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

**COMPETENCY BASED CURRICULUM**

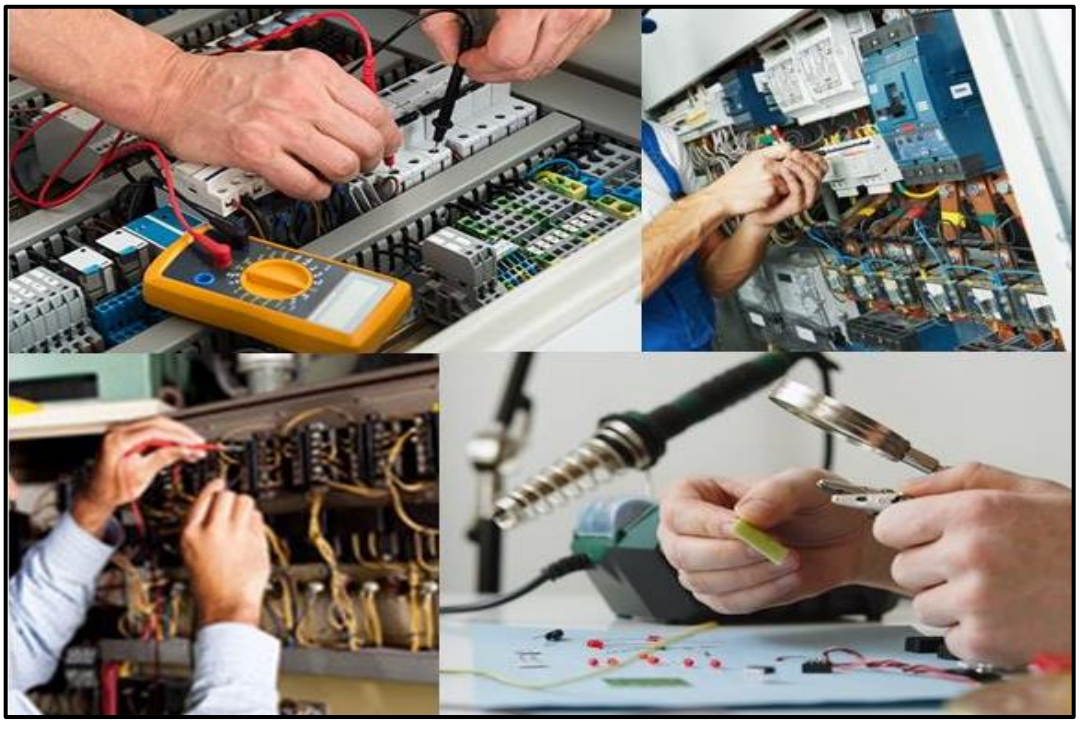
# INDUSTRY INTEGRATED ELECTRICIAN

**(Duration: Two Years)**

## CRAFTSMEN TRAINING SCHEME (CTS)

## (Flexi-MoU)

## NSQFLEVEL- 4



## SECTOR – POWER

# INDUSTRY INTEGRATED ELECTRICIAN

**(Engineering Trade)**

**(Designed in 2024)**

**Version: 1.0**

## CRAFTSMEN TRAINING SCHEME (CTS)

**Under Flexi-MoU**

**Developed By**

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# 1. COURSE INFORMATION

Flexi-MoU is one of the pioneer programmes under DGT on the basis of the MoU in between DGT and Industrial Training Partner (ITP) for propagating vocational training to allow industries to take advantage of various schemes for conducting training programme in higher employment potential courses according to needs of industries. The concept of Flexi-MoU was introduced in June-July 2014. DGT and CUTM have decided to sign this memorandum of understanding to provide an opportunity to the youth to acquire skills related to *Industry Integrated Electrician* trade through specially designed "Learn and Earn" approach consisting a mix of theoretical and On-the-Job Training (OJT) components and hence improve their employability potential and to contribute in the overall growth of industry by creating a pool of skilled resources.

During the two years' duration of the programme, a candidate is trained on professional skills and knowledge, Engineering Drawing, Workshop Calculation and Science and Employability skill related to job role. In addition to this a candidate is entrusted to undertake project work and extra-curricular activities to build up confidence. The broad components covered during the course are given below:

**FIRST YEAR:**

The first year of Industry Integrated Electrician, meticulously designed to equip students with the essential skills and knowledge required in the field. From interpreting engineering drawings with precision to implementing rigorous safety measures, participants will learn to create profiles according to specifications, execute electrical wire joints including soldering and crimping, and measure insulation resistance in underground cables. The course delves into validating the characteristics of electrical and magnetic circuits, scrutinizing electronic and electro-mechanical actuating systems, and mastering the installation, testing, and maintenance of batteries and solar cells. Participants will gain expertise in estimating costs, sourcing components, and conducting testing for wiring systems, alongside developing comprehensive plans for earthing system installation. Practical training includes strategizing and executing electrical lighting system installations, testing industrial wiring systems, and handling electrical or electronic module installations and dismantling. Moreover, students will learn to select and utilize appropriate instruments for measurements, including analog, digital, and smart meters, while also conducting testing, verifying discrepancies, and calibrating instruments. The curriculum encompasses planning, executing, and repairing household appliance installations, testing transformer performance, interpreting engineering drawings, and applying fundamental mathematical concepts and scientific principles relevant to the field.

**SECOND YEAR:**

In this year students will learn testing and maintaining AC motors and starters to developing intricate plans for the commissioning process and performance assessment of DC machines, participants will delve into the intricacies of motor winding, alternators, and generator sets. Hands-on experience awaits as students construct electronic circuits, assemble accessories, and wire control cabinets with precision. They'll master speed regulation techniques, fault detection, and troubleshooting in a myriad of equipment including inverters, stabilizers, and UPS systems. The curriculum extends further to exploring renewable energy solutions such as solar panel installations and elevated service line construction, while also analyzing defects and conducting maintenance on circuit breakers. Students will dive into sensor technology, PLC commissioning, and the burgeoning fields of IoT and IIoT, understanding their implications in industrial applications. Additionally, they will design and assess Pneumatic-Hydraulic circuits, and execute maintenance on central alarm systems and CCTV setups. Through practical application of engineering drawings, coupled with a solid foundation in mathematical concepts and scientific principles, graduates will emerge prepared to tackle real-world challenges in the dynamic realm of electrical industry.

# 2. TRAINING SYSTEM

## 2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development and Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/labor market. DGT is futuristic in preparing the prospective Indian workforce in building skills and capabilities as per the needs of the industry. In this quest, it has changed the paradigm of growth to a job-oriented training by partnering with industry to be an enabler of responsible, sustainable and inclusive growth. Towards this objective, DGT signed this MOU with Industrial Training Partner (ITP).

Industry Integrated Electrician trade under CTS (Flexi-MoU) is of two years' duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory and Practical) imparts professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skill, knowledge and life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by DGT under Flexi-MoU which is recognized worldwide.

Industrial Training Partner (ITP) shall conduct courses at the Industry Partner's location. On the job training will be conducted inside the Plant premises. It will also ensure the eligible trainees take up Apprenticeship / higher education in suitable streams and shall also guide the students to become Entrepreneurs. Industrial Training Partner (ITP) will strictly follow the policy guidelines for Flexi-MoU as in place from time to time. No deviation for the same would be permitted. Admission and Exam for trades run under Flexi-MoU at training locations of Industrial Training Partner. Theory content is provisioned to be 25% and practical content is provisioned to be 75%.

### 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 and 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 Assistant Electrician and will progress further as 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 or any other recognized University as applicable.

## 2.3 COURSE STRUCTURE

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

| S No. | Course Element | Notional Training Hours | |
|---|---|---|---|
| | | 1st Year | 2nd Year |
| 1 | Professional Skill (Trade Practical) | 270 | 330 |
| 2 | Professional Knowledge (Trade Theory) | 300 | 300 |
| 3 | Employability Skills | 120 | 60 |
| 4 | On the job Training | 750 | 750 |
| 5 | Mandatory OJT/Group Project | 150 | 150 |
| | **Total** | **1590** | **1590** |

## 2.4 ASSESSMENT AND CERTIFICATION

The trainee will be tested for his 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 ITP

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.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 Controller of examinations, DGT as per the guidelines. The pattern and marking structure is 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 percent for Trade Practical and Formative assessment is 60% and for all other subjects is 33%. There will be no grace marks.

### 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 should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/ wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE (Occupational Safety and Health Environment) and self-learning attitude are to be considered while assessing competencies.

Assessment will be evidence based, comprising the following:

- Job carried out in labs/workshop
- Record book/daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and Punctuality
- Assignment

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 while assessing:

| Performance Level | Evidence |
|---|---|
| (a)Weightage in the range of 60-75% to be allotted during assessment | |
| For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices. | • 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>• Occasionalsupport in completing the project/job. |
| (b)Weightage in the range of above 75%-90% to be allotted during assessment | |
| For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices. | • 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. |
| (c)Weightage in the range of above 90% to be allotted during assessment | |
| 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

**Electrician, General** installs, maintains and repairs electrical machinery equipment and fittings in factories, workshops power house, business and residential premises etc., Studies drawings and other specifications to determine electrical circuit, installation details, etc. Positions and installs electrical motors, transformers, switchgears. Switchboards, Microphones, loud-speakers 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.

**Reference NCO-2015:**

a) 7411.0100 – Electrician, General
b) 7412.0200 – Electrical Fitter

**Reference NOS:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| i. | PSS/N2001 | xi. | PSS/N9460 | xxi. | PSS/N9468 | xxxi. | PSS/N9483 |
| ii. | PSS/N9451 | xii. | PSS/N9461 | xxii. | PSS/N9469 | xxxii. | PSS/N9484 |
| iii. | PSS/N9452 | xiii. | PSS/N9462 | xxiii. | PSS/N9470 | xxxiii. | PSS/N9485 |
| iv. | PSS/N9453 | xiv. | PSS/N9463 | xxiv. | PSS/N9471 | xxxiv. | PSS/N9486 |
| v. | PSS/N9454 | xv. | PSS/N9464 | xxv. | PSS/N9472 | xxxv. | PSS/N9487 |
| vi. | PSS/N9455 | xvi. | PSS/N9465 | xxvi. | PSS/N9473 | xxxvi. | PSS/N9488 |
| vii. | PSS/N9456 | xvii. | PSS/N9401 | xxvii. | PSS/N9474 | xxxvii. | PSS/N9489 |
| viii. | PSS/N9457 | xviii. | PSS/N9402 | xxviii. | PSS/N9475 | | |
| ix. | PSS/N9458 | xix. | PSS/N9466 | xxix. | PSS/N9476 | | |
| x. | PSS/N9459 | xx. | PSS/N9467 | xxx. | PSS/N9482 | | |

# 4. GENERAL INFORMATION

| | |
|---|---|
| **Name of the Trade** | **INDUSTRY INTEGRATED ELECTRICIAN (FLEXI MoU)** |
| **NCO–2015** | 7411.0100, 7412.0200 |
| **NOS Covered** | PSS/N9451, PSS/N9452, PSS/N9453, PSS/N9454, PSS/N9455, PSS/N9456, PSS/N9457, PSS/N9458, PSS/N9459, PSS/N9460, PSS/N9461, PSS/N9462, PSS/N9463, PSS/N9464, PSS/N9465, PSS/N9401, PSS/N9402, PSS/N9466, PSS/N9467, PSS/N9468, PSS/N9469, PSS/N9470, PSS/N9471, PSS/N9472, PSS/N9473, PSS/N9474, PSS/N9475, PSS/N9476, PSS/N9482, PSS/N9483, PSS/N9484, PSS/N9485, PSS/N9486, PSS/N9487, PSS/N9488, PSS/N9489 |
| **NSQF Level** | Level-4 |
| **Duration of Craftsmen Training (Instructional Hours)** | Two year (3180 Hours) |
| **Entry Qualification** | Passed 10$^{th}$ class examination. |
| **Minimum Age** | 18 years as on first day of academic session. |
| **Eligibility for PwD** | LD, LC, DW, AA, DEAF, HH |
| **Unit Strength (No. Of Student)** | 20 |
| **Space Norms** | 98 Sq. m |
| **Power Norms** | 5.2 KW (for two units in one shift) |
| **Instructors Qualification for** | |
| **(i) Industry Integrated Electrician Trade** | B. Voc/Degree in Electrical/ Electrical and Electronics Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.<br>**OR**<br>03 years Diploma in Electrical/ Electrical and Electronics Engineering from AICTE/recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.<br>**OR**<br>Ex-serviceman from Indian Armed Forces with 15 years of service in related fields as per equivalency through DGR. Candidates |

| | |
|---|---|
| | should have undergone methods of Instruction of course with minimum 02 years of experience in technical training institute of Indian Armed Forces.<br>**OR**<br>NTC/NAC in the related trades with 3 years' experience in the relevant field.<br><br>**Essential Qualification:**<br>Relevant Regular / RPL variants of National Craft Instructor Certificate (NCIC) 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. However, both of them must possess NCIC in any of Its variants.*** |
| **(ii)Workshop Calculation and Science** | B.Voc./Degree in Engineering from AICTE/UGC recognized Engineering College/University with one-year experience in the relevant field.<br>**OR**<br>03 years Diploma in Engineering from AICTE/recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.<br>**OR**<br>NTC/NAC in any one of the engineering trades with three years' experience.<br><br>**Essential Qualification:**<br>National Craft Instructor Certificate (NCIC) in relevant trade<br>**OR**<br>NCIC in RoDA or any of its variants under DGT |
| **(iii) Engineering Drawing** | B.Voc./Degree in Engineering from AICTE/UGC recognized Engineering College/University with one-year experience in the relevant field.<br>**OR**<br>03 years Diploma in Engineering from AICTE/ recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.<br>**OR** |

| | |
|---|---|
| | NTC/NAC in any one of the Electrical groups (Gr-II) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience.<br>**Essential Qualification:**<br>National Craft Instructor Certificate(NCIC)in relevant trade<br>**OR**<br>NCIC in RoDA/D'man (Mech/Civil) or any of its variants under DGT. |
| **(iv) Employability Skill** | MBA/BBA/Any Graduate/ Diploma in any discipline with Two years' experience with short-term ToT Course in Employability Skills<br><br>(Must have studied English/Communication Skills and Basic Computer at 12th/Diploma level and above)<br>**OR**<br>Existing Social Studies Instructors in it is with short term ToT Course in Employability Skills |
| **(v)Minimum age for Instructor** | 21 years |
| **List of Tools and 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.***

