

Syllabus For Assistant Rural Electrician Cum Lineman

Course Name	ASSISTANT RURAL ELECTRICIAN CUM LINEMAN, V2
Course Code	STC -PWR/2021 /3101, V2
Level	3
Occupation	ASSISTANT RURAL ELECTRICIAN CUM LINEMAN
Job Description	Electrification in rural and urban areas. Erection of overhead distribution line. Servicing and maintenance of the distribution line. Overhead Service line and Energy meter connection.
Course Duration	Total Duration 390 Hrs (T-90, P-180, OJT-60 and ES-60)
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	B.E./B.Tech in Electrical Engineering with 2 years Experience in the relevant field. OR Diploma in Electrical Engineering with 3 years Experience in the relevant field. OR ITI in Electrician trade with 5 years Experience in the relevant field.

Structure of Course:

Module No.	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs) [Multiple of 30]
1	Apply Safe Working Practices	10	20	30
2	Recognize single phase and three phase AC distribution systems and its components.	10	20	30
3	Identify different materials used in Low voltage Distribution System.	20	40	60
4	Demonstrate different Tools used in overhead Distribution line during Inspection and maintenance work.	20	40	60
5	Perform internal house wiring for domestic consumer	10	20	30

6	Calculate cost of electricity for domestic / commercial consumer from meter reading	10	20	30
7	Carry out routine operation and maintenance of an 11/0.433 KV Distribution Substation	10	20	30
8.	OJT		60	60
9.	Employability Skill- 60hrs	--	--	60
	TOTAL:	90	240	390

Employability Skill: 60Hrs (Provided by NCVET)

OJT: 60 hours (in multiple of 30)

SYLLABUS:

Module No. 1: Workplace Safety

Outcome: Apply Safe Working Practices

Theory Content:

Height of Poles and Towers, Sag & Span, Span length of different voltages, conductor size, selection of Insulators, Conductor spacing, earthing line guard, bridling, sag and tension, safe distance of line of different voltages from ground, trees, buildings & structures, telegraph & telephone lines, difference between phases, road crossing, railway crossing, river crossing.

Pole erection Procedures, D.P. erection procedures, stay erection, erection of cross arm and insulators, stringing of conductor, line joints, different types of joints, sagging line conductor, safety during stringing, measurement of sag, insulator winding, jumpering, fixing line guards.

Practical Content:

Practical exposure on Line Item. Field study for Line material towards practical use of equipment. Field study at locality of village for observation of safe distance of the existing lines from trees, buildings & structures, telegraph & telephone lines, road crossing, other electrical line crossing, difference between phases, railway crossing, river crossing etc.

Module No. 2: Single phase and three phase AC distribution systems

Outcome: Recognize single phase and three phase AC distribution systems and its components.

Theory Content:

Concept of:

Alternating Current, Direct Current, Voltage, Resistance, Conductance, Frequency, Current, Phase, Neutral, Phase Voltage, Line voltage, suitable voltages for Generation, Transmission & Distribution, Extra High Tension, High Tension, Low Tension, Line, and sub-station arrangements, Overheads and underground Distribution Line, Transformer, Circuit Breaker, Bus Bar, lightning arrester etc.

Concept of

Resistance, Insulation Resistance, Ohm's Law, single phase, and 3 phase arrangement, Relation between phase and line voltage in three phase system, Power, Energy, Power factor, Voltage loss, Voltage regulation.

Practical Content:

1. Identify types of wires, cables and verify their specifications.
2. Verify the characteristics of series, parallel and its combination circuit.
3. Connect a lamp load in star and delta and determine relationship between line and phase values.
4. Identify phase/neutral/earth in a single phase circuit.
5. Test single phase voltage using test lamp.
6. Test Three phase voltage using test lamp
7. Measure three phase current and identify balanced / unbalanced load.

Module No. 3: Low voltage Distribution System.

Outcome: Identify different materials used in Low voltage Distribution System.

