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GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

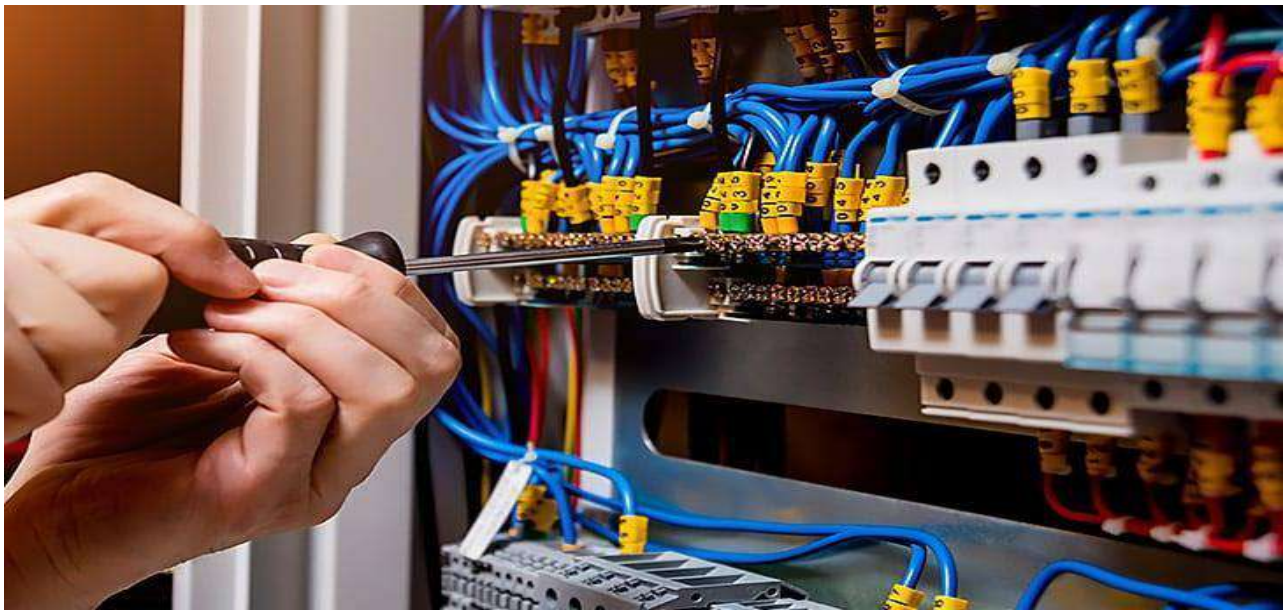
**COMPETENCY BASED CURRICULUM**

# ELECTRICIAN

**(Duration: Two Years)**

## CRAFTSMEN TRAINING SCHEME (CTS)

## NSQF LEVEL: 4



## SECTOR – POWER

**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**

Kolkata -700091

# ELECTRICIAN

(Engineering Trade)

**(Revised in August 2025)**

**Version: 3.0**

## CRAFTSMEN TRAINING SCHEME (CTS)

## NSQF LEVEL: 4

Directorate General of Training

Developed By

**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**

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# 1. COURSE INFORMATION

During the two years duration of Electrician trade candidates are trained on professional skills & knowledge, Engineering Drawing, Workshop Calculation & Science and Employability skill related to job roles. In addition to this a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The Broad components covered during the course are given below:

**FIRST YEAR**: In this year the trainee learns about safety and environment, use of fire extinguishers, artificial respiratory resuscitation to begin with. He gets the idea of trade tools & its standardization, identifies different types of conductors, cables & their skinning & joint making. Basic electrical laws like Kirchhoff's law, ohm's law, laws of resistances and their application in different combinations of electrical circuit are practiced along with laws of magnetism. The trainee practices on circuit for single phase and poly-phase circuits for 3 wire /4 wire balanced & unbalanced loads. Skilling practice on different types & combination of cells for operation and maintenance is being done. Wiring practice with installation of different accessories like MCB, distribution fuse box and mounting energy meters are practiced as per IE rules for hostel/residential building, workshop and its fault detection are done by trainee. The trainee will practice for pipe & plate earthing. Different types of light fitting are to be done like HP/LP mercury vapour and sodium vapour are prominent. The trainee will practice on different types of measuring instruments for measurement of electrical parameters in single & three phase circuits. He will gain skill on range extension, calibration and testing of meters. Practice for dismantling, assembling and testing of heating element equipment, induction heating equipment, grinding machines and washing machines will be done by trainee. Skill will be gained on transformer for operation, efficiency, series parallel operation, replacement of transformer oil and combination of single-phase transformers for 3 phase operations. The trainee will practice on winding of small transformer.

**SECOND YEAR**: In this year the trainee will study the details of electrical rotating machines viz. DC machines, induction motors, alternators & MG sets and practice on them. The trainee will practice on determining characteristics, their performance analysis, starting, speed control and reversing direction of rotation of machines. He will practice on synchronization of alternators, winding practice and over hauling will be practiced for DC machine and induction motors. Practices on diodes for bridge rectifier, switching devices & amplifiers by electronic components, different wave shape generation and testing by CRO. Designing control cabinet, assembling control elements and their wiring are to be practiced. Speed control of AC/DC motors by electronic controller will be practiced. The trainee will practice on testing, analyzing and repairing of voltage stabilizer, emergency light, battery charger, UPS and inverter. He will gain knowledge of thermal, hydel, solar & wind energy systems. The trainee will practice on distribution system, domestic service line and accessories & their protection by practicing on relay and circuit breaker for operation and maintenance. Install and troubleshoot Electric Vehicle charging stations.

# 2. TRAINING SYSTEM

## 2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under the aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variants and Apprenticeship Training Scheme (ATS) are two pioneer schemes of DGT for strengthening vocational training.

Electrician trade under CTS is one of the most popular courses delivered nationwide through network of ITIs. The course is of two years duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) impart professional skills and knowledge, while Core area (Employability Skills) impart requisite core skills, knowledge and life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

### Trainees broadly need to demonstrate that they are able to:

- Read and interpret technical parameters/ documents, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge & employability skills while performing jobs.
- Check the job/ assembly as per drawing for functioning identify and rectify errors in job/ assembly.
- Document the technical parameters related to the task undertaken.

## 2.2 PROGRESSION PATHWAYS

- Can join industry as Electrician and will progress further as Senior Electrician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can appear in 10+2 examination through National Institute of Open Schooling (NIOS) for acquiring higher secondary certificate and can go further for General/ Technical education
- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

## 2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of two-years: -

| S No. | Course Element | Notional Training Hours | |
|---|---|---|---|
| | | 1st Year | 2nd Year |
| 1 | Professional Skill (Trade Practical) | 840 | 840 |
| 2 | Professional Knowledge (Trade Theory) | 240 | 300 |
| 3 | Employability Skills | 120 | 60 |
| | **Total** | **1200** | **1200** |
| On the Job Training (OJT)/ Group Project * | | 150 | 150 |
| Optional Courses** | | 240 | 240 |
| **Grand Total** | | **1590** | **1590** |

** The trainee has to undergo 150 hours of mandatory OJT (On the Job Training) at nearby industry or wherever industry not available then group project has to be done with the supervision of the trade instructor for every year.*

*** Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for obtaining 10th/ 12th class certificate from NIOS along with ITI certification, or, short term courses for extra skills/knowledge.*

## 2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his/her skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute has to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.cstaricalcutta.gov.in or www.bharatskills.gov.in

b) The final assessment will be in the form of summative assessment. The All India Trade Test for awarding NTC will be conducted by DGT as per the guidelines. The pattern and marking structure are being notified by DGT from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

## 2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one-year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percentage for Trade Practical and Formative assessment is 60% & for all other subjects are 33%.

## 2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration to be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitive to environment and regularity in training. The sensitivity towards Occupational Safety, Health and Environment (OSHE) and self-learning attitude to be considered while assessing competency.

Assessment will be evidence based comprising some of the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work
- Computer based multiple choice question examination
- Practical Examination

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming examination for audit and verification by examination body. The following marking pattern to be adopted for formative assessment:

| Marks Allotted during Assessment | Performance Level | Evidence |
|---|---|---|
| Marks between 60% to 75% | For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship. | ● Demonstration of good skill in the use of hand tools, machine tools and workshop equipment<br>● 60-70% accuracy achieved while undertaking different work with those demanded by the component/job.<br>● A fairly good level of neatness and consistency in the finish<br>● Occasional support in completing the project/job. |
| Marks above 75% to 90% | For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship. | ● Good skill levels in the use of hand tools, machine tools and workshop equipment<br>● 70-80% accuracy achieved while undertaking different work with those demanded by the component/job.<br>● A good level of neatness and consistency in the finish<br>● Little support in completing the project/job |
| Marks Above 90% | For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship. | ● High skill levels in the use of hand tools, machine tools and workshop equipment<br>● Above 80% accuracy achieved while undertaking different work with those demanded by the component/job.<br>● A high level of neatness and consistency in the finish.<br>● Minimal or no support in completing the project. |

# 3. JOB ROLE

**Brief Description of Job Roles:**

**Electrician General;** installs, maintains and repairs electrical machinery equipment and fittings in factories, workshops powerhouse, business and residential premises etc. Studies drawings and other specifications to determine electrical circuit, installation details etc. Positions and installs electrical motors, transformers, switchgears. Switch boards and other electrical equipment, fittings and lighting fixtures. Makes connections and solders terminals. Tests electrical installations and equipment and locates faults using megger, test lamps etc. Repairs or replaces defective wiring, burnt out fuses and defective parts and keeps fittings and fixtures in working order. May do armature winding, draw wires and cables and do simple cable jointing. May operate, attend and maintain electrical motors, pumps etc.

**Electrical Fitter**; fits and assembles electrical machinery and equipment such as motors, transformers, generators, switchgears, fans etc., Studies drawings and wiring diagrams of fittings, wiring and assemblies to be made. Collects prefabricated electrical and mechanical components according to drawing and wiring diagrams and checks them with gauges, megger etc. to ensure proper function and accuracy. Fits mechanical components, resistance, insulators, etc., as per specifications, doing supplementary tooling where necessary. Follows wiring diagrams, makes electrical connections and solders points as specified. Checks for continuity, resistance, circuit shorting, leakage, earthing, etc. at each stage of assembly using megger, ammeter, voltmeter and other appliances and ensures stipulated performance of both mechanical and electrical components filled in assembly. Erects various equipment such as bus bars, panel boards, electrical posts, fuse boxes switch gears, meters, relays etc. using non-conductors, insulation hoisting equipment as necessary for receipt and distribution of electrical current to feeder lines. Installs motors, generators, transformer etc. as per drawings using lifting and hoisting equipment as necessary, does prescribed electrical wiring, and connects to supply line. Locates faults in case of breakdown and replaces blown out fuse, burnt coils, switches, conductors etc. as required. Checks, dismantles, repairs and overhauls electrical units periodically or as required according to scheduled procedure. May test coils. May specialize in repairs of particular equipment manufacturing, installation or powerhouse work and be designated accordingly.

