

POWER ELECTRICIAN

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5



SECTOR – Electrical (Including New and Renewable Energy)



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

POWER ELECTRICIAN

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 5

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Developed By

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Directorate General of Training
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2. Naval Dockyard Apprentice Mumbai
3. Torrent Power, Ahmedabad

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1. BACKGROUND

1.1 Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate (ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry. There are four categories of apprentices namely; **trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

1.2 Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

1.3 Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.
- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.
- Scope has been extended also to non-engineering occupations.
- Establishments have been permitted to outsource basic training in an institute of their choice.
- The burden of compliance on industry has been reduced significantly.



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2.1 GENERAL

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

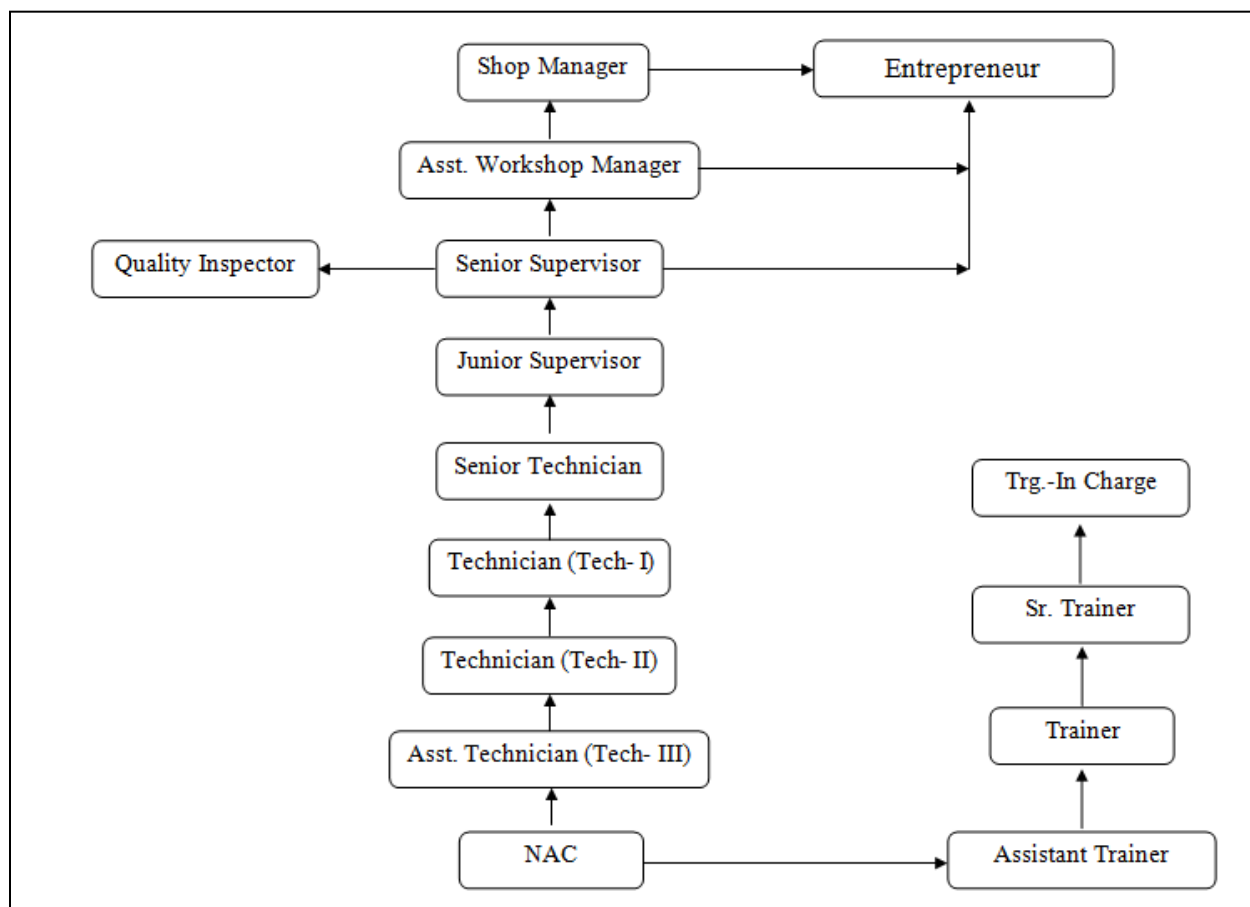
Power Electrician trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, Engineering Drawing and Employability Skills imparts requisite core skills & knowledge and life skills. After passing out the training programme, the trainee is being awarded National Apprenticeship Certificate (NAC) by NCVT having worldwide recognition.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/document, 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, core skills & employability skills while performing jobs and solve problem during execution.
- 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 CAREER PROGRESSION PATHWAYS:

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Indicative pathways for vertical mobility.



2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years (*Basic Training and On-Job Training*): -

Total training duration details: -

Time (in months)	1-3	4-12	13-15	16-24
Basic Training	Block– I	-----	Block – II	-----
Practical Training (On - job training)	----	Block – I	-----	Block – II

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A. Basic Training

For 02 yrs. Engg. Course :- (Total 06 months: 03 months in 1st yr. + 03 months in 2nd yr.)

For 01 yr. Engg. course :- (Total 03 months: 03 months in 1st yr.)

Sl. No.	Course Element	Total Notional Training Hours	
		For 02 yrs. course	For 01 yr. course
1	Professional Skill (Trade Practical)	550	275
2	Professional Knowledge (Trade Theory)	240	120
3	Workshop Calculation & Science	40	20
4	Engineering Drawing	60	30
5	Employability Skills	110	55
	Total (including Internal Assessment)	1000	500

B. On-Job Training:-

For 02 yrs. Engg. Course :- (Total 18 months: 09 months in 1st yr. + 09 months in 2nd yr.)

Notional Training Hours for On-Job Training: 3120 Hrs.

For 01 yr. Engg. course :- (Total 12 months)

Notional Training Hours for On-Job Training: 2080 Hrs.

C. Total training hours:-

Duration	Basic Training	On-Job Training	Total
For 02 Engg. yrs. course	1000 hrs.	3120 hrs.	4120 hrs.
For 01 yr. Engg. course	500 hrs.	2080 hrs.	2580 hrs.

2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt of India from time to time. The Employability skills will be tested in first two semesters only.

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NAC will be conducted by NCVT on completion of course as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India 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

The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%. The candidate pass in each subject conducted under all India trade test.

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 team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSH and self-learning attitude are to be considered while assessing competency.