## LEARNING OUTCOME (TRADE SPECIFIC)

**FIRST YEAR**

1. Apply industrial safety practices. (NOS: PSS/N9451)
2. Create profile according to the provided drawing with the required level of accuracy, ensuring strict adherence to safety precautions. (NOS: PSS/N9452)
3. Prepare electrical wire joints, carryout soldering, crimping and measure insulation resistance of underground cable. (NOS: PSS/N9453)
4. Validate the characteristics of electrical and magnetic circuits. (NOS: PSS/N9454)
5. Verify characteristics of electronic, and electro-mechanical actuating system. (NOS: PSS/N9455)
6. Perform the installation, testing, and maintenance of batteries and solar cells. (NOS: PSS/N9456)
7. Determine the approximate cost, gather components, install, and conduct testing of a wiring system. (NOS: PSS/N9457)
8. Develop comprehensive plan and make necessary preparations for the installation of an earthing system. (NOS: PSS/N9458)
9. Strategize and carry out the installation of electrical lighting system, followed by performing testing procedures. (NOS: PSS/N9459)
10. Plan and perform testing of industrial wiring systems. (NOS: PSS/N9460)
11. Perform installation and dismantling of the electrical or electronic modules. (NOS: PSS/N9461)
12. Select appropriate analog or digital instruments and conduct measurements, while also installing or diagnosing smart meters. (NOS: PSS/N9462)
13. Conduct testing, verify discrepancies, and calibrate instruments. (NOS: PSS/N9463)
14. Develop a plan and execute the installation, fault detection, and repair of household appliances. (NOS: PSS/N9464)
15. Conduct testing, assess the performance, and perform maintenance on transformers. (NOS: PSS/N9465)
16. Read and apply engineering drawing for different application in the field of work. (NOS: PSS/N9401)
17. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: PSS/N9402)

**SECOND YEAR**

18. Execute testing and maintenance of AC motor and starter. (NOS: PSS/N9466)
19. Develop a comprehensive plan, implement the commissioning process, and assess the performance of DC machines. (NOS: PSS/N9467)
20. Carry out testing and maintenance activities for DC machines and motor starters. (NOS: PSS/N9468)
21. Differentiate, arrange, and execute the process of motor winding. (NOS: PSS/N9469)
22. Plan, execute commissioning and evaluate performance of AC motors. (NOS: PSS/N9470)
23. Develop comprehensive plan, conduct testing, assess performance, and perform maintenance on alternators or generator sets (MG sets). (NOS: PSS/N9471)
24. Construct basic electronic circuits and conduct functional testing. (NOS: PSS/N9472)
25. Assemble accessories and carry out wiring of control cabinets and equipment. (NOS: PSS/N9473)
26. Implement speed regulation of AC and DC motors utilizing solid-state components. (NOS: PSS/N9474)
27. Detect faults and troubleshoot problems in inverters, stabilizers, battery chargers, emergency lights, UPS systems, and other related equipment. (NOS: PSS/N9475)
28. Construct an elevated service line for residential electricity, outline diverse power plant arrangements, and elucidate the concept of a smart distribution grid and its elements. (NOS: PSS/N9476)
29. Strategize, build, and deploy a solar panel installation. (NOS: PSS/N9482)
30. Analyze the defects and perform maintenance on circuit breakers. (NOS: PSS/N9483)
31. Identify and evaluate different types of sensors and sensor-based technology in industry application. (NOS: PSS/N9484)
32. Understand the process of commissioning of PLC unit and field Input/output (I/O). (NOS: PSS/N9485)
33. Understand the basic utility of the Internet of Things (IoT) and Industrial IoT (IIoT) in Industrial applications. (NOS: PSS/N9486)
34. Plan and design Pneumatic - Hydraulic circuits and check their functionality. (NOS: PSS/N9487)
35. Execute testing and maintenance of the central alarm system (alarm control panel, smoke sensor, over temperature sensor and jet nozzle). (NOS: PSS/N9488)
36. Execute CCTV maintenance and fault detection. (DVR/NVR, cable connectors, dc power source and mic audio connectors) (NOS: PSS/N9489)
37. Read and apply engineering drawing for different application in the field of work. (NOS: PSS/N9401)
38. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: PSS/N9402)

# 6. ASSESSMENT CRITERIA

| LEARNING OUTCOMES | ASSESSMENT CRITERIA |
|---|---|
| **FIRST YEAR** | |
| 1. Apply industrial safety practices. (NOS: PSS/N9451) | Identify various electrical installations at work. |
| | Identify safety symbols and hazards. |
| | Demonstrate preventive measures for electrical accidents. |
| | Demonstrate safe methods of fire fighting in case of an electrical fire. |
| | Demonstrate the use of fire extinguishers. |
| | Practice elementary first aid. |
| | Demonstrate how to rescue a person and perform artificial respiration. |
| | Follow the correct disposal procedure for waste materials. |
| | Use of personal protective equipment. |
| | Demonstrate cleanliness and procedure to maintain it. |
| | Identify trade tools and machinery. |
| | Follow safe methods of lifting and handling tools and equipment. |
| | |
| 2. Create profile according to the provided drawing with the required level of accuracy, ensuring strict adherence to safety precautions. (NOS: PSS/N9452) | Identify the trade tools; demonstrate their uses with safety, care & maintenance. |
| | Prepare a simple half lap joint using firmer chisel with safety. |
| | Prepare tray using sheet metal with the safety. |
| | Demonstrate fixing of surface mounting type of accessories. |
| | Perform connections of electrical accessories. |
| | Make and wire up of a test board and test it. |
| | |
| 3. Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance of underground cable. (NOS: PSS/N9453) | Observe safety/ precaution during joints & soldering. |
| | Make simple straight twist and rat-tail joints in single strand conductors. |
| | Make married and 'T' (Tee) joint in stranded conductors. |
| | Prepare a Britannia straight and 'T' (Tee) joint in bare conductors. |
| | Prepare western union joint in bare conductor. |
| | Solder the finished copper conductor joints with precaution. |
| | Prepare termination of cable lugs by using crimping tool. |

| | |
|---|---|
| | Make straight joint in different types of underground cables. |
| | Measure insulation resistance of underground cable. |
| | |
| 4. Validate the characteristics of electrical and magnetic circuits. (NOS: PSS/N9454) | Identify types of wires, cables and verify their specifications. |
| | Verify the characteristics of series, parallel and its combination circuit. |
| | Analyze the effect of the short and open in series and parallel circuits. |
| | Verify the relation of voltage components of RLC series circuit in AC. |
| | 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. |
| | Prepare/ connect a lamp load in star and delta and determine relationship between line and phase values with precaution. |
| | Connect balanced and unbalanced loads in 3 phase star system and measure the power of 3 phase loads. |
| | Make the solenoid and determine its polarity for the given direction of current. |
| | Group the given capacitors to get the required capacity and voltage rating. |
| | |
| 5. Verify characteristics of electronic, and electro-mechanical actuating system. (NOS: PSS/N9455) | Explain the V-I characteristics of SCR and measure latching and holding currents. |
| | Verify the three-phase fully/half-controlled bridge rectifier with resistive and inductive loads. |
| | Perform the triggering of IGBT, MOSFET and power transistor. |
| | Identify the linear to rotary actuators in the machine. |
| | |
| 6. Perform the installation, testing, and maintenance of batteries and solar cells. (NOS: PSS/N9456) | Assemble a DC source 6V/500 mA using 1.5V cells. |
| | Determine the internal resistance of cell and make grouping of cells. |
| | Explain charging of battery and test for its condition with safety/ precaution. |
| | Carry out installation and maintenance of batteries. |
| | Determine total number of cells required for a given power requirement. |
| | |
| 7. Determine the approximate | Comply with safety & IE rules when performing the wiring. |

| | |
|---|---|
| cost, gather components, install, and conduct testing of a wiring system. (NOS: PSS/N9457) | Prepare and mount the energy meter board. |
| | Draw and wire up the consumers main board with ICDP switch and distribution fuse box. |
| | Draw and wire up a bank/hostel/jail in PVC conduit. |
| | Identify the types of fuses their ratings and applications. |
| | Identify the parts of a relay, MCB & ELCB and check its operation. |
| | 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. |
| | Estimate the requirement for conduit wiring (3 phase) and wire up. |
| | Estimate the materials and wire up the lighting circuit for a Godown. |
| | Estimate the materials and wire up a lighting circuit for a corridor in conduit. |
| | Test, locate the fault and repair a domestic wiring installation. |
| | |
| 8. Develop comprehensive plan and make necessary preparations for the installation of an earthing system. (NOS: PSS/N9458) | Plan work in compliance with standard safety norms related with earthing installation. |
| | Install the pipe earthing and test it. |
| | Install the plate earthing and test it. |
| | Measure the earth electrode resistance using earth tester. |
| | Carry out earth resistance improvement. |
| | |
| 9. Strategize and carry out the installation of electrical lighting system, followed by performing testing procedures. (NOS: PSS/N9459) | Plan work in compliance with standard safety norms related with electrical illumination system. |
| | Install light fitting with reflectors for direct and indirect lighting. |
| | Assemble and connect a single twin tube fluorescent light. |
| | Connect, install and test the HPMV & HPSV lamp with accessories. |
| | Prepare and test a decorative serial lamp set for 240 V using 6V bulb and flasher. |
| | Install light fitting for show case window lighting. |
| | |
| 10. Plan and perform testing of industrial wiring systems. (NOS: PSS/N9460) | Identify the industrial illumination wiring installations for insulation resistance using a megger. |
| | Perform troubleshooting of faults present in the industrial wiring. |
| | Perform different types of cable jointing. |

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| | Inspect and test the wiring installations. |
| | Common faults and their troubleshooting. |
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| 11. Perform installation and dismantling of the electrical or electronic modules. (NOS: PSS/N9461) | Dismantle a given SMPS and identify its components. |
| | Test the different components on the UPS PCB provided. |
| | Demonstrate the use of soldering, use of flux. |
| | Make mesh soldering on the material provided. |
| | |
| 12. Select appropriate analog or digital instruments and conduct measurements, while also installing or diagnosing smart meters. (NOS: PSS/N9462) | Identify the type of electrical instruments. |
| | Extend the range of MC voltmeter and ammeter. |
| | Measure the frequency-by-frequency meter. |
| | Measure the power and energy in a single & three phase circuit using wattmeter and energy meter with CT and PT. |
| | Measure the value of resistance, voltage and current using digital multimeter. |
| | Measure the power factor in poly-phase circuit and verify the same with voltmeter, ammeter, watt-meter readings. |
| | Identify components of smart meters. |
| | Install and diagnose smart meters. |
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| 13. Conduct testing, verify discrepancies, and calibrate instruments. (NOS: PSS/N9463) | Test single phase energy meter for its errors. |
| | Determine the measurement errors while measuring resistance by voltage drop method. |
| | Calibrate the analog multimeter. |
| | |
| 14. Develop plan and execute the installation, fault detection, and repair of household appliances. (NOS: PSS/N9464) | Plan work in compliance with standard safety norms related with domestic appliances. |
| | Service and Repair of calling bell/ buzzer/ Alarm. |
| | Service and repair an automatic iron. |
| | Repair and service of oven having multi-range heat control. |
| | Replace the heating element in a kettle and test. |
| | Service and repair an induction heater. |
| | Service and repair a geyser. |
| | Service and repair a mixer. |
| | Service and repair of washing machine. |
| | Install a pump set. |
| | Service and repair of table fan. |
| | Service, repair and install a ceiling fan. |
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| 15. Conduct testing, assess the | Plan work in compliance with standard safety norms related |

