

Syllabus for Electrician

Course Name	Electrician
Sector	POWER
Course Code	PWR/2023/ELEC-RPL/268
Level	RPL LEVEL 3
Occupation	Electrician / Wireman
Job Description	The electrician plays the role of interpreting drawings, using tools for maintenance, handling wiring for machines, connecting electrical systems.
Course Duration	Total Duration 80 Hrs (T-25, P-55) RPL
Trainees' Entry Qualification	Grade 10 OR Grade 8 with two year of (NTC/ NAC) after 8 th OR Grade 8 pass and pursuing continuous schooling in regular school with vocational subject OR 8th grade pass with 2 yrs relevant experience OR Previous relevant Qualification of NSQF Level 2 with one yr experience OR Previous relevant Qualification of NSQF Level 2.5 with 6 months experience
Trainers Qualification	BE/B.TECH. / Diploma in Electrical Engineering with 1 Yr experience in relevant field. OR ITI in Electrician trade with 3 Yrs experience in relevant field

Structure of Course:

Module No.	Module name	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
1	Workplace Safety	Apply Safe Working Practices	1	1	2
2	Basic Engineering Drawing	Practice & interpret technical drawings	2	6	8
3	Selection of tools and measuring instruments	Identify and select tools and measuring instruments required for electrical machine maintenance, fittings and testing.	2	4	6
4	Basics of Electricity	Verify fundamental Laws of Electricity	2	4	6
5	Single phase and three phase a.c.	Measure various parameters of single	4	6	10

Module No.	Module name	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	systems	phase and three phase a,c, systems.			
6	Basic Electrical Household Wiring	Perform household electrical wiring with accessories, cables etc.	2	10	12
7	Electrical Machines	Demonstrate working of Electrical Machines explaining basic principles.	10	20	30
8	Employability Skill		2	4	6
TOTAL:			25	55	80

SYLLABUS:

Module No. 1: Workplace Safety

Outcome: Apply Safe Working Practices

Mapped to CON/0805/OC1

Theory Content:

- Maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements according to site policy.
- Recognize any unsafe situations according to site policy, and assess his report accordingly.
- Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
- Concepts of standard operation of electrical mains.
- Response to emergencies seg. Power failure, fire and system failure.

Practical Content:

- Recognize any unsafe situations according to site policy, and assess his report accordingly.
- Demonstrate Personal Productive Equipment (PPE) like: safety helmet, safety glove, safety shoe, use the same as per related working environment.
- Demonstrate basic first aid & CPR and use them under different circumstances.
- Identify different fire extinguishers and use the same as per requirement in a mock drill.
- Concept of standard operation of electrical mains and other switches.
- Response to emergencies of power failure and system failure.

Tools & Equipment: First Aid box, Different types of fire extinguishers, PPE kits, Safety charts.

Module No. 2: Basic Engineering Drawing

Outcome: Practice & interpret technical drawings

Theory Content:

- Introduction of technical drawing and lettering
- Use and care drawing boards and different drawing instruments, Drawing sheets and their sizes.
- Explain Types of Lines: Horizontal, Vertical, Inclined, parallel lines.
- Concept of using Scales in Drawing – Enlarging, Full Size & Reducing Scale.

Practical Content:**Introduction of technical drawing and lettering**

- How to begin a drawing – Layout of drawing sheet.
- Drawing of — i) Horizontal lines, ii) Vertical lines, iii) Inclined lines, iv) Parallel lines, v) Dividing a
- Single stroke Lettering by conventional method.
- Dimensioning—System of Dimensioning

Geometrical Construction

- Geometrical construction of Polygons (Pentagon, Hexagon & Octagon) by general method.

Orthographic Projection of Line & Lamina

- Projector; Plane of projection – Vertical Plane, Horizontal Plane & Profile Plane. Concept of 1st angle
- Projection; 3rd angle Projection. Reference Line – Symbol of methods of projection. (Demonstration with models).
- Projection of Points, Lines & Lamina (Square, rectangular, triangular, hexagonal, pentagonal and circular) parallel to VP and angle with HP & vice versa.