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
- Project work

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
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(a) Weightage in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b) Weightage in the range of above 75% - 90% to be allotted during assessment	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A good level of neatness and consistency in the finish • 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 • Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

Brief description of Job roles:

Electrician, General 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.

Mechanic, Precision Instrument, Electrical Mechanic Precision Instrument Electrical; Meter Repairer, Electrical repairs and sets electrical parts of precision instruments such as megger, voltmeter, ammeter, condensers, galvanometers, etc., to high accuracy for recording correct readings by reviving, replacements and necessary adjustments. Studies drawings, circuit diagrams and other specifications and examines instrument visually to locate any apparent loose connection, short circuits etc. Dismantles instrument using insulated screw drivers, pliers, special spanners etc., and checks components, insulation wiring, fittings and other features with precision mechanical and electrical measuring instruments to locate wear and tear, short circuits and other defects. Cleans necessary or any fluid used in instrument and their various parts using special brushes. Checks gear shell, bearing jewels and other operating parts and repairs or replaces worn out and damaged ones. Assembles parts, replaces insulation and makes electrical wiring and connections according to diagram and prescribed specification. Examines assembled or repaired instrument by standard tests, makes necessary adjustments and ensures correct reading and desired performance within prescribed limits. Seals cut-outs, meters etc. to avoid manipulation. May wind coils, set new resistance and perform other electrical functions, if required.

Electrical Fitter

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

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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 fitted in assembly. Erects various equipment such as bus bars, panel boards, electrical posts, fuse boxes switch gears, meters, relays etc. using non-conductors, insulation hoisting equipment as necessary for receipt and distribution of electrical current to feeder lines. Installs motors, generators, transformer etc. as per drawings using lifting and hoisting equipment as necessary, does prescribed electrical wiring, and connects to supply line. Locates faults in case of breakdown and replaces blown out fuse, burnt coils, switches, conductors etc. as required. Checks, dismantles, repairs and overhauls electrical units periodically or as required according to scheduled procedure. May test coils. May specialize in repairs of particular equipment manufacturing, installation or power house work and be designated accordingly.

Power Plant Operator

Power-Plant Operator operates boilers, turbines, generators, and auxiliary equipment at generating plant to produce electricity: Monitors control board and regulates equipment, according to procedures and information obtained from recording and indicating instruments. Adjusts controls of water and cold feed systems, blowers, and igniters to start up or shut down boilers. Controls operation of boiler auxiliary equipment, such as water and vacuum pumps, coal driers and pulverisers, steam condensers, and soot blowers, to ensure efficient operation of boilers. Adjusts boiler controls to provide steam at specified temperature and pressure for turbine loads according to power demands. Adjusts controls to regulate speed, voltage, and phase of incoming turbines to coincide with voltage and phase of power being generated. Synchronizes incoming generating units with units in operation and closes circuit breaker at exact instant of coincidence. Monitors gauges to determine effect of generator load on related equipment, such as bus bars and voltage regulators. Adjusts transformer controls to regulate flow of power between generating stations and substations. Operates switchgear to regulate and transfer power loads to protect maintenance workers engaged in repairing or cleaning equipment. Records malfunctions of equipment, instruments, or controls on log sheet.

Electrical Switch Board Operator

Electrical Switch Board Operator: Switch Board Assistant; Switch Board Attendant; Sub-Station Attendant (Power Station) operates and attends switches and switchgear on switch boards to regulate flow of electric current from power house or substation to different feeding units. Synchronises generators and motor connectors to bus bar (conductor forming common junction between two or more electrical circuits) receiving electrical current from other generating units by operating switches on panel board. Operates various controls to switch on

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and off current supply to different feeder units depending on load-requirements and as per instructions of superiors. Controls and regulates voltage, frequency and power factor according to demand and system condition. Disconnects generator from bus bar to decrease power output or to cut out faulty units and equalises load among remaining operating generators. Maintains records of switching operations and generator output at regular intervals and submits daily reports to superiors. Reports to superiors of major breakdown, power failure and malfunctioning of switch board equipment, instrument or relays. Isolates feeding units in case of break-down and fixes danger notices. May clean panel board periodically. May overhaul and repair panel equipment. May supervise working and cleaning of static or rotary electrical plants. May check voltage and specific gravity of stand by storage batteries, maintain them and keep them fully charged.

Reference NCO 2015:

- (i) 7411.0100 – Electrician, General
- (ii) 7412.0100 – Mechanic, Precision Instrument, Electrical
- (iii) 7412.0200 – Electrical Fitter
- (iv) 3131.0500 – Power Plant Operator
- (v) 3131.0600 – Electrical Switch Board Operator



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4. NSQF LEVEL COMPLIANCE

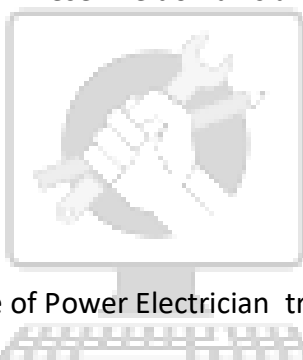
NSQF level for Power Electrician trade under ATS: **Level 5**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

- a. Process
- b. professional knowledge,
- c. professional skill,
- d. core skill and
- e. Responsibility.



The Broad Learning outcome of Power Electrician trade under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 5	Job that requires well developed skill, with clear choice of procedures in familiar context.	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problem by selecting and applying basic methods, tools, materials and information.	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication.	Responsibility for own work and Learning and some responsibility for other's works and learning.

5. GENERAL INFORMATION

Name of the Trade	POWER ELECTRICIAN
NCO - 2015	7411.0100, 7412.0100, 7412.0200, 3131.0500, 3131.0600
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years (02 Blocks each of one year duration).
Duration of Basic Training	a) Block –I : 3 months b) Block – II : 3 months Total duration of Basic Training: 6 months
Duration of On-Job Training	a) Block–I: 9 months b) Block–II : 9 months Total duration of Practical Training: 18 months
Entry Qualification	Passed 10 th Class with Science and Mathematics under 10+2 system of Education or its equivalent
Selection of Apprenticeship	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Examination	The internal examination/ assessment will be held on completion of each block. Final examination for all subjects will be held at the end of course and same will be conducted by NCVT.
Infrastructure for Basic Training	As per related trade of ITI
Rebate to Ex-ITI Trainees	01 year
CTS trades eligible for POWER ELECTRICIAN Apprenticeship	ELECTRICIAN

Note:

- Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.
- For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT.

