

EE-108 Electrical and Electronics Lab

Course Title	Electrical and Electronics Lab	Course Code	EE-108
Semester/Year	I Year	Course Group	Core
Teaching Scheme (L:T:P)	15:0:30	Credits	2
Methodology	Lecture + Practical	Total Contact Periods	90
CIE	60 Marks	SEE	40 Marks

COURSE DESCRIPTION

The **Electrical and Electronics Lab (EE-108)** provides practical training in electrical wiring, soldering, and basic electronic circuit construction. The course helps students understand electrical and electronic components, instruments, and their real-time applications through hands-on experiments, reinforcing theoretical concepts from EE-105.

PREREQUISITES

Knowledge of basic electricity and electronics (as covered in EE-105).

COURSE OBJECTIVES

1. To identify and safely use basic electrical tools and accessories.
2. To perform electrical wiring, jointing, and soldering operations.
3. To construct, test, and analyze basic electrical and electronic circuits using laboratory instruments.
4. To develop skills in IoT-based applications using microcontrollers and sensors.
5. To follow safety standards and best practices in all laboratory activities.

COURSE OUTCOMES (COs)

Upon completion of the course, the student will be able to:

CO	Course Outcome Description	CL	Linked POs	Hours
CO1	Identify tools, accessories, and perform various electrical joints.	R/U/A	1, 4, 5, 6, 7	9
CO2	Demonstrate various electrical wiring circuits.	U/A	1, 4, 5, 6, 7	9
CO3	Identify soldering equipment and perform soldering on PCB.	R/U/A	1, 3, 4, 5, 6, 7	9
CO4	Use CRO/DSO and function generators to analyze diode rectifier circuits.	R/U/A	1, 2, 4, 6, 7	12
CO5	Draw characteristics of Field Effect Transistor through experiment.	U/A	1, 4, 6, 7	9
CO6	Analyze the effect of feedback gain on oscillator frequency.	R/U/A	1, 4, 6, 7	12
CO7	Design circuits using Op-amps for various applications.	A	1, 4, 6, 7	12
CO8	Interface and operate basic IoT components for monitoring and control.	R/U/A	1, 2, 3, 4, 5, 6, 7	18

CL: R = Remembering, U = Understanding, A = Application

COURSE CONTENT

Unit – I: Electrical Tools, Accessories & Joints

DURATION:9 HOURS

Identification of electrical tools, wiring accessories, protective devices, wires, and cables. Practice of electrical joints: straight (married), T-joint, Western Union joint, and pigtail joint with safety precautions.

Unit – II: Electrical Wiring Circuits

DURATION:10 HOURS

Installation and testing of wiring circuits: lamp control circuits, staircase wiring, godown wiring, electrical bell circuit, ceiling fan with regulator, and fluorescent lamp connections using PVC surface conduit system.

Unit – III: Soldering Practices

DURATION:9 HOURS

Identification and handling of soldering tools and components. Practice of soldering on PCB and understanding characteristics of good solder joints.

Unit – IV: Diode Circuits & Measurements

DURATION:10 HOURS

Use of CRO/DSO and function generator. Construction and testing of diode switching circuits, clippers, full-wave rectifiers, and regulated power supply using Zener diode.

Unit – V: Transistors, Amplifiers & Oscillators

DURATION:12 HOURS

Characteristics of JFET, RC-coupled amplifier frequency response, Hartley oscillator, and analysis of feedback effect on oscillator frequency.

Unit – VI: Op-Amps & IoT Applications

DURATION:18 HOURS

Operational amplifier applications: inverting, non-inverting, and summing amplifiers. Introduction to basic IoT applications using Arduino/Raspberry Pi with sensors and wireless control.

CO-PO MAPPING MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	Linked Pos
CO1	3	–	–	3	1	2	1	1, 4, 5, 6, 7
CO2	3	–	–	3	3	3	1	1, 4, 5, 6, 7
CO3	3	–	2	2	2	3	1	1, 3, 4, 5, 6, 7
CO4	3	1	–	3	–	3	1	1, 2, 4, 6, 7

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Linked Pos
CO5	3	–	–	3	–	3	1	1, 4, 6, 7
CO6	3	–	–	3	–	3	1	1, 4, 6, 7
CO7	3	–	–	3	–	3	1	1, 4, 6, 7
CO8	3	1	1	3	1	3	1	1, 2, 3, 4, 5, 6, 7