**Reference NCO-2015:**

i) 7411.0100 – Electrician General
ii) 7412.0200 – Electrical Fitter

**Reference NOS:**

(i) PSS/N9490
(ii) PSS/N9491
(iii) PSS/N9492
(iv) PSS/N9493
(v) PSS/N9494
(vi) PSS/N9495
(vii) PSS/N9403
(viii) PSS/N9496
(ix) PSS/N9404
(x) PSS/N9497
(xi) PSS/N9498
(xii) PSS/N9401
(xiii) PSS/N9402
(xiv) PSS/N9499
(xv) PSS/N9507
(xvi) PSS/N9500
(xvii) PSS/N9405
(xviii) PSS/N9406
(xix) PSS/N9407
(xx) PSS/N9408
(xxi) PSS/N9501
(xxii) PSS/N9409
(xxiii) PSS/N9508
(xxiv) PSS/N9502
(xxv) PSS/N9410

# 4. GENERAL INFORMATION

| | |
|---|---|
| **Name of the Trade** | **ELECTRICIAN** |
| **Trade Code** | DGT/1001 |
| **NCO - 2015** | 7411.0100, 7412.0200 |
| **NOS Covered** | PSS/N9490, PSS/N9491, PSS/N9492, PSS/N9493, PSS/N9494, PSS/N9495, PSS/N9403, PSS/N9496, PSS/N9404, PSS/N9497, PSS/N9498, PSS/N9401, PSS/N9402, PSS/N9499, PSS/N9507, PSS/N9500, PSS/N9405, PSS/N9406, PSS/N9407, PSS/N9408, PSS/N9501, PSS/N9409, PSS/N9508, PSS/N9502, PSS/N9410 |
| **NSQF Level** | Level: 4 |
| **Duration of the Trade** | Two Years |
| **Entry Qualification** | Passed 10th class examination with Science and Mathematics or with vocational subject in same sector or its equivalent. |
| **Minimum Age** | 14 years as on first day of academic session. |
| **Eligibility for PwD** | LD, LC, DW, AA, DEAF, HH |
| **Unit Strength (No. Of Student)** | 20 (There is no separate provision of supernumerary seats) |
| **Space Norms** | 98 Sq. m |
| **Power Norms** | 5.2 KW (for two units in one shift) |
| **Instructors Qualification for** | |
| **(i) Electrician Trade** | B.Voc/Degree in Electrical/ Electrical and Electronics Engineering from AICTE/UGC recognized Engineering College/ university with **one-year of teaching or industry experience** in the electrical field.<br>**OR**<br>03 years Diploma in Electrical/ Electrical and Electronics Engineering from AICTE/recognized board of technical education with **two years of teaching or industry experience** in the electrical field.<br>**OR**<br>NTC/NAC passed in the trade of "Electrician" with **three years of teaching or industry experience** in the electrical field.<br><br>**Essential Qualification:**<br>Regular/ RPL variants of National Craft Instructor Certificate (NCIC) in Electrician trade under DGT.<br><br>***NOTE: Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.*** |

| | |
|---|---|
| **(ii) Workshop Calculation & Science** | B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with **one year of teaching or industry experience**.<br>**OR**<br>03 years Diploma in Engineering from AICTE/ recognized board of technical education with **two years of teaching or industry experience.**<br>**OR**<br>NTC/ NAC in any one of the engineering trades with **three years of teaching or industry experience**.<br><br>**Essential Qualification:**<br>Regular/ RPL variants of National Craft Instructor Certificate (NCIC) in any one of the engineering trades or RoDA. |
| **(iii) Engineering Drawing** | B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with **one year of teaching or industry experience.**<br>**OR**<br>03 years Diploma in Engineering from AICTE / recognized board of technical education with **two years of teaching or industry experience.**<br>**OR**<br>NTC/ NAC in any one of the engineering/ Draughtsman group of trades with **three years of teaching or industry experience**.<br><br>**Essential Qualification:**<br>Regular/ RPL variants of National Craft Instructor Certificate (NCIC) in any one of the engineering trades or RoDA. |
| **(iv) Employability Skill** | MBA/ BBA/ Any Graduate/ Diploma in any discipline with **Two years' of teaching or industry experience with short term ToT Course** in Employability Skills conducted by DGT institutions.<br>(Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above)<br>**OR**<br>Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills conducted by DGT institutions. |
| **Minimum age for Instructor** | 21 years |
| **List of Tools & Equipment** | As per Annexure-I |

# 5. LEARNING OUTCOME

***Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.***

## 5.1 LEARNING OUTCOMES

| Sl. No. | NOS CODE | Learning Outcome | Duration | | |
|---|---|---|---|---|---|
| | | | Practical | Theory | Total |
| **First Year** | | | | | |
| 1. | PSS/N9490 | Undertake basic safety practices, firefighting, elementary first aid, disposal of waste material, handling and maintenance of trade tools. | 40 | 5 | 45 |
| 2. | PSS/N9491 | Prepare electrical wire joints; carry out soldering, crimping and measure insulation resistance of underground cable. | 95 | 25 | 120 |
| 3. | PSS/N9492 | Verify characteristics of electrical and magnetic circuits. | 160 | 35 | 195 |
| 4. | PSS/N9493 | Install, test and maintenance of batteries and solar cell. | 50 | 10 | 60 |
| 5. | PSS/N9494 | Estimate, Assemble, install and test wiring system. | 200 | 40 | 240 |
| 6. | PSS/N9495 | Plan and prepare Earthing installation. | 25 | 5 | 30 |
| 7. | PSS/N9403 | Plan and execute electrical illumination system and test. | 45 | 15 | 60 |
| 8. | PSS/N9496 | Select and perform measurements using analog / digital instruments and install/ diagnose smart meters. | 50 | 10 | 60 |
| 9. | PSS/N9404 | Perform testing, verify errors and calibrate instruments. | 25 | 5 | 30 |
| 10. | PSS/N9497 | Plan and carry out installation, fault detection and repairing of domestic appliances. | 75 | 15 | 90 |
| 11. | PSS/N9498 | Execute testing, evaluate performance and maintenance of transformer. | 75 | 15 | 90 |
| 12. | PSS/N9401 | Read and apply engineering drawing for different application in the field of work. | - | 30 | 30 |
| 13. | PSS/N9402 | Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. | - | 30 | 30 |
| **Employability Skills** | | | | **120** | **120** |
| **Total** | | | **840** | **360** | **1200** |
| **Second Year** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 14. | PSS/N9499 | Plan, execute commissioning and evaluate performance of DC machines. | 35 | 10 | 45 |
| 15. | PSS/N9499 | Execute testing, and maintenance of DC machines and motor starters. | 80 | 25 | 105 |
| 16. | PSS/N9507 | Distinguish, organise and perform motor winding. | 100 | 20 | 120 |
| 17. | PSS/N9500 | Plan, execute commissioning and evaluate performance of AC motors. Execute testing, and maintenance of AC motors and starters. | 120 | 30 | 150 |
| 18. | PSS/N9405 | Plan, execute testing, evaluate performance and carry out maintenance of Alternator / MG set. | 83 | 22 | 105 |
| 19. | PSS/N9406 | Assemble simple electronic circuits and test for functioning. | 115 | 35 | 150 |
| 20. | PSS/N9407 | Assemble accessories and carry out wiring of control cabinets and equipment. | 82 | 23 | 105 |
| 21. | PSS/N9408 | Perform speed control of AC and DC motors by using solid state devices. | 50 | 10 | 60 |
| 22. | PSS/N9501 | Detect the faults and troubleshoot inverter, stabilizer, battery charger, emergency light and UPS etc. | 50 | 10 | 60 |
| 23. | PSS/N9409 | Plan, assemble and install solar panel. | 25 | 05 | 30 |
| 24. | PSS/N9508 | Erect overhead domestic service line, outline various power plant layout and explain smart distribution grid and its components. | 50 | 10 | 60 |
| 25. | PSS/N9502 | Examine the faults and carry out repairing of circuit breakers. | 25 | 05 | 30 |
| 26. | PSS/N9410 | Install and troubleshoot Electric Vehicle charging stations. | 25 | 05 | 30 |
| 27. | PSS/N9401 | Read and apply engineering drawing for different application in the field of work. | - | 45 | 45 |
| 28. | PSS/N9402 | Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. | - | 45 | 45 |
| | | **Employability Skills** | | **60** | **60** |
| | | **Total** | **840** | **360** | **1200** |
| | | **Grand Total** | **1680** | **720** | **2400** |

# 6. ASSESSMENT CRITERIA

| LEARNING OUTCOMES | ASSESSMENT CRITERIA |
|---|---|
| **FIRST YEAR** | |
| 1. Undertake basic safety practices, firefighting, elementary first aid, disposal of waste material, handling and maintenance of trade tools. (NOS: PSS/N9490) | • Identify the trade tools; demonstrate their uses with safety, care & maintenance.<br>• Use of personal protective equipment.<br>• Perform filing and hacksawing.<br>• Demonstrate fixing of surface mounting type of accessories.<br>• Demonstrate elementary first aid.<br>• Rescue a person and perform artificial respiration. |
| | |
| 2. Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance of underground cable. (NOS: PSS/N9491) | • Observe safety/ precaution during joints & soldering.<br>• Make simple straight twist and rat-tail joints in single strand conductors.<br>• Make married and 'T' (Tee) joint in stranded conductors.<br>• Prepare a Britannia straight and 'T' (Tee) joint in bare conductors.<br>• Prepare western union joint in bare conductor.<br>• Solder the finished copper conductor joints with precaution.<br>• Prepare termination of cable lugs by using crimping tool.<br>• Make straight joint in different types of underground cables.<br>• Measure insulation resistance of underground cable. |
| | |
| 3. Verify characteristics of electrical and magnetic circuits. (NOS: PSS/N9492) | • Identify types of wires, cables and verify their specifications.<br>• Verify the characteristics of series, parallel and its combination circuit.<br>• Analyze the effect of the short and open in series and parallel circuits.<br>• Verify the relation of voltage components of RLC series circuit in AC.<br>• Determine the power factor by direct and indirect methods in an AC single phase RLC parallel circuit. |