6. LEARNING OUTCOME

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Power Electrician course of 02 years duration under ATS.

Block I & II:-

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*
4. Select and ascertain measuring instrument and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and organize the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

Block – I

1. Observe & practice safety in all electrical works. Practice providing First Aid.
2. Identify & use all hand tools.
3. Check the gauges of wire & select suitable wires for the required current rating.
Practice wire joints & providing cable glands. Soldering practice.
4. Carryout fitting & carpentry jobs

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5. Connect & measure voltage, current, resistance power & energy in DC & AC(1ph & 3ph) circuits. Use of power analyzer, measurement of THd, Harmonics due to digital switching.
6. Electrical wiring: Repair / replace switches, sockets, light points. Provide new points in PVC casing capping & PVC conduits.
7. Charging & maintenance of different type of Batteries. Checking specific gravity, voltage, condition monitoring of Battery Bank, assessment of high spots, on line isolation precautions etc.
8. Install pipe & plate earth stations. Measure earth resistance, improve the same & maintain earth stations. Earth Monitoring systems with reference to various standards, familiarization with health monitoring equipment.
9. Providing power supply to motors, equipments & appliances. Crimping the lugs, providing cable glands & connections.
10. Attending to minor faults in machines, their controls & appliances.
11. Replacing the bulbs, tubes, trouble shooting, repair & maintenance. Wire up in PVC casing & capping.
12. Assisting in operation & maintenance of Transformer substation, circuit breakers, batteries etc.
13. Trouble shooting rectifiers, filters, power supplies, voltage stabilizers, controlled rectifiers. Identifying faulty thyristors in circuits, replacing them.
14. Provide light/socket points, for various equipments and appliances.
15. Decides the size of cable & provides power supply to machines & equipments, provide earth connections.
16. Testing the condition of DC motor Checking power input & output in DC drives. Replacing faulty components.

B. BLOCK – II (09 months)

17. Observe & practice safety in all electrical works. Practice providing First Aid.
18. Connection & testing of single & three phase motor. Checking power input & output in AC drives. Replacing faulty components. Power factor correction using Synchronous motor.
19. Diesel Generating set: Operation, operating switch gears, trouble shooting & maintenance.
20. Parallel operation of Generators to an infinite bus bar. Protective system for Generator. Care and maintenance of Alternator.
21. Preventive & corrective maintenance of various Power Station equipment. Different protections for power plant. Power station emergencies & handling.

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22. Checking Electrical connections, locating faults and removal of faults in Air Compressor, AC plants, cranes, lifts, hoists. Operates & maintain Air compressor, AC plant, cranes, lifts, hoists.
23. Trouble shoots & repair machine tools.
24. Operation of Control Room. Operation of Switchgear. Use of PLCC/ SCADA. Reading of panel meter & filling log sheet. Preparing report.
25. Erection of high tension (HT) and extra high tension (EHT) overhead line. Testing of HT/EHT overhead lines. Maintenance of overhead lines equipment.
26. Underground cable joining, HT/LT. Testing of underground cables, trouble shooting, Locating faults, open circuit, short circuit & leakage in cables, performing cable joints. Maintenance of lightening arrestor.
27. Installation operation and maintenance of oil circuit breaker, Air circuit breaker, SF6 circuit breaker, Vacuum circuit breaker, etc.
28. Maintenance of transformer equipment such as : Oil gauge, Tap Changer, Bushes, Breather, Earth fault relay, Protective relay, etc.
29. Erection of LT overhead lines. Testing & maintenance of LT overhead lines. Type and procedure of attending complaints. Different type of control switches erection. Commission of street light poles, cable circuits & lamps.

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

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7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	1. 2. Recognize and report all unsafe situations according to site policy.
	1. 3. Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1. 4. Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	1. 5. Identify and observe site policies and procedures in regard to illness or accident.
	1. 6. Identify safety alarms accurately.
	1. 7. Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1. 8. Identify and observe site evacuation procedures according to site policy.
	1. 9. Identify Personal Protective Equipment (PPE) and use the same as per related working environment.
	1. 10. Identify basic first aid and use them under different circumstances.
	1. 11. Identify different fire extinguisher and use the same as per requirement.
	1. 12. Identify environmental pollution & contribute to avoidance of same.
	1. 13. Take opportunities to use energy and materials in an environmentally friendly manner
	1. 14. Avoid waste and dispose waste as per procedure
	1. 15. Recognize different components of 5S and apply the same in the working environment.
2. Understand, explain different mathematical calculation & science in the field of study including basic	2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction.

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electrical and Apply in day to day work.[Different mathematical calculation & science –Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]	2.2	Measure dimensions as per drawing
	2.3	Use scale/ tapes to measure for fitting to specification.
	2.4	Comply given tolerance.
	2.5	Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6	Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7	Explain basic electricity, insulation & earthing.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. [Different engineering drawing- Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]	3. 1.	Read & interpret the information on drawings and apply in executing practical work.
	3. 2.	Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
	3. 3.	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
4. Select and ascertain measuring instrument and measure dimension of components and record data.	4.1	Select appropriate measuring instruments such as micrometers, vernier callipers, dial gauge, bevel protector and height gauge (as per tool list).
	4.2	Ascertain the functionality & correctness of the instrument.
	4.3	Measure dimension of the components & record data to analyse the with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve	5.1	Explain the concept of productivity and quality tools and apply during execution of job.
	5.2	Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.

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productivity & quality.	5.3 Knows benefits guaranteed under various acts
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using Available resources.	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	7. 1. Explain personnel finance and entrepreneurship.
	7. 2. Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
	7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and organize the work related to the occupation.	8. 1. Use documents, drawings and recognize hazards in the work site.
	8. 2. Plan workplace/ assembly location with due consideration to operational stipulation
	8. 3. Communicate effectively with others and plan project tasks
	8. 4. Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.
SPECIFIC OUTCOME	
Block-I & II (Section:10)	
<i>Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under block – I & block – II(section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of Planning (Identify, ascertain, estimate etc.); Execution (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and Checking/ Testing to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.</i>	