Freehand Sketch

Introduction – Necessity.

- b) Free hand sketches of rolled steel sections – i) T-section, ii) I-section, iii) Angle section, iv) Channel section, v) Circular section, vi) Rectangular Section, vii) Steel flat, viii) Double ended wrench, ix) Screw driver, x) Nail puller.

Tools & Equipment needed: Drawing instrument box, Drawing instrument box, Set square celluloid 30°-60°, French-curves (set of 12 celluloid), T-Square or Mini drafter, Drawing board.

Module No.3: Selection of tools and measuring instruments

Outcome: Identify and select tools and measuring instruments required for electrical machine maintenance, fittings and testing.

Mapped to PWR/3107/OC1

Theory Content:**1.1 Tools:**

i) Operation, ii) Diagram, iii) Application of the following tools:- Plier Insulated, Plier Side Cutting, Screw Driver, Neon Tester, Hammer, Pincer, Chisel, Hand Drill Machine, Allen Key, Grease Gun, Out Side Micrometer, Motorised Bench Grinder, Rawl plug tool and bit, Crimping Tool, Wire stripper, Try Square, Outside and Inside Divider Calliper, Pliers flat nose, Pliers round nose, Tweezers, Spanner, Gauge, wire imperial, file set, Soldering Iron.

1.2 Measuring Instruments:

i) Working principle, ii) Connection diagram, iii) Application of the following instruments:- Digital Multi Meter, Analog Multi Meter, Ohm Meter – Series & Shunt Type, A.C. & D.C. Voltmeter, A.C. & D.C. Ammeter, Wattmeter, DC Power Supply, Megger, Earth tester, Clamp meter.

Practical Content:

1. Familiarization of different tools and their practical application.
2. Measurement of A.C, D.C voltage and current, resistance using digital multimeter / A.C. & D.C. Voltmeter / A.C. & D.C. Ammeter.
3. Measurement of power for 3-phase (star and delta) and single phase load using wattmeter.
4. Measurement of high resistance/ insulation resistance using Megger.
5. Measurement of Earth resistance using Earth tester.
6. Operation of D.C. power supply.
7. Use of clamp meter for measurement of current, voltage.

Tools & Equipment: Screw driver, Electrician screw driver, Electrician connector, Neon Tester, Knife double bladed Electrician, Plier side cutting, Hammer, cross peen, Crimping tool, Wire stripper, Scissors blade, Hacksaw frame, Soldering Iron, Digital multimeter, A.C. Voltmeter, D.C. Voltmeter, A.C. Ammeter, D.C. Ammeter, Wattmeter, Clamp meter, Fuse, etc.

Module No 4: Basics of Electricity

Outcome: Verify fundamental Laws of Electricity

Theory Content:

Definition of Charge, Potential, Potential difference, Current, Unit of Charge, Potential, Current, Power and energy.

Ohms Law, Resistor & Resistance, Conductance, Unit of resistance and conductance, Series and parallel resistances, Effect of Voltage and current in series and parallel connection, Equivalence resistance in a series / parallel combination of resistance.

Kirchoff's Current Law, Kirchoff's Voltage Law.

Wheatstone Bridge, Simple application of Wheatstone Bridge.

Heating Effect of Current, Calculation of Heating effect in simple series and parallel circuit. Interconversion between joule and watt. Working of Fuse

Practical Content:

1. Measure Resistance using multimeter
2. Verify Ohm's Law
3. Verify Kirchoff's Voltage Law
4. Verify Kirchoff's Current Law
5. Verify Wheatstone Bridge

6. Test current and voltage relationships in series and parallel connection using simple resistors.
7. Identify Fuses with different current carrying capacity.