| | |
|---|---|
| | • Identify the phase sequence of a 3 ø supply using a phase-sequence meter.<br>• Prepare/ connect a lamp load in star and delta and determine relationship between line and phase values with precaution.<br>• Connect balanced and unbalanced loads in 3 phase star system and measure the power of 3 phase loads.<br>• Make the solenoid and determine its polarity for the given direction of current.<br>• Group the given capacitors to get the required capacity and voltage rating. |
| | |
| 4. Install, test and maintenance of batteries and solar cell. (NOS: PSS/N9493) | • Assemble a DC source 6V/500 mA using 1.5V cells.<br>• Determine the internal resistance of cell and make grouping of cells.<br>• Explain charging of battery and test for its condition with safety/ precaution.<br>• Carry out installation and maintenance of batteries.<br>• Determine total number of cells required for a given power requirement.<br>• Demonstrate Charging and discharging of Lithium-ion battery, measure voltage and current to identify basic faults. |
| | |
| 5. Estimate, Assemble, install and test wiring system. (NOS: PSS/N9494) | • Comply with safety & IE rules when performing the wiring.<br>• Prepare and mount the energy meter board.<br>• Draw and wire up the consumers main board with ICDP switch and distribution fuse box.<br>• Draw and wire up a bank/hostel/jail in PVC conduit.<br>• Identify the types of fuses their ratings and applications.<br>• Identify the parts of a relay, MCB & ELCB and check its operation.<br>• Estimate the cost of material for wiring in PVC channel for an office room having 2 lamps, 1 Fan, one 6A socket outlet and wire up.<br>• Estimate the requirement for conduit wiring (3 phase) and wire up.<br>• Estimate the materials and wire up the lighting circuit for a godown.<br>• Estimate the materials and wire up a lighting circuit for a |

| | |
|---|---|
| | corridor in conduit.<br>• Test, locate the fault and repair a domestic wiring installation. |
| | |
| 6. Plan and prepare Earthing installation. (NOS: PSS/N9495) | • Plan work in compliance with standard safety norms related with earthing installation.<br>• Install the pipe earthing and test it.<br>• Install the plate earthing and test it.<br>• Measure the earth electrode resistance using earth tester.<br>• Carry out earth resistance improvement. |
| | |
| 7. Plan and execute electrical illumination system and test. (NOS: PSS/N9403) | • Plan work in compliance with standard safety norms related with electrical illumination system.<br>• Install light fitting with reflectors for direct and indirect lighting.<br>• Assemble and connect a single twin tube fluorescent light.<br>• Connect, install and test the HPMV & HPSV lamp with accessories.<br>• Prepare and test a decorative serial lamp set for 240 V using 6V bulb and flasher.<br>• Install light fitting for show case window lighting. |
| | |
| 8. Select and perform measurements using analog / digital instruments and install/ diagnose smart meters. (NOS: PSS/N9496) | • Identify the type of electrical instruments.<br>• Extend the range of MC voltmeter and ammeter.<br>• Measure the frequency-by-frequency meter.<br>• Measure the power and energy in a single & three phase circuit using wattmeter and energy meter with CT and PT.<br>• Measure the value of resistance, voltage and current using digital multimeter.<br>• Measure the power factor in poly-phase circuit and verify the same with voltmeter, ammeter, watt-meter readings.<br>• Identify components of smart meters.<br>• Install and diagnose smart meters. |
| | |
| 9. Perform testing, verify errors and calibrate instruments. (NOS: PSS/N9404) | • Test single phase energy meter for its errors.<br>• Determine the measurement errors while measuring resistance by voltage drop method. |

| | |
|---|---|
| | • Calibrate the analog multimeter. |
| | |
| 10. Plan and carry out installation, fault detection and repairing of domestic appliances. (NOS: PSS/N9497) | • Plan work in compliance with standard safety norms related with domestic appliances.<br>• Service and Repair of calling bell/ buzzer/ Alarm.<br>• Service and repair an automatic iron.<br>• Repair and service of oven having multi-range heat control.<br>• Replace the heating element in a kettle and test.<br>• Service and repair an induction heater.<br>• Service and repair a geyser.<br>• Service and repair a mixer.<br>• Service and repair of washing machine.<br>• Install a pump set.<br>• Service and repair of table fan.<br>• Service, repair and install a ceiling fan. |
| | |
| 11. Execute testing, evaluate performance and maintenance of transformer. (NOS: PSS/N9498) | • Plan work in compliance with standard safety norms related with transformer.<br>• Identify the types of transformers and their specifications.<br>• Identify the terminals; verify the transformation ratio of a single-phase transformer.<br>• Connect and test a single-phase auto- transformer.<br>• Determine the losses (iron loss and copper loss) and the regulation of a single-phase transformer at different loads.<br>• Measure the current and voltage using CT and PT.<br>• Carry out winding for small transformer of 1KVA rating.<br>• Test the transformer oil with oil testing kit.<br>• Connect 3 single phase transformers for 3 phase operation of delta-delta /delta-star /star-star /star-delta.<br>• Connect the given two single phase transformers in parallel /series (secondary only) and measure voltage.<br>• Connect & test 3 phase transformer in parallel. |
| | |
| 12. Read and apply engineering drawing for different application in the field of work. (NOS: PSS/N9401) | • Read & interpret the information on drawings and apply in executing practical work.<br>• Read & analyze the specification to ascertain the material requirement, tools and assembly/ maintenance parameters.<br>• Encounter drawings with missing/ unspecified key information and make own calculations to fill in missing |

| | |
|---|---|
| | dimension/ parameters to carry out the work. |
| | |
| 13. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: PSS/N9402) | • Solve different mathematical problems<br>• Explain concept of basic science related to the field of study |
| **SECOND YEAR** | |
| 14. Plan, execute commissioning and evaluate performance of DC machines. (NOS: PSS/N9499) | • Plan work in compliance with standard safety norms related with DC machines.<br>• Determine the load performance of a different type of DC generator on load.<br>• Connect, start, run and reverse direction of rotation of different types of DC motors.<br>• Conduct the load performance tests on different type of DC motor.<br>• Control the speed of a DC motor by different method. |
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| 15. Execute testing, and maintenance of DC machines and motor starters. (NOS: PSS/N9499) | • Test a DC machine for continuity and insulation resistance.<br>• Maintenance, troubleshooting & servicing of DC machines.<br>• Test armature by using growler.<br>• Maintain, service and troubleshoot the DC motor starter. |
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| 16. Distinguish, organize and perform motor winding. (NOS: PSS/N9507) | • Rewind the field coil /armature winding/ table fan /ceiling fan.<br>• Draw winding diagram & rewind a single-phase split type motor (Concentric coil winding).<br>• Draw winding diagram & rewind a 3-phase squirrel cage induction motor (single layer distributed winding).<br>• Draw winding diagram & rewind a 3-phase induction motor (single layer concentric type half coil connection).<br>• Draw winding diagram & rewind a 3-phase squired cage induction motor. (Double layer distributed type winding) |
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| 17. Plan, execute commissioning and evaluate performance of AC motors. Execute testing, | • Plan work in compliance with standard safety norms related with AC motors.<br>• Draw circuit diagram and connect forward & reverse a 3- |

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| and maintenance of AC motors and starters. (NOS: PSS/N9500) | phase squirrel cage induction motor.<br>• Start, run and reverse an AC 3 phase squirrel cage induction motor by different type of starters.<br>• Measure the slip of 3 phase squirrel cage induction motor by tachometer for different output. Draw slip/ load characteristics of the motor.<br>• Determine the efficiency of 3 phase squirrel cage induction motor by no load test/ blocked rotor test and brake test.<br>• Plot the speed torque (Slip/Torque) characteristics of slip ring induction motor.<br>• Demonstrate speed control of 3 phase induction motor.<br>• Connect, start and run a 3-phase synchronous motor.<br>• Connect start, run, control speed and reverse the DOR of different type of single-phase motors.<br>• Install a single-phase AC motor.<br>• Test continuity and insulation of various AC motors.<br>• Maintain, service and troubleshoot of three phase AC motors.<br>• Maintain, service and troubleshoot of different types of single-phase AC motors.<br>• Maintain, service and troubleshoot the AC motor starter. |
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| 18. Plan, execute testing, evaluate performance and carry out maintenance of Alternator / MG set. (NOS: PSS/N9405) | • Plan work in compliance with standard safety norms related with Alternator & MG set.<br>• Connect start and run an alternator and build up the voltage.<br>• Determine the load performance of a 3-phase alternator.<br>• Start and load a MG set with 3 phase induction motor coupled to DC shunt generator and build up the voltage.<br>• Perform/ Explain alignment of MG set.<br>• Preventive and breakdown maintenance of alternator / MG set.<br>• Explain the effect of excitation current in terms of V-curves of synchronous motor. |
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| 19. Assemble simple electronic circuits and test for functioning. (NOS: PSS/N9406) | • Perform soldering on components/ lug / board with safety.<br>• Identify the passive /active components by visual appearance, code number and test for their condition. |

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| | • Identify the control and functional switches in CRO and measure the D.C. & A.C. voltage, frequency and time period.<br>• Construct and test a half & full wave rectifier with and without filter circuits.<br>• Demonstrate use of function generator.<br>• Troubleshoot defects in simple power supplies. |
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| 20. Assemble accessories and carry out wiring of control cabinets and equipment. (NOS: PSS/N9407) | • Draw the layout diagram of 3 phase AC motor control cabinet.<br>• Mount the control elements & wiring accessories on the control panel.<br>• Carry out wiring in control cabinet for local and remote control of induction motor.<br>• Draw & wire up the control panel for forward/ reverse operation of induction motor.<br>• Perform wiring for automatic start delta starter.<br>• Draw & wire up control panel for sequential motor control for three motors.<br>• Draw & wire up the control panel for a given circuit diagram and connect the motor.<br>• Test the control panel for all the required logics. |
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| 21. Perform speed control of AC and DC motors by using solid state devices. (NOS: PSS/N9408) | • Control the speed of DC motor by using DC drive.<br>• Speed control of universal motor by using SCR.<br>• Control speed and reverse the direction of rotation of different type of three phase induction motors using VVVF control /AC drive |
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| 22. Detect the faults and troubleshoot inverter, stabilizer, battery charger, emergency light and UPS etc. (NOS: PSS/N9501) | • Operation and maintenance of inverter.<br>• Troubleshoot and service a voltage stabilizer.<br>• Identify the parts, trace the connection and test the DC regulated power supply with safety.<br>• Troubleshoot and service a DC regulated power supply.<br>• Test battery charger for its operation.<br>• Prepare an emergency light.<br>• Carryout maintenance of UPS. |
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| 23. Plan, assemble and install solar panel. (NOS: PSS/N9409) | • Plan work in compliance with solar panel installation norms.<br>• Combination of solar cells for given power requirement.<br>• Assemble and install solar panel.<br>• Check the functionality of solar panel. |