Correlation Scale: 1 = Low, 2 = Medium, 3 = High

SUGGESTED LEARNING OUTCOMES

CO1: Identify Tools, Accessories and Perform Various Joints

- 1.1 Identify electrical wiring tools: screwdrivers, pliers, drilling machines, rawl plug jumper, voltage tester, splicers, standard wire gauge.
- 1.2 Identify wiring accessories: switches, ceiling roses, lamp holders, sockets, plug tops.
- 1.3 Identify main switches: DP mains, isolators, changeover switches.
- 1.4 Identify protective devices: fuses, MCBs, ELCBs, RCCBs.
- 1.5 Identify wires and cables by size, rating, and application.
- 1.6 Perform straight/married joint.
- 1.7 Perform T-joint.
- 1.8 Perform Western Union joint.
- 1.9 Perform pigtail joint.

CO2: Demonstrate Various Electrical Wiring Circuits

- 2.1 Make a circuit for two lamps controlled by two switches with switch-controlled 2/3-pin socket using PVC surface conduit.
- 2.2 Make a circuit for staircase wiring.
- 2.3 Make a circuit for godown wiring.
- 2.4 Make a circuit for electrical bell connection.
- 2.5 Make a circuit for ceiling fan with regulator.
- 2.6 Make connection for fluorescent lamp with choke and starter.

CO3: Identify Soldering Equipment and Perform Soldering

- 3.1 Identify and handle soldering tools and components.
- 3.2 Practice soldering on PCB.

CO4: Analyze Diode Rectifier Circuits

- 4.1 Measure amplitude, frequency, and time period of signals using CRO.
- 4.2 Construct and test diode switching circuit.
- 4.3 Build and test unbiased serial clipper circuit.
- 4.4 Build full-wave center-tapped rectifier with filter.

4.5 Build full-wave bridge rectifier with filter.

4.6 Draw regulation characteristics of Zener diode regulated power supply.

CO5: Draw FET Characteristics

5.1 Draw input and output characteristics of JFET and determine pinch-off voltage and transconductance.

5.2 Demonstrate FET as constant current source with appropriate bias.

CO6: Analyze Oscillator Feedback

6.1 Construct RC-coupled amplifier and draw frequency response.

6.2 Build Hartley oscillator and verify effect of tank circuit component values on frequency.

CO7: Design Op-Amp Circuits

7.1 Obtain specifications of IC 741, LM324, and LM339 from datasheets.

7.2 Construct and verify inverting amplifier using Op-amp.

7.3 Construct and verify non-inverting amplifier using Op-amp.

7.4 Construct and verify summing amplifier using Op-amp.

CO8: Implement IoT Applications

8.1 Control LED ON/OFF using mobile application via ESP8266/ESP32 (Wi-Fi) or HC-05 (Bluetooth) with Arduino/Raspberry Pi.

8.2 Use DHT11 sensor to read temperature and humidity and display on serial monitor or mobile dashboard.

8.3 Use LDR to sense light intensity and automatically switch LED/relay.

8.4 Use level sensors to indicate LOW, MEDIUM, and HIGH water levels using LEDs or mobile display.

LAB SAFETY & GUIDELINES

1. Always wear safety goggles, gloves, and lab coat during experiments.
2. Use insulated tools for electrical wiring.
3. Ensure proper earthing and isolation before testing circuits.
4. Handle soldering iron with care; avoid burns and fumes.
5. Follow instructor guidelines while using CRO, function generators, and IoT kits.
6. Report any equipment malfunction immediately.
7. All wiring experiments must be done on PVC surface conduit.
8. PVC casing capping may be demonstrated for one exercise.

ASSESSMENT SCHEME

Continuous Internal Evaluation (CIE): 60 Marks

- Lab Record & Performance: **30 Marks**
- Internal Lab Test (Mid): **20 Marks**
- Viva-Voce & Attendance: **10 Marks**

Year End Examination (SEE): 40 Marks

- Practical Experiment: **25 Marks**

- Viva-Voce: **10 Marks**
- Lab Record Submission: **5 Marks**

REFERENCE BOOKS & RESOURCES

1. Electrical Technology – Vol. I – B.L. Theraja
2. Practical Electronics for Engineers – K. Bhargava
3. Op-Amps and Linear Integrated Circuits – R. Gayakwad
4. IoT with Arduino and Raspberry Pi – S. Monk
5. *EE-105 Fundamentals of Electrical Engineering* – SBTET
6. *EE-108 Lab Manual* – Department of EEE, SBTET