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| performance, and perform maintenance on transformers. (NOS: PSS/N9465) | with transformer. |
| | Identify the types of transformers and their specifications. |
| | Identify the terminals; verify the transformation ratio of a single-phase transformer. |
| | Connect and test a single-phase auto- transformer. |
| | Determine the losses (iron loss and copper loss) and the regulation of a single-phase transformer at different loads. |
| | Measure the current and voltage using CT and PT. |
| | Carry out winding for small transformer of 1KVA rating. |
| | Test the transformer oil with oil testing kit. |
| | Connect 3 single phase transformers for 3 phase operation of delta-delta /delta-star /star-star /star-delta. |
| | Connect the given two single phase transformers in parallel /series (secondary only) and measure voltage. |
| | Connect & test 3 phase transformer in parallel. |
| | |
| 16. 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. |
| | Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters. |
| | Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work. |
| | |
| 17. 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 |
| | Explain concept of basic science related to the field of study |
| **SECOND YEAR** | |
| 18. Execute testing and maintenance of AC motor and starter. (NOS: PSS/N9466) | Identify and list down the types of motors in the work. |
| | Measure the RPM of the given motor using tachometer. |
| | Identify the types of motor starters provided. |
| | Perform and verify the star delta connection as per the load requirement. |
| | Concept on motor starter types of starters DOL, star and delta connection auto transformer starter. |
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| 19. Develop comprehensive plan, implement the commissioning process, and assess the performance of DC machines. (NOS: PSS/N9467) | Plan work in compliance with standard safety norms related with DC machines. |
| | Determine the load performance of a different type of DC generator on load. |
| | Connect, start, run and reverse direction of rotation of different types of DC motors. |
| | Conduct the load performance tests on different type of DC motor. |
| | Control the speed of a DC motor by different method. |
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| 20. Carry out testing and maintenance activities for DC machines and motor starters. (NOS: PSS/N9468) | Test a DC machine for continuity and insulation resistance. |
| | Maintenance, troubleshooting & servicing of DC machines. |
| | Test armature by using growler. |
| | Maintain, service and troubleshoot the DC motor starter. |
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| 21. Differentiate, arrange, and execute the process of motor winding. (NOS: PSS/N9469) | Rewind the field coil /armature winding/ table fan /ceiling fan. |
| | Draw winding diagram & rewind a single-phase split type motor (Concentric coil winding). |
| | Draw winding diagram & rewind a 3-phase squirrel cage induction motor (single layer distributed winding). |
| | Draw winding diagram & rewind a 3-phase induction motor (single layer concentric type half coil connection). |
| | Draw winding diagram & rewind a 3-phase squired cage induction motor. (Double layer distributed type winding) |
| | |
| 22. Plan, execute commissioning and evaluate performance of AC motors. (NOS: PSS/N9470) | Plan work in compliance with standard safety norms related with AC motors. |
| | Draw circuit diagram and connect forward & reverse a 3-phase squirrel cage induction motor. |
| | Start, run and reverse an AC 3 phase squirrel cage induction motor by different type of starters. |
| | Measure the slip of 3 phase squirrel cage induction motor by tachometer for different output. Draw slip/ load characteristics of the motor. |
| | Determine the efficiency of 3 phase squirrel cage induction motor by no load test/ blocked rotor test and brake test. |
| | Plot the speed torque (Slip/Torque) characteristics of slip ring induction motor. |
| | Demonstrate speed control of 3 phase induction motor. |
| | Connect, start and run a 3-phase synchronous motor. |

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| | Connect start, run, control speed and reverse the DOR of different type of single-phase motors. |
| | Install a single-phase AC motor. |
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| 23. Develop a comprehensive plan, conduct testing, assess performance, and perform maintenance on alternators or generator sets (MG sets). (NOS: PSS/N9471) | Plan work in compliance with standard safety norms related with Alternator & MG set. |
| | Connect start and run an alternator and build up the voltage. |
| | Determine the load performance of a 3-phase alternator. |
| | Start and load a MG set with 3 phase induction motor coupled to DC shunt generator and build up the voltage. |
| | Perform/ Explain alignment of MG set. |
| | Preventive and breakdown maintenance of alternator / MG set. |
| | Explain the effect of excitation current in terms of V-curves of synchronous motor. |
| | |
| 24. Construct basic electronic circuits and conduct functional testing. (NOS: PSS/N9472) | Perform soldering on components/ lug / board with safety. |
| | Identify the passive /active components by visual appearance, code number and test for their condition. |
| | Identify the control and functional switches in CRO and measure the D.C. & A.C. voltage, frequency and time period. |
| | Construct and test a half &full wave rectifier with and without filter circuits. |
| | Construct circuit by using transistor as a switch. |
| | Construct and test a UJT as relaxation oscillator & electronic timer. |
| | Construct amplifier circuit using Transistor, FET and JFET and test. |
| | Construct and test lamp dimmer using TRIAC/DIAC. |
| | Test IGBT and use in circuit for suitable operation. |
| | Construct and test the universal motor speed controller using SCR with safety. |
| | Construct and test logic gate circuits. |
| | |
| 25. Assemble accessories and carry out wiring of control cabinets and equipment. (NOS: PSS/N9473) | Draw the layout diagram of 3 phase AC motor control cabinet. |
| | Mount the control elements & wiring accessories on the control panel. |
| | Carry out wiring in control cabinet for local and remote control of induction motor. |
| | Draw & wire up the control panel for forward/ reverse |

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| | operation of induction motor. |
| | Perform wiring for automatic start delta starter. |
| | Draw & wire up control panel for sequential motor control for three motors. |
| | Draw & wire up the control panel for a given circuit diagram and connect the motor. |
| | Test the control panel for all the required logics. |
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| 26. Implement speed regulation of AC and DC motors utilizing solid-state components. (NOS: PSS/N9474) | Control the speed of DC motor by using DC drive. |
| | Speed control of universal motor by using SCR. |
| | 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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| 27. Detect faults and troubleshoot problems in inverters, stabilizers, battery chargers, emergency lights, UPS systems, and other related equipment. (NOS: PSS/N9475) | Operation and maintenance of inverter. |
| | Troubleshoot and service a voltage stabilizer. |
| | Identify the parts, trace the connection and test the DC regulated power supply with safety. |
| | Troubleshoot and service a DC regulated power supply. |
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| 28. Construct an elevated service line for residential electricity, outline diverse power plant arrangements, and elucidate the concept of a smart distribution grid and its elements. (NOS: PSS/N9476) | Prepare single line diagram of thermal/ hydel/ Solar /Wind power plants. |
| | Prepare layout plan and single line diagram of transmission line. |
| | Draw an overhead and domestic service line. |
| | Explain erection of an overhead service line pole for single phase 240V distribution system. |
| | Identify different type of insulator used in HT and LT line. |
| | Fasten jumper in insulators. |
| | Connect feeder cable with domestic service line. |
| | Identify components and equipment of smart distribution grid. |
| | Explain Smart Grid Communication infrastructure components. |
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| 29. Strategize, build, and deploy a solar panel installation. (NOS: PSS/N9482) | Plan work in compliance with solar panel installation norms. |
| | Combination of solar cells for given power requirement. |
| | Assemble and install solar panel. |
| | Check the functionality of solar panel. |
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| 30. Analyze the defects and perform maintenance on circuit breakers. (NOS: PSS/N9483) | Prepare layout plan and single line diagram of Distribution substation |
| | Illustrate application of relays in control circuits and examine its operation. |
| | Identify parts of circuit breaker and check its operation. |
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| 31. Identify and evaluate different types of sensors and sensor-based technology in industry application. (NOS: PSS/N9484) | Identify and list the sensor with specifications in the given machine. |
| | Carry and draw out the sensor connection as per the datasheet provided. |
| | Create a sensor -using IR led and TSOP sensor (optional- relay for the application). |
| | Repair and maintenance of the given sensor. |
| | Working principle of thermocouple and its applications. |
| | Explain the need and choice of sensors. |
| | Explain the working principle of thermocouple and its applications. |
| | |
| 32. Understand the process of commissioning of PLC unit and field Input/output (I/O). (NOS: PSS/N9485) | Perform and verify the commissioning of the PLC. |
| | Create a ladder logic program for and gate logic. |
| | Create a led blinking program using Timer. |
| | Perform loading and download of the program in the programming forum. |
| | The Process of uploading and downloading the program using the PG/PC interface. |
| | Explain the process for making minor changes in the program using the PG/PC interface. |
| | Identify the alarm (Run, stop, standby mode, error mode and overheated or short circuit mode). |
| | Test the control panel for all the required logics PG/Pc interface. |
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| 33. Understand the basic utility of the Internet of Things (IoT) and Industrial IoT (IIoT) in Industrial applications. (NOS: PSS/N9486) | Explain the need for IoT in the industries. |
| | Explain the IoT architecture interfacing the sensor protocol and controller to the internet. |
| | Explain the wireless data collection to the mobile application. |
| | Explain the industrial getaways IIOT. |
| | Explain the need for IoT in the industries. |
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| 34. Plan and design Pneumatic - Hydraulic circuits and check | Design the piping layout for the given application. |
| | Draw the schematic symbol of the hydraulic components. |

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| their functionality. (NOS: PSS/N9487) | Draw the schematic symbol of pneumatic. |
| | Perform and list down the component with specifications for creating a hydraulic circuit for a single-acting hand-operated system. |
| | Perform and list down the components with specifications, creating a hydraulics circuit for controlling the speed of the cylinder or hydraulic conveyor. |
| | Construct and verify the functionality of the flow control valve in meter-in and meter-out circuit. |
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| 35. Execute testing and maintenance of the central alarm system (alarm control panel, smoke sensor, over temperature sensor and jet nozzle). (NOS: PSS/N9488) | Perform the false or testing of the alarm system. |
| | Prepare the checklist of sensor and control panels with proper Tagging. |
| | Explain the types of fire alarm systems in use today non – addressable, addressable and hybrid. |
| | Perform the false or testing of the alarm system. |
| | |
| 36. Execute CCTV maintenance and fault detection. (DVR/NVR, cable connectors, dc power source and mic audio connectors). (NOS: PSS/N9489) | Identify the different types of cameras used in your industry. |
| | Perform and plan the wiring layout and routing for the camera to DVR. |
| | Identify the alarm in the DVR and troubleshoot as per the given Instruction. |
| | Perform the changing of the batteries in the DVR. |
| | Perform the cleaning of the BNC connector and power connector in the CCTV installation. |
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| 37. 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. |
| | Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters. |
| | |
| 38. 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 |
| | Explain concept of basic science related to the field of study |
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# 7. TRADE SYLLABUS

| SYLLABUS – INDUSTRY INTEGRATED ELECTRICIAN (FLEXI-MoU) | | | |
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| **FIRST YEAR** | | | |
| **Duration** | **Reference Learning Outcomes** | **Professional Skills (Trade Practical)** | **Professional Knowledge (Trade Theory)** |
| Professional Skill 15 Hrs.<br><br>Professional Knowledge 12 Hrs.<br><br>On the Job Training 03 Hrs. | Apply industrial safety practices. | 1. Identify various electrical installations inthe industry.<br>2. Identify safety symbols and hazards.<br>3. Demonstrate preventive measures for electrical accidents.<br>4. Demonstrate safe methods of fire fighting in case of an electrical fire.<br>5. Follow the correct disposal procedure for waste materials.<br>6. Use of personal protective equipment.<br>7. Demonstrate cleanliness and procedure to maintain it.<br>8. Identify tools and machinery.<br>9. Follow safe methods of lifting and handling tools and equipment.<br>10. Identify the machine hazards in the work area.<br>11. Develop documents to implement the work procedure and emergency Procedures.<br>12. Establish machine-specific lockout and tagout (LOTO) Procedures | Scope of Industry Integrated Electrician in industry<br>First aid safety practice.<br>Hazards identification and prevention.<br>Types and working of fire extinguishers<br>Response to emergencies<br>Machine safety procedures<br>Appropriate ventilation (local exhaust ventilation, dust collection systems)<br>Guarding (fixed or interlocking)<br>Devices to prevent body part contact (push stick, holding device, two-handed activation controls)<br>Visible and accessible stopping mechanism (emergency stop)<br>Barriers, sensors, signs and alarms (fixed area barriers, visible lights, signage on machines/area, horns and sirens, restricted space painted on floor)<br>Preventative inspections/ testing (pre-use testing and inspection, documented annual service/ maintenance)<br>Safe work procedures, LOTO<br>PPE (safety footwear, |