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| 24. Erect overhead domestic service line and outline various power plant layout and explain smart distribution grid and its components. (NOS: PSS/N9508) | • Prepare layout plan and single line diagram of transmission line.<br>• Draw an overhead and domestic service line.<br>• Explain erection of an overhead service line pole for single phase 230V distribution system.<br>• Identify different type of insulator used in HT and LT line.<br>• Fasten jumper in insulators.<br>• Connect feeder cable with domestic service line.<br>• Identify components and equipment of smart distribution grid.<br>• Explain Smart Grid Communication infrastructure components. |
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| 25. Examine the faults and carry out repairing of circuit breakers. (NOS: PSS/N9502) | • Prepare layout plan and single line diagram of Distribution substation<br>• Illustrate application of relays in control circuits and examine its operation.<br>• Identify parts of circuit breaker and check its operation. |
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| 26. Install and troubleshoot Electric Vehicle charging stations. (NOS: PSS/N9410) | • Explain charger specifications.<br>• Demonstrate installation of EV charging Station for Public places/ Home. |
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| 27. Read and apply engineering drawing for different application in the field of work. (NOS: PSS/N9401) | • Read & interpret the information on drawings and apply in executing practical work.<br>• Read & analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.<br>• Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work. |
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| 28. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: PSS/N9402) | • Solve different mathematical problems<br>• Explain concept of basic science related to the field of study |
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# 7. TRADE SYLLABUS

| SYLLABUS FOR ELECTRICIAN TRADE | | | |
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| **FIRST YEAR** | | | |
| **Duration** | **Reference Learning Outcome** | **Professional Skills (Trade Practical)** | **Professional Knowledge (Trade Theory)** |
| Professional Skill 40 Hrs.;<br><br>Professional Knowledge 05 Hrs. | 1. Undertake basic safety practices, firefighting, elementary first aid, disposal of waste material, handling and maintenance of trade tools. | 1. Visit various sections of the institutes and location of electrical installations.<br>2. Identify safety symbols and hazards.<br>3. Preventive measures for electrical accidents and practice steps to be taken in such accidents.<br>4. Practice safe methods of fire fighting in case of electrical fire.<br>5. Use of fire extinguishers. | Scope of the electrician trade.<br>Safety rules and safety signs.<br>Types and working of fire extinguishers.<br>Environment, Health, and Safety (EHS) Policy |
| | | 6. Practice elementary first aid.<br>7. Rescue a person and practice artificial respiration.<br>8. Disposal procedure of waste materials including E-waste.<br>9. Use of personal protective equipment.<br>10. Practice on cleanliness and procedure to maintain it. | First aid safety practice.<br>Hazard identification and prevention.<br>Personal safety and factory safety.<br>Response to emergencies e.g., power failure, system failure and fire etc.<br>Recycling of waste. |
| | | 11. Identify trade tools and machineries.<br>12. Practice safe methods of lifting and handling of tools & equipment.<br>13. Select proper tools for operation and precautions in operation. | Concept of Standards and advantages of BIS/ISI.<br>Trade tools specifications.<br>Introduction to National Electrical Code-2011. |

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| | | 14. Care & maintenance of trade tools. | |
| | | 15. Operations of allied trade tools.<br>16. Workshop practice on filing and hacksawing. | Allied trades: Introduction to fitting tools, safety precautions. Description of files, hammers, chisels hacksaw frames, blades, their specification and grades.<br>Types of drills, description & drilling machines. |
| Professional Skill 95 Hrs.;<br><br>Professional Knowledge 25 Hrs. | 2. Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance of underground cable. | 17. Identify various types of cables and measure conductor size using SWG and micrometer.<br>18. Prepare terminations of cable ends<br>19. Practice on skinning, twisting and crimping. | Fundamentals of electricity, definitions, units & effects of electric current and voltage.<br>Conductors and insulators.<br>Conducting materials and their comparison.<br>IP Rating<br>Does and don'ts on electrical safety<br>Cable glands |
| | | 20. Make simple twist, married, Tee and western union joints.<br>21. Make Britannia straight, Britannia Tee and rat tail joints.<br>22. Practice in Soldering of joints / lugs. | Joints in electrical conductors.<br>Techniques of soldering.<br>Types of solders and flux. |
| | | 23. Identify various parts, skinning and dressing of underground cable.<br>24. Make straight joint of different types of underground cable.<br>25. Test insulation resistance of underground cable using megger.<br>26. Test underground cables for faults and remove the fault. | Underground cables: Description, types, various joints and testing procedure.<br>Cable insulation & voltage grades<br>Precautions in using various types of cables. |

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| Professional Skill 160 Hrs.;<br><br>Professional Knowledge 35 Hrs. | 3. Verify characteristics of electrical and magnetic circuits. | 27. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources and analyses by drawing graphs.<br>28. Measure current and voltage in electrical circuits to verify Kirchhoff's Law<br>29. Verify laws of series and parallel circuits with voltage source in different combinations.<br>30. Measure voltage and current against individual resistance in electrical circuit<br>31. Measure current and voltage and analyse the effects of shorts and opens in series circuit.<br>32. Measure current and voltage and analyse the effects of shorts and opens in parallel circuit. | Ohm's Law; Simple electrical circuits and problems.<br>Kirchhoff's Laws and applications.<br>Series and parallel circuits.<br>Open and short circuits in series and parallel networks. |
| | | 33. Measure resistance using voltage drop method.<br>34. Measure resistance using Wheatstone bridge.<br>35. Determine the thermal effect of electric current.<br>36. Determine the change in resistance due to temperature.<br>37. Verify the characteristics of series parallel combination of resistors. | Laws of Resistance and various types of resistors.<br>Wheatstone bridge; principle and its applications.<br>Effect of variation of temperature on resistance.<br>Different methods of measuring the values of resistance.<br>Series and parallel combinations of resistors. |

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| | | 38. Determine the poles and plot the field of a magnet bar.<br>39. Wind a solenoid and determine the magnetic effect of electric current.<br>40. Determine direction of induced emf and current.<br>41. Practice on generation of mutually induced emf.<br>42. Measure the resistance, impedance and determine inductance of choke coils in different combinations.<br>43. Identify various types of capacitors, charging / discharging and testing.<br>44. Group the given capacitors to get the required capacity and voltage rating. | Magnetic terms, magnetic materials and properties of magnet.<br>Principles and laws of electro-magnetism.<br>Self and mutually induced EMFs.<br>Electrostatics: Capacitor- Different types, functions, grouping and uses. |
| | | 45. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC series circuits.<br>46. Measure the resonance frequency in AC series circuit and determine its effect on the circuit.<br>47. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC parallel circuits.<br>48. Measure the resonance frequency in AC parallel circuit and determine its effects on the circuit.<br>49. Measure power, energy for lagging and leading power factors in single phase | Inductive and capacitive reactance, their effect on AC circuit and related vector concepts.<br>Comparison and Advantages of DC and AC systems.<br>Related terms frequency, Instantaneous value, R.M.S. value Average value, Peak factor, form factor, power factor and Impedance etc.<br>Sine wave, phase and phase difference.<br>Active and Reactive power.<br>Single Phase and three-phase system.<br>Problems on A.C. circuits. |

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| | | circuits and compare characteristic graphically.<br>50. Measure Current, voltage, power, energy and power factor in three phase circuits.<br>51. Practice improvement of PF by use of capacitor in three phase circuit. | |
| | | 52. Ascertain use of neutral by identifying wires of a 3-phase 4 wire system and find the phase sequence using phase sequence meter.<br>53. Determine effect of broken neutral wire in three phase four wire system.<br>54. Determine the relationship between Line and Phase values for star and delta connections.<br>55. Measure the Power of three phase circuit for balanced and unbalanced loads.<br>56. Measure current and voltage of two phases in case of one phase is short-circuited in three phase four wire system and compare with healthy system. | Advantages of AC poly-phase system.<br>Concept of three-phase Star and Delta connection.<br>Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load.<br>Phase sequence meter. |
| Professional Skill 50 Hrs.;<br><br>Professional Knowledge 10 Hrs. | 4. Install, test and maintenance of batteries and solar cell. | 57. Use of various types of cells.<br>58. Practice on grouping of cells for specified voltage and current under different conditions and care.<br>59. Prepare and practice on battery charging and details of charging circuit. | Chemical effect of electric current and Laws of electrolysis.<br>Explanation of Anodes and cathodes.<br>Types of cells and batteries, advantages / disadvantages and their applications. |

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| | | 60. Practice on routine, care/ maintenance and testing of batteries.<br>61. Determine the number of solar cells in series / parallel for given power requirement.<br>62. Practice on Charging and discharging of Lithium-ion battery, measure voltage and current to identify basic faults. | Lead acid cell; Principle of operation and components.<br>Lithium-ion battery<br>Types of battery charging, Safety precautions, test equipment and maintenance.<br>Basic principles of Electro-plating and cathodic protection<br>Grouping of cells for specified voltage and current.<br>Principle and operation of solar cell. |
| Professional Skill 200 Hrs.;<br><br>Professional Knowledge 40 Hrs. | 5. Estimate, Assemble, install and test wiring system. | 63. Identify various conduits and different electrical accessories.<br>64. Practice cutting, threading of different sizes & laying Installations.<br>65. Prepare test boards / extension boards and mount accessories like lamp holders, various switches, sockets, fuses, relays, MCB, ELCB, RCCB, MCCB etc. | I.E. rules on electrical wiring.<br>Types of domestic and industrial wirings.<br>Study of wiring accessories e.g. switches, fuses, relays, MCB, ELCB, RCCB, MCCB etc.<br>Data sheets, Grading of cables and current ratings.<br>Principle of laying out of domestic wiring.<br>Voltage drop concept.<br>Introduction to analog and digital timers, impulse relays, dusk and dawn switches, |
| | | 66. Draw layouts and practice in PVC Casing-capping, Conduit wiring with minimum to more number of points of minimum 15 mtr length.<br>67. Wire up PVC conduit wiring to control one lamp from two different places.<br>68. Wire up PVC conduit wiring to control one lamp from three different places. | PVC conduit and Casing-capping wiring system.<br>Different types of wiring - Power, control, Communication and entertainment wiring.<br>Wiring circuits planning, permissible load in sub-circuit and main circuit. |

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| | | 69. Wire up PVC conduit wiring and practice control of sockets and lamps in different combinations using switching concepts. | |
| | | 70. Wire up the consumers main board with MCB & DB's switch and distribution fuse box.<br>71. Prepare and mount the energy meter board.<br>72. Estimate the cost/bill of material for wiring of hostel/ residential building and workshop.<br>73. Practice wiring of hostel and residential building as per IE rules.<br>74. Practice wiring of institute and workshop as per IE rules.<br>75. Practice testing / fault detection of domestic and industrial wiring installation and repair.<br>76. Demonstrate home automation. | Estimation of load, cable size, bill of material and cost.<br>Inspection and testing of wiring installations.<br>Special wiring circuit e.g., godown, tunnel and workshop etc. |
| Professional Skill 25 Hrs.;<br><br>Professional Knowledge 05 Hrs. | 6. Plan and prepare Earthing installation. | 77. Prepare pipe earthing and measure earth resistance by earth tester / megger.<br>78. Prepare plate earthing and measure earth resistance by earth tester / megger.<br>79. Test earth leakage by ELCB and relay. | Importance of Earthing.<br>Plate earthing and pipe earthing methods and IEE regulations.<br>Earth resistance and earth leakage circuit breaker.<br>Earthing grid, earthing faults |
| Professional Skill 45 Hrs.;<br><br>Professional | 7. Plan and execute electrical illumination system and test. | 80. Install light fitting with reflectors for direct and indirect lighting.<br>81. Group different wattage of | Laws of Illuminations.<br>Types of illumination system.<br>Illumination factors, intensity of light. |