BASIC TRAINING (Block – I)**Duration: (03) Three Months**

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	1. Implementation of various safety measures in the shop floor. 2. Visit to different sections of the Institute. 3. Demonstration of elementary first aid. Artificial Respiration. 4. Practice on use of fire extinguishers. 5. Occupational Safety & Health. 6. Importance of housekeeping & good shop floor practices. 7. Health, Safety and Environment guidelines, legislations & regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction. 8. Personal protective Equipment(PPE):- 9. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. 10. Preventive measures for electrical accidents & steps to be taken in such accidents. 11. Use of Fire extinguishers.	Occupational Safety & Health Basic safety introduction, Personal protection:- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Use of Fire extinguishers. Visit & observation of sections. Various safety measures involved in the Industry. Elementary first Aid. Concept of Standard Soft Skills: its importance and Job area after completion of training. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure.
2	12. Familiarization with signs and symbols of Electrical accessories.	Fundamental of electricity: Fundamental terms- Current, Voltage definitions, AC, DC, Phase, Neutral, Earth. Units & effects of electric current.
3	13. Skinning the cables 14. Demonstration & Practice on bare conductors joints--such as rat tail, Britannia, straight, Tee, Western	Solders, flux and soldering technique. Resistors types of resistors & properties of resistors. Introduction of National Electrical Code.

	union Joints. 15. Practice in soldering & brazing. 16. Practice on crimping thimbles, Lugs. 17. Demonstration and identification of types of cables. 18. Demonstration & practice on using standard wire gauge & micrometer.	Explanation, Definition and properties of conductors, insulators and semi-conductors. Types of wires & cables, standard wire gauge. Specification of wires & Cables- insulation & voltage grades- Low , medium & high voltage
4	19. Verification of Ohm's Law. 20. Measuring unknown resistance. 21. Verification of laws of series and parallel circuits. 22. Experiment on poly phase circuits. Current, voltage, power and power factor measurement in single & poly- phase circuits. Measurement of energy in single and poly-phase circuits. - Use of phase sequence meter. 23. Practice on three phase four wire system for understanding phase and line voltage & current.	Ohm's Law - Simple electrical circuits and problems. Reading of simple Electrical Layout. Resistors -Law of Resistance. Series and parallel circuits & related calculation. Alternating Current -Comparison and Advantages D.C and A.C. Related terms Frequency, Instantaneous value, R.M.S. value Average value, Peak factor, form factor, sine wave, phase and phase difference. Inductive and Capacitive reactance, Impedance (Z), power factor (p.f). Active and Reactive power. Single Phase and three-phase system etc. Power consumption in series and parallel, P.F. etc. Concept three-phase Star and Delta connection. Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load. Three phase four wire system Use of power analyzer, measurement of THd, Harmonics due to digital switching.
5	24. Demonstration of trade hand tools. 25. Use, care & maintenance of various hand tools. 26. Practice on installation and overhauling common electrical accessories as per simple Electrical circuit / Layout. 27. Make test board.	Identification of Trade-Hand tools-Specifications Common Electrical Accessories, their specifications in line with NEC 2011-Explanation of switches lamp holders, plugs and sockets. Developments of domestic circuits, Alarm & switches, with individual switches, Two way switch .Security surveillance, Fire alarm, MCB, ELCB, MCCB.

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		Series –parallel testing board & use.
6	28. Identification of parts of battery. 29. Practice on Battery Charging. 30. Preparation of battery charging. 31. Testing of cells, Installation of batteries. 32. Charging of batteries by different methods. 33. Routine care & maintenance of Batteries	Chemical effect of electric current- Principle of electrolysis. Faraday's Law of electrolysis. Lead acid cell-description, methods of charging-Precautions to be taken & testing equipment, Different types of lead acid cells. Sealed Maintenance free Batteries, Solar battery. Load & back up time calculation
7	34. Practice on Earthing - different methods of earthing. 35. Measurement of Earth resistance by earth tester. 36. Testing of Earth Leakage by ELCB and relay.	Earthing - Principle of different methods of earthing & selection. i.e. Pipe, Plate, etc Importance of Earthing. Improving of earth resistance Earth Leakage circuit breaker (ELCB).
8	37. Diodes -symbol - Tests - Construct & Test Half wave rectifier ckt., Full wave rectifier ckt., Bridge rectifier ckt. 38. Measurement & calculation of electrical parameters using C.R.O. 39. Different wave shapes of rectifiers and their values using C.R.O. 40. Identification of terminals, construction & Testing of transistor. 41. Operation, maintenance & troubleshooting of inverter, Voltage stabilizer, DC regulated power supply, UPS, etc	Basic electronics - Semiconductor energy level, atomic structure 'P' type and 'N' type. Type of materials –P-N-junction. Classification of Diodes – Reverse and Forward Bias, Heat sink. Specification of Diode PIV rating. Explanation and importance of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit. Filter circuits-passive filter. Working principle and uses of an oscilloscope. Types of transistors & its application. Specification and rating of transistors.
9	42. Practice in casing, Capping and Conduit wiring. 43. Testing of wiring installation by meggar. 44. Fixing of calling bells/buzzers. 45. Identification & demonstration on conduits and accessories & their uses, cutting, threading & laying. 46. Installation, Testing, Maintenance and Repairing of wiring.	Electric wirings , I.E. rules. Types & selection of wirings both domestic and industrial. Specifications for wiring. Grading of cables and current ratings. Principle of laying out in domestic wiring. Estimate the cost of wiring system Voltage drop concept. Wiring system - P.V.C., concealed

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	47. Application of fuses, relay, MCB, ELCB.	system. Specifications, standards for conduits and accessories - Power Wiring - Control Wiring - Information Communication - Entertainment Wiring. Testing of wiring installation by meggar Study of Fuses, Relays, Miniature circuit breakers (MCB), ELCB, etc.
10-11	48. Identification of the parts of a D.C. machine. 49. No load & Load performance of a different type of DC generator. 50. Calculation of regulation & efficiency. 51. Connect, start, run and reverse a different type of DC motor. 52. Load performance test on different type of DC motor& calculation of efficiency. 53. Speed of a DC motor by different method. 54. Maintenance, troubleshooting & servicing of DC machines. 55. Overhaul a DC machine.	D.C. Machines - General concept of Electrical Machines. Principle of D.C. generator. Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring Brushes, Laminated core. Explanation of D.C. Generators-types, parts-Practical uses. Description of series, shunt and compound generators and their selection. Types of D. C. Motor. Starters used in D.C. motors Types of speed control of DC motors in industry. Application of D.C. motors. Care, Routine & preventive maintenance.
12	56. Identification of types of transformers. 57. Connection of transformers, Transformation ratio, testing of transformer, calculate the losses & efficiency. 58. Use of Current Transformer (C.T.) and Potential (Voltage) transformer (P.T.) Testing of single phase and Three Phase Transformers - Cleaning, maintenance, testing and changing of oil.	Working principle of Transformer, losses & efficiency. classification C.T., P.T. Instrument and Auto Transformer(Variac), Construction, Single phase and Poly phase. Type of Cooling for transformer. Protective devices. Components, Auxiliary parts i.e. breather, Conservator, buchholz relay, other protective devices. Transformer oil testing and Tap changer (off load and on load). Dry type transformer. Bushings and termination.
13	59. Identify & select different type of Instruments. 60. Use of -PMMC , MI meter, Multi-	Electrical Measuring Instruments - -types, indicating types PMMC & MI meter (Ammeter,