Theory Content:

1. Understanding the concept of low voltage distribution system
2. Identification of commonly used conductors and cables in low voltage distribution.
3. Identifying various types of insulating materials used in low voltage distribution systems.
4. Exploring the properties and functions of insulators.
5. Introduction to connectors and joints used in low voltage distribution.
6. Identification of different types of connectors and joints.
7. Introduction to various metering and measurement devices used in low voltage distribution

Practical Content:

1. Perform hands-on exercises to examine the physical characteristics and properties of conductors and cables.
2. Learn how to measure the diameter and gauge of conductors using appropriate tools.
3. Recognize various insulating materials used in low voltage distribution systems.
4. Conduct experiments to understand the insulating properties of different materials.
5. Understand the process of connecting and disconnecting cables using connectors and joints.
6. Identify different metering and measurement devices used in low voltage distribution.
7. Practice measuring voltage, current, and power using appropriate measuring instruments.

Module No. 4: Overhead Distribution line

Outcome: Demonstrate different Tools used in overhead Distribution line during Inspection and maintenance work.

Theory Content:

Line support, different types of Poles and Towers, Insulator, Conductor, Bracket, Cross Arm, Earthing arrangement, Stays & struts, Bracings, different types of Insulators for HT & LT Line, Post Insulator, Disc. Insulator, different types of Conductors, other line equipment (clamp, strain clamp, parallel groove (PG) clamp, Bolted clip, sleeve, aluminum tape and binding wire, line vibration, Insulator Hardware.

Screw driver, pliers, cutting pliers, nose pliers, hammer, hand drill, hack saw, tennon saw, knife, chisel,

files, wrench & spanner, pipe wrench, standard wire gauge, bench vice, micro meter, plumb bob, punching machine, chain-pulley block, max puller, draw vice, hand glove, safety row, Earthing rod with chain, energy meter, ammeter, volt meter, clip on ammeter, energy meter etc.

Practical Content:

1. Line patrolling, condition of pole, conductor, apparatus, insulators, earthing, lightning arrester. Field study on Shut down procedure and authorized person for shut down. Isolation and earthing of line and cross checking for confirmation. List of activities for related to pole, insulator, Nut & Bolts, earthing, lighting arrester, earthing horn, P.G. Clamp, Line isolator etc. Removal of isolation and withdrawal of shut down.
2. Drawal of service line, single phase and 3 phase and termination at both ends. Installation of Meter. Identification of single and 3 phase Meter, cut out, Meter Board, C.I. Box, D.P. Box, etc. Installation of Meter, shut down of L.T line and termination at overhead line and termination at Meter.

Module No. 5: Internal house wiring for domestic consumer

Outcome: Perform internal house wiring for domestic consumer

Theory Content:

Series parallel connection. Types of switches, fuses, their ratings and applications. Parts of MCB, ELCB and RCCB.

Estimate the requirement and make wiring for consumers' main board with ICDDP switch and distribution fuse box in a house (for casing capping and conduit wiring).

Estimate wiring material for wiring of a house with two rooms (for casing capping and conduit wiring).

Draw circuit for tube light, staircase lighting.

Practical Content:

1. Prepare and mount the energy meter.
2. Do wiring for consumer's main board with ICDDP switch and distribution fuse box in a house/building.
3. Demonstrate the types of fuses, their ratings and applications and also to identify the parts of a MCB, ELCB and RCCB.
4. Estimate the requirement for casing capping /PVC conduit and Practice of common domestic wiring for light, fan, staircase lighting for a house with upto two rooms.
5. Test domestic wiring installation by using Megger.
6. Practical exposure on Sub-station. Visit to Sub-stations, for practical demonstration on components. Make a report of items and their function.

Module No. 6: Calculate cost of electricity

Outcome: Calculate cost of electricity for domestic / commercial consumer from meter reading

Theory Content:

Meter Reading, Billing & Realization of Revenue. : Different types of Meter ie. Conventional, static and others. Procedure of taking meter reading at the consumer end and calculation of energy bill from applicable tariff.

Practical Content:

Module No. 7: 11/0.433 KV Distribution Substation

Outcome: Carry out routine operation and maintenance of an 11/0.433 KV Distribution Substation

Theory Content:

Different parts and components, their function.

Various equipment, protection elements and components and their function for a distribution substation (1KV/.433KV)

Practical Content:

Practical demonstration of Erection of Distribution Transformer (100 KV A and below). Site selection, erection of pole, erection of fitting, fixing of insulator, fixing of main switch, erection of earthing, installation of fusing, installation of Distribution Transformer.