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| Knowledge 15 Hrs. | | lamps in series for specified voltage.<br>82. Practice installation of various lamps e.g., LED, HP mercury vapour, LP mercury vapour, HP sodium vapour, LP sodium vapour, etc.<br>83. Prepare and arrange decorative lamp circuit to produce rotating light effect/running light effect.<br>84. Install light fitting for show case lighting. | Type of lamps, advantages/ disadvantages and their applications.<br>Calculations of lumens and efficiency. |
| Professional Skill 50 Hrs.;<br><br>Professional Knowledge 10 Hrs. | 8. Select and perform measurements using analog / digital instruments and install/ diagnose smart meters. | 85. Practice on various analog and digital measuring Instruments.<br>86. Practice on measuring instruments in single and three phase circuits e. g. multi-meter, Wattmeter, Energy meter, Phase sequence meter and Frequency meter, multi-function Meter etc.<br>87. Measure power in three phase circuit using two wattmeter methods.<br>88. Measure power factor in three phase circuit by using power factor meter and verify the same with voltmeter, ammeter and wattmeter readings.<br>89. Measure electrical parameters using tong tester in three phase circuits.<br>90. Demonstrate Smart Meter, its physical components and | Classification of electrical instruments and essential forces required in indicating instruments.<br>PMMC and Moving iron instruments.<br>Measurement of various electrical parameters using different analog and digital instruments.<br>Measurement of energy in three phase circuit.<br>Automatic meter reading infrastructures and Smart meter.<br>Concept of Prosumer and distributed generation.<br>Electrical supply requirements of smart meter,<br>Detecting/clearing the tamper notifications of meter. |

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| | | Communication components.<br>91. Perform meter readings, install and diagnose smart meters. | |
| Professional Skill 25 Hrs.;<br><br>Professional Knowledge 05 Hrs. | 9. Perform testing, verify errors and calibrate instruments. | 92. Practice for range extension and calibration of various measuring instruments.<br>93. Determine errors in resistance measurement by voltage drop method.<br>94. Test single phase energy meter for its errors. | Errors and corrections in measurement.<br>Loading effect of voltmeter and voltage drop effect of ammeter in circuits.<br>Extension of range and calibration of measuring instruments. |
| Professional Skill 75 Hrs.;<br><br>Professional Knowledge 15 Hrs. | 10. Plan and carry out installation, fault detection and repairing of domestic appliances. | 95. Dismantle and assemble electrical parts of various electrical appliances e.g., cooking range, geyser, washing machine and pump set.<br>96. Service and repair of electric iron, electric kettle, cooking range and geyser.<br>97. Service and repair of induction heater and oven.<br>98. Service and repair of mixer and grinder.<br>99. Service and repair of washing machine. | Working principles and circuits of common domestic equipment and appliances.<br>Concept of Neutral and Earth. |
| Professional Skill 75 Hrs.;<br><br>Professional Knowledge 15 Hrs. | 11. Execute testing, evaluate performance and maintenance of transformer. | 100. Verify terminals, identify components and calculate transformation ratio of single-phase transformers.<br>101. Perform OC and SC test to determine and efficiency of single-phase transformer.<br>102. Determine voltage regulation of single-phase transformer at different | Working principle, construction and classification of transformer.<br>Single phase and three phase transformers.<br>Turn ratio<br>parallel operation of transformer.<br>Voltage Regulation and efficiency.<br>Auto Transformer and |

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| | | loads and power factors.<br>103. Perform series and parallel operation of two single phase transformers.<br>104. Verify the terminals and accessories of three phase transformer HT and LT side. | instrument transformers (CT & PT). |
| | | 105. Perform 3 phase operation (i) delta-delta, (ii) delta-star, (iii) star-star, (iv) star-delta by use of three single phase transformers.<br>106. Perform testing of transformer oil.<br>107. Practice on winding of small transformer.<br>108. Practice of general maintenance of transformer. | Method of connecting three single phase transformers for three phase operation.<br>Types of Cooling, protective devices, bushings and termination etc.<br>Testing of transformer oil.<br>Materials used for winding and winding wires in small transformer. |
| **ENGINEERING DRAWING** | | | |
| Professional Knowledge<br>ED- 30 Hrs. | 12. Read and apply engineering drawing for different application in the field of work. | Introduction to Engineering Drawing and Drawing Instruments –<br>● Conventions<br>● Sizes and layout of drawing sheets<br>● Title Block, its position and content<br>● Drawing Instrument<br>Free hand drawing of –<br>● Geometrical figures and blocks with dimension<br>● Transferring measurement from the given object to the free hand sketches.<br>● Free hand drawing of hand tools.<br>Drawing of Geometrical figures:<br>● Angle, Triangle, Circle, Rectangle, Square, Parallelogram.<br>● Lettering & Numbering – Single Stroke<br>Dimensioning Practice<br>● Types of arrow head<br>Symbolic representation<br>● Different electrical symbols used in the related trades<br>Reading of Electrical Circuit Diagram | |

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| | | Reading of Electrical Layout drawing |
| **WORKSHOP CALCULATION & SCIENCE** | | |
| Professional Knowledge WCS- 30 Hrs. | 13. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. | **Unit, Fractions**<br>Classification of unit system<br>Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units<br>Measurement units and conversion<br>Factors, HCF, LCM and problems<br>Fractions - Addition, substraction, multiplication & division<br>Decimal fractions - Addition, subtraction, multiplication & division<br>Solving problems by using calculator<br>**Square root, Ratio and Proportions, Percentage**<br>Square and square root<br>Simple problems using calculator<br>Applications of Pythagoras theorem and related problems<br>Ratio and proportion<br>Ratio and proportion - Direct and indirect proportions<br>Percentage<br>Percentage - Changing percentage to decimal and fraction<br>**Material Science**<br>Types metals, types of ferrous and non-ferrous metals<br>Introduction of iron and cast iron<br>**Mass, Weight, Volume and Density**<br>Mass, volume, density, weight<br>Related problems for mass, volume, density, weight<br>Work, power, energy, HP, IHP, BHP and efficiency<br>Potential energy, kinetic energy and related problems with assignment<br>**Heat & Temperature and Pressure**<br>Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals<br>Scales of temperature, Celsius, Fahrenheit, kelvin and conversion between scales of temperature<br>Heat &Temperature - Temperature measuring instruments, types of thermometers, pyrometer and transmission of heat - Conduction, convection and radiation.<br>**Mensuration**<br>Area and perimeter of square, rectangle and parallelogram<br>Area and perimeter of Triangles<br>Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse<br>Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder |

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| | | **Trigonometry**<br>Measurement of angles<br>Trigonometrical ratios<br>Trigonometrical tables |
| **Project work / Industrial visit**<br>**Broad Areas:**<br>a) Overload protection of electrical equipment<br>b) Automatic control of streetlight/night lamp<br>c) Fuse and power failure indicator using relays<br>d) Door alarm/indicator<br>e) Decorative light with electrical flasher | | |

| SYLLABUS FOR ELECTRICIAN TRADE | | | |
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| **SECOND YEAR** | | | |
| **Duration** | **Reference Learning Outcome** | **Professional Skills (Trade Practical)** | **Professional Knowledge (Trade Theory)** |
| Professional Skill 35 Hrs.;<br><br>Professional Knowledge 10 Hrs. | 14. Plan, execute commissioning and evaluate performance of DC machines. | 109. Identify terminals, parts and connections of different types of DC machines.<br>110. Measure field and armature resistance of DC machines.<br>111. Determine build up voltage of DC shunt generator with varying field excitation and performance analysis on load.<br>112. Test for continuity and insulation resistance of DC machine.<br>113. Demonstrate special type motors viz., BLDC motor, Servo motor, Permanent Magnet Synchronous Motor (PMSM) | General concept of rotating electrical machines.<br>Principle of DC generator.<br>Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring and Brushes, Laminated core etc.<br>E.M.F. equation<br>Separately excited and self-excited generators.<br>Series, shunt and compound generators. |
| Professional Skill 80 Hrs.;<br><br>Professional Knowledge 25 Hrs. | 15. Execute testing, and maintenance of DC machines and motor starters. | 114. Perform no load and load test and determine characteristics of series and shunt generators.<br>115. Perform no load and load test and determine characteristics of compound generators (cumulative and differential).<br>116. Practice dismantling and assembling in DC shunt motor. | Commutation, inter poles and connection of inter poles.<br>Parallel Operation of DC Generators.<br>Load characteristics of DC generators.<br>Application, losses & efficiency of DC Generators.<br>Routine & maintenance. |

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| | | 117. Practice dismantling and assembling in DC compound generator. | |
| | | 118. Conduct performance analysis of DC series, shunt and compound motors.<br>119. Dismantle and identify parts of three point and four-point DC motor starters.<br>120. Assemble, Service and repair three point and four-point DC motor starters.<br>121. Practice maintenance of carbon brushes, brush holders, Commutator and slip rings. | Principle and types of DC motor.<br>Relation between applied voltage back e.m.f., armature voltage drops, speed and flux of DC motor.<br>DC motor Starters, relation between torque, flux and armature current.<br>Changing the direction of rotation.<br>Characteristics, Losses & Efficiency of DC motors.<br>Routine and maintenance. |
| Professional Skill 35 Hrs.;<br><br>Professional Knowledge 10 Hrs. | 16. (a) Distinguish, organize and perform motor winding. | 122. Perform speed control of DC motors - field and armature control method.<br>123. Carry out overhauling of DC machines.<br>124. Perform DC machine winding by developing connection diagram, test on growler and assemble. | Methods of speed control of DC motors.<br>Lap and wave winding and related terms. |
| Professional Skill 120 Hrs.;<br><br>Professional Knowledge 30 Hrs. | 17. Plan, execute commissioning and evaluate performance of AC motors. Execute testing, and maintenance of AC motors and starters. | 125. Identify parts and terminals of three phase AC motors.<br>126. Make an internal connection of automatic star-delta starter with three contactors.<br>127. Connect, start and run three phase induction motors by using DOL, star-delta and auto-transformer starters. | Working principle of three phase induction motor.<br>Squirrel Cage Induction motor, Slip-ring induction motor; construction, characteristics, Slip and Torque.<br>Different types of starters for three phase induction motors, its necessity, basic contactor circuit, parts and their functions. |

