BATTERY REPAIRER

COMPETENCY BASED CURRICULUM

(Duration: 1 Yr. 3 Months)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 4

SECTOR – Electrical
(Including New and Renewable Energy)

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

BATTERY REPAIRER

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 4

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City,
Kolkata – 700 091

ACKNOWLEDGEMENT

The DGT sincerely express appreciation for the contribution of the Industry, State Directorate, Trade Experts and all others who contributed in revising the curriculum.

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

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
1.	Sh. D L Meena, ADT	RDAT Faridabad	Expert Member
2.	Sh. D P Rana, Training Officer	RDAT Faridabad	Expert Member

CONTENTS

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.

2. TRAINING SYSTEM

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.