SUGGESTED E-LEARNING RESOURCES

1. Online Simulation Platforms

- **TinkerCAD Circuits** – Virtual circuit design and Arduino simulation
<https://www.tinkercad.com/circuits>
- **LTspice** – Free SPICE simulator for analog and digital circuits
<https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html>
- **Proteus Design Suite** – Professional PCB design and simulation (student version available)

2. Video Tutorials & Lecture Series

- **NPTEL – Basic Electrical and Electronics Engineering**
<https://nptel.ac.in/courses/108108076>
- **Khan Academy – Electrical Engineering**
<https://www.khanacademy.org/science/electrical-engineering>
- **GreatScott! (YouTube)** – Practical electronics projects and tutorials
- **ElectroBOOM (YouTube)** – Humorous and educational electrical safety and experiments

3. Interactive Lab & Experiment Portals

- **PhET Interactive Simulations – Circuit Construction Kit**
<https://phet.colorado.edu/en/simulations/circuit-construction-kit-dc>
- **Falstad Circuit Simulator** – Real-time interactive circuit simulation
<http://www.falstad.com/circuit/>
- **Arduino Project Hub** – Community-based IoT and Arduino project tutorials
<https://create.arduino.cc/projecthub>

4. Reference & Learning Portals

- **All About Circuits** – Textbook-style articles, forums, and tools
<https://www.allaboutcircuits.com/>
- **Electrical4U** – Free electrical engineering tutorials
<https://www.electrical4u.com/>

- **Electronics Tutorials** – Step-by-step guides on electronics basics
<https://www.electronics-tutorials.ws/>
- **5. Mobile Apps for Learning**
- **ElectroDroid** – Electrical/electronics reference and calculators (Android)
- **EveryCircuit** – Interactive circuit simulator (iOS/Android)
- **Arduino Science Journal** – Sensor-based data logging and experiments
- **6. Institutional & Open Courseware**
- **MIT OpenCourseWare – Circuits and Electronics**
<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/>
- **IIT Bombay Virtual Labs – Electrical Engineering**
<http://vlabs.iitb.ac.in/vlabs-dev/labs/electrical-engineering/>

RECOMMENDATION FOR STUDENTS

Students are encouraged to use simulation tools like **TinkerCAD** or **LTspice** to practice circuit designs before performing physical experiments in the lab. Watching related **NPTEL videos** and exploring **PhET simulations** will strengthen conceptual understanding and lab preparedness.

MODEL QUESTION PAPERS
MID – I EXAMINATION
State Board of Technical Education & Training, Telangana
Diploma in Electrical & Electronics Engineering – I Year

Course Code: EE-108

Time: 1 Hour

Course Name: Electrical and Electronics Lab

Max. Marks: 20

Instructions:

1. Answer **any one** question allotted by the examiner.
2. All necessary tools, components, and instruments will be provided.
3. Follow all safety precautions during the experiment.
4. Record observations and submit the lab record sheet.

List of Practical Questions:

1. **Perform married jointing of given wires and insulate properly.**
(Tools: Wires, pliers, insulation tape)
2. **Make a T-joint with given wires and insulate.**
(Tools: Wires, pliers, insulation tape)
3. **Perform Western Union jointing of given wires.**
(Tools: Wires, pliers, soldering iron, solder)
4. **Make a pigtail joint with given wires.**
(Tools: Wires, pliers)
5. **Install a wiring circuit for one lamp controlled by one switch using PVC surface conduit system.**
(Components: Switch, lamp holder, wires, PVC conduit)
6. **Install a wiring circuit for two lamps controlled by two switches using PVC surface conduit.**
(Components: Two switches, two lamp holders, wires, PVC conduit)
7. **Connect a circuit for one lamp controlled by one switch with provision of a 2-pin socket.**
(Components: Switch, lamp holder, 2-pin socket, wires)
8. **Install a staircase wiring circuit using two-way switches.**
(Components: Two 2-way switches, lamp holder, wires)
9. **Connect a godown wiring circuit for three lamps.**
(Components: Three switches, three lamp holders, wires)
10. **Connect an electrical bell circuit with push button and bell.**
(Components: Push button, bell, transformer, wires)

11. **Install a ceiling fan with regulator wiring circuit.**
(Components: Fan, regulator, switch, wires)
12. **Control an LED ON/OFF using a mobile application via ESP8266 (Wi-Fi).**
(Components: ESP8266, LED, breadboard, jumper wires, mobile with app)
13. **Use a DHT11 sensor to read temperature and humidity and display values on the serial monitor.**
(Components: Arduino, DHT11, USB cable, PC with Arduino IDE)
14. **Use an LDR to automatically switch an LED ON/OFF based on light intensity.**
(Components: LDR, LED, Arduino, resistor, breadboard)
15. **Use water level sensors to indicate LOW, MEDIUM, and HIGH levels using LEDs.**
(Components: Water level sensor module, 3 LEDs, Arduino, breadboard)