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| | | | eyewear, hand protection, face shields, hearing protection, respirators) |
| Professional Skill 10 Hrs.<br><br>Professional Knowledge 10 Hrs.<br><br>On the Job Training 40 Hrs. | Create profile according to the provided drawing with the required level of accuracy, ensuring strict adherence to safety precautions. | 1. Identify safety symbols and hazards.<br>2. Preventive measures for electrical accidents and practice steps to be taken in such accidents.<br>3. Practice safe methods of fire fighting in case of electrical fire.<br>4. Identify electrical hand tools. (Combination plier, screw driver, hammer etc.<br>5. Identify water, foam, dry powder, carbon dioxide, halon type fire extinguishers.<br>6. Identify type of protection equipment and their use.<br>7. Operate dry powder type fire extinguishers.<br>8. Practice rescue operation for person suffering from an electric shock.<br>9. Practice the Nelson's arm-lift back- pressure and mouth to mouth artificial respiration.<br>10. Use of personal protective equipment (PPE). | Introduction to the electrical trade.<br>Benefit of the trade.<br>First aid safety practice<br>Fire extinguisher, types, and use.<br>Class A type fire extinguisher, class B type fire extinguisher, Class C type fire extinguisher, Class D type fire extinguisher.<br>Hazard identification and prevention.<br>Personal safety and factory safety.<br>Response to emergencies e.g. power failure, system failure and fire etc. |
| | | 11. Measure the thickness of a wire using micrometers and standard wire gauge.<br>Screw Pitch Gauge:<br>12. Select the appropriate screw pitch gauge that matches the thread type and pitch of the job to | BIS/ISI concept.<br>Introduction to National Electrical Code-2011.<br><br>Electrical hand tools, specification, use, care and maintenance.<br>Measuring instruments, use |

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| | | measure.<br>13. Place the gauge's teeth against the thread of the job, ensuring they fit snugly into the thread grooves.<br>14. Check the fit for any resistance or looseness.<br>15. Compare the measurement on the gauge with the known pitch of the job.<br>Fillet Gauge:<br>16. Select the appropriate fillet gauge that corresponds to the desired fillet radius range.<br>17. Position the gauge against the fillet on the job, aligning it with the contour of the fillet.<br>18. Check the contact between the gauge's curved surface and the fillet.<br>19. Verify the radius by compareing the measurement on the gauge with the desired fillet radius.<br>Radius Gauge:<br>20. Select the appropriate radius gauge with a range of sizes that covers the expected radius of the job.<br>21. Align the gauge against the curved surface of the job, ensuring a good fit between the gauge's contours and the job's surface.<br>22. Check the fit for any gaps or irregularities.<br>23. Compare the measurement on the gauge with the | and maintenance. |

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| | | desired radius.<br>24. Prepare industrial distribution board by using different types of hammers and cold chisels. (e.g., Claw Hammer, Ball Peen Hammer, Rubber Mallet, Dead Blow Hammer, Cold Chisel)<br>25. Prepare small job using of fitting tools (files, hand file, half round file etc.) | |
| | | 26. Care and maintenance of drill machine, hammer, punch, etc.<br>27. Make electrical wooden and iron board by using hand and electrical power drill machine. | 5S concept.<br>Types of drills, description & drilling machines.<br>Visit and observation of sections. |
| Professional Skill 20 Hrs.<br><br>Professional Knowledge 20 Hrs.<br><br>On the Job Training 50 Hrs. | Prepare electrical wire joints, carryout soldering, crimping and measure insulation resistance of underground cable. | 1. Observe safety/ precaution during joints & soldering.<br>2. Make simple straight twist and rat-tail joints in single strand conductors.<br>3. Make western union joint.<br>4. Make Britannia straight, Britannia Tee joints.<br>5. Practice on skinning, twisting and crimping.<br>6. Remove insulation from the cable and wire.<br>7. Test insulation resistance of underground cable using megger.<br>8. Make straight joint of twin core. | Conductor, properties of a good conductor.<br>Difference between a wire and cable.<br>Measurement of size of cable. |
| | | 9. Practice straight and TEE joint of 3 core cable / lugs.<br>10. Solder sleeve joint of 7/20 aluminum conductor P.V.C cable. | Types of cable and their joint.<br>Necessity of tinning.<br>Voltage grade of cable. |

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| | | 11. Identify different parts of armored cable.<br>12. Measure the short circuit and grounding of the underground cable.<br>13. Practice straight and TEE joint of 4 core cable.<br>14. Make Britannia Tee and straight joint of Copper GI wire. | Selection of cable for wiring installation.<br>Insulation and protective covering of different cable along with their use and meagering. |
| Professional Skill 28 Hrs.<br><br>Professional Knowledge 40 Hrs.<br><br>On the Job Training 112 Hrs. | Validate the characteristics of electrical and magnetic circuits. | 1. Conduct multiple experiments with different resistances and voltages, and compare the calculated and measured values to verify Ohm's law<br>2. Verify Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL) by conducting multiple experiments.<br>3. Measure the power of a given load using a voltmeter and an ammeter.<br>4. Measure the voltage, current and resistance of given of load<br>5. Measure the power by using watt meter.<br>6. Practice the connections of single-phase energy meter with different loads.<br>7. Measure the resistance of a metal filament lamp and a carbon filament lamp at various voltage. | Nature of electricity and its fundamental laws.<br>Types of electrical circuit.<br>Definitions of electrical terms.<br>Ohm's law, laws of resistance.<br>Specific resistance of a conductor.<br>Combination of resistance. |
| | | 8. Verify the laws of resistance in parallel circuit.<br>9. Verify the law of resistance in series circuit.<br>10. Set up the Wheatstone | Effect of resistance by changing the temperature and changing the material.<br>Equivalent resistance determination by series and |

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| | | bridge, Balance the bridge and measure the resistance.<br>11. Determine the resistance by hot and cold condition in a metal.<br>12. Find the resistance of a carbon and tungsten lamp at various voltage and draw a curve. | parallel circuit.<br>Unknown resistance determination by Wheatstone bridge.<br>Determine the value of resistance by using voltmeter and ammeter.<br>Comparison of series and parallel circuit. |
| | | 13. Draw the magnetic field of two similar bar magnets with like and unlike poles facing each other with the help of magnetic needle.<br>14. Identify the magnetic field of current carrying conductor.<br>15. Make a magnet from piece of iron by passing electric current.<br>16. Induce electric current through magnet and coil.<br>17. Observe the effect of eddy current in between electromagnet.<br>18. Identify parts of Electric Bell and telegraph circuits.<br>19. Interpret the working of an electric bell and a telegraph circuit.<br>20. Measure the capacitance of paper capacitor, oil capacitor, mica capacitor, ceramic capacitor.<br>21. find the capacitance in a series group of capacitors and the energy stored in the circuit<br>22. Test the magnetic field with | Classification of magnet.<br>Test of magnet.<br>Method of magnetization.<br>Fundamental magnetic terms.<br>Properties of magnetic lines of force.<br>Properties of magnetic field.<br>Categorization of magnetic substance.<br><br>Oersted law and its rules.<br>Faradays law of electromagnetic induction.<br>Fleming's right-hand rules.<br>Determine LENZS. LAW |

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| | | iron filling.<br>23. Trace the magnetic field of a U shape magnet and a bar magnet with the help of Magnetic needle.<br>24. Identify the construction of capacitor. | |
| | | 25. Verify the characteristics of pure resistive, inductive and capacitive load in circuit.<br>26. Verify the effect of pure capacitive load and find the inductance of a coil.<br>27. Verify the effect of resistance and inductance load connected in series. And resistance and condenser connected in series.<br>28. Verify the effect of resistive, inductive and capacitive load connected in arc series circuit.<br>29. Verify effect of resistance and inductance connected in arc parallel circuit.<br>30. Verify effect of inductance and capacitance connected in arc parallel circuit.<br>31. Verify the effect of resistance and capacitance connected in arc parallel circuit.<br>32. Connection of single-phase watt meter for measuring power. | Types of capacitors.<br>Capacitance of the capacitor.<br>Grouping of the capacitor.<br>Energy stored in capacitor.<br><br>General definition of cycle, periodic time, frequency, instantaneous value, peak value, RMS value, average value.<br>Vector and scalar quantity.<br>AC as compared to DC same voltage, self-inductance, impedance, admittance, combination resistance, inductance and capacitance.<br>Effect of variation of frequency on inductive and capacitive circuit.<br>Power factor and its importance. |
| | | 33. Measurement of A.C single phase power by three-volt meters method and three ammeter method. | Different system of generation of AC supply.<br>Three- Phase system and single-phase system. |

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| | | 34. Verify effect of resistive, inductive and capacitive load in arc single phase parallel circuit.<br>35. Calibration of single-phase energy meter. | |
| | | 36. To verify the effect of three phase star connected balanced load.<br>37. To verify effect of unbalanced load in star system.<br>38. Verify effect of balanced load in delta connection.<br>39. Measure three phase power by three wattmeter's methods.<br>40. Measure three phase power by two-watt meters method.<br>41. Measure of 3 phase power by one wattmeter's method. | Phase sequences and definitions of fundamental terms.<br>Application of star and delta connection.<br>Power in a three-phase system.<br>Measurement of power in three phase circuits. |
| Professional Skill 45 Hrs.<br><br>Professional Knowledge 15 Hrs.<br><br>On the Job Training 30 Hrs. | Verify characteristics of electronic, and electro-mechanical actuating system. | 1. Identify V-I characteristics of SCR and measure latching and holding currents.<br>2. Identify three-phase fully/half-controlled bridge rectifier with resistive and inductive loads.<br>3. Perform triggering of (i) IGBT (ii) MOSFET (iii) power transistor.<br>4. Select MOSFET/IGBT based single-phase bridge inverter.<br>5. Identify the linear to rotary actuators in the machine and understand their application. | Introduction to power electronics<br>Working and application of SCR, rectifier (half-wave, full wave and bridge), thyristor, IGBT, MOSFET<br>Overview of the liner and rotary actuator<br>Features of linear and rotary actuators<br>Advantages of linear and rotary actuators |

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| | | 6. Identify the rotary to the linear actuator and understand their application. | |
| Professional Skill 10 Hrs.<br><br>Professional Knowledge 10 Hrs.<br><br>On the Job Training 70 Hrs. | Perform the installation, testing, and maintenance of batteries and solar cells. | 1. Make post strap with terminal post for a lead acid battery<br>2. Identify the components of a Metal Rectifier Battery Charger Circuit.<br>3. Interpret working of a Metal Rectifier Battery Charger Circuit.<br>4. Components of a tuner rectifier battery charger.<br>5. Interpret operation of a tuner rectifier battery charger.<br>6. Prepare cell connector for connecting the cell.<br>7. Measure the specific gravity of electrolyte by the hydrometer.<br>8. Discharge battery and replace its plates.<br>9. Prepare an electrolyte for lead acid battery.<br>10. Assemble positive and negative plates with post strap.<br>11. Charge a battery-by-battery charger and test. | Production of EMF by chemical action.<br>Primary and secondary cell.<br>Voltaic cell, Daniel cell, Leclanché cell, dry cell.<br>Characteristics, care and maintenance of primary cell.<br>Difference between EMF and PD of a cell.<br>Grouping of cells (series combination, parallel combination and series parallel combination.)<br>Secondary cell.<br>Advantage and characteristics of good secondary cell.<br>Differentiation between cell and battery.<br>Construction of lead acid battery.<br>Preparation of electrolyte.<br>Determination of specific gravity of an electrolyte.<br>Charging and discharging of battery.<br>Capacity of battery.<br>Preparation of battery charger. |
| Professional Skill 17 Hrs.<br><br>Professional Knowledge 40 Hrs.<br><br>On the Job | Determine the approximate cost, gather components, install, and conduct testing of a wiring system. | 1. Prepare the different types of electrical circuit connections used in house wiring and fix wooden or plastic gutties in a wall.<br>2. Make a series parallel testing board.<br>3. Control one lamp with one switch in cleat wiring. | General electrical accessories of wiring system.<br>Selection of cable for wiring installation.<br>Application of different type of wiring accessories like, main switch, intermediate switch, three pin wall socket.<br>Wiring diagram of different |

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| Training<br>93 Hrs. | | 4. Connect the wires with electrical accessories and fix the various electrical accessories on the wooden board and round block.<br>5. Control two lamps with two switches in cleat wiring.<br>6. Control one lamp from two places in cleat wiring.<br>7. Control one lamp, and one socket independently in cleat wiring. | type connection. |
| | | 8. Prepare layout as well as prepare go down wiring circuit having three lamps in PVC.<br>9. Make a circuit for one electric bell, controlled form three rooms using bell indicator wiring is to be carried out PVC.<br>10. Make straight joint of teak wood batten and T joint as well cross joint.<br>11. Control one lamp with one switch batten wiring and three place control in a batten wiring. | System of supply, tree system and distribution system.<br>Selection of wiring, batten wiring system.<br>Cleat wiring system, wooden casing capping wiring system.<br>Rules for wiring.<br>Conduit wiring and concealed wiring system.<br>Separation of power and lighting circuit. |
| | | 12. Fit KWH meter in consumer house and take reading.<br>13. Plan and perform wiring for lamp, fan and three pin sockets in two rooms ensuring separate circuit in each room.<br>14. Control the entire wiring through MCB and ELCB. | Testing of wiring installation.<br>Insulation test between conductors and earth.<br>Prepare the list of material to wiring the tunnel and stair case wiring.<br>Fusing factor of the fuse and MCB and how to calculate the current rating of house. |
| | | 15. Prepare the material of wiring go down wiring and dining hall.<br>16. Make straight, Tee and | |

