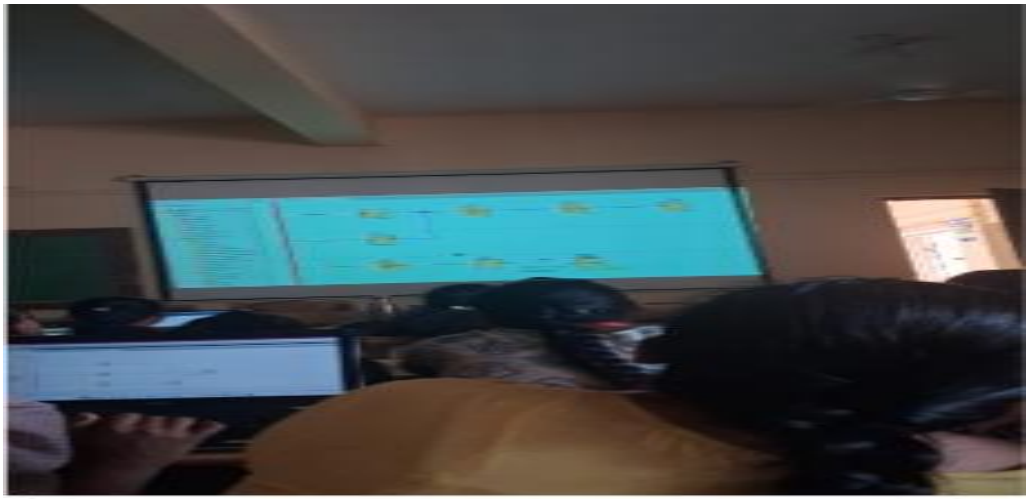
The session focused on essential electrical safety practices and accident prevention. It highlighted precautionary measures during installation and maintenance work, including the use of PPE, proper power isolation, and adherence to standard operating procedures. Protection systems such as fuses, circuit breakers, and relays were explained, along with protection against faults like overcurrent, short circuits, and earth leakage. Basic training on electrical shock treatment and first aid, including CPR and safe power disconnection, was also provided. Additionally, earthing methods like plate and pipe earthing were introduced to ensure safe fault current dissipation and reduce shock risks.

Session 2:

This session explained how electrical supply is received from the pole through service lines to the meter board. It covered the role of protective devices such as service fuses installed before the energy meter. The function of the energy meter in recording electricity consumption for billing was discussed. The flow of power from the meter board to the distribution board was explained, along with how the distribution board supplies electricity to different circuits using safety devices like MCBs and RCDs.

Session 3:

The final session reinforced the concept of electrical power flow from the pole to the meter board and then to the distribution board. It emphasized the role of service fuses for protection, the function of the energy meter, and the distribution of power to various circuits. The importance of MCBs and RCDs in protecting against overloads and electrical faults was also highlighted.



Skill Laboratory Title "PLC and its Applications", for 2nd Semester EEE Department
Dr. AIT Bengaluru-56.

Suggestions for Improvement of the Skill Lab – PLC and Its Application

- Increase the number of PLC kits and hardware components to ensure better hands-on practice for all students.
- Incorporate more real-time industrial case studies and practical applications to enhance understanding.
- Provide advanced training modules covering topics like SCADA, HMI, and industrial networking.
- Allocate more lab hours to allow sufficient time for practice, troubleshooting, and project work.
- Organize industry visits or guest lectures from automation experts to give practical exposure.
- Ensure proper maintenance and regular updating of lab equipment and software.
- Introduce mini-projects or group-based assignments to encourage teamwork and innovation.
- Provide additional learning resources such as manuals, video tutorials, and simulation software.
- Conduct regular assessments and feedback sessions to monitor student progress and improve learning outcomes.

Day 2

Session: 1

i) Lighting Circuit

- Supplies power to lights and fans.
- Uses low current and smaller wires.
- Controlled by switches and protected by MCB/fuse.

ii) Heating Circuit

- Supplies power to high-load appliances (heater, geyser).
- Uses high current and thicker wires.
- Separate circuit with higher rating protection.

Session: 2

Fluorescent Tube Light Wiring

- Uses choke (ballast), starter, and tube light.
- Starter initiates glow; choke regulates current.

LED Tube Light Wiring

- Direct connection with driver (no choke/starter).
- Energy efficient and low power consumption.

2-Way Staircase Wiring

- Two switches control one light from different locations.
- Commonly used in staircases and corridors.

Serial Set Wiring

- Lamps connected in series.
- Same current flows; voltage divides across lamps.

Electrical Drawing (2BHK & 3BHK)

- Shows layout of lighting, fan, and power circuits.
- Indicates switchboards, wiring paths, and distribution board connections.

Session: 3

PLC Programming (IEC 61131-3)

- Standard for PLC programming languages.
- Includes Ladder Diagram, Function Block, Structured Text, etc.