Tools and Equipment: Resistors, Connecting wires, Voltmeter, Ammeter, Wheatstone Bridge trainer kit, D.C. Voltage sources, Common household fuses with different current rating

Module No. 5: Single phase and three phase a.c. systems

Outcome: Measure various parameters of single phase and three phase a,c, systems.

Theory Content:

Concept of:

Alternating Current Vs Direct Current,

Alternating Current and Voltage – Frequency, Current, Phase, Neutral

Effect of alternating Voltage applied across Resistance, Inductance, Capacitance, R-L Series circuit, R-C series circuit, R-L-C series circuit. Concept of active and reactive Power and Power Factor in a.c. circuit.

Single phase and three phase a.c. circuit. Star and Delta system three phase a.c. system, Relation between Phase and Line Voltage as well as phase and line current in three phase system for Star and Delta connection. Power in 3 phase system.

Introduction to 3 ph 3 wire and 3 ph 4 wire system

Practical Content:

1. Identify phase/neutral/earth in a single-phase circuit.
2. Measure frequency in a.c. system
3. Test single phase voltage using test lamp.
4. Test Three phase voltage using test lamp.
5. Measure power and power factor in a single phase a.c. circuit (R,R-L, R-C circuit)
6. Measure three phase current in a 3-ph a.c. system and identify balanced / unbalanced load.
7. Measure three phase power using single phase wattmeter.
8. Measure phase sequence in a 3-ph system

Tools & Equipment:

Test Lamp (220V, 60 W) – 3 nos, single phase a.c. Wattmeter (2 nos), Power Factor meter, Resistor Bank, Inductor, Capacitors.

Tong Tester, Phase sequence meter, Frequency meter

Module No. 6: Basic Electrical Household Wiring

Outcome: Perform household electrical wiring with accessories, cables etc.

Theory Content:

Electrical wiring and materials:

1. Types of wiring system, Schematic diagram of wiring system. Accessories used for wiring—Main switch (ICDP, ICTP&N), Distribution board, Fuse, MCB, Cable, Conduit, Casing, Inspection box, One way Switch, Two way switch, Switch board, Plug Socket (only specification and use), Fan regulator.
2. Concept of Earthing, requirement of earthing, types of earthing system – rod, pipe and plate earthing, Earthing of electrical installation, Earthing of electrical machines.

Practical Content:

1. Perform Conduit Wiring for a given case of light, fan and Power circuit
2. Perform Casing capping wiring for a given case of combination of Light, fan and Power Circuit.
3. Install energy meter (ICDP, ICTP&N)
4. Provide Earthing in an Installation
5. Check Earthing of an installation
6. Replacement of Fuse in household electric connection

Tools & Equipment: Wiring materials like conducting wires, Earthing wires, Fuse, casing capping materials, Conduit, Conduit bend, Saddle, Junction box, Socket, other wiring accessories Electrical Drilling Machines, Wiring Board,

Module No. 7: Electrical Machines

Outcome: Demonstrate working of Electrical Machines explaining basic principles.

Theory Content:

- 1 Different types of Electrical Machines: Static / Rotatory, DC / AC, single phase / three phase
- 2 DC Machine different parts
- 3 DC Motor connection: Series, Shunt, Compound, Basic Working Principles (How does the motor run, need for a starter)
- 4 Difference in DC Motor and Generator
- 5 DC generator – Basic working principles, Generation of Voltage.
- 6 AC Motor: Induction Motors: Single phase and Three Phase, Basic Working Principle (Running of a motor)
- 7 Three Phase Induction Motor: Squirrel cage and Slip ring Motor Introduction. Need for a starter.
- 8 Single Phase Transformer: Basic Working Principles (How does Voltage is produced in secondary – No deduction)
- 9 Relationship between Primary and Secondary Voltage in a single phase transformer
- 10 Three phase transformers: Core type (only concept)
- 11 Different parts of a Distribution transformer