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	meter(Digital/Analog) , Wattmeter, P F meter, Energy meter, Frequency meter, 61. Phase sequence meter, Digital Instruments, etc 62. Range extension of meters.	Voltmeter) -Range extension -Multimeter (Digital/Analog) -Wattmeter - P.F. meter - Energy meter (Digital/analog) - Insulation Tester (Megger), Earth tester. - Frequency meter - Phase Sequence meter - Multimeter –Analog and Digital - Tong tester - Techometer.
	Assessment/Examination 03days	

Note: - More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.



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BASIC TRAINING (Block – II)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1-2	63. Identification of parts and terminals of AC motors. 64. Connection, starting, running of AC motors using Starters. Load test & efficiency calculation. 65. Rotor resistance starter, etc 66. Speed control of Induction motors by various methods. 67. Practical application of A.C. motors. 68. Connection of single phase motor, identification, testing, running and reversing. 69. Maintain, service and trouble shoot the single phase motor. 70. Install a single phase motor. 71. Overhauling of AC motors.	Three phase Induction motor – Working principle –Production of rotating magnetic field, Squirrel Cage Induction motor, Slip-ring induction motor. Control & Power circuit of starters D.O.L Starter, Forward /Reverse starter, Star /Delta starter, Autotransformer starter, Rotor resistance starter, etc Single phasing preventer. Application of Induction Motor Care, Routine & preventive maintenance. Single phase induction motor- Working principle, different method of starting and running (capacitor start, permanent capacitor, capacitor start & run, shaded pole technique). FHP motors, Repulsion motor, stepper motor, Application of single phase motor.
3	72. Connect, start and run a 3 phase synchronous motor. 73. Practice for Power factor correction.	SYNCHRONOUS MOTOR - Working principle, effect of change of excitation and load. Power factor correction of industrial load.
4-5	74. Identification of parts and terminals of Alternator. 75. Connection, starting, running of Alternator. 76. Practice on alternators, voltage Building,, Parallel operation & load sharing. 77. Practice on installation, running and maintenance of Alternators.	Alternator Explanation of alternator, working principle, voltage build-up, loading, Regulation. Types of prime mover, phase sequence, Parallel operation & load sharing. Specification of alternators
6-7	78. Prepare layout plan, single line diagram of different type of power plant.	POWER GENERATION : Generation sources of energy, Comparison of energy resources. Types of fuels. Advantages of liquid fuel & solid fuel. Various ways of electrical power generation. • Thermal • Gas • Hydro electric • Nuclear •

		Non-Conventional , Schematic arrangement & Comparison of above Power Plant.
8-9	79. Prepare layout plan and single line diagram of transmission system with all accessories utilized. 80. Schematic of a overhead and domestic service line. 81. Binding of Pin type insulator, shackle type and suspension type insulators. 82. Straight joint of different types of underground cables. 83. Fixing of jumper by crimping tool. 84. Test the underground cables for open, short circuit & ground fault and also check insulation resistance.	Transmission Of Electrical Power Electrical Supply System: Comparison of AC and DC transmission. Advantages of High transmission voltage. Various systems of power transmission and their comparison. Introduction to High voltage DC transmission system (HV DC). Introduction to Single phase , three phase-3 wire system in transmission lines Overhead Lines: Main components of overhead lines-Types of powerline Low voltage line, medium Voltage line & high voltage line,, line supports, Insulators, types of Insulators, Potential distribution over suspension insulator string, string efficiency & method of its improvement. Performance of Transmission Lines: Performance of single phase short transmission line. Three phase transmission line. Effect of load Power factor on regulation and efficiency. Under Ground Cable : Construction of cables. Material for cables, its insulation. Classification of cables, cables for 3-phase service, Laying of underground cable. Types of cable faults and their location.
10-11	85. Prepare layout plan and single line diagram of Distribution system with all accessories. 86. Erect an overhead service line pole for single phase 240v distribution system. 87. Replacement of oil and testing of its die-electric.	DISTRIBUTION OF POWER Sub-station: Its function and equipment used in substation. Distribution System : Classification of distribution system-AC distribution, D.C. distribution, methods of

	88. Recharge the silica gel in breather. 89. Testing and charging of emergency battery.	obtaining 3-wire dc system. Overhead v/s underground distribution system. Introduction to Switch Gear: Essential features of switchgears. Switch gear equipments, bus-bar arrangement, Switch gear accommodation, Short circuit, faults in power system. Introduction to protection schemes – Types & Characteristics of relays (Over current, Over voltage, IDMT, Differential protection scheme of transformer, Buchholz relay, Carrier protection schemes)
12-13	90. Schematic diagram of a different type of Circuit Breakers. 91. Replacement of fuse element. 92. Installation of fuses on H.T. Line & L.T. Line. 93. Test /Check different type of protection relay. 94. Schematic diagram of a different type of Switch utilization on HT & LT lines.	Circuit Breakers : Circuit breakers - arc , Principles of arc extinction, Methods of arc extinction, Classification of circuit breakers, Oil circuit breakers Air-blast circuit breaker, Vacuum circuit breaker, SF6 circuit breaker, MCB, ELCB. Fuses Desirable characteristics of fuse element, Fuse element material, Types of fuses, HRC fuses, ICTP switch, Low voltage fuses, High voltage fuses, Current carrying capacity of fuse element , Difference between a fuse and a circuit breaker. Introduction of MOV lightning arrestors used in HT lines. Relays: Their types, viz. over current, earth fault relay, wire differential, Buchholz's relays, their operation and maintenance. Horn Gap Switches/ Air break switch, Disconnect Switch, Grounding Switch, Surge Arrestors & Current Limiting Reactors: Its working and utilization on HT& LT lines.
Assessment/Examination 03days		