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| | | corner joint of casing capping.<br>17. Plan and perform wiring for lamp, ceiling fan fluorescent tube and three pin wall sockets independently in casing capping wiring<br>18. Control the installation with MCB, ELCB.<br>19. Practice Megger testing of different wiring system.<br>20. Practice threading and bending of conduit pipe. | |
| Professional Skill 04 Hrs.<br><br>Professional Knowledge 06 Hrs.<br><br>On the Job Training 20 Hrs. | Develop comprehensive plan and make necessary preparations for the installation of an earthing system. | 1. Identify and select material used in plate eating.<br>2. Install pipe eating machine.<br>3. Check for proper functionality.<br>4. List out the material used in pipe eating.<br>5. Install pipe eating machine in one place.<br>6. Check for proper functionality.<br>7. Perform earthing installation.<br>8. Check earth continuity of newly installation building. | System of earthing, pipe earthing and plate earthing.<br>Rules of earthing, Double earthing.<br>Method of improving the earth resistance.<br>Resistance of earth electrode and size of earth continuity. |
| Professional Skill 02 Hrs.<br><br>Professional Knowledge 10 Hrs.<br><br>On the Job Training 78 Hrs. | Strategize and carry out the installation of electrical lighting system, followed by performing testing procedures. | 1. Make row of small lamps.<br>2. Make connection of decoration lamps with electronic chaser.<br>3. Make connection of 40W fluorescent tube with ac and dc supply.<br>4. Make a connection for street light fitting with two 40 watts tubes and two 40 watts chokes.<br>5. Make connection of high- | Definition and meaning of terms used in illumination engineering used in illumination engineering.<br>Factors to be viewed for correct illumination.<br>Types of light sources.<br>Properties of good illumination.<br>Types of light sources. Direct light, indirect lighting, semi direct lighting. |

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| | | pressure mercury vapor lamp (H.P.M.V) and measure it's starting and running current.<br>6. Make connection of sodium vapor lamp and measure it's starting and working current.<br>7. Make connection of carbon filament lamp and measure it's current.<br>8. Make connection of neon sign tube and prepare a rotating light circuit. | Carbon arc lamp, gas discharge lamp.<br>Types of gas discharge lamp. |
| Professional Skill 39 Hrs.<br><br>Professional Knowledge 12 Hrs.<br>On the Job Training 09 Hrs. | Plan and perform testing of industrial wiring systems. | 1. Test the industrial illumination wiring installations for insulation resistance using a megger.<br>2. Perform troubleshooting of faults present in the industrial wiring. | Inspection and testing of wiring installations.<br>Common faults and their troubleshooting. |
| Professional Skill 51 Hrs.<br><br>Professional Knowledge 18 Hrs.<br><br>On the Job Training 21 Hrs. | Perform installation and dismantling of the electrical or electronic modules. | 1. Dismantle a given SMPS and identify its components.<br>2. Test the Different components on the PCB provided.<br>3. Dismantle the UPS: List down the components used identify the application of the components.<br>4. Test the components desolder the faulty components and replace them.<br>1. Mesh soldering on material provided. | Introduction to AC to DC converter power sources (SMPS)<br>Concept of the working of UPS (uninterrupted power supply)<br>Introduction to DC to AC inverter, batteries and connection<br>Demonstrate the use of soldering, use of flux and lead.<br>Desoldering process using decal pump. |
| Professional Skill 08 Hrs. | Select appropriate analog or digital | 1. Use 3 phase watt meter, multimeter, frequency | Introduction of electrical instruments. |

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| Professional Knowledge 06 Hrs.<br><br>On the Job Training 46 Hrs. | instruments and conduct measurements, while also installing or diagnosing smart meters. | meter with 3 phase and single-phase supply.<br>2. Identify moving coil instruments and moving iron instruments.<br>3. Identify and test function of dynamometer type instruments and induction type instrument.<br>4. Identify the parts and function of single-phase and three phase energy meters.<br>5. Measure the 3-phase balance load by 3-watt meter method in balance and Unbalance load.<br>6. Apply 2-watt meter method to find total wattage of the building with balance and Unbalance load. | Indicating type instruments.<br>Different method of controlling torque.<br>Damping devices of the instruments.<br>Working principle and construction of moving coil and moving iron instrument.<br>Application of moving coil and moving iron instruments.<br>Extension of instrument range.<br>Construction and working of Dynamometer and induction type instrument.<br>Type of integrating instruments. |
| Professional Skill 02 Hrs.<br><br>Professional Knowledge 05 Hrs.<br><br>On the Job Training 23 Hrs. | Conduct testing, verify discrepancies, and calibrate instruments. | 1. Identify the function and use insulation tester.<br>2. Measure the Current and voltage by using current transformer & potential transformer.<br>3. Test the function of KVAR meter and its use also know the function of thermocouple. | Construction and working principle of KWH meter and power factor meter.<br>Construction and working principle of insulation tester current transformer, and potential transformer. |
| Professional Skill 07 Hrs.<br><br>Professional Knowledge 16 Hrs.<br><br>On the Job Training 67 Hrs. | Develop a plan and execute the installation, fault detection, and repair of household appliances. | 1. Identify and select the parts of table fan and ceiling fan and interpret its working.<br>2. Identify the parts of food mixture and grinder and interpret its working.<br>3. Identify the parts of washing machine and interpret its working.<br>4. Prepare an element for 100 | Parts and working of heating elements.<br>Parts and working of hot plate and electric oven.<br>Working of electric kettle, bell, and buzzer.<br>Principle of GEYSER and types of geysers.<br>Principle of food mixture and grinder and speed control of |

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| | | watts heater.<br>5. Measure its power by using wattmeter.<br>6. Design a heating element for 600 watts, 220 volts.<br>7. Replace the heating element of soldering iron.<br>8. Repair and maintain hot plate, electric kettle, electric bell, and buzzer. | that. |
| | | 9. Dismantle the room heater, and identify its parts and assemble.<br>10. Dismantle the automatic electric iron.<br>11. Change the heating element of automatic electric iron.<br>12. Dismantle and identify parts of a washing machine.<br>13. Reassemble the parts of washing machines. | Working principle of washing machine and type of washing machines and parts of washing machine. |
| Professional Skill 12 Hrs.<br><br>Professional Knowledge 20 Hrs.<br><br>On the Job Training 88 Hrs. | Conduct testing, assess the performance, and perform maintenance on transformers. | 1. Calculate iron losses of single-phase transformer by open circuit test or no-load test.<br>2. Determine voltage regulation of single-phase transformer.<br>3. Interpret application of current transformer.<br>4. Interpret Design of transformer with the help of chart.<br>5. Find the terminal of single-phase transformer.<br>6. Calculate copper losses of single-phase transformer by short circuit test.<br>7. Find the efficiency of single-phase transformer at | Construction of core type, shell-type, Berry-Type transformer.<br>Advantage of transformer.<br>Relation between the voltage and current of primary and secondary.<br>Parts of a transformer.<br>Losses in a transformer (copper losses, iron losses, hysteresis loss.).<br>Rating of transformer.<br>Construction and uses of an autotransformer.<br>Different methods of connecting the winding of a three-phase transformer.<br>Scott connection of transformer winding. |

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| | | different load.<br>8. Find polarity of single-phase transformer.<br>9. Identify the parts and winging of autotransformer.<br>10. Interpret the LT and HT of 3 phase transformer.<br>11. Parallel operation of 3 phase transformer. Or grouping of transformers.<br>12. Find the efficiency of three phase transformer.<br>13. Care and maintenance of transformer. | Cooling of transformer- Natural oil cooling, oil blast cooling, forced water cooling, and forced air cooling.<br>Paralleling of transformers and advantage of parallel operation.<br>Method of testing oil in a transformer.<br>Humming of transformer<br>Troubleshooting of transformer and it remedies.<br>Identification of bushes and its fitting. |
| **ENGINEERING DRAWING** | | | |
| Professional Knowledge<br>30 Hrs. | 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<br>• Triangle<br>• Circle<br>• Rectangle<br>• Square<br>• Parallelogram.<br>Lettering & Numbering - Single Stroke<br>Dimensioning Practice, Types of arrowheads<br>Symbolic representation, Different electrical symbols used in the related trades<br>Reading of Electrical Circuit Diagram<br>Reading of Electrical Layout drawing | |
| **WORKSHOP CALCULATION AND SCIENCE** | | | |

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| Professional Knowledge 30 Hrs. | Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. | **WORKSHOP CALCULATION & SCIENCE**<br>**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 thermometer, 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<br>**Trigonometry**<br>• Measurement of angles |

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| | | • Trigonometrical ratios<br>• Trigonometrical tables |
| **MANDATORY OJT/GROUP PROJECT (150 Hours)** | | |
| **Note:** The duration of Professional skills (Trade practical) and Professional knowledge (Trade theory) are indicative only. The Training Institute has the flexibility to adopt suitable training duration for effective training. | | |

| MANDATORY OJT/GROUP PROJECT – FIRST YEAR | | |
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| **DURATION: 150 HOURS** | | |
| **Duration** | **Reference Learning outcome** | **Professional Skills (Trade Practical)** |
| Professional Skills 30 Hrs. | Preparation and installation of BLDC motor and wiring harness of Electric Vehicle. | • Identify the component of Electric Vehicle wiring harness.<br>• Identify the type of wire used In Electric Vehicle wiring harness.<br>• Prepare the sequence ally arrangement of wiring harness.<br>• Clamping practice of different lugs male and female socket.<br>• Identify the parts and termination of BLDC Motor.<br>• Practice installation of BLDC motor in Electric Vehicle.<br>• Troubleshoot and repair of wiring harness and BLDC Motor. |
| Professional Skills 20 Hrs. | Preparation and installation of Servo motor with Arduino Uno to complete Smart Dustbin. | • Identify the electronic components of Arduino Uno, Ultrasonic sensor.<br>• Check the continuity of the servo motor and dc power supply of the machine with jumper.<br>• Make circuit diagram and layout diagram of the smart dustbin.<br>• Make assemble to check the function of the smart dustbin. |
| Professional Skills 20 Hrs. | Development of High-security finger print door locks system. | • Identify the component of single channel relay module, finger print module and voice module.<br>• Check the output of 12-volt power supply with the help of multimeter and function of Arduino Uno.<br>• Interpret the circuit diagram of Industrial high security finger print door lock system.<br>• Install and check the function of industrial high security finger print door lock system. |
| Professional Skills 20 Hrs. | Performs the industry smart conference hall load control system | • Identify the equipment of ALEXA, NODE MCU, 8 channel Relay module, LPG GAS Sensor MQ2, Humidity sensor, Ultrasonic sensor, jumper wire, Buzzer, and LED.<br>• Practice the connection of ALEXA, FLAME Sensor, and Ultrasonic sensor.<br>• Make programing of NODE MCU as per required load control of the room.<br>• Prepare the circuit diagram, install the component and test the system as per the program loaded.<br>• Trace the fault and rectify. |
| Professional Skills 30 Hrs. | Performs the installation of Industrial control panel | • Install the panel board according to the manufacturer's instructions and relevant codes and standards.<br>• Connect the various components of the panel board, such as |

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| | design. | circuit breakers, transformers, and switches.<br>• Troubleshoot any issues with the panel board, such as faulty connections or malfunctioning components.<br>• Replace any faulty components, such as fuses or circuit breakers. |
| Professional Skills 30 Hrs. | Installing and troubleshooting solar panels. | • Install and mount solar panels on roofs or other structures using proper equipment and following safety measures.<br>• Wiring solar panels in series and parallel configurations to meet system voltage and current requirements.<br>• Install and wiring inverters and other balance-of-system components to convert DC power to AC power and integrate with the electrical grid.<br>• Diagnose and troubleshoot issues with solar panel systems, such as faulty connections or defective components.<br>• Repairing or replacing damaged or malfunctioning solar panels, including the frame, glass, and electrical wiring. |
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| SYLLABUS – INDUSTRY INTEGRATED ELECTRICIAN (FLEXI-MoU) | | | |
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| **SECOND YEAR** | | | |
| **Duration** | **Reference Learning Outcomes** | **Professional Skills (Trade Practical)** | **Professional Knowledge (Trade Theory)** |
| Professional Skill 15 Hrs.<br><br>Professional Knowledge 10 Hrs.<br><br>On the Job Training 35 Hrs. | Execute testing and maintenance of AC motor and starter. | 1. Identify and list down the types of the motor in the work.<br>2. List the specification and application of the motors.<br>3. Measure the RPM of the given motor.<br>4. Identify the types of Motor stators provided.<br>5. Perform and verify the star delta connection as per the load requirement. | Introduction to motor, types of motor, working principle and application<br>Motor specification as per the voltage rating, RPM and power factor<br>Uses of the tachometer and its notation<br>Concept of motor starter types of starters.<br>DOL, star and delta connection auto transformer starter.<br>Common maintenance of the AC motor |
| Professional Skill 10 Hrs.<br><br>Professional Knowledge 10 Hrs.<br><br>On the Job Training 40 Hrs. | Develop a comprehensive plan, implement the commissioning process, and assess the performance of DC machines. | 1. Identify stator, yoke, Rotor, winding, poles, and commutator of DC machine.<br>2. Determine build up voltageof DC shunt generator with varying field excitation and performance analysis on load.<br>3. Overhauling of DC machine.<br>4. Find terminals of DC machine with the help of Mugger and series testing lamp.<br>5. Measure the armature resistance of DC machine.<br>6. Measure the field resistance of DC machine.<br>7. Find the short resistance between winding and body and winding to winding<br>8. Start, run and reverse of Compound generator. | Basic knowledge of DC Generator.<br>Working principle of DC generator.<br>Essential requirements of dc generator.<br>Parts of machine-like field pole, armature core, winding, yoke, slip ring, commutator, brushes, brush lead, rocker, front end cover, rear end cover, cooling fan, bearing, shaft, eye bolt, bed plate, coupling, terminal box.<br>Types of generators. |