Practical Content:

1. Identify different parts of a DC Motor

2. Identify different parts of a AC Induction Motor
3. Connect and run a DC Series Motor
4. Connect and Run a DC Shunt Motor / Compound Motor
5. Connect a DC generator and develop electricity.
6. Connect and run a single-phase induction motor
7. Connect and run a three-phase squirrel cage induction motor using starter (DOL, Star-Delta)

Tools & Equipment: DC series motor, DC shunt motor, single phase AC induction motor, Three Phase Induction motor, DC Motor Starter, DOL starter, Star Delta Starter,

Module No. 8: Employability Skills

Detail Content

- **Basic English Skills**

1. Converse using basic English sentences.
2. How to Greet others
3. Read and interpret text written in basic English
4. Write a short note/paragraph / letter using basic English

- **Communication Skills**

1. Demonstrate how to communicate effectively using verbal and nonverbal communication Etiquette.
2. Discuss the significance of working collaboratively with others in a team

- **Financial Skills**

1. Outline the importance of selecting the right financial institution, product and service
2. Demonstrate how to carry out offline and online financial transactions, safely and securely like net banking, wallet payment, UPI.
3. List the common components of salary and compute income, expenditure, taxes, investments etc.

- **Essential Digital Skills**

1. Familiarization of working with computer
2. Discuss the significance of displaying responsible online behavior while browsing using various social media platforms, e-mails, etc., safely and securely
3. Send email with attachment. Receive email and download attachment

- **Customer Service Skills**

1. Explain the significance of identifying customer needs and responding to them in a professional manner.
2. Discuss the significance of maintaining hygiene and dressing appropriately

Learning Outcome – Assessment Criteria

Module No.	Outcome	Assessment Criteria
1	Apply Safe Working Practices	After completion of this module students will be able to: <ol style="list-style-type: none"> 1. Apply and maintain Safe Working Practices 2. Recognize any unsafe situations according to site policy. 3. Identify fire and safety and fire hazards 4. Identify different fire extinguishers and use them as per requirements.
2	Practice & interpret technical drawings	After completion of this module students will be able to: <ol style="list-style-type: none"> 1. Draw plane figures applying drawing instruments with proper layout and folding of drawing sheets. 2. Construct Line, Lettering, Dimensioning, and Scale – Plain, Diagonal 3. Draw plan, elevation, side view of different objects with appropriate type of lines and dimensions as per standard convention 4. Draw simple geometrical figure like square, rectangle, circle using CAD. 5. Electric Wiring Related Symbols According to BIS. 6. Draw the Electrical Circuits and Variabilities Symbols, Symbols of Variable Resistors
3	Identify and select tools and measuring instruments required for electrical machine maintenance, fittings and testing.	After completion of this module students will be able to: <ol style="list-style-type: none"> 1. Identify different tools required for electrical machine maintenance and fittings. 2. Identify different measuring instruments required for testing of electrical machine. 3. Use different tools required for electrical machine maintenance and fittings. 4. Use different measuring instruments required for testing of electrical machine.
4	Verify fundamental Laws of Electricity	After completion of this module students will be able to: <ol style="list-style-type: none"> 1. Define current, Voltage with units 2. Define resistance and conductance with unit 3. Verify Ohm's Law 4. Verify Kirchoff's Laws 5. Verify Wheatstone Bridge Principle