Ladder Logic

- Graphical programming based on relay logic.
- Uses contacts and coils for control operations.

Data Types & Data Storage

- Includes BOOL, INT, REAL, TIMER, COUNTER.
- Data stored in memory areas like registers and data blocks.

PLC Hardware Setup

- Consists of CPU, input/output modules, power supply.
- Interfaces sensors (inputs) and actuators (outputs).

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Challenges of Conducting Skill Lab – PLC and Its Application

- Limited availability of PLC kits and hardware components, leading to reduced individual practice.
- High cost of PLC equipment, maintenance, and software licenses.
- Insufficient lab time to cover both theory and hands-on training effectively.
- Variation in students' prior knowledge, making it difficult to maintain a uniform learning pace.
- Technical issues such as hardware faults, wiring errors, or software glitches.
- Lack of exposure to real-time industrial environments and applications.
- Need for trained instructors with expertise in PLC programming and industrial automation.
- Difficulty in troubleshooting complex programs for beginners.
- Power supply interruptions affecting continuous practical sessions.

Day: 3

Session: 1

Programmable Logic Controller (PLC) automation is widely used in industrial systems to control machinery and processes efficiently. A PLC is a digital computer designed for automation of electromechanical processes such as motor control, assembly lines, and material handling systems.

In this report, the basic architecture of a PLC, including input/output modules, CPU, power supply, and programming devices, is studied. PLCs are programmed using languages such as Ladder Logic, which is easy to understand and resembles electrical relay circuits.

The report demonstrates how PLC automation improves reliability, accuracy, and flexibility in industrial operations. Various applications such as motor start/stop control, interlocking systems, and sequential operations are implemented using PLC programming.

Overall, PLC automation reduces manual intervention, enhances safety, and increases productivity in industries, making it an essential component of modern automation systems.

Session: 2

Components of an industrial control system

An industrial control system (ICS) is used to monitor and control industrial processes efficiently and safely. It consists of several key components that work together to ensure smooth operation.

The main components include **sensors**, which detect physical parameters such as temperature, pressure, and level, and **transducers**, which convert these measurements into electrical signals. These signals are sent to the **controller**, typically a Programmable Logic Controller (PLC), which processes the input data and makes decisions based on the programmed logic.

The **actuators** are responsible for carrying out control actions, such as operating motors, valves, and relays. The system also includes **Human Machine Interface (HMI)**, which allows operators to monitor system status and control processes visually.

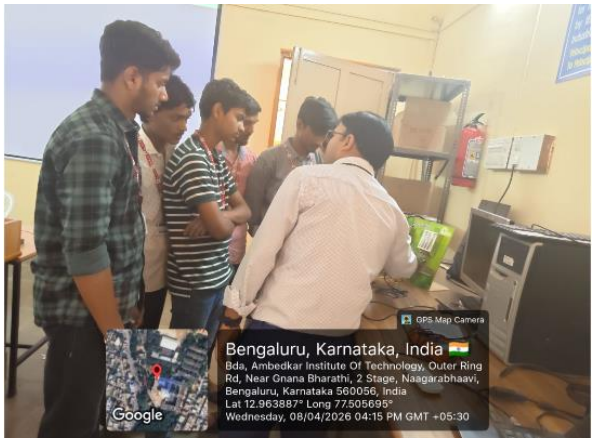
Communication systems like industrial networks enable data exchange between components, while **power supply units** provide the necessary electrical energy for operation.

Overall, these components work together to achieve accurate control, automation, and improved efficiency in industrial processes.

Session: 3

Sensor interfacing with PLC Object detection automation Sorting system application

Sensor interfacing with PLC enables real-time data input using devices like proximity and photoelectric sensors. In object detection, sensors identify items and send signals to the PLC for control actions. In sorting systems, the PLC processes sensor inputs and directs actuators to separate objects automatically, improving efficiency and accuracy.



Details of Hands-on Activities – Skill Lab: PLC and Its Application

The Skill Lab involved a series of practical activities aimed at developing hands-on skills in PLC programming and industrial automation.

- **Introduction to PLC Hardware:**
  Students identified and studied different parts of the PLC such as CPU, input/output modules, power supply, and communication ports.
- **Wiring of Input and Output Devices:**
  Practical sessions were conducted on connecting switches, push buttons, sensors (inputs), and loads like lamps, relays, and motors (outputs) to the PLC.
- **Basic PLC Programming:**
  Students learned ladder logic programming using PLC software and created simple programs like ON/OFF control of lamps using push buttons.
- **Implementation of Logic Functions:**
  Activities included programming basic logic operations such as AND, OR, NOT using ladder diagrams.
- **Timer and Counter Operations:**
  Hands-on exercises were performed using timers and counters to control operations like delay, sequencing, and counting events.
- **Motor Control Applications:**
  Students implemented PLC-based motor control circuits such as start/stop control and forward/reverse operation.
- **Troubleshooting and Debugging:**
  Training was provided on identifying and correcting errors in wiring and PLC programs.
- **Mini Projects:**
  Students worked on simple automation projects such as traffic light control, water level control, or sequential lighting systems.