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| | | 128. Connect, start, run and reverse direction of rotation of slip-ring motor through rotor resistance starter and determine performance characteristic. | |
| | | 129. Determine the efficiency of squirrel cage induction motor by brake test.<br>130. Determine the efficiency of three phase squirrel cage induction motor by no load test and blocked rotor test.<br>131. Measure slip and power factor to draw speed-torque (slip/torque) characteristics.<br>132. Test for continuity and insulation resistance of three phase induction motors.<br>133. Perform speed control of three phase induction motors by various methods like rheostatic control, autotransformer etc. | Single phasing prevention.<br>No load test and blocked rotor test of induction motor.<br>Losses & efficiency.<br>Various methods of speed control.<br>Braking system of motor.<br>Maintenance and repair. |
| | | 134. Identify parts and terminals of different types of single-phase AC motors.<br>135. Install, connect and determine performance of single-phase AC motors.<br>136. Start, run and reverse the direction of rotation of single-phase AC motors.<br>137. Practice on speed control of single-phase AC motors.<br>138. Compare starting and | Working principle, different method of starting and running of various single-phase AC motors.<br>Domestic and industrial applications of different single-phase AC motors.<br>Characteristics, losses and efficiency. |

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| | | running winding currents of a capacitor run motor at various loads and measure the speed. | |
| Professional Skill 65 Hrs.;<br><br>Professional Knowledge 10 Hrs. | 16 (b). Distinguish, organize and perform motor winding. | 139. Perform winding of three phase AC motor by developing connection diagram, test and assemble.<br>140. Maintain, service and troubleshoot the AC motor starter. | Concentric/ distributed, single/ double layer winding and related terms. |
| | | 141. Carry out maintenance, service and repair of single-phase AC motors.<br>142. Practice on single/double layer and concentric winding for AC motors, testing and assembling.<br>143. Connect, start, run and reverse the direction of rotation of universal motor.<br>144. Carry out maintenance and servicing of universal motor. | Concentric/ distributed, single/ double layer winding and related terms.<br>Troubleshooting of single-phase AC induction motors and universal motor. |
| Professional Skill 83 Hrs.;<br><br>Professional Knowledge 22 Hrs. | 18. Plan, execute testing, evaluate performance and carry out maintenance of Alternator / MG set. | 145. Install an alternator, identify parts and terminals of alternator.<br>146. Test for continuity and insulation resistance of alternator.<br>147. Connect, start and run an alternator and build up the voltage.<br>148. Determine the load performance and voltage regulation of three phase alternator. | Principle of alternator, phase sequence and parallel operation.<br>Effect of changing the field excitation and power factor correction. |

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| | | 149. Install a synchronous motor, identify its parts and terminals. | Working principle of synchronous motor.<br>Effect of change of excitation and load. |
| Professional Skill 115 Hrs.;<br><br>Professional Knowledge 35 Hrs. | 19. Assemble simple electronic circuits and test for functioning. | 150. Determine the value of resistance by colour code and identify types.<br>151. Test active and passive electronic components and its applications. | Resistors – colour code, types and characteristics.<br>Active and passive components.<br>Atomic structure and semiconductor theory. |
| | | 152. Determine V-I characteristics of semiconductor diode.<br>153. Construct half wave, full wave and bridge rectifiers using semiconductor diode. | P-N junction, classification, specifications, biasing and characteristics of diodes.<br>Rectifier circuit - half wave, full wave, bridge rectifiers and filters.<br>Principle of operation, types, characteristics and various configuration of transistor.<br>Application of transistor as a switch, voltage regulator and amplifier. |
| | | 154. Operate and set the required frequency using function generator.<br>155. Troubleshoot defects in simple power supplies. | Basic concept of power electronics devices.<br>IC voltage regulators<br>Digital Electronics - Binary numbers, logic gates and combinational circuits.<br>Familiarity and working of SCR, DIAC, TRIAC and IGBT. |
| Professional Skill 82 Hrs.;<br><br>Professional Knowledge 23 Hrs. | 20. Assemble accessories and carry out wiring of control cabinets and equipment. | 156. Design layout of control cabinet, assemble control elements and wiring accessories for:<br>(i) Local and remote control of induction motor.<br>(ii) Forward and reverse | Study and understand Layout drawing of control cabinet, power and control circuits.<br>Various control elements: Isolators, pushbuttons, switches, indicators, MCB, fuses, relays, timers and limit switches etc. |

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| | | operation of induction motor.<br>(iii) Automatic star-delta starter with change of direction of rotation.<br>(iv) Sequential control of three motors. | |
| | | 157. Carry out wiring of control cabinet as per wiring diagram, bunching of XLPE cables, channeling, tying and checking etc.<br>158. Mount various control elements e.g., circuit breakers, relays, contactors and timers etc.<br>159. Identify and install required measuring instruments and sensors in control panel.<br>160. Test the control panel for its performance. | Wiring accessories: Race ways/ cable channel, DIN rail, terminal connectors, thimbles, lugs, ferrules, cable binding strap, buttons, cable ties, sleeves, gromats and clips etc.<br>Testing of various control elements and circuits. |
| Professional Skill 50 Hrs.;<br><br>Professional Knowledge 10 Hrs. | 21. Perform speed control of AC and DC motors by using solid state devices. | 161. Perform speed control of DC motor using thyristors / DC drive.<br>162. Perform speed control and reversing the direction of rotation of AC motors by using thyristors / AC drive. | Working, parameters and applications of AC / DC drive.<br>Speed control of 3 phase induction motor by using VVVF/AC Drive.<br>Installation of AC/DC drives |
| Professional Skill 50 Hrs.;<br><br>Professional Knowledge 10 Hrs. | 22. Detect the faults and troubleshoot inverter, stabilizer, battery charger, emergency light and UPS etc. | 163. Assemble circuits of voltage stabilizer and UPS.<br>164. Prepare an emergency light.<br>165. Assemble circuits of battery charger and inverter.<br>166. Test, analyze defects and repair voltage stabilizer, emergency light and UPS. | Basic concept, block diagram and working of voltage stabilizer, battery charger, emergency light, inverter and UPS.<br>Preventive and breakdown maintenance.<br>Solar inverter |

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| | | 167. Maintain, service and troubleshoot battery charger and inverter.<br>168. Install an Inverter with battery and connect it in domestic wiring for operation. | |
| Professional Skill 25 Hrs.;<br><br>Professional Knowledge 05 Hrs. | 23. Plan, assemble and install solar panel. | 169. Prepare layout plan and identify different elements of solar power system.<br>170. Prepare layout plan and identify different elements of wind power system.<br>171. Assemble and connect solar panel for illumination. | Various ways of electrical power generation by non-conventional methods.<br>Power generation by solar and wind energy.<br>Principle and operation of solar panel. |
| Professional Skill 50 Hrs.;<br><br>Professional Knowledge 10 Hrs. | 24. Erect overhead domestic service line, outline various power plant layout and explain smart distribution grid and its components. | 172. Practice installation of insulators used in HT/LT line for a given voltage range.<br>173. Draw single line diagram of transmission and distribution system.<br>174. Measure current carrying capacity of conductor for given power supply.<br>175. Fasten jumper in pin, shackle and suspension type insulators. | Transmission and distribution networks.<br>Line insulators, overhead poles and method of joining aluminum conductors.<br>Smart Grid System. |
| | | 176. Erect an overhead service line pole for single phase 230V distribution system in open space.<br>177. Practice on laying of domestic service line.<br>178. Install bus bar and bus coupler on LT line. | Safety precautions and IE rules pertaining to domestic service connections.<br>Various substations.<br>Various terms like – maximum demand, average demand, load factor, diversity factor, plant utility factor etc. |
| Professional Skill 25 Hrs.; | 25. Examine the faults and carry | 179. Identify various parts of relay and ascertain the | Types of relays and its operation.<br>Types of circuit breakers, their |

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| Professional Knowledge 05 Hrs. | out repairing of circuit breakers. | operation.<br>180. Practice setting of pick up current and time setting multiplier for relay operation.<br>181. Identify the parts of circuit breaker, check its operation.<br>182. Practice on repair and maintenance of circuit breaker. | applications and functioning.<br>Production of arc and quenching. |
| Professional Skill 25 Hrs.;<br><br>Professional Knowledge 05 Hrs. | 26. Install and troubleshoot Electric Vehicle charging stations. | 183. Demonstrate different charger specifications.<br>184. Perform installation of EV charging Station for Public places.<br>185. Perform installation of Home EV charging stations. | EV scenario in India and EV Charging basic theory.<br>EV Charging safety requirements. |
| **ENGINEERING DRAWING** | | | |
| Professional Knowledge ED- 45 Hrs. | 27. Read and apply engineering drawing for different application in the field of work. | Reading of Electrical Sign and Symbols.<br>Sketches of Electrical components.<br>Reading of Electrical wiring diagram and Layout diagram. Reading of Electrical earthing diagram. Drawing the schematic diagram of plate and pipe earthing.<br>Drawing of Electrical circuit diagram.<br>Drawing of Block diagram of Instruments & equipment of trades. | |
| **WORKSHOP CALCULATION & SCIENCE** | | | |
| Professional Knowledge WCS- 45 Hrs. | 28. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the | **Friction**<br>Friction - Lubrication<br>**Algebra**<br>Algebra - Addition, subtraction, multiplication & division<br>Algebra - Theory of indices, algebraic formula, related problems<br>**Elasticity**<br>Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus<br>**Profit and Loss**<br>Profit and loss - Simple problems on profit & loss<br>Profit and loss - Simple and compound interest | |

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| | field of study. | **Estimation and Costing**<br>Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade.<br>Estimation and costing - Problems on estimation and costing |
| **Project work / Industrial visit:**<br>a) Battery charger/Emergency light<br>b) Control of motor pump with tank level<br>c) DC voltage converter using SCRs<br>d) Logic control circuits using relays<br>e) Alarm/indicator circuits using sensors | | |

| SYLLABUS FOR CORE SKILLS |
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| 1. Employability Skills (Common for all CTS trades) (120 Hrs. for 1st year + 60 Hrs.for 2nd year) |

Learning outcomes, assessment criteria, syllabus and Tool List of Employability Skills is provided separately in www.cstaricalcutta.gov.in / www.bharatskills.gov.in / www.dgt.gov.in.

