ASSISTANT RURAL ELECTRICIAN CUM LINEMAN (ARELA)

SYLLABUS

(Safety Practices 25 Hrs, Theory 100 Hrs, Practical 450 Hrs, Employability Skill 75 Hrs)

Theory (T):

1. Some basic definitions and understanding: (T-2hrs)
   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.

2. Basic Principles of Electricity. (T-3hrs)
   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.

3. Introduction to Material for Overhead Line.(T-15hrs)
   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.

4. Demonstration of Toots & Equipment (T-10 Hrs)
   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.

5. House wiring (T-15 hrs)
   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 ICDP 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.

6. Distribution Line Safety as per Indian Electricity Rules (T-25 hrs)
   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.

7. 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 (Th – 5 Hrs)

8. Distribution Transformer (T -25 Hrs)
   Different parts and components, their function.
   Various equipment, protection elements and components and their function for a distribution substation11KV/.433KV)

PRACTICAL: (P – 300 Hrs)

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.
8. Prepare and mount the energy meter.
9. Do wiring for consumer's main board with ICDP switch and distribution fuse box in a house/building.
10. Demonstrate the types of fuses, their ratings and applications and also to identify the parts of a MCB, ELCB and RCCB.
11. 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.
12. Test domestic wiring installation by using Megger.
13. Practical exposure on Sub-station. Visit to Sub-stations, for practical demonstration on components. Make a report of items and their function.
14. 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.
15. 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.

16. 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.
17. 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.

APPRENTICESHIP COMPONENT (150 Hrs)

Trainee needs to spend 150 Hours in actual working environment with a contractor / State Electricity Distribution Board/any other organization engaged in the related field for first hand exposure to topics covered under the course. A report related to jobs done on this need to be prepared and placed before Assessor for assessment.

Detail of Employability Skills Syllabus (100 Hrs)

Sl. No.	Content	Details
1.	English Literacy & Communication Skills	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech) Transformation of sentences, Voice change, Change of tense, Spellings. Reading and understanding simple sentences about self, work and environment. Construction of simple sentences, Writing simple English. Speaking with preparation on self, on family, on friends, classmates, on know, picture reading gain confidence through role-playing . Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication. Communication and its importance, Principles of Effective communication, Types of communication – verbal, non verbal, written, email, talking on phone. Non verbal communication –characteristics, components-Para-language, Body – language, Barriers to communication and dealing with barriers. Handling nervousness/ discomfort. Self awareness, Importance of Commitment, Ethics and Values, Ways to Motivate Oneself, Personal Goal setting and Employability Planning. Manners, Etiquettes, Dress code for an interview, Do's & Don'ts for an interview, Problem Solving, Confidence Building, Attitude.
2.	I.T. Literacy	Introduction, Computer and its applications, Hardware andperipherals, Switching on-Starting and shutting down ofcomputer. Basics of Operating System, WINDOWS, The user interfaceof Windows OS, Create, Copy, Move and delete Files andFolders, Use of External memory like pen drive, CD, DVDetc, Use of Common applications. Basic operating of Word Processing, Creating, opening andclosing Documents, use of shortcuts, Creating and Editing ofText, Formatting the Text, Insertion & creation of Tables.Printing document. Basics of Excel worksheet, understanding basic commands,creating simple worksheets, understanding sample worksheets,use of simple formulas and functions, Printing of simple excel sheets Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internetusing Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social

		media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT – ACT, types of cyber crimes.
3.	Entrepreneurship Skills	Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of Entrepreneur, Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales &distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix. Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme. Project formation, Feasibility, Legal formalities i.e.,Shop Act, Estimation & Costing, Investment procedure – Loan procurement – Banking Processes.
4.	Productivity & Quality Tools	Definition, Necessity, Meaning of GDP. Personal / Workman – Incentive, Production linked Bonus, Improvement in living standard. Industry Nation. Skills, Working Aids, Automation, Environment, Motivation. How improves or slows down. Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance. Meaning of quality, Quality characteristic. Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles. Idea of ISO 9000 and BIS systems and its importance in maintaining qualities. Purpose of Housekeeping, Practice of good House keeping. Basic quality tools with a few examples