MID– II EXAMINATION
State Board of Technical Education & Training, Telangana
Diploma in Electrical & Electronics Engineering – I Year

Course Code: EE-108
Time: 1 Hour

Course Name: Electrical and Electronics Lab
Max. Marks: 20

Instructions:

1. Answer **any one** question allotted by the examiner.
2. Use CRO/DSO, function generator, and components as required.
3. Draw observed waveforms and record measurements.
4. Submit the lab record with observations and calculations.

List of Practical Questions:

1. **Measure amplitude, frequency, and time period of a given sinusoidal signal using CRO.**
(Instruments: CRO, function generator)
2. **Construct and test a diode switching circuit. Observe input and output waveforms.**
(Components: Diode, resistor, function generator, CRO)
3. **Build and test an unbiased serial clipper circuit. Plot input-output waveform.**
(Components: Diode, resistor, function generator, CRO)
4. **Build a full-wave centre-tapped rectifier with filter. Measure DC output voltage and ripple.**
(Components: Transformer, diodes, capacitor, load resistor, multimeter)
5. **Build a full-wave bridge rectifier with filter. Observe output waveform on CRO.**
(Components: Diodes (4), capacitor, load, CRO, transformer)
6. **Draw the regulation characteristics of a Zener diode regulated power supply.**
(Components: Zener diode, resistors, variable load, DC supply, multimeter)
7. **Draw input and output characteristics of a JFET. Determine pinch-off voltage and transconductance.**
(Components: JFET, DC supplies, resistors, multimeters)
8. **Demonstrate a FET as a constant current source with appropriate biasing.**
(Components: FET, resistors, DC supply, ammeter)
9. **Construct an RC-coupled amplifier and draw its frequency response curve.**
(Components: Transistor, resistors, capacitors, function generator, CRO)
10. **Build a Hartley oscillator and verify the effect of varying tank circuit components on frequency.**
(Components: Transistor, inductor, capacitors, CRO, DC supply)

11. **Obtain the specifications of IC 741, LM324, and LM339 from datasheets and list key parameters.**
(Resources: Datasheets, internet access optional)
12. **Construct and verify an inverting amplifier using Op-amp IC 741.**
(Components: IC 741, resistors, function generator, CRO, DC supply)
13. **Build and verify a non-inverting amplifier using Op-amp IC 741.**
(Components: IC 741, resistors, function generator, CRO)
14. **Build and verify a summing amplifier using Op-amp IC 741.**
(Components: IC 741, resistors, DC sources, multimeter)

YEAR END EXAMINATION
State Board of Technical Education & Training, Telangana
Diploma in Electrical & Electronics Engineering – I Year

Course Code: EE-108
Time: 2 Hours

Course Name: Electrical and Electronics Lab
Max. Marks: 40

Instructions:

1. Answer **any two** questions allotted by the examiner (one from Group A and one from Group B).
2. All tools, instruments, and components will be provided.
3. Follow safety procedures and lab discipline.
4. Submit detailed lab record with circuit diagrams, observations, and results.

Group A: Electrical Wiring & Joints (Answer anyone)

1. Perform Western Union jointing and insulation of given wires.
2. Install a wiring circuit for two lamps controlled by two switches with a 3-pin socket.
3. Install a staircase wiring circuit and demonstrate its operation.
4. Connect a godown wiring circuit for three lamps.
5. Install a ceiling fan with regulator and demonstrate speed control.

Group B: Electronics & IoT Circuits (Answer anyone)

6. Build a full-wave bridge rectifier with filter and measure DC output voltage.
7. Draw the regulation characteristics of a Zener diode power supply.
8. Draw input and output characteristics of JFET and calculate parameters.
9. Construct an RC-coupled amplifier and plot frequency response.
10. Build a Hartley oscillator and measure output frequency.
11. Control an LED via mobile app using ESP8266 Wi-Fi module.
12. Interface DHT11 sensor with Arduino and display temperature/humidity on serial monitor.
13. Automate an LED using LDR based on ambient light.
14. Build a water level indicator using sensors and LEDs.

Marking Scheme for End Examination:

- **Circuit Connection & Performance:** 15 Marks
- **Observation & Measurements:** 10 Marks
- **Viva-Voce:** 10 Marks
- **Lab Record Submission:** 5 Marks
- Total:** 40 Marks