## ANNEXURE-I

| List of Tools & Equipment | | | |
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| **ELECTRICIAN (for batch of 20 candidates)** | | | |
| **S No.** | **Name of the Tools and Equipment** | **Specification** | **Quantity** |
| **A. TRAINEES TOOL KIT** (For each additional unit trainees tool kit Sl. 1-12 is required additionally) | | | |
| 1. | Measuring Steel Tape | 5 meters | 20 +1 Nos. |
| 2. | Combination Plier Insulated | 200 mm | 20 +1 Nos. |
| 3. | Screwdriver Insulated | 4 mm x 150 mm, Diamond Head | 20 +1 Nos. |
| 4. | Screwdriver Insulated | 6 mm x 150 mm | 20 +1 Nos. |
| 5. | Electrician screwdriver thin stem insulated handle | 4 mm x 100 mm | 20 +1 Nos. |
| 6. | Heavy Duty Screwdriver insulated | 5 mm x 200 mm | 20 +1 Nos. |
| 7. | Electrician Screwdriver thin stem insulated handle | 4 mm x 250 mm | 20 +1 Nos. |
| 8. | Punch Centre | 9 mm X 150 mm | 20 +1 Nos. |
| 9. | Knife Double Bladed Electrician | 100 mm | 20 +1 Nos. |
| 10. | Neon Tester | 500 V | 20 +1 Nos. |
| 11. | Steel Rule Graduated both in Metric and English Unit | 300 mm with precision of 1/4th mm | 20 +1 Nos. |
| 12. | Hammer, cross peen with handle | 250 grams | 20 +1 Nos. |
| **B. SHOP TOOLS & EQUIPMENT** – For 2 (1+1) units no additional items are required | | | |
| **(i) List of Tools & Accessories** | | | |
| 13. | Hammer, ball peen with handle | 500 grams | 4 Nos. |
| 14. | Pincer | 150 mm | 4 Nos. |
| 15. | C- Clamp | 200 mm and 100 mm | 2 Nos. each |
| 16. | Spanner Adjustable drop forged, SS | 150 mm & 300mm | 2 Nos. each |
| 17. | Blow lamp brass | 0.5 ltr | 1 No. |
| 18. | Chisel Cold | 25 mm x 200 mm | 2 Nos. |
| 19. | Chisel firmer with wooden Handle | 6 mm x 200 mm | 2 Nos. |
| 20. | Allen Key alloy steel | 1.5-10 mm (set of 9) | 1 Set |
| 21. | Grease Gun | 0.5 ltr. Capacity | 1 No. |
| 22. | Bradawl | | 2 Nos. |
| 23. | Pully Puller with 3 legs | 150 mm & 300 mm | 1 each |
| 24. | Bearing Puller (inside and outside) | 200 mm | 1 No. each |
| 25. | Pipe vice Cast Iron with hardened jaw open type | 100 mm | 2 Nos. |
| 26. | Scissors blade, SS | 200 mm | 4 Nos. |

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| 27. | Scissors blade, SS | 150 mm | 2 Nos. |
| 28. | Crimping Tool | 1.5 sq mm to 16 sq mm | 2 Nos. |
| | | 16 sq mm to 95 sq mm | 2 Nos. |
| 29. | Wire Cutter and Stripper | 150 mm | 4 Nos. |
| 30. | Mallet hard wood | 0.50 kg | 4 Nos. |
| 31. | Hammer Extractor type | 250 grams | 4 Nos. |
| 32. | Hacksaw frame | Adjustable 300 mm<br>Fixed 150 mm | 2 Nos. each |
| 33. | Try Square | 150 mm blade | 4 Nos. |
| 34. | Outside Calliper | 150 mm spring type | 2 Nos. |
| 35. | Inside Calliper | 150 mm spring type | 2 Nos. |
| 36. | Divider | 150 mm spring type | 2 Nos. |
| 37. | Pliers long nose insulated | 150 mm | 4 Nos. |
| 38. | Pliers flat nose insulated | 200 mm | 4 Nos. |
| 39. | Pliers round nose insulated | 100 mm | 4 Nos. |
| 40. | Tweezers | 150 mm | 4 Nos. |
| 41. | D.E. metric Spanner Double Ended | 6 - 32 mm | 2 Set |
| 42. | Drill S.S. Twist block | 2 mm, 5 mm and 6 mm set of 3 | 4 Set |
| 43. | Gauge, wire imperial stainlees steel marked in SWG & mm | Wire Gauge - Metric | 4 Nos. |
| 44. | File flat | 200 mm 2nd cut with handle | 8 Nos. |
| 45. | File half round | 200 mm 2nd cut with handle | 4 Nos. |
| 46. | File round | 200 mm 2nd cut with handle | 4 Nos. |
| 47. | File flat rough | 150 mm with handle | 4 Nos. |
| 48. | File flat bastard | 250 mm with handle | 4 Nos. |
| 49. | File flat smooth | 250 mm with handle | 4 Nos. |
| 50. | File Rasp, half round | 200 mm bastard with handle | 4 Nos. |
| 51. | Copper bit soldering iron. | 0.25 kg | 2 Nos. |
| 52. | De soldering Gun | Heat proof nozzle, PVC type, 250mm | 4 Nos. |
| 53. | Hand Vice | 50 mm jaw | 4 Nos. |
| 54. | Table Vice | 100 mm jaw | 8 Nos. |
| 55. | Oil Can | 250 ml | 2 Nos. |
| 56. | Contactor & auxiliary contacts | 3 phase, 415 Volt, 25 Amp with 2 NO and 2 NC | 2 Nos. each |
| 57. | Contactor & auxiliary contacts. | 3 phase, 415 Volt, 32 Amp with 2 NO and 2 NC | 2 Nos. each |
| 58. | Limit Switch | Limit Switch, Liver operated 2A 500v, 2-contacts | 2 Nos. |

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| 59. | Rotary Switch | 16 A, 440 V | 2 Nos. |
| 60. | Electromagnetic cutout Relay -<br>a. Cut out Relays<br>b. Over current<br>c. Under voltage | a. 16A, 440 V<br>b. 16A, 440 V<br>c. 360V-440 V | 2 Nos. each |
| 61. | Pin Type, shackle type, egg type & suspension type insulators including hardware fitting | | 2 Nos. each |
| 62. | Hydrometer | | 2 Nos. |
| 63. | Portable Electric Drill Machine | 0-12 mm capacity 750w, 240v with chuck and key | 1 No. |
| | Cordless Electric Drill Machine | 18 Volt | 1 No. |
| 64. | Load Bank (Lamp / heater Type) | 6 KW, 3Ph | 1 No. |
| | GI pipe bending machine | 19 mm to 32 mm | 1 No. |
| | PVC pipe bending spring | 19 mm to 25 mm | 1 No. |
| 65. | Brake Test arrangement with two spring balance rating | 0 to 25 kg | 1 No. |
| 66. | Out Side Micrometer | 0 - 25 mm least count 0.01mm | 2 Nos. |
| 67. | Thermometer Digital | 0° C - 150° C | 1 No. |
| 68. | Series Test Lamp | 230 V, 60 W | 4 Nos. |
| 69. | Knife Switch DPDT fitted with fuse terminals | 16 Amp | 4 Nos. |
| 70. | Knife Switch TPDT fitted with fuse terminals | 16 Amp, 440 V | 4 Nos. |
| 71. | Miniature circuit Breaker | 16 amp | 2 Nos. |
| 72. | Earth Plate | 60cm X 60cm X 3.15mm Copper Plate<br>60cm X 60cm X 6mm GI Plate | 1 Each |
| 73. | Earth Electrode | Primary Electrode 2100x28x3.25mm<br>Secondary Cu Strip 20x5mm | 1 No. |
| 74. | MCCB | 100Amps, Triple pole | 1 No. |
| 75. | ELCB and RCCB | 25Amps, double pole and 25Amps, double pole, IΔn 30 mA | 1 Each |
| 76. | Fuses | HRC<br>Glass<br>Rewire Type | 4 Each |
| 77. | Rheostat (Sliding type) | 0 - 25 Ohm, 2 Amp<br>0 - 300 Ohm, 2 Amp<br>0 -1 Ohm, 10Amp<br>0 -10 Ohm, 5 Amp | 1 No. each |
| 78. | Capacitors | Electrolytic<br>Ceramic<br>Polyester film | 2 Each |

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| | | Variable<br>Dual run | |
| 79. | Various Lamps | Halogen Incandescent Lamp<br>HP mercury vapor Lamp<br>High-pressure sodium Lamp<br>Low-pressure sodium Lamp<br>LED | 1 Each |
| 80. | Plug socket, Piano Switch, Lamp Holder | 230 V, 6 A | 2 Each |
| 81. | Cables:<br>a. Twisted Pair<br>b. Non-Metallic Sheathed Cable<br>c. Underground Feeder Cable<br>d. Ribbon Cable<br>e. Metallic Sheathed Cable<br>f. Multi-Conductor Cable<br>g. Coaxial Cable<br>h. Direct-Buried Cable<br>i. Optical fibre cable | 1 mtr each | 1 Each |
| 82. | Cable tie | | As required |
| 83. | Bus bar with brackets | 1 mtr each | 3 Nos. |
| 84. | Rubber mat | 2’ x 4’ x 1” | 2 Nos. |
| 85. | Electrician Helmet | | 2 Nos. |
| 86. | RCC Pole with accessories (MS angle iron, ‘C’ clamp, stay insulator etc.) and materials | 6 Mtr | 1 No. |
| 87. | Safety Belt | Standard quality | 2 Nos. |
| **(ii) List of Equipment** | | | |
| 88. | Ohm Meter; Series Type & Shunt Type, portable box type | 50/2000-ohm analog | 2 Nos. each |
| 89. | Digital Multi Meter | DC 200mv -1000v,0 – 10A & AC 200mv- 750v , 0-10A, resistance 0-20 MΩ and 3 1/2 digit | 12 Nos. |
| 90. | Multifunction meter | | 1 No. |
| 91. | A.C. Voltmeter M.I. analog, portable box type housed in Bakelite case | Multi range 75 V - 150V - 300V - 600V | 3 Nos. |
| 92. | Milli Voltmeter centre zero analog, portable box type housed in Bakelite case | 100 – 0 – 100 mV | 2 Nos. |
| 93. | Ammeter MC analog, portable box type housed in Bakelite case | 0 - 500 mA, 0-5 A, 0-25 A | 2 Nos. each |

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| 94. | AC Ammeter MI, analog, portable box type housed in Bakelite case | 0 - 1 A, 0-5 A, 0-25 A | 2 Nos. each |
| 95. | Kilo Wattmeter Analog | 0-1.5-3KW, pressure coil rating-240v/440v, current rating-5A/10A Analoge, portable type Housed in Bakelite case | 2 Nos. |
| 96. | Digital Wattmeter | 230 V, 1 KW, 50 Hz | 2 Nos. |
| 97. | A.C. Energy Meter | Single Phase, 10 A, 240 V induction type | 2 Nos. |
| 98. | A.C. Energy Meter | Three Phase, 15 A , 440 V induction type | 2 Nos. |
| 99. | Power Factor Meter Digital | 440 V, 20 A, Three Phase portable box type | 2 Nos. |
| 100. | Frequency Meter | 45 to 55 Hz | 2 Nos. |
| 101. | Magnetic Flux Meter | 0-500 tesla | 2 Nos. |
| 102. | Lux meter | lux meter LCD read out 0.05 to 7000 lumens with battery. | 2 Nos. |
| 103. | Tachometer | Analog Type - 10000 RPM | 1 No. |
| 104. | Tachometer | Digital Photo Sensor Type - 10000 RPM | 1 No. |
| 105. | Tong Tester / Clamp Meter | 0 - 100 A (Digital Type) | 2 Nos. |
| 106. | Megger | Analog - 500 V | 2 Nos. |
| 107. | 3- point D.C. Starter | For 2.5 KW DC motor | 1 No. |
| 108. | 4- point D.C. Starter | For 2.5 KW DC motor | 1 No. |
| 109. | Wheat Stone Bridge with galvanometer and battery | | 2 Nos. |
| 110. | Single Phase Variable Auto Transformer | 0 - 270 V, 10Amp (Air cooled) | 2 Nos. |
| 111. | Phase Sequence Indicator | 3 Phase, 415 V | 2 Nos. |
| 112. | Growler | 230 V, 50 Hz, Single Phase, Adjustable jaws, Testing armature with ampere meter and testing probes. | 1 No. |
| 113. | AC Starters: -<br>a. Resistance type starter<br>b. Direct online Starter<br>c. Star Delta Starter- Manual<br>d. Star Delta Starter – Semi automatic | For A.C Motors of 2 to 5 H.P. | 1 No. each |