Module No.	Outcome	Assessment Criteria
		6. Explain heating effect of current 7. Identify fuses with different current rating
5	Measure various parameters of single phase and three phase a,c, systems.	After completion of this module students will be able to: <ol style="list-style-type: none"> 1. Measure Voltage, Current, Frequency, Power, Power Factor of a single phase A.C. system. 2. Define and measure voltage, Current, Power, Power Factor of a 3phase A.C. system 3. Understand relation and measure phase voltage, phase current, Line voltage. Line current in a 3 ph A.C. system 4. Use test lamp to test single phase and three phase voltage (line and phase) 5. Identify 3-phase 3-wire & 3-phase 4-wire system
6	Perform household electrical wiring with accessories, cables etc.	After completion of this module students will be able to: <ol style="list-style-type: none"> 1. Identify materials for service connection - PVC wire, Insulator, G.I wire, Stay wire, Stay bow, Stay rod, Egg insulator, Conduit 2. Calculate cable length for service connection. 3. Install single phase energy meter and DPIC main switch for domestic purpose 4. Install three phase energy meter with TPIC main switch for commercial purpose. 5. Install Earthing for service connection. 6. Demonstrate fuse replacement and checking of healthy line
7	Demonstrate working of Electrical Machines explaining basic principles.	After completion of this module students will be able to: <ol style="list-style-type: none"> 1. Identify different parts of a DC Motor 2. Connect and run a DC Series / Shunt / Compound Motor with Starter. 3. Connect and run a single phase ac induction motor 4. Connect and run a three phase induction motor using DOL / Star-Delta Starter 5. Identify different parts of Distribution Transformer 6. Explain basic principles of power transfer in a transformer.
8	Employability Skill	As per guided curriculum

Tools & Equipments: (For 30 Trainees)

Sl. No.	Item Description	Specification	Qty / Number
1.	Rule wooden	4 fold 60 mm	5 Nos.
2.	Screw driver	100 mm	5 Nos.
3.	Screw driver	150 mm	5 Nos.
4.	Heavy duty screw driver	200 mm	5 Nos.
5.	Electrician screw driver	250 mm thin stem insulated handle	5 Nos.
6.	Electrician connector, screw driver	100 mm insulated handle thin stem	5 Nos.
7.	Neon Tester	Standard	5 Nos.
8.	Plier insulated	150 mm	5 Nos.
9.	Plier side cutting	150 mm	5 Nos.
10.	Knife double bladed Electrician	Standard	5 Nos.
11.	Hammer, cross peen	115 grams with handle	5 Nos.
12.	Hammer ball peen	0.75 kg. With handle	5 Nos.
13.	Pincer	150 mm	5 Nos.
14.	Firmer chisel wood	12 mm	5 Nos.
15.	Saw tenon	250 mm	5 Nos.
16.	Steel rule	300 mm	5 Nos.
17.	C. Clamp	200 mm, 150 mm and 100 mm.	5 Nos.
18.	Spanner	150 mm adjustable 15 degree	5 Nos.
19.	Blow lamp	0.5 litre	5 Nos.
20.	Chisel	25 mm & 6 mm	5 Nos.
21.	Electric drill machine portable	6 mm capacity	5 Nos.
22.	Allen key	Standard	5 Nos.
23.	Oil can	0.12 litre	5 Nos.
24.	Grease gun	Standard	5 Nos.
25.	Outside micrometer	0 to 25 mm	5 Nos.
26.	Motorised bench grinder	Grinder motor: 0.55 KW , 0.75 HP, 3 Phase , 2800 RPM	5 Nos.
27.	Pulley puller	3 jaw	5 Nos.
28.	Bearing puller	as per SKF bearing no.	5 Nos.
29.	Crimping tool	Standard	5 Nos.
30.	Scissors blade	150 mm	5 Nos.
31.	Wire stripper	20 cm	5 Nos.
32.	Hacksaw frame	200 mm adjustable	5 Nos.
33.	Hacksaw frame	300 mm adjustable	5 Nos.
34.	Flat nose plier	100 mm	5 nos
35.	Tweezers	100 mm	5 nos.
36.	Spanner	D.E. metric standard set	5 Nos.
37.	Gauge, wire imperial	Standard	5 Nos.
38.	File flat	200 mm 2nd cut	6 nos.
39.	File half round	200 mm 2nd cut	5 nos.