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| | | 9. Start, run and reverse direction of rotation of DC shunt generator.<br>10. Start, run and reverse direction of rotation of DC series generator. | |
| Professional Skill 10 Hrs.<br><br>Professional Knowledge 10 Hrs.<br><br>On the Job Training 40 Hrs. | Carry out testing and maintenance activities for DC machines and motor starters. | 1. Determine the open circuit characteristics, ECC and load test of series generator.<br>2. Determine the open circuit characteristics, ECC and load test of shunt generator.<br>3. Determine the open circuit characteristics and ECC and load test of compound generator.<br>4. Re-charging (Magnetizing) the field of a dc generator.<br>5. Over hauling of DC shunt motor.<br>6. Over hauling of DC series motor.<br>7. Over hauling of DC compound generator. | Equation of generator.<br>Types of winding, characteristics of generator, method of magnetization.<br>Separately excited and self-excited generator. Armature reaction.<br>Remedies of armature reaction.<br>Commutation.<br>Losses in DC generator.<br>Different power stages of DC generator.<br>Efficiency of dc generator. |
| | | 8. Exchange carbon brushes, brush holders, Commutator and slip rings.<br>9. Identify terminal connections and performance characteristics of DC series motor.<br>10. Identify terminal connections and performance characteristics of DC shunt motor.<br>11. Identify terminal connections and performance characteristics of DC compound generator.<br>12. Identify the NVC, OLRC, Stud and starting resistance of 3- | Introduction of dc machine.<br>Fleming's left-hand rule.<br>Difference between construction of DC motor and generator.<br>Terms used in dc motor.<br>Classification of dc motor.<br>Characteristics of dc motor.<br>Necessity of starter.<br>Types of starters. |

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| | | point starter.<br>13. Connect and run the DC shunt motor with 3-point starter. Change the DOR of motors.<br>14. Connect start and run the D.C compound motor with 4-point starter | |
| Professional Skill 10 Hrs.<br><br>Professional Knowledge 10 Hrs.<br><br>On the Job Training 40 Hrs. | Differentiate, arrange, and execute the process of motor winding. | 1. Control speed of DC shunt motor by armature and field method.<br>2. Find the copper and iron loss of dc shunt motor.<br>3. Measure the speed of DC motor by using TECO meter.<br>4. Apply break test method to find the efficiency of DC motor.<br>5. Test armature short in growler and assemble. | Speed variation of dc motor.<br>Voltage control method.<br>Armature reaction of dc motor.<br>Commutation of dc motor.<br>Losses in DC motor.<br>Common defects and their remedies in DC motor. |
| Professional Skill 15 Hrs.<br><br>Professional Knowledge 10 Hrs.<br><br>On the Job Training 35 Hrs. | Plan, execute commissioning and evaluate performance of AC motors. | 1. Start the induction motor by using ATS.<br>2. Connect a three-phase motor with star delta starter to measure it's starting.<br>3. Run current and change its direction of rotation.<br>4. Find the efficiency of induction motor.<br>5. Identify the pairs of windings of three phase squirrel cage induction motor and test earth.<br>6. Test the over load and No volt coilusing star delta starter (manual and automatic)<br>7. Identify and select different parts of ATS and slip ring motor starter.<br>8. Start the induction motor by | Introduction of 3 phase induction.<br>Principle of different type induction motor.<br>Torque of induction motor.<br>Construction and characteristics of different type induction motor.<br>Details of DOL, Star Delta, automatic star delta and ATS. |

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| | | using DOL starter.<br>9. Start the induction motor by using star delta starter. | |
| | | 10. Run a three-phase double squirrel cage induction motor with DOL.<br>11. Perform load test of a three-phase induction motor and draw various curves.<br>12. Measure the slip of a slipring induction motor or squirrel cage induction motor.<br>13. Measure insulation resistance of the winding to body and winding to earth. | Starting of induction motor.<br>Application of different type induction motor.<br>Losses and efficiency of different type induction motor.<br>Speed control of induction motor.<br>Power state of induction motor.<br>Troubles and remedies of induction motor.<br>Definition of concentric, distributed, single double layer winding. |
| Professional Skill 10 Hrs.<br><br>Professional Knowledge 10 Hrs.<br><br>On the Job Training 40 Hrs. | Develop comprehensive plan, conduct testing, assess performance, and perform maintenance on alternators or generator sets (MG sets). | 1. Perform armature winding, field winding.<br>2. Select different essential parts of alternator.<br>3. Find the resistance of armature and field winding.<br>4. Connect and run the single-phase alternator with shunt motor, verify the effect of variation of speed and excitation in frequency and voltage.<br>5. Start and run synchronies the alternators by Dark lamp method.<br>6. Connect & run three phase alternators, measure its voltage frequency. | Basic concept of an alternator.<br>Advantage of keeping the armature in stationary.<br>To know the working of Stator, Rotor, Exciter,<br>Relation between speed, pole and frequency.<br>Types of alternators.<br>Single phase and 3 phase alternators.<br>Coil span factor and distribution factor.<br>How to generate emf in an alternator.<br>Synchronous scope and voltage regulation of an alternator. |
| | | 7. Draw magnetizing curve of an alternator.<br>8. Find the voltage regulation of an alternator.<br>9. Start run and synchronies the alternators by bright lamp method. | Parallel operation of alternator.<br>Rating of alternator. Dark and bright lamp method.<br>Alternator efficiency and characteristics.<br>Power factor improvement. |

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| | | 10. Coupling and prime over the alternator.<br>11. Connect and take the reading of the motor generator by putting load. | Care and maintenance of an alternator.<br>Motor generator set preparation. |
| Professional Skill 15 Hrs.<br><br>Professional Knowledge 10 Hrs.<br><br>On the Job Training 65 Hrs. | Construct basic electronic circuits and conduct functional testing. | 1. Find the value of resistance by multimeter.<br>2. Find the value of resistance by color code method.<br>3. Design battery eliminator with full- wave rectifier and test its functions.<br>4. Identify terminals of transistors. | Principle of Transistors and inductors.<br>Energy band and levels.<br>Resistance measurements |
| | | 5. Test the capacitor by multimeter.<br>6. Find the value of capacitor by color code chart.<br>7. Test diode by multimeter<br>8. Identify half wave rectifier. | Semi-conducting material and devices.<br>Half wave rectifier, full wave rectifier.<br>Characteristics of P-N junction, diode, transistor.<br>Specification of P-N junction, diode, transistor.<br>Use of diode, transistor. |
| | | 9. Connect the oscilloscope to different points in a circuit and observe the waveforms and measurements.<br>10. Gain insights into the behavior and characteristics of various components using oscilloscope.<br>11. Test oscilloscope and its parts with function generator working.<br>12. Interpret working of current and voltage curve of diode valve.<br>13. Verify the characteristic of germanium and silicon diode forward and reverse biased. | Number conversion.<br>Decimal, Binary, octal, hexadecimal.<br>Binary addition, subtraction, multiplication, division.<br>Basic principle and truth table of AND gate, Nor gate, not gate, |

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| | | 14. Calculate forward resistance of silicon or germanium diode.<br>15. Make voltage stabilizer with Zener diode.<br>16. Illustrate transistor biasing effect.<br>17. Make one light using LDR. | Use of SCR, DIAC, TRIAC and IGBT<br>Function of OSCILLOSCOPE.<br>Use of function generator. |
| Professional Skill 10 Hrs.<br><br>Professional Knowledge 15 Hrs.<br><br>On the Job Training 65 Hrs. | Assemble accessories and carry out wiring of control cabinets and equipment. | 1. Identify the tools and equipment of wiring accessories.<br>2. Wiring of two remote control stations of the induction motor. | How to know the Construction of control panel. |
| | | 3. Remote control of induction motor.<br>4. Prepare connection of reverse and forward operation of induction motor. | Machine control panel layout and wiring.<br>Control and power circuit of machine.<br>Working and application of different control elements. |
| | | 5. Identify, select and interpret working of the control panels, MCCB, ELCB, Bus-Bar, MCB, etc.<br>6. Prepare wiring of control panel and bunching of a cable.<br>7. Identify safety instrument and controlling instruments of the control panel.<br>8. Demonstrate function of control panel and its proper working with parameter checking. | Introduction of different wiring accessories.<br>Flexible metal conduit, intermediate metal conduit, rigid metal conduit, metal wire ways, terminals connectors, DIN rails, use of ferrules, etc. |
| Professional Skill 10 Hrs.<br><br>Professional Knowledge 05 Hrs.<br>On the Job | Implement speed regulation of AC and DC motors utilizing solid-state components. | 1. Perform Speed control of universal motor by using SCR.<br>2. Perform Speed control of dc motor by using drive.<br>3. Perform AC motor speed control by using AC drive. | Working principle of electrical drives.<br>Three phase induction motor speed control using variable control system or ac drive. |

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| Training<br>45 Hrs. | | | |
| Professional Skill 10 Hrs.<br><br>Professional Knowledge 10 Hrs.<br><br>On the Job Training 40 Hrs. | Detect faults and troubleshoot problems in inverters, stabilizers, battery chargers, emergency lights, UPS systems, and other related equipment. | 1. Prepare of light using VDR.<br>2. Prepare an emergency light.<br>3. Construct automatic voltage stabilizer.<br>4. Make inverter.<br>5. Construct UPS.<br>6. Perform Breakdown maintenance and preventive maintenance. | Classification, construction, working and application of thyristor.<br>Classification of power transistors.<br>Manual and automatic voltage stabilizer.<br>Basic concept of uninterruptible power supply and its block diagram. |
| Professional Skill 20 Hrs.<br><br>Professional Knowledge 10 Hrs.<br><br>On the Job Training 60 Hrs. | Construct an elevated service line for residential electricity, outline diverse power plant arrangements, and elucidate the concept of a smart distribution grid and its elements. | 1. Prepare small distribution system concept.<br>2. Prepare the Lay out diagram of grid to substation.<br>3. Draw layout of hydroelectric power plant.<br>4. Identify function of different layout elements and schematic diagram arrangement.<br>5. Draw layout of Nuclear Power plant and identify functions of different layout elements. | Comparison between hydro power plant and solar power plant.<br>Principle of power generation of power plant. |
| | | 1. Fix pin insulator on cross arm.<br>2. Bind the pin insulator through neck and top side.<br>3. Bind shackle insulator with winding wire.<br>4. Bind stay or egg insulator with winding wire. | How to transmission of power for generating station to Grid.<br>What are the materials used in transmission purpose.<br>How to prepare transmission tower line. |
| | | 5. Install overhead service line for a single-story building.<br>6. Install overhead line for double story or multi- story building.<br>7. Install bus bar and bus coupler on LT line. | Advantage of high voltage transmission system.<br>Overhead lines.<br>Type of insulator and their uses.<br>Bus bar system and their uses |

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| Professional Skill 10 Hrs.<br><br>Professional Knowledge 05 Hrs.<br><br>On the Job Training 15 Hrs. | Strategize, build, and deploy a solar panel installation. | 1. Measure the voltage of solar cell and interpret its construction.<br>2. Visit and prepare layout plan and identify different elements of wind power system.<br>3. Visit and Prepare layout plan and identify different elements of solar power system. | Production of power by wind power plant and its principle.<br>Principle of power generation of photo voltaic cell.<br>How to installation material of power station. |
| Professional Skill 10 Hrs.<br><br>Professional Knowledge 05 Hrs.<br><br>On the Job Training 15 Hrs. | Analyze the defects and perform maintenance on circuit breakers. | 1. Skinning of an armored cable.<br>2. Identify the Different parts of circuit breaker<br>3. Use isolators.<br>4. Test the ACB with load and find it's current.<br>5. Overhaul circuit breaker. | Isolator and circuit breaker.<br>Principle of oil circuit breaker.<br>Principle of air circuit breaker.<br>Static lightning discharge controlling devices.<br>Purpose of a lightning arrester. |
| Professional Skill 30 Hrs.<br><br>Professional Knowledge 15 Hrs.<br><br>On the Job Training 15 Hrs. | Identify and evaluate different types of sensors and sensor-based technology in industry application. | 1. Identify and list the sensor with specifications in the given machine.<br>2. Carry and draw out the sensor connection as per the datasheet provided.<br>3. Create a sensor-using IR led and TSOP sensor (optional-relay for the application).<br>6. Repair and maintenance of the given sensor. | Overview of the sensor<br>Types of sensors used in the industry<br>(motion sensor, pressure sensor, temperature sensor accelerometer sensor, photo sensor, ultrasonic sensor and magnetic field sensor)<br>Difference between sensor and transducer<br>Active and passive sensor<br>Working principle of thermocouple and its applications<br>Need and choosing of sensors. |
| Professional Skill 25 Hrs. | Understand the process of commissioning of PLC unit and field Input/output (I/O). | 1. Perform and verify the commissioning of the PLC.<br>2. Perform and mounting of the PLC and D-rail. | Basic programmable logic controller<br>Sourcing and sinking of PLC and additional IO modules |