Outcomes

Outcomes to be assessed	Assessment criteria for the outcome
1. Apply Safe Working Practices	(1.1) Maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements according to site policy.
	(1.2) Recognize any unsafe situations according to site policy, and assess his report accordingly.
	(1.3) Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	(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.
	(1.5) Demonstrate basic first aid & CPR and use them under different circumstances.
	(1.6) Identify different fire extinguishers and use the same as per requirement in a mock drill.
2. Recognize single phase and three phase AC	(2.1) Define and measure Voltage, Current, Power, Power Factor of a single phase A.C. system.

distribution systems and its components.	(2.2) Define and measure voltage, Current, 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.
3. Identify different materials used in Low voltage Distribution System.	(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.
4. Demonstrate different Tools used in overhead Distribution line work.	(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.
5.Perform internal house wiring for domestic consumer	(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.
	(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
	(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.
	(5.4)Perform wiring for a Staircase.

	(5.5)Test a domestic wiring installation by using Megger before giving supply.
	(5.6) Replace fuse, check meter, overhead line and service connection installations.
6. Calculate cost of electricity for domestic / commercial consumer from meter reading	(6.1) Explain tariff for domestic and commercial users
	(6.2) Study the reading of Energy meter and calculate energy bill of given load.
	(6.3) Calculate cost of electrical energy considering the required tariff of any system.
7. Inspect, maintain and repair Distribution line components	(7.1) Explain and perform off-line overhead line maintenance procedure
	(7.2) Explain and perform off-line underground line maintenance procedure
	(7.3) Check the stay wire assembly along with gay insulators.
	(7.4) Determine location of fault, isolate fault and restore power to customers using equipment such as switches.
	(7.5) Repair conductor by splicing, jointing, using armor rods, line guards, vibration dampers
	(7.6) Replace components like isolators, conductors, switches, terminations and insulators safely.
	(7.7) Carry out conductor stringing procedures taking into account permissible sagging.
8. Carry out routine operation and maintenance of an 11/0.433 KV Distribution Substation	(8.1) Explain standard installation process of a pole mounted distribution transformer.
	(8.2) Explain installation process of lightning arrester, earth connection, and anti-climbing devices on poles.
	(8.3) Place and remove gang operating switch and drop out fuse as per standard procedure
	(8.4) Connect and / or join Low Voltage cable, whenever required, as per standard procedures.
	(8.5) Check Distribution Transformer for Oil Level, Break Down Voltage, acidity, Sludge, dust, breather (colour of silica gel)
	(8.6) check and note for any abnormality in tap position and gap of arching horn, neutral grounding, loose connections of the terminations of HV & LV.
9. Able to work in real job situation with special emphasis on basic safety and hazards in this domain**.**	(9.1) Assessor will check report prepared for this component of training of the course and assess whether competency has been developed to work in the real job situation with special emphasis on basic safety and hazards in this domain. (The trainee is expected to undertake work in actual workplace under any supervisor / contractor for 150 Hours.)
10. Understand and practice soft skills	(10.1) Assessor will rate the trainee on his ability to practice soft skills, including clear and concise communication, in day to day work with team and with higher authority
11. Demonstrate knowledge of concept and	(11.1) Apply basic arithmetic calculations for arriving dimensional parameters as per drawing.

principles of basic arithmetic and financial calculation and apply knowledge of specific area to perform practical operations.	(11.2) Apply basic financial calculation to understand cost of materials & labour and basic concepts of profit/loss.
	(11.3) Engage in basic banking transactions as customer
12. Explain time management, entrepreneurship and manage/organize related task in day to day work for personal & social growth.	(12.1) Explain importance & factors affect the development of entrepreneurship.
	(12.2) Identify service providers for developing entrepreneur/ business establishment.
	(12,3)Knowledge of Bye laws for Formation of rural Electric Cooperative Society with advantages and experience.