Sl. No.	Item Description	Specification	Qty / Number
40.	File round	200 mm 2nd cut	5 nos.
41.	File flat	150 rough	5 nos.
42.	File flat	250 mm smooth	5 nos.
43.	Soldering Iron	25 watt, 65 watt	5 nos. each
44.	Desoldering gun	Spring loaded vacuum style solder remover	5 nos.
45.	Growler	Input 230V AC, Armature dia 20-100mm	5 Nos.
46.	Digital multimeter	3 ½ digits, LCD display, 0-1000 M Ohms, 750 volt AC, 1000V DC, 10A	5 Nos.
47.	A.C. Voltmeter	MI type, 0-500V	5 Nos.
48.	D.C. Voltmeter	MC type, 0-500V	5 Nos.
49.	A.C. Ammeter	MI type, 0-10A	5 Nos.
50.	D.C. Ammeter	MC type, 0-10A	5 Nos.
51.	Wattmeter	Dynamometer type, 150-300-600V, 5-10A	5 Nos.
52.	Megger	500 Volt	5 Nos.
53.	Digital 4-wire Earth resistance tester	Earth Resistance 0-2Ω, 0-20Ω, 0-200Ω, 0-2kΩ. Voltage 0-300 AC	5 Nos.
54.	D.C. power supply	Dual channel, 0-30V, 2A	5 Nos.
55.	Clamp meter	AC/DC current 0-400A, AC/DC voltage 0-600V, Frequency 5-500Hz	5 Nos.
56.	Fuse	Kit Kat type, 10A	10 Nos.
57.	Fuse	Cartridge type, 10A	10 Nos.
58.	Conduit	PVC, 25 mm diameter, 2mm thick, for 1.5 mm ² Al wire	20 Nos.
59.	Conduit bend	20 mm	20 Nos.
60.	Saddle	20 mm, metallic	50 Nos.
61.	Junction box	25 mm, two way	10 Nos.
62.	Socket	5 Pin, 240V, 16A	10 Nos.
63.	Contactors	3-phase, 440volt, 16amp, 2NO+ 2NC auxiliary contacts	10 Nos.
64.	Thermal overload relay	3-phase, 0-15 A, 440V	10 Nos.
65.	Timer relay	On delay type, 240V, 1NO+1NC	10 Nos.
66.	Timer relay	Off delay type, 240V, 1NO+1NC	10 Nos.
67.	Push button switch	10A, 240V	10 Nos.
68.	M.C.B.	4 pole, 16 A, 440V	10 Nos.
69.	DC 4-point starter	5 HP, 240V DC	5 Nos.
70.	Different parts of a DC motor for assembling	Dismantled DC Motor	1 No
71.	Different parts of a 3-phase squirrel cage induction motor for assembling	Dismantled 3-phase squirrel cage induction motor	1 No
72.	Different parts of a single phase	Dismantled single phase induction	1 No

Sl. No.	Item Description	Specification	Qty / Number
	induction motor for assembling	motor	
73.	DC shunt motor	2 HP, 220V	1 No
74.	3-phase squirrel cage induction motor	3-phase 400 volt, 50 Hz, 2 HP, 1440 rpm	1 No
75.	Single phase induction motor	1 HP, 230 volt, 50 Hz, capacitor run	1 No
76.	Single phase induction motor	1 HP, 230 volt, 50 Hz, capacitor run	1 No
77.	D.O.L starter	3-phase, 400 V, 50 Hz, 5HP	2 Nos.
78.	Automatic Star-Delta starter	3-phase, 400 V, 50 Hz, 7.5HP	2 Nos.
79.	Manual Star-Delta starter	3-phase, 400 V, 50 Hz, 7.5HP	2 Nos.
80.	Electrical control panel	Control panel components – voltmeters, ammeter, wattmeter, RPM meter, frequency meter, contactor, relay, switch, indicator lamp, MCB, Main switch, Bus bar	1 Set