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| Professional Knowledge 15 Hrs.<br><br>On the Job Training 20 Hrs. | | 3. Create a ladder logic program for gate logic in the given software.<br>4. Create a ladder logic Program for OR gate logic in the given software.<br>5. Create a led blinking Program using Timer.<br>6. Create a led blinking program using Counter.<br>7. Perform loading and download of the program in the programming forum. | NO, NC and coil symbols used in Programming<br>Introduction to ladder logic<br>Alarm identification (Run, stop, standby mode, error mode and overheated or short circuit mode)<br>Timer, counter and set-reset memory<br>understand the process of uploading and downloading the program using the PG/PC interface.<br>Understand the process for making minor changes in the Program using the PG/Pc interface |
| Professional Skill 30 Hrs.<br><br>Professional Knowledge 15 Hrs.<br><br>On the Job Training 45 Hrs. | Understand the basic utility of the Internet of Things (IoT) and Industrial IoT (IIoT) in Industrial applications. | 1. Apply IoT in the Industries.<br>2. Interface the sensor protocol and controller to the internet.<br>3. Wireless data collection to the mobile application.<br>4. Industrial getaways IIOT. | Introduction and history of IoT (internet of things)<br>Application and need of IoT in the Industries<br>Explain “Things” (physical things and Virtual things)<br>Explain the IoT architecture interfacing the sensor protocol and controller to the internet.<br>Explain the wireless data collection to the mobile application.<br>Industrial getaways IIOT |
| Professional Skill 30 Hrs.<br><br>Professional Knowledge 15 Hrs.<br><br>On the Job Training 45 Hrs. | Plan and design Pneumatic - Hydraulic circuits and check their functionality. | 1. Design the piping layout for the given application.<br>2. Draw the schematic symbol of the hydraulics components.<br>3. Draw the schematic symbol of the pneumatic.<br>4. Perform and List down the component with the specification for creating a hydraulic circuit for a single- | Understand the piping layout and components used in the given circuit diagram<br>Principle of hydraulics system components of hydraulics system (fluid reservoir, hydraulic pump, fluid line, valves and actuator)<br>Application of hydraulics system<br>Explanation with load lifting consists of the pressure relief |

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| | | acting hand-operated system.<br>5. Perform and list down the components with specifications, creating a hydraulics circuit for controlling the speed of the cylinder or hydraulic conveyor.<br>6. Create a pneumatic circuit for open-close of the gripper.<br>7. Construct and verify the functionality of the flow control valve in Meter-in and Meter-out circuit. | valve, directional control valve, reservoir and motor-driven oil pump)<br>Principle of pneumatic system<br>Components of pneumatic system (FLR unit, flow control valve with check, shuttle valve, 5/2 solenoid valve 3/2 solenoid valve) Application of single-acting cylinder and double-acting cylinder<br>Install the hydraulic pump and motor and verify their function in the hydraulic power pack.<br>Maintenance of hydraulic motor and pump |
| Professional Skill 30 Hrs.<br><br>Professional Knowledge 15 Hrs.<br><br>On the Job Training 45 Hrs. | Execute testing and maintenance of the central alarm system (alarm control panel, smoke sensor, over temperature sensor and jet nozzle). | 1. Perform the drill or testing of the alarm system.<br>7. Prepare the checklist of the sensor and control panel with proper tagging. | Overview of the central alarm system<br>Requirement of fire alarm system.<br>types of fire alarm systems in use today<br>Non – Addressable<br>Addressable Ems<br>Hybrid<br>Maintenance<br>Regular testing and inspection regular testing and Inspection<br>False alarm management<br>Common maintenance problems and troubleshooting |
| Professional Skill 30 Hrs.<br><br>Professional Knowledge 15 Hrs.<br><br>On the Job Training 45 Hrs. | Execute CCTV maintenance and fault detection. (DVR/NVR, cable connectors, dc power source and mic audio connectors) | 1. Visit and identify the different types of cameras used in your industry.<br>2. Plan the wiring layout and routing for the camera to DVR.<br>3. Identify the alarm in the DVR and troubleshoot as per the given instruction.<br>4. Changing the DVR battery. | Overview of the components used in the CCVT installation detail construction of the camera, and detail construction of the DVR (digital video recorder).<br>Types of cameras (bullet dome PTZ and IP camera<br>Connection of the HDD to the DVR/NV set up the storage |

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| | | 8. Cleaning of the BNC connector and power connector. | Connection of the camera with BNC connector and DC power source<br>Demonstration on the general maintenance of the CCTV camera and connector<br>Maintenance of the DC power source (DVR/NVR, cable connectors, DC power source and mic audio connectors) |
| **ENGINEERING DRAWING** | | | |
| Professional Knowledge 30 Hrs. | 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 AND SCIENCE** | | | |
| Professional Knowledge 60 Hrs. | Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. | **Friction**<br>• Lubrication.<br>**Algebra**<br>• Addition, subtraction, multiplication & division.<br>• Theory of indices, algebraic formula, related problems.<br>**Elasticity**<br>• Elastic, plastic materials, stress, strain and their units and young's modulus.<br>**Profit and Loss**<br>• Simple problems on profit & loss.<br>• Simple and compound interest.<br>**Estimation and Costing**<br>• Simple estimation of the requirement of material etc., as applicable to the trade.<br>• Problems on estimation and costing. | |
| **MANDATORY OJT/GROUP PROJECT (Duration 240 Hours)** | | | |
| ***Note:*** *The duration of Professional skills (Trade practical) and Professional knowledge (Trade theory) are indicative only. The Training Institute has the flexibility to adopt suitable training duration for effective* | | | |

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| *training.* |

| MANDATORY OJT/GROUP PROJECT – SECOND YEAR | | |
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| **DURATION: 150 HOURS** | | |
| **Duration** | **Reference Learning Outcome** | **Professional Skills (Trade Practical)** |
| Professional Skills 30 Hrs. | Install and troubleshoot Electric Vehicle charging stations. | • Prepare EV charger.<br>• Install one EV charging in your lab.<br>• Repair and maintenance of EV charging station. |
| Professional Skills 30 Hrs. | Develop Vehicle accident alert system. | • Identify and test the instrument of GSM Module, GPS Module, Accelerometer, lead, buzzer, 12-volt power supply.<br>• Assemble the component of the PCB as per circuit diagrams.<br>• Test the function of each component and working condition of the vehicle accident alert system.<br>• Install the circuit one of the vehicles and test its working. Trace the fault. |
| Professional Skills 30 Hrs. | Develop the module to protect industries form LPG GAS LEAKAGE. | • Determine the parts of an instrument of the module like Arduino UNO, GSM module, LPG Gas sensor MQ2, Alarm, 1 Channel relay module, etc.<br>• Program the NODE MCU; properly check the working condition as per loaded program.<br>• Prepare the circuit diagram as per requirements.<br>• Install the component and the instrument to the PCB board, and check the working condition.<br>• Follow the safety measures and trace the fault and remedies as per the requirement. |
| Professional Skills 30 Hrs. | Identify areas for process improvement by evaluating the factor affecting Quality of products and services. | • Identify the factors affecting the quality of product and service.<br>• Apply statistical techniques.<br>• Develop capacity of productivity.<br>• Fix product section.<br>• Prepare product design.<br>• Manufacture product.<br>• Correction of quality deficiencies.<br>• Different form of inspection.<br>➢ Incoming inspection.<br>➢ In- process inspection.<br>➢ Final inspection. |
| Professional Skills 30 Hrs. | Operate Robotic automation system. | • Operate robotic welding systems for specific welding tasks.<br>• Troubleshoot and repair faults in a robotic welding system, |

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| | | such as faulty sensor readings or programming errors.<br>• Perform robotic pick and place systems to move products or materials within a manufacturing facility.<br>• Test and optimize the speed and efficiency of a robotic pick and place system.<br>• Install a robotic assembly line system to automate the manufacturing process.<br>• Designing and implementing safety protocols for robotic systems to ensure worker safety. |
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| SYLLABUS FOR CORE SKILLS |
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| 1. Employability Skills (Common for all CTS trades) (120 Hrs. + 60 Hrs.) |

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in / www.dgt.gov.in

## ANNEXURE-I

| List of Tools & Equipment | | | |
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| **INDUSTRY INTEGRATED 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 meter | (20 +1) Nos. |
| 2. | Combination Plier Insulated | 200 mm | (20 +1) Nos. |
| 3. | Screwdriver Insulated | 4mm X 150 mm, Diamond Head | (20 +1) Nos. |
| 4. | Screwdriver Insulated | 6mm X 150 mm | (20 +1) Nos. |
| 5. | Electrician screwdriver thin stem insulated handle | 4mm X 100 mm | (20 +1) Nos. |
| 6. | Heavy Duty Screwdriver insulated | 5mm X 200 mm | (20 +1) Nos. |
| 7. | Electrician Screwdriver thin stem insulated handle | 4mm X 250 mm | (20 +1) Nos. |
| 8. | Punch Centre | 9mm 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 & 300mm | 1 each |
| 24. | Bearing Puller (inside and outside) | 200 mm | 1 No. each |
| 25. | Pipe vice Cast Iron with hardened | 100 mm | 2 Nos. |

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| | jaw open type | | |
| 26. | Scissors blade, SS | 200mm | 4 Nos. |
| 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. | Snip Straight and Bent heavy duty | 250 mm | 2 Nos. each |
| 42. | D.E. metric Spanner Double Ended | 6 - 32 mm | 2 Set |
| 43. | Drill hand brace | 0-100mm | 4 Nos. |
| 44. | Drill S.S. Twist block | 2 mm, 5 mm and 6 mm set of 3 | 4 Set |
| 45. | Plane cutters | 50 mm X 200mm | 2 Nos. |
| 46. | Smoothing cutters | 50 mm X 200mm | 2 Nos. |
| 47. | Gauge, wire imperial stainlees steel marked in SWG & mm | Wire Gauge - Metric | 4 Nos. |
| 48. | File flat | 200 mm 2nd cut with handle | 8 Nos. |
| 49. | File half round | 200 mm 2nd cut with handle | 4 Nos. |
| 50. | File round | 200 mm 2nd cut with handle | 4 Nos. |
| 51. | File flat rough | 150 mm with handle | 4 Nos. |
| 52. | File flat bastard | 250 mm with handle | 4 Nos. |
| 53. | File flat smooth | 250 mm with handle | 4 Nos. |
| 54. | File Rasp, half round | 200 mm bastard with handle | 4 Nos. |
| 55. | Copper bit soldering iron. | 0.25 kg | 2 Nos. |
| 56. | De soldering Gun | Heat proof nozzle, PVC type, 250mm | 4 Nos. |
| 57. | Hand Vice | 50 mm jaw | 4 Nos. |
| 58. | Table Vice | 100 mm jaw | 8 Nos. |
| 59. | Oil Can | 250 ml | 2 Nos. |
| 60. | Contactor & auxiliary contacts | 3 phase, 415 Volt, 25 Amp with 2 NO | 2 Nos. each |

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| | | and 2 NC | |
| 61. | Contactor & auxiliary contacts. | 3 phase, 415 volt, 32 Amp with 2 NO and 2 NC | 2 Nos. each |
| 62. | Limit Switch | Limit Switch, Liver operated 2A 500v, 2-contacts | 2 Nos. |
| 63. | Rotary Switch | 16 A/440v | 2 Nos. |
| 64. | Relay-<br>a. Cut out Relays<br>b. Reverse current<br>c. Over current<br>d. Under voltage | <br>a. 16A, 440V<br>b. 16A, 440V<br>c. 16A, 440V<br>d. 360V-440V | 2 No. each |
| 65. | Pin Type, shackle type, egg type & suspension type insulators including hardware fitting | | 2 Nos. each |
| 66. | Hydrometer | | 2 Nos. |
| 67. | Hand Drill Machine | 0-6 mm capacity | 2 Nos. |
| 68. | Portable Electric Drill Machine | 0-12 mm capacity 750w, 240v with chuck and key | 1 No. |
| 69. | Load Bank ( Lamp / heater Type) | 6 KW, 3Ph | 1 No. |
| 70. | Brake Test arrangement with two spring balance rating | 0 to 25 kg | 1 No. |
| 71. | Laboratory Type Induction Coil | 1000 W | 2 Nos. |
| 72. | Out Side Micrometer | 0 - 25 mm least count 0.01mm | 2 Nos. |
| 73. | Thermometer Digital | 0° C - 150° C | 1 No. |
| 74. | Series Test Lamp | 230V, 60W | 4 Nos. |
| 75. | Knife Switch DPDT fitted with fuse terminals | 16 Amp | 4 Nos. |
| 76. | Knife Switch TPDT fitted with fuse terminals | 16 Amp/ 440 V | 4 Nos. |
| 77. | Miniature circuit Breaker | 16 amp | 2 Nos. |
| 78. | Earth Plate | 60cm X 60cm X 3.15mm Copper Plate<br>60cm X 60cm X 6mm GI Plate | 1 Each |
| 79. | Earth Electrode | Primary Electrode 2100x28x3.25mm<br>Secondary Cu Strip 20x5mm | 1 No. |
| 80. | MCCB | 100Amps, Triple pole | 1 No. |
| 81. | ELCB and RCCB | 25Amps, double pole and 25Amps, double pole, IΔn 30 mA | 1 Each |
| 82. | Fuses | HRC<br>Glass<br>Rewire Type | 4 Each |