Learning Outcome – Assessment Criteria

Module No.	Outcome	Assessment Criteria
1	Apply Safe Working Practices	<p>After completion of this module students will be able to:</p> <p>(1.1) Maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements according to site policy.</p> <p>(1.2) Recognize any unsafe situations according to site policy, and assess his report accordingly.</p> <p>(1.3) Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.</p> <p>(1.4) Demonstrate Personal Productive Equipment (PPE) like: safety helmet, safety glove, safety shoe, climbing harness, lanyard and tool belt (when climbing), earth rod (discharge rod), and safety rope and use the same as per related working environment.</p> <p>(1.5) Demonstrate basic first aid & CPR and use them under different circumstances.</p> <p>(1.6) Identify different fire extinguishers and use the same as per requirement in a mock drill.</p>
2	Recognize single phase and three phase AC distribution systems and its components.	<p>After completion of this module students will be able to:</p> <p>(2.1) Define and measure Voltage, Current, Power, Power Factor of a single phase A.C. system.</p> <p>(2.2) Define and measure voltage, Current,</p>

Module No.	Outcome	Assessment Criteria
		<p>Power, Power Factor of a 3phase A.C. system (2.3). Understand relation and measure phase voltage, phase current, Line voltage. Line current in a 3 ph A.C. system (2.4) Use test lamp to test single phase and three phase voltage (line and phase) (2.5) Define standard Low, Medium, High & Extra high voltage. (2.6) Identify 3-phase 3-wire & 3-phase 4-wire system (2.7) Identify different components / accessories used in distribution system.</p>
3	Identify different materials used in Low voltage Distribution System.	<p>After completion of this module students will be able to: (3.1) Identify different types of Pole, Towers, X-arms, Timbers, Sky pin, Arm pin, Clevis, isolators for Distribution System. (3.2) Identify different types of insulators- Pin, Strain, Disc, Shackle, Gay and their place of applications in power line. (3.3) Recognize size & types of conductors and its application in distribution system. Know the specification of the conductors for procurement. (3.4) Identify guying materials, anchoring materials, different connectors, lightning arrester. Understand the function of each item and their place of applications. (3.5) Identify and specify different types of fuses, their rating required at different locations in distribution system. (3.6) Identify the components in the panel board of low voltage distribution. (3.7) Identify 3phase 3 wire and 3 phase 4 wire cable (3.8) Identify the difference of overhead and underground cable.</p>
4	Demonstrate different Tools used in overhead Distribution line during Inspection and maintenance work.	<p>After completion of this module students will be able to: 4.1) Demonstrate following tools : Screw driver, Pliers, Cutting Pliers, Nose Pliers, Hammer, Hand drill, Hack Saw, Knife, Files, Chisel, Wrench & Spanner, Pipe-wrench, S.W.G., bench Vice, Plumb bob, Chain pulley, Block, Max puller, Draw vice Hand Glove, Earthing Rod with chain etc. 4.2) Identify and Explain Ammeter, Volt meter, Clip-on-meter, Energy Meter, Multi meter Etc. 4.3) Explain and perform off-line overhead line maintenance procedure 4.4) Explain and perform off-line underground line maintenance procedure 4.5) Check the stay wire assembly along with gay insulators (4.6) Determine location of fault, isolate fault and restore power to customers using equipment such as switches 4.7) Repair conductor by splicing, jointing, using armor rods, line guards, vibration dampers (4.8) Replace components like isolators,</p>

Module No.	Outcome	Assessment Criteria
		conductors, switches, terminations and insulators safely. 4.9) Carry out conductor stringing procedures taking into account permissible sagging.
5	Perform internal house wiring for domestic consumer	<p>After completion of this module students will be able to:</p> <p>(5.1) Estimate requirement of material for wiring up to the consumers main board with ICDP switch and distribution fuse box in a house/building.</p> <p>(5.2) Estimate the materials (Distribution Board , Switch Board , Switches, Main Switch, MCB) required for wiring for lighting and fan circuit for up to two rooms in a single storied residential house fir (a) Casing Capping and (ii) Conduit wiring</p> <p>(5.3) Perform wiring from energy meter to main switch and from main switch to distribution box and then to lighting and fan circuit of two rooms in a single storied residential house.</p> <p>(5.4) Perform wiring for a Staircase.</p> <p>(5.5) Test a domestic wiring installation by using Megger before giving supply.</p> <p>(5.6) Replace fuse, check meter, overhead line and service connection installations.</p>
6	Calculate cost of electricity for domestic / commercial consumer from meter reading	<p>After completion of this module students will be able to:</p> <p>(6.1) Explain tariff for domestic and commercial users</p> <p>(6.2) Study the reading of Energy meter and calculate energy bill of given load.</p> <p>(6.3) Calculate cost of electrical energy considering the required tariff of any system.</p>
7	Carry out routine operation and maintenance of an 11/0.433 KV Distribution Substation	<p>After completion of this module students will be able to:</p> <p>(7.1) Explain standard installation process of a pole mounted distribution transformer.</p> <p>(7.2) Explain installation process of lightning arrester, earth connection, and anti-climbing devices on poles.</p> <p>(7.3) Place and remove gang operating switch and drop out fuse as per standard procedure</p> <p>(7.4) Connect and / or join Low Voltage cable, whenever required, as per standard procedures.</p> <p>(7.5) Check Distribution Transformer for Oil Level, Break Down Voltage, acidity, Sludge, dust, breather (colour of silica gel)</p> <p>(7.6) check and note for any abnormality in tap position and gap of arching horn, neutral grounding, loose connections of the terminations of HV & LV.</p>

