CHAPTER FOUR

SYSTEM IMPLEMENTATION AND TESTING

4.1 Introduction

This chapter presents the implementation processes and testing procedures of the electrification system designed for the Electronics and Power Laboratories. The chapter discusses the installation phases, materials used, system integration, safety precautions, and the methods employed in testing the effectiveness of the electrification system. The goal of this phase is to ensure that all electrical and power distribution systems are correctly installed, functional, and compliant with safety standards.

4.2 Implementation Process

The implementation was carried out in well-structured phases to ensure minimal disruption to laboratory activities and to maintain quality standards. The main stages involved are:

4.2.1 Site Preparation

The existing electrical infrastructure was assessed to identify areas requiring upgrades. Equipment placement, cable routes, and distribution points were also mapped out.

4.2.2 Material Procurement and Logistics

Essential electrical components and tools were procured based on the specifications in the design. Materials included:

- Copper wires and armored cables
- Miniature Circuit Breakers (MCBs) and Residual Current Devices (RCDs)
- Distribution boards
- Conduits, sockets, and switches
- Power backup units (UPS or inverter)
- Energy meters
- Protective earth rods and grounding cables

4.2.3 Installation

The installation was executed in line with the approved electrical design layout.

- **Wiring**: Proper trunking and conduiting were carried out for both surface and concealed wiring.

- **Switches and Sockets**: Strategically placed to serve multiple lab benches and test ing equipment.
- **Lighting System**: Energy-efficient LED lights were installed for consistent illumina tion.
- **Power Backup System**: A UPS and inverter system were integrated to ensure unin terrupted power supply during outages.
- **Grounding**: Grounding was implemented to prevent electrical hazards and improv e safety.
- **Distribution Board Setup**: Sub-panels and MCBs were configured to protect circuit s and isolate faults.

4.3 Safety Considerations

Throughout the implementation, strict safety protocols were observed:

- Use of Personal Protective Equipment (PPE) by installation personnel
- Compliance with IEEE and local electrical codes
- Testing of circuits before energizing
- Clear labeling of all circuit breakers and control points
- Fire extinguishers and emergency cut-off switches installed at strategic locations

4.4 Testing and Evaluation

4.4.1 Electrical Continuity Test

This test ensured that all electrical connections were complete and conductive. A digital multimeter was used to verify continuity from switches to sockets and equipment points.

4.4.2 Insulation Resistance Test

Using an insulation resistance tester (megger), insulation between conductors and betwe en conductors and earth was measured. Values above 1 MΩ were confirmed, indicating acceptable insulation quality.

4.4.3 Earth Resistance Test

A ground tester was used to verify that the earth resistance was below the recommended value (typically <5 ohms), ensuring effective fault current dissipation.

4.4.4 Load Testing

The system was subjected to simulated load conditions using dummy resistive loads an d actual lab equipment. The distribution network showed no signs of overheating or volt age drops.

4.4.5 Backup Power Test

The inverter and UPS systems were tested under different loading scenarios. Automatic switching and power delivery within seconds of mains failure were confirmed.

4.5 Observations

The electrification system performed effectively during all tests. The system demonstrat ed:

- Stable voltage output across various load points
- Proper circuit isolation during simulated faults
- No significant power fluctuations during transition to backup power
- Efficient lighting and power delivery across lab sections

4.6 Challenges Encountered

- **Delay in material delivery** affected the project timeline.
- **Undocumented wiring** from the previous installation caused minor complications in the rewiring phase.
- **Power supply inconsistency** from the utility grid led to temporary interruptions dur ing testing.

4.7 Mitigation Measures

- Early procurement planning for future phases
- Use of circuit tracing tools to identify undocumented wiring
- Installation of temporary power support during grid failure

BEME: Electrification of Electronics and Power Laboratories

S/NO	Description	Unit/Quantity	Unit Rate (₦)	Total Cost (₦)
1.	PVC Conduit (20mm/25mm)	500m	500	250,000
2.	Electrical Wires ($1.5mm^2$, $2.5 mm^2$, $4mm^2$)	20	15,000	300,000
3.	13A Socket Outlets (Double)	60	3,500	210,000
4.	Switches (1 Gang, 2 Gang)	30	2,000	60,000
5.	Trunking (PVC/Aluminium)	300m	1,200	360,000
6.	LED Panel Lights (60W)	20	15,000	300,000

7.	Outdoor Security Floodlight (100W)	4	18,000	72,000
8.	Emergency Lights	6	12,000	72,000
9.	Copper Earth Rod (5ft x 16mm)	4	25,000	100,000
10.	Earth Cable ($16mm^2$)	2	45,000	90,000
11.	RCCB – 63A	4	25,000	100,000
12.	TOTAL			1,752,000