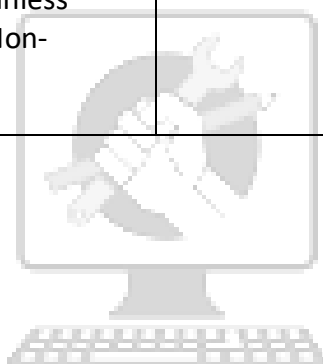
NOTE: - More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	Workshop Calculation and Science (Duration: - 20 hrs.)	Engineering Drawing (Duration: - 30 hrs.)
1.	Unit: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units.	Engineering Drawing: Introduction and its importance - Viewing of engineering drawing sheets. Method of Folding of printed Drawing Sheet as per BIS SP:46-2003 Drawing Instruments : their Standard and uses - Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.
2.	Fractions & Simplification: Fractions, Decimal fraction, Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems Simplification using BODMAS.	Lines : - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line - Methods of Division of line segment
3.	Square Root : Square and Square Root, method of finding out square roots, Simple problem using calculator	Drawing of Geometrical Figures: Definition, nomenclature and practice of - - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.
4.	Ratio &Proportion: Simple calculation on related problems.	Lettering and Numbering as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper

		case and Lower case.
5.	Percentage: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	Free Hand sketch: Hand tools and measuring instruments used in Electrician / Power electrician trade .
6.	Material Science : properties -Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.	Free hand drawing : - Lines, polygons, ellipse, etc. - Geometrical figures and blocks with dimension. - Transferring measurement from the given object to the free hand sketches.



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Block – II		
Sl. No.	Workshop Calculation and Science (Duration: - 20 hrs.)	Engineering Drawing (Duration : - 30 hrs.)
1.	Mass ,Weight and Density : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals	Symbolic Representation (as per BIS SP:46-2003) of : - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings
2.	Work, Power and Energy: work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	Construction of Scales and diagonal scale
3.	Algebra: Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Three phase Induction motor Free hand sketching of Slip-ring and Squirrel cage Induction motor. Typical wiring diagram for drum controller operation of A.C. wound rotor motor.
4.	Mensuration: Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle. Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids – cube, cuboid, cylinder and Sphere.	Drawing the schematic diagram of Autotransformer starter, DOL starter and Star Delta Starter. Drawing the schematic diagram of A.C. motor speed control by SCR /AC Drive.
5.	Trigonometry: Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding height and distance by trigonometry	Distribution of Power Types of insulator used in over head line. (Half sectional views) Different type of distribution systems and methods of connections. Layout diagram of a substation. Single line diagram of substation feeders.

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

Block – I (Duration – 55 hrs.)		
1. English Literacy		Duration : 20 Hrs. Marks : 09
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.	
Reading	Reading and understanding simple sentences about self, work and environment	
Writing	Construction of simple sentences Writing simple English	
Speaking / Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.	
2. I.T. Literacy		Duration : 20 Hrs. Marks : 09
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.	
Word processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.	
Computer Networking and Internet	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet,	

	Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
3. Communication Skills	
Duration : 15 Hrs. Marks : 07	
Introduction to Communication Skills	Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.
Motivational Training	Characteristics Essential to Achieving Success. The Power of Positive Attitude. Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning.
Facing Interviews	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.
Behavioral Skills	Problem Solving Confidence Building Attitude
Block – II	
Duration – 55 hrs.	
4. Entrepreneurship Skills	
Duration : 15 Hrs. Marks : 06	
Concept of	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue

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Entrepreneurship	Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.
Project Preparation & Marketing analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
Institutions Support	Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.
5. Productivity	
Duration : 10 Hrs. Marks : 05	
Benefits	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.
Comparison with developed countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
6. Occupational Safety, Health and Environment Education	
Duration : 15 Hrs. Marks : 06	
Safety & Health	Introduction to Occupational Safety and Health importance of safety and health at workplace.
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.
Accident & safety	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.

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First Aid	Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. Safety, health, welfare under legislative of India.
Ecosystem	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of Energy, re-use and recycle.
Global warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and Harvesting of water.
Environment	Right attitude towards environment, Maintenance of in -house environment.
7. Labour Welfare Legislation	
Duration : 05 Hrs. Marks : 03	
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.
8. Quality Tools	
Duration : 10 Hrs. Marks : 05	
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of House-keeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples.

10. DETAILS OF COMPETENCIES (ON-JOB TRAINING)

The **competencies/ specific outcomes** on completion of On-Job Training are detailed below: -

Block – I

1. Observe & practice safety in all electrical works. Practice providing First Aid.
2. Identify & use all hand tools
3. Check the gauges of wire & select suitable wires for the required current rating.
Practice wire joints & providing cable glands. Soldering practice.
4. Carryout fitting & carpentry jobs
5. Connect & measure voltage, current, resistance power & energy in DC & AC(1ph & 3ph) circuits. Use of power analyzer, measurement of THd, Harmonics due to digital switching.
6. Electrical wiring: Repair / replace switches, sockets, light points. Provide new points in PVC casing capping & PVC conduits.
7. Charging & maintenance of different type of Batteries. Checking specific gravity, voltage, condition monitoring of Battery Bank, assessment of high spots, on line isolation precautions etc.
8. Install pipe & plate earth stations. Measure earth resistance, improve the same & maintain earth stations. Earth Monitoring systems with reference to various standards, familiarization with health monitoring equipment.
9. Providing power supply to motors, equipments & appliances. Crimping the lugs, providing cable glands & connections.
10. Attending to minor faults in machines, their controls & appliances.
11. Replacing the bulbs, tubes, trouble shooting, repair & maintenance. Wire up in PVC casing & capping.
12. Assisting in operation & maintenance of Transformer substation, circuit breakers, batteries etc.
13. Trouble shooting rectifiers, filters, power supplies, voltage stabilizers, controlled rectifiers. Identifying faulty thyristors in circuits, replacing them.
14. Provide light/socket points, for various equipments and appliances.
15. Decides the size of cable & provides power supply to machines & equipments, provide earth connections.
16. Testing the condition of DC motor Checking power input & output in DC drives.
Replacing faulty components.