LIST OF TOOLS & EQUIPMENTS FOR

ASSISTANT RURAL ELECTRICIAN CUM LINEMAN

SL. No.	Name of the Tools	Specification
1	Measuring Steel Tape	3 meter
2	Insulated Combination Pliers	200 mm
3	Insulated Screw Driver	200 mm
4	Heavy Duty Insulated Screw Driver	300 mm
5	Steel Rule (graduated both in Metric and British Unit)	300 mm
6	Electrician Knife	100 mm
7	Neon Tester	500 Volt
8	Wire Stripper	150 mm

B. Shop Tools& Equipment:

SL. No.	Name of the Tools /Equipment	Specification
9	Ball Peen Hammer with handle	250 grams
10	Cross peen Hammer with handle	250 grams
11	Adjustable Spanner (drop forged)	200 mm & 300 mm
12	Firmer Chisel with handle	12 mm x 150mm& 6 mm x 150 mm
13	Bradawl	200 mm
14	Hacksaw frame With Blade	300 mm
15	Try Square	200 mm blade
16	D. E. metric Spanner	6 mm – 32 mm
17	Imperial Wire Gauge	Metric
18	Flat File with handle	2 nd Cut, 200 mm
19	Hand Vice	50 mm Jaw
20	Table Vice	100 mm Jaw
21	Cutting Pliers	200 mm
22	Portable Electrical Drill machine	500 watt; 6 mm -12 mm capacity
23	R.C.C. Drill Bit	4 mm & 6 mm
24	Drill bit	4 mm & 6 mm
25	Electrician Helmet	Yellow colour
26	Earth Electrode	25 mm dia. X 1200 mm G.I. Rod

C. Meters & Equipment:

SL. No.	Name of the Meters / Equipment	Specification
27	Digital Multimeter	DC & AC – 750 volt, AC – 10 amps. , Resistance- upto 20 Mega-ohm and 3 $\frac{1}{2}$ digit
28	Tong Tester/ Clamp Meter	0 – 40 amps., Digital type
29	A.C. Single Phase Energy Meter	0 – 20 amps., 240 volt, Digital type
30	M.C. type Ammeter	0 – 5 amps, analog
31	M.C. type Voltmeter	0 – 250 - 500 Volt, Multirange, analog
32	Safety Belt	Used to work on Electrical Pole/ Tower

Marks Distribution

Outcome	Outcome Code	Total Th Marks	Total Pr Marks
Apply Safe Working Practices	PWR/3101/OC1	10	80
Recognize single phase and three phase AC distribution systems and its components.	PWR/3101/OC2	20	80
Identify different materials used in Low voltage Distribution System.	PWR/3101/OC3	30	110
Demonstrate different Tools used in overhead Distribution line during Inspection and maintenance work.	PWR/3101/OC4	30	110
Perform internal house wiring for domestic consumer	PWR/3101/OC5	20	90
Calculate cost of electricity for domestic / commercial consumer from meter reading	PWR/3101/OC6	20	90
Carry out routine operation and maintenance of an 11/0.433 KV Distribution Substation	PWR/3101/OC7	20	90
Work in real job situation with special emphasis on basic safety and hazards in this domain (OJT).	PWR/3101/OC8	0	150
Employability Skill-60 Hrs	DGT/VSQ/N0102	50	0