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| 83. | 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 |
| 84. | Capacitors | Electrolytic<br>Ceramic<br>Polyester film<br>Variable<br>Dual run | 2 Each |
| 85. | Various Electronic components | Resistors, Diode, Transistor, UJT, FET, SCR, DIAC, TRAIC, IGBT, Small transformer etc. | As required |
| 86. | Various Lamps | Halogen Incandescent Lamp<br>Fluorescent tube<br>HP mercury vapor Lamp<br>High-pressure sodium Lamp<br>Low-pressure sodium Lamp<br>LED | 1 Each |
| 87. | Plug socket<br>Piano Switch<br>Lamp Holder | 230 V, 5 A | 2 Each |
| 88. | Cables:<br>Twisted Pair<br>Non-Metallic Sheathed Cable<br>Underground Feeder Cable<br>Ribbon Cable<br>Metallic Sheathed Cable<br>Multi-Conductor Cable<br>Coaxial Cable<br>Direct-Buried Cable | 1 mtr each | 1 Each |
| 89. | Bus bar with brackets | 1 mtr each | 3 Nos. |
| 90. | Rubber mat | 2’ x 4’ x 1” | 2 Nos. |
| 91. | Electrician Helmet | Yellow Colour | 2 Nos. |
| 92. | RCC Pole with accessories (MS angle iron, ‘C’ clamp, stay insulator etc.) and materials | 6 Mtr | 1 No. |
| 93. | Safety Belt | Standard quality | 2 Nos. |
| **(ii) List of Equipment** | | | |
| 94. | Ohm Meter; Series Type & Shunt Type, portable box type | 50/2000-ohm analog | 2 Nos. each |

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| 95. | Digital Multi Meter | DC 200mv -1000v,0 – 10A & AC 200mv- 750v , 0-10A, resistance 0-20 MΩ and 3 1/2 digit | 12 Nos. |
| 96. | A.C. Voltmeter M.I. analog, portable box type housed in Bakelite case | Multi range 75 V - 150V - 300V - 600V | 3 Nos. |
| 97. | Milli Voltmeter centre zero analog, portable box type housed in Bakelite case | 100 – 0 – 100 mV | 2 Nos. |
| 98. | Ammeter MC analog, portable box type housed in Bakelite case | 0 - 500 mA, 0-5 A, 0-25 A | 2 Nos. each |
| 99. | AC Ammeter MI, analog, portable box type housed in Bakelite case | 0 - 1 A, 0-5 A, 0-25 A | 2 Nos. each |
| 100. | 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. |
| 101. | Digital Wattmeter | 230 V, 1 KW, 50 Hz | 2 Nos. |
| 102. | A.C. Energy Meter | Single Phase, 10 A, 240 V induction type | 2 Nos. |
| 103. | A.C. Energy Meter | Three Phase, 15 A , 440 V induction type | 2 Nos. |
| 104. | Power Factor Meter Digital | 440 V, 20 A, Three Phase portable box type | 2 Nos. |
| 105. | Frequency Meter | 45 to 55 Hz | 2 Nos. |
| 106. | Magnetic Flux Meter | 0-500 tesla | 2 Nos. |
| 107. | Lux meter | lux meter LCD read out 0.05 to 7000 lumens with battery. | 2 Nos. |
| 108. | Tachometer | Analog Type - 10000 RPM | 1 No. |
| 109. | Tachometer | Digital Photo Sensor Type - 10000 RPM | 1 No. |
| 110. | Tong Tester / Clamp Meter | 0 - 100 A (Digital Type) | 2 Nos. |
| 111. | Megger | Analog - 500 V | 2 Nos. |
| 112. | 3- point D.C. Starter | For 2.5 KW DC motor | 1 No. |
| 113. | 4- point D.C. Starter | For 2.5 KW DC motor | 1 No. |
| 114. | Wheat Stone Bridge with galvanometer and battery | | 2 Nos. |
| 115. | Single Phase Variable Auto Transformer | 0 - 270 V, 10Amp (Air cooled) | 2 Nos. |
| 116. | Phase Sequence Indicator | 3 Phase, 415 V | 2 Nos. |

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| 117. | Growler | 230 V, 50 Hz, Single Phase, Adjustable jaws, Testing armature with ampere meter and testing probes. | 1 No. |
| 118. | 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<br>e. Star Delta Starter – Fully automatic<br>f. Star Delta Starter - Soft starter<br>g. Auto Transformer type | For A.C Motors of 2 to 5 H.P. | 1 No. each |
| 119. | Oscilloscope Dual Trace | 20 MHz | 1 No. |
| 120. | Function Generator | 2 to 200 KHz, Sine, Square, Triangular 220 V, 50 Hz, Single Phase | 1 No. |
| 121. | Soldering Iron | 25-Watt, 65 Watt and 120-Watt, 230 Volt | 2 Nos. each |
| 122. | Temperature controlled Soldering Iron | 50-Watt, 230 Volt | 2 Nos. |
| 123. | Discrete Component Trainer | Discrete Component (for diode and transistor circuit) with regulated power supply +5,0- 5 V,+12 ,0-12 V | 2 Nos. |
| 124. | Linear I.C. Trainer | Linear I.C. Trainer with regulated power supply 1.2V to 15V PIC socket 16pin and 20 pins with bread board | 1 No. |
| 125. | Digital I.C. Trainer | Digital I.C. Trainer 7 segment display and bread board | 1 No. |
| 126. | Domestic Appliances – | | |
| | a. Electric Induction plate | a. 1500 Watt, 240V | 1 No. each |
| | b. Electric Kettle | b. 1500 Watts, 240V | |
| | c. Electric Iron | c. Automatic - 750 W, 240 V | |
| | d. Immersion Heater | d. 1500 Watt, 240V | |
| | e. A.C. Ceiling Fan and AC Table Fan | e. 68-Watt, 230 V | |
| | f. Geyser (Storage type) | f. 10 litre | |
| | g. Mixture & Grinder | g. 750 W, 240 V | |
| | h. Washing Machine Semi-Automatic | h. 5 Kg, | |
| | i. Motor Pump set | i. 1 HP, 1 Phase, 240 V | |
| 127. | Oil Testing Kit | Oil Testing Kit 230 V, single phase 50 Hz 60 VA output 0-60 KV Variable | 1 No. |

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| 128. | Inverter with Battery | 1 KVA with 12 V Battery<br>Input- 12 volt DC,<br>Output- 220 volt AC | 1 No. |
| 129. | Voltage Stabilizer | AC Input - 150 - 250 V, 600 VA<br>AC Output - 240 V, 10 A | 1 No. |
| 130. | DC Power Supply | 0 - 30 V, 5 A | 2 Nos. |
| 131. | Battery Charger | 0 - 6 - 9 - 12 - 24 - 48 V, 30amp | 1 No. |
| 132. | Current Transformer | 415 V, 50Hz, CT Ratio 25 / 5 A, 5VA | 2 Nos. |
| 133. | Potential Transformer | 415 V, 50Hz, PT Ratio, 440V/110V, 10VA | 2 Nos. |
| 134. | Solar panel with Battery | 18 Watt | 1 Set |
| 135. | I 5 and I7 Computer or latest Version | 2.8 GHz & above, 1 GB RAM, 80 GB HDD, DVD Combo Drive, 19/21" Monitor, optical scroll mouse, multimedia keyboard, 32 bit LAN card with UPP port, necessary Drivers, etc.<br>OR<br>(Latest Version) | 2 Nos. |
| 136. | Ink jet/ laser printer | | 1 No. |
| **C. Shop Machinery** - For 4 (2+2) units no additional items are required | | | |
| 137. | D.C. Shunt Generator with control panel | D.C. Shunt Generator with control panel,2.5 KW, 220V &3phase Squirrel cage Induction Motor, 5HP, 440V with control panel & star delta starter | 1 No. |
| 138. | 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, 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. |

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| 139. | 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. |
| 140. | DC Series Motor coupled with spring balance load | 2.5 KW, 220 Volts | 1 No. |
| 141. | DC Shunt Motor | 2.5 KW, 220 V | 1 No. |
| 142. | DC compound Motor with starter and switch | 2.5 KW ,220 volts | 1 No. |
| 143. | 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 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. | 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. |
| 144. | 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. |
| 145. | AC phase-wound slip ring Motor with starter switch | 5 HP, 440 V, 3 Phase, 50 Hz | 1 No. |
| 146. | Universal Motor with starter/switch | 240 V, 50 Hz, 1 HP | 1 No. |
| 147. | Synchronous motor with accessories like starter, excitation arrangements. | 3 Phase, 3 HP, 440V, 50Hz, 4 Pole | 1 No. |
| 148. | Thyristor /IGBT controlled D.C. motor drive with tacho-generator feedback arrangement | 1 HP | 1 No. |
| 149. | Thyristor/IGBT controlled A.C. motor drive with | VVVF control 3 Phase, 2 HP | 1 No. |
| 150. | Single phase Transformer, core type, air cooled | 1 KVA , 240/415 V, 50 Hz | 3 Nos. |
| 151. | Three phase transformer, shell type oil cooled with Delta/ Star | 3 KVA , 415/240 V, 50 Hz | 2 Nos. |
| 152. | Electrical Machine Trainer – | Suitable for demonstrating the construction and functioning of | 1 for 8 (4+4) Units |

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| | | 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 | |
| 153. | 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 |
| 154. | Used DC Generators-series, shunt and compound type for overhauling practice | | 1 No. Each |
| 155. | Pillar Electric Drill Machine Motorized | 12-20 mm Capacity, 1HP, 440V, 3 phase, Induction Motor with DOL starter, Bench Type | 1 No. |
| 156. | Motorised Bench Grinder | 1 HP. 3 phase, 440V with DOL starter, Double side with smooth and rough wheel with Tool Base | 1 No. |
| 157. | A.C. Series type Motor | 1 HP, 240 V, 50 Hz | 1 No. |
| 158. | Single Phase Capacitor Motor with starter switch | 1 HP, 240 V, 50 Hz | 1 No. |
| 159. | Manual Motor coil Winding Machine | With step arbor | 1 No. |
| 160. | Ceiling fan coil Winding Machine | 250V, 50 Hz, 1-Φ, with speed control | 1 No. |
| 161. | Primary current injection set | 220V, 50 Hz, 1-Φ, output current - 200 A (min) with timer | 1 No. |
| 162. | Stepper Motor with Digital Controller | | 1 No. |
| 163. | Shaded Pole Motor | Fractional HP, 240 V, 50 Hz | 1 No. |
| 164. | Smart Meter | 1 Phase - Smart Energy Meter<br>3 Phase - Smart Energy Meter | 1 No. each |
| 165. | EV Charger | 3 phase input | 1 No. |
| 166. | EV Charger (Home) | 1 Phase input | 1 No. |
| 167. | PLC | | As required |
| 168. | Hydraulic and Pneumatic Circuit | | As required |
| 169. | Various Sensor | | As required |
| **D. Shop Floor Furniture and Materials** - For 2 (1+1) units no additional items are required | | | |
| 170. | Working Bench | 2.5 m x 1.20 m x 0.75 m | 4 Nos. |
| 171. | Wiring Board | 3-meter x1 meter with 0.5 meter projection on the top | 1 No. |
| 172. | Instructor's table | | 1 No. |

| | | | |
|---|---|---|---|
| 173. | Instructor's chair | | 2 Nos. |
| 174. | Metal Rack | 100cm x 150cm x 45cm | 4 Nos. |
| 175. | Lockers with drawers | | 1 for Each Trainee |
| 176. | Almirah | 2.5 m x 1.20 m x 0.5 m | 1 No. |
| 177. | Black board/white board | (minimum 4X6 feet) | 1 No. |
| 178. | Fire Extinguisher CO2 | 2 KG | 2 Nos. |
| 179. | Fire Buckets | Standard size | 2 Nos. |

***Note: -***

1. *All the tools and equipment are to be procured as per BIS specification.*
2. *Internet facility is desired to be provided in the class room.*

## 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 Apprenticeship 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 | Dwarfisms |
| MI | Mental Illness |
| AA | Acid Attack |
| PwD | Person with disabilities |