Block – II

17. Observe & practice safety in all electrical works. Practice providing First Aid.
18. Connection & testing of single & three phase motor. Checking power input & output in AC drives. Replacing faulty components. Power factor correction using Synchronous motor.
19. Diesel Generating set: Operation, operating switch gears, trouble shooting & maintenance.
20. Parallel operation of Generators to an infinite bus bar. Protective system for Generator. Care and maintenance of Alternator.
21. Preventive & corrective maintenance of various Power Station equipment. Different protections for power plant. Power station emergencies & handling.
22. Checking Electrical connections, locating faults and removal of faults in Air Compressor, AC plants, cranes, lifts, hoists. Operates & maintain Air compressor, AC plant, cranes, lifts, hoists.
23. Trouble shoots & repair machine tools.
24. Operation of Control Room. Operation of Switchgear. Use of PLCC/ SCADA. Reading of panel meter & filling log sheet. Preparing report.
25. Erection of high tension (HT) and extra high tension (EHT) overhead line. Testing of HT/EHT overhead lines. Maintenance of overhead lines equipment.
26. Underground cable joining, HT/LT. Testing of underground cables, trouble shooting, Locating faults, open circuit, short circuit & leakage in cables, performing cable joints. Maintenance of lightening arrestor.
27. Installation operation and maintenance of oil circuit breaker, Air circuit breaker, SF6 circuit breaker, Vacuum circuit breaker, etc.
28. Maintenance of transformer equipment such as : Oil gauge, Tap Changer, Bushes, Breather, Earth fault relay, Protective relay, etc.
29. Erection of LT overhead lines. Testing & maintenance of LT overhead lines. Type and procedure of attending complaints. Different type of control switches erection. Commission of street light poles, cable circuits & lamps.

Note:

1. Industry must ensure that above mentioned competencies are achieved by the trainees during their on job training.
2. In addition to above competencies/ outcomes industry may impart additional training relevant to the specific industry.

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

POWER ELECTRICIAN			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-19 is required additionally)			
Sl. no.	Name of the Tool & Equipments	Specification	Quantity
1	Steel tape	3 mt length	21 nos.
2	Plier insulated	150mm	21 nos.
3	Plier side cutting	150mm	21 nos.
4	Nose plier	150mm	21 nos.
5	Screw driver	150 mm	21 nos.
6	Electrician connector screwdriver, insulated handle thin stem	100mm	21 nos.
7	Heavy duty screwdriver	200mm	21 nos.
8	Electrician Screwdriver, thin stem, insulated handle	250mm	21 nos.
9	Punch centre	150mmX9mm	21 nos.
10	Electrician knife	50 mm blade	21 nos.
11	Neon tester		21 nos.
12	Steel rule	300mm	21 nos.
13	Hammer, Cross peen with handle	250 gm	21 nos.
14	Hammer, ball peen with handle	750gm	21 nos.
15	Gimlet	6mm	21 nos.
16	Bradawl	150mm x 6mm	21 nos.
17	Pincer	150 mm	21 nos.
18	Scriber (knurled centre position)		21 nos.
19	Digital multimeter		21 nos.
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
20.	C- clamp	100mm, 150mm, 200mm	2 Nos. each
21.	Adjustable spanner	150mm, 300mm	2 Nos.

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			each
22.	Blow lamp	0.5 ltr	1
23.	Melting pot		1
24.	Ladel		1
25.	Chisel cold firmer	25mm x 200 mm	2
26.	Chisel	25mm & 6 mm	2 Nos. each
27.	Hand drill machine		2
28.	Portable electric drill machine	12 mm capacity	1
29.	Pillar Electric Drill machine	12 mm capacity	1
30.	Allen key set		2 sets
31.	Oil can	0.12 ltr	1
32.	Grease gun		1
33.	Out side Micrometer		2
34.	Motorised Bench grinder		1
35.	Rawl plug tool & bit		2 sets
36.	Pulley puller		2
37.	Bearing puller		2
38.	Pipe vice		2
39.	Thermo meter	0-100 deg C	1
40.	Scissors blade	150mm	2
41.	Crimping tool		2 sets
42.	Wire stripper	20 Cm	2
43.	Chissel cold flat	12mm	2
44.	Mallet hard wood	0.5Kg	2
45.	Mallet hard wood	1 Kg	2
46.	Hammer extractor type	0.4 Kg	2
47.	Hacksaw frame	200mm & 300mm adjustable	2 each
48.	Try square	150 mm blade	2
49.	Outside & inside divider caliper		2 each
50.	Pliers flat nose	150mm	4
51.	Pliers round nose	100 mm	4
52.	Tweezers	100mm	4
53.	Snip straight & bent	150mm	2 each
54.	Double ended spanner set metric		2 sets
55.	HSS drill bit set	(2-12mm)	4 sets

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56.	Plane, smoothing cutters	50mm	2
57.	Gauge, wire imperial		2
58.	File flat	200mm 2 nd cut	8
59.	File half round	200 mm 2 nd cut	4
60.	File round	200mm 2 nd cut	4
61.	File flat rough	150mm	4
62.	File flat bastard	250mm	4
63.	File flat smooth	250mm	4
64.	File Rasp half round bastard	200 mm	4
65.	Soldering iron	25 W, 65 W	2 each
66.	Copper bit soldering iron	0.25 kg	2
67.	Desoldering gun		4
68.	Hand vice	50mm jaw	4
69.	Bench vice	100mm jaw	6
70.	Pipe cutter to cut pipes	upto 5cm dia	2
71.	Stock & die set GI pipe	for 20mm to 50 mm	1
72.	Stock & dies conduit		1
73.	Ohm meter; series & shunt type		2 each
74.	Multimeter (analog)	0-1000 M ohm, 2.5 to 500V	2
75.	Digital Multimeter		4
76.	AC voltmeter MI	0-500V	2
77.	Milli Voltmeter centre zero	100-0-100 mV	1
78.	DC milli Ammeter	0-500 mA	1
79.	Ammeter MC	0-5A, 0-25A	1 each
80.	AC Ammeter MI	0-5A, 0-25A	1 each
81.	KiloWatt meter	0-1-3 KW	1
82.	AC Energy meter, single phase	5A, 3 ph 15 A	1 each
83.	Power factor meter, single phase		1
84.	Frequency meter		1
85.	Flux meter		1
86.	DC power supply	0-30V, 2 Amp	2
87.	Rheostats	0-1 ohm 5A, 0-10 ohm 5A, 0-25 ohm 1A, 0-300 ohm 1A	1 each
88.	Digital Tachometer		1
89.	Growler		1
90.	Tong tester / clamp meter AC	0-100 A	1