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| | e. Star Delta Starter – Fully automatic<br>f. Star Delta Starter - Soft starter<br>g. Auto Transformer type | | |
| 114. | Function Generator | 2 to 200 KHz, Sine, Square, Triangular 220 V, 50 Hz, Single Phase | 1 No. |
| 115. | Soldering Iron | 25-Watt, 65 Watt and 120-Watt, 230 Volt | 2 Nos. each |
| 116. | Temperature controlled Soldering Iron | 50-Watt, 230 Volt | 2 Nos. |
| 117. | Discrete Component Trainer | Discrete Component (for diode and transistor circuit) with regulated power supply +5,0- 5 V,+12 ,0-12 V | 2 Nos. |
| 118. | Domestic Appliances – | | |
| | a. Electric Induction plate | 1500 Watt, 240V | 1 No. each |
| | b. Electric Kettle | 1500 Watts, 240V | |
| | c. Electric Iron | Automatic - 750 W, 240 V | |
| | d. BLDC motor with controller | 200 W | |
| | e. Servo motor with resolver | 10 N-M | |
| | f. PMSM with controller | 1 HP | |
| | d. Immersion Heater | 1500 Watt, 240V | |
| | e. A.C. Ceiling Fan and AC Table Fan | 68-Watt, 230 V | |
| | f. Geyser (Storage type) | 10 litre | |
| | g. Mixture & Grinder | 750 W, 240 V | |
| | h. Washing Machine Semi-Automatic | 5 Kg | |
| | i. Motor Pump set | 1 HP, 1 Phase, 240 V | |
| 119. | Oil Testing Kit | Oil Testing Kit 230 V, single phase 50 Hz, 60 VA, output 0-60 KV Variable | 1 No. |
| 120. | Inverter with Battery | 1 KVA with 12 V Battery<br>Input- 12 volt DC, Output- 220 volt AC | 1 No. |
| 121. | Voltage Stabilizer | AC Input - 150 - 250 V, 600 VA<br>AC Output - 240 V, 10 A | 1 No. |
| 122. | DC Power Supply | 0 - 30 V, 5 A | 2 Nos. |
| 123. | Battery Charger | 0 - 6 - 9 - 12 - 24 - 48 V, 30 amp | 1 No. |
| 124. | Current Transformer | 415 V, 50Hz, CT Ratio 25 / 5 A, 5VA | 2 Nos. |
| 125. | Potential Transformer | 415 V, 50Hz, PT Ratio, 440V/110V, 10 VA | 2 Nos. |
| 126. | Solar panel with Battery | 18 Watt | 1 Set |
| 127. | MPPT based charge controller | | 1 No. |

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| 128. | Desktop Computer | CPU: 64 Bit / i5 or latest processor, Speed: 3 GHz or Higher. RAM:- 16 GB DDR-IV or Higher, Wi-Fi Enabled. Graphics 4 GB & higher Network Card: Integrated Gigabit Ethernet, with USB Mouse, USB Keyboard and Monitor (Min. 19 inch. or higher) Licensed Operating System and Antivirus compatible with trade related software. | 2 Nos. |
| 129. | Digital Timer | On-delay and off-delay (230V) | 1 each |
| 130. | Impulse relay | 16 A, 230 V | 1 No. |
| 131. | Dusk and dawn switch | 16 A, 230 V | 1 No. |
| 132. | Inkjet/ laser printer | | 1 No. |
| **C. Shop Machinery** - For 4 (2+2) units no additional items are required | | | |
| 133. | Motor-Generator (AC to DC) | Squirrel Cage Induction Motor with star delta starter and directly coupled to DC shunt generator and switch board mounted with regulator, air breaker, ammeter, voltmeter (digital), knife blade switches and fuses, set complete with case iron and plate, fixing bolts, foundation bolts and flexible coupling. Induction Motor rating: 7.5 HP, 415V, 50 cycles, 3 phases. DC Shunt Generator rating: 5 KW, 440V (Output voltage varies 110-440V) | 1 No. |
| 134. | D.C. Compound Generator with control panel including fitted rheostat, voltmeter, ammeter and breaker | D.C. Compound Generator with control panel including fitted rheostat, voltmeter, ammeter and breaker, 2.5 KW, 220V &3phase Squirrel cage Induction Motor, 5HP, 440V, with control panel & star delta starter | 1 No. |
| 135. | DC compound Motor with starter and switch | 2.5 KW ,220 volts | 1 No. |
| 136. | Motor Generator (DC to AC) set consisting of - Shunt Motor with starting compensator and switch directly coupled to AC generator with exciter and switch board | Shunt Motor rating: 5 HP, 440V AC Generator rating: 3-Phase, 4 wire, 3.5 KVA, 400/230 Volts, 0.8 pf, 50 cycles | 1 No. |

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| | mounted with regulator, breaker, ammeter, voltmeter frequency meter, knife blade switch and fuses etc. Set complete with cast iron bed plate, fixing bolts, foundation bolts and flexible coupling. | | |
| 137. | AC Squirrel Cage Motor with star delta starter and triple pole iron clad switch fuse with Mechanical Load | 5 HP, 3-Phase, 415 V, 50 Hz | 1 No. |
| 138. | AC phase-wound slip ring Motor with starter switch | 5 HP, 440 V, 3 Phase, 50 Hz | 1 No. |
| 139. | Universal Motor with starter/switch | 240 V, 50 Hz, 1 HP | 1 No. |
| 140. | Synchronous motor with accessories like starter, excitation arrangements | 3 Phase, 3 HP, 440V, 50Hz, 4 Pole | 1 No. |
| 141. | Thyristor /IGBT controlled D.C. motor drive with tacho-generator feedback arrangement | 1 HP | 1 No. |
| 142. | Thyristor/IGBT controlled A.C. motor drive with | VVVF control 3 Phase, 2 HP | 1 No. |
| 143. | Single phase Transformer, core type, air cooled | 1 KVA, 240/415 V, 50 Hz | 3 Nos. |
| 144. | Three phase transformer, shell type oil cooled with Delta/ Star | 3 KVA, 415/240 V, 50 Hz | 2 Nos. |
| 145. | Electrical Machine Trainer | Suitable for demonstrating the construction and functioning of different types of DC machines and AC machines (single phase and three phase). Should be fitted with friction brake arrangement, dynamo meter, instrument panel and power supply unit | 1 for 8 (4+4) Units |
| 146. | Diesel Generator Set with changeover switch, over current breaker and water/ air-cooled with armature, star-delta connections AC 3 phase | 7.5 KVA, 415 volt or higher rating | 1 No. per institute |
| 147. | Used DC Generators-series, shunt and compound type for overhauling practice | | 1 No. Each |
| 148. | Pillar Electric Drill Machine Motorized | 12-20 mm Capacity, 1HP, 440V, 3 phase, Induction Motor with DOL starter, Bench Type | 1 No. |
| 149. | Motorised Bench Grinder | 1 HP, 3 phase, 440V with DOL | 1 No. |

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| | | starter, Double side with smooth and rough wheel with Tool Base | |
| 150. | A.C. Series type Motor | 1 HP, 240 V, 50 Hz | 1 No. |
| 151. | Single Phase Capacitor Motor with starter switch | 1 HP, 240 V, 50 Hz | 1 No. |
| 152. | Manual Motor coil Winding Machine | With step arbor | 1 No. |
| 153. | Ceiling fan coil Winding Machine | 250V, 50 Hz, 1-Φ, with speed control | 1 No. |
| 154. | Primary current injection set | 220V, 50 Hz, 1-Φ, output current - 200 A (min) with timer | 1 No. |
| 155. | Stepper Motor with Digital Controller | 12V | 1 No. |
| 156. | Shaded Pole Motor | Fractional HP, 240 V, 50 Hz | 1 No. |
| 157. | Smart Meter (with overload, overcurrent, tempering, magnetic interference protection) | 1 Phase - Smart Energy Meter<br>3 Phase - Smart Energy Meter | 1 No. each |
| 158. | EV Charger | 3 phase input | 1 No. |
| 159. | EV Charger (Home) | 1 Phase input | 1 No. |
| **D. Shop Floor Furniture and Materials** - For 2 (1+1) units no additional items are required | | | |
| 160. | Working Bench | 2.5 m x 1.20 m x 0.75 m | 4 Nos. |
| 161. | Wiring Board | 3-meter x1 meter with 0.5-meter projection on the top | 1 No. |
| 162. | Instructor's table | | 1 No. |
| 163. | Instructor's chair | | 2 Nos. |
| 164. | Metal Rack | 100cm x 150cm x 45cm | 4 Nos. |
| 165. | Lockers with drawers | | 1 for Each Trainee |
| 166. | Almirah | 2.5 m x 1.20 m x 0.5 m | 1 No. |
| 167. | Black board/white board | minimum 4x6 feet | 1 No. |
| 168. | Fire Extinguisher $CO_2$ | 2 KG | 2 Nos. |
| 169. | Fire Buckets | Standard size | 2 Nos. |
| ***Note: -***<br>1. *All the tools and equipment are to be procured as per BIS specification.*<br>2. *Internet facility is desired to be provided in the class room.* | | | |

## ANNEXURE-II

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities and all others who contributed in revising the curriculum.

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

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## ANNEXURE-III

| ABBREVIATIONS | |
|---|---|
| CTS | Craftsmen Training Scheme |
| ATS | Apprenticeship Training Scheme |
| CITS | Craft Instructor Training Scheme |
| DGT | Directorate General of Training |
| MSDE | Ministry of Skill Development and Entrepreneurship |
| NTC | National Trade Certificate |
| NAC | National Apprentiship Certificate |
| NCIC | National Craft Instructor Certificate |
| LD | Locomotor Disability |
| CP | Cerebral Palsy |
| MD | Multiple Disabilities |
| LV | Low Vision |
| HH | Hard of Hearing |
| ID | Intellectual Disabilities |
| LC | Leprosy Cured |
| SLD | Specific Learning Disabilities |
| DW | Dwarfism |
| MI | Mental Illness |
| AA | Acid Attack |
| PwD | Person with disabilities |


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