Day 4

Session: 1

PLC Programming (IEC 61131-3)

- International standard for PLC programming languages.
- Defines languages like Ladder Diagram (LD), Function Block Diagram (FBD), and Structured Text (ST).
- Ensures uniformity, portability, and easy maintenance of programs.
- Supports efficient control of industrial automation processes.

Session: 2

Timers, Counters & Math Operations

- Timers provide time delay functions (ON delay, OFF delay).
- Counters count events (up/down counting).
- Math operations perform calculations (addition, subtraction, etc.) in PLC.

Liquid Level Control in a Tank

- Uses level sensors to monitor liquid level.
- PLC controls inlet/outlet valves or pumps.
- Maintains desired level and prevents overflow/dry run.

Primary–Backup Pump System

- Two pumps used for reliability and continuous operation.
- One pump works as main, the other as standby.
- Backup pump starts automatically if primary fails.

Session: 3

Conveyor Delay Control System

- Uses timers to introduce delay in conveyor operation.
- Controls start/stop sequence for smooth material handling.

Timer-Based Automation

- Automation based on preset time intervals.
- Used for sequential operations and process control.

Counter Simulation

- Counts number of objects/events using PLC logic.

- Used for monitoring production and batch control.

Day 5

Session:1

HMI and SCADA

Human Machine Interface (HMI) and Supervisory Control and Data Acquisition (SCADA) are essential systems used in industrial automation for monitoring and control. HMI provides a graphical interface that allows operators to interact with machines, view process data, and control operations easily.

SCADA is a centralized system that collects data from multiple devices such as PLCs and sensors, and enables remote monitoring and control of industrial processes. It also supports data logging, alarm management, and real-time visualization.

Together, HMI and SCADA improve system efficiency, enhance operator control, and ensure safe and reliable industrial operations.

Session: 2

Elements, Text fields, Alarm creation demo Adding Buttons, Lamps, Attaching tags

This report covers the basic elements used in HMI/SCADA design. Elements such as text fields are used to display system information and process values clearly to the operator.

Alarm creation is demonstrated to notify users of abnormal conditions, improving safety and quick response. Buttons are added for control operations like start/stop, while indicator lamps are used to show system status (ON/OFF, fault conditions).

Tags are attached to all elements to link them with PLC variables, enabling real-time data communication. Overall, these features help in effective monitoring, control, and visualization of industrial processes.

Session: 3

PLC based motor start/stop Motor control both direction Interlocking system

This report presents the implementation of motor control using a Programmable Logic Controller (PLC). The motor start/stop operation is achieved through push buttons connected to PLC inputs, where the PLC controls the motor via output signals.

For bidirectional control, the motor is operated in both forward and reverse directions using appropriate control logic. Safety is ensured through an interlocking system, which prevents simultaneous activation of both directions, avoiding damage to the motor.

Overall, PLC-based motor control provides reliable, safe, and efficient operation in industrial applications.

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Day 6

Session: 1

- Mini **Project Automation**

  - Implementation of PLC-based automation for a small industrial application.
  - Integrates sensors, actuators, and control logic.
  - Demonstrates practical understanding of automation concepts.

- **Testing and Demonstration**

  - System tested for proper operation and accuracy.
  - Live demonstration to verify functionality and performance.
  - Ensures reliability and correct working of the project.

Session: 2

- **Evaluation of Training Program / Feedback for Program / Valedictory Session**

Conclusion – Skill Laboratory Training on PLC and Its Applications (2nd Semester EEE)

The 6-day Skill Laboratory training on Programmable Logic Controller (PLC) and its applications was successfully conducted for 2nd semester EEE students. The program provided a balanced combination of theoretical knowledge and hands-on practical experience, enabling students to understand the fundamentals of PLC programming, wiring, and industrial automation.

Throughout the training, students actively participated in various hands-on activities, which helped them develop practical skills in ladder logic programming, troubleshooting, and real-time control applications. The inclusion of mini projects allowed students to apply their learning in a practical way, enhancing their problem-solving ability, creativity, and teamwork.

The program concluded with the submission of project reports, followed by a feedback session where students shared their learning experiences and suggestions. An evaluation test was conducted to assess the knowledge and skills acquired during the training.

The valedictory function marked the successful completion of the program, with proper arrangements made for guest speakers, including snacks and lunch. Certificates were distributed to all participating students, recognizing their efforts and successful completion of the training.

Overall, the Skill Lab training was highly effective in strengthening students' technical competencies, improving their confidence, and preparing them for future academic and industrial challenges in the field of automation and control systems.