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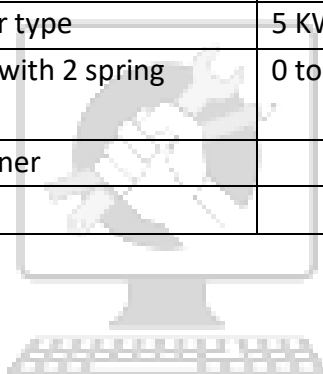
91.	Megger	500V	1
92.	Oscilloscope dual trace	30 MHz	1
93.	Function Generator		1
94.	Hygrometer		1
95.	Lux meter		1
96.	Hydro meter		1
97.	Current transformer	415 V, 50 Hz , CT Ratio 10/5A,	1
98.	Potential Transformer	415/110 V	1
99.	Wood Saw	250 mm	1
100.	Tenon Saw		1
101.	Guarded Test Lamp		1
C : GENERAL MACHINERY INSTALLATIONS			
102.	Voltage Stabilizer	Input 15-230 V AC, Output 220 V AC	1
103.	3 point DC starter		1
104.	4 point DC starter		1
105.	Electrical Machine Trainer: suitable for demonstrating the construction & functioning of different types of DC machines & AC machines (single phase & 3 phase). Should be fitted with brake arrangement, Dynamometer, Instrument panel & power supply unit		1
106.	Motor generator (AC to DC): consisting of: Squirrel cage induction motor with star delta starter & directly coupled to DC shunt generator & switch board mounted with regulator, air breaker, ammeter, voltmeter, knife blade switches & fuses, set complete with case iron & plate, fixing bolts, foundation bolts & flexible coupling.	Induction motor rating: 5 KW, 400V, 50 Hz, 3 ph. DC shunt generator rating: 3.5 KW, 220V	1 set
107.	Used DC generators – series, shunt & compound type, (for overhauling practice)		1 each
108.	DC shunt motor	2 – 2.5 KW, 220V	1
109.	DC series motor coupled with mechanical load	2 KW, 220V	1
110.	DC compound motor with starter & switch	2.5 KW, 220V	1

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111.	Single phase Transformer, core type, air cooled	1 KVA, 240/415 V, 50Hz	3
112.	3 phase transformer, shell type, oil cooled with all mounting,	2 KVA, 415/240V, 50 Hz (Delta /Star)	2
113.	Starters for AC motors. a. Resistance type starter. b. Direct on line starter. c. Star delta starter – Manual, semi-automatic & Automatic. d. Auto Transformer type starter	2 to 5 HP	1 each
114.	Motor generator (DC to AC) set consisting of Shunt motor with starting compensator & switch directly coupled to AC generator with exciter & switch board mounted with regulator, breaker, ammeter, voltmeter, frequency meter, knife blade switch & fuses etc. Set complete with cast iron bed plate, fixing bolts, foundation bolts & flexible coupling.	Shunt motor Rating- 5KW, 220V. AC generator rating – 3 ph, 4 wire, 3.5 KVA, 400/230 V, 0.8 pf, 50 Hz	1 set
115.	AC squirrel cage induction motor with star delta starter & triple pole Iron clad switch fuse.	2 to 3 HP, 3 ph, 400V, 50 Hz	1
116.	AC 3 ph wound slipring motor with starter & switch	5 HP, 400V, 50 Hz	1
117.	Single phase capacitor motor with starter switch	1 HP, 230 V, 50 Hz	1
118.	Universal motor with starter / switch	230 V, ¼ HP, 50 Hz	1
119.	Stepper Motor with digital controller		1
120.	Shaded pole motor		1
121.	3 ph Synchronous motor	3 HP, 415 V, 50 Hz, 4 pole, with accessories	1
122.	Domestic Appliances: Electric hot plate	1500W	1
123.	Electric kettle	1500W	1
124.	Electric Iron	1500 W	1
125.	Immersion heater	1500 W	1
126.	Ceiling fan		1
127.	Geyser storage type	15 lts. min	1
128.	Mixer & Grinder		1

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129.	Washing Machine		1
130.	Inverter	1 KVA with 12 V battery, input 12 V DC, Output 220V AC	1
131.	Thyristor / IGBT controlled DC motor Drive, with tachogenerator feed back arrangement	1 HP	1 set
132.	Thyristor / IGBT controlled AC motor Drive with VVVF control	3 ph, 2 HP,	1 set
133.	Battery charger		1
134.	1 Ph variable Auto Transformer		1
135.	Load bank, lamp / heater type	5 KW	1
136.	Brake test arrangement with 2 spring balance	0 to 25 Kg rating	1
137.	Discreet component trainer		2
138.	Oil testing kit		1



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**INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING
DRAWING**

TRADE: POWER ELECTRICIAN

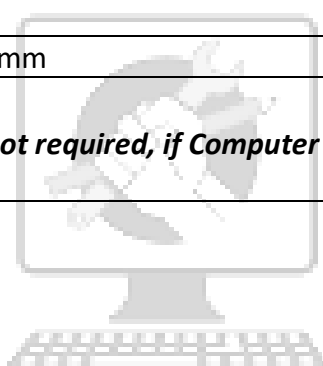
LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES

1) **Space Norms** : 45 Sq. m.(For Engineering Drawing)

2) **Infrastructure:**

A : TRAINEES TOOL KIT:-			
Sl. No.	Name of the items	Specification	Quantity
1.	Draughtsman drawing instrument box		20+1 set
2.	Set square celluloid 45°	(250 X 1.5 mm)	20+1 set
3.	Set square celluloid 30°-60°	(250 X 1.5 mm)	20+1 set
4.	Mini drafter		20+1 set
5.	Drawing board IS: 1444	(700mm x500 mm)	20+1 set
B : Furniture Required			
Sl. No.	Name of the items	Specification	Quantity
1	Drawing Board		20
2	Models : Solid & cut section		as required
3	Drawing Table for trainees		as required
4	Stool for trainees		as required
5	Cupboard (big)		01
6	White Board	8ft. x 4ft.	01
7	Trainer's Table		01
8	Trainer's Chair		01

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS		
Sl. No.	Name of the Equipment	Quantity
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 Nos.
2.	UPS - 500VA	10 Nos.
3.	Scanner cum Printer	1 No.
4.	Computer Tables	10 Nos.
5.	Computer Chairs	20 Nos.
6.	LCD Projector	1 No.
7.	White Board 1200mm x 900mm	1 No.
Note: - Above Tools & Equipments not required, if Computer LAB is available in the institute.		



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FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor :						Year of Enrollment :							
Name & Address of ITI (Govt./Pvt.) :						Date of Assessment :							
Name & Address of the Industry :						Assessment location: Industry / ITI							
Trade Name :			Semester:			Duration of the Trade/course:							
Learning Outcome:													
Sl. No	Maximum Marks (Total 100 Marks)	15	5	10	5	10	10	5	10	15	15	Total internal assessment Marks	Result (Y/N)
	Candidate Name	Father's/Mother's Name	Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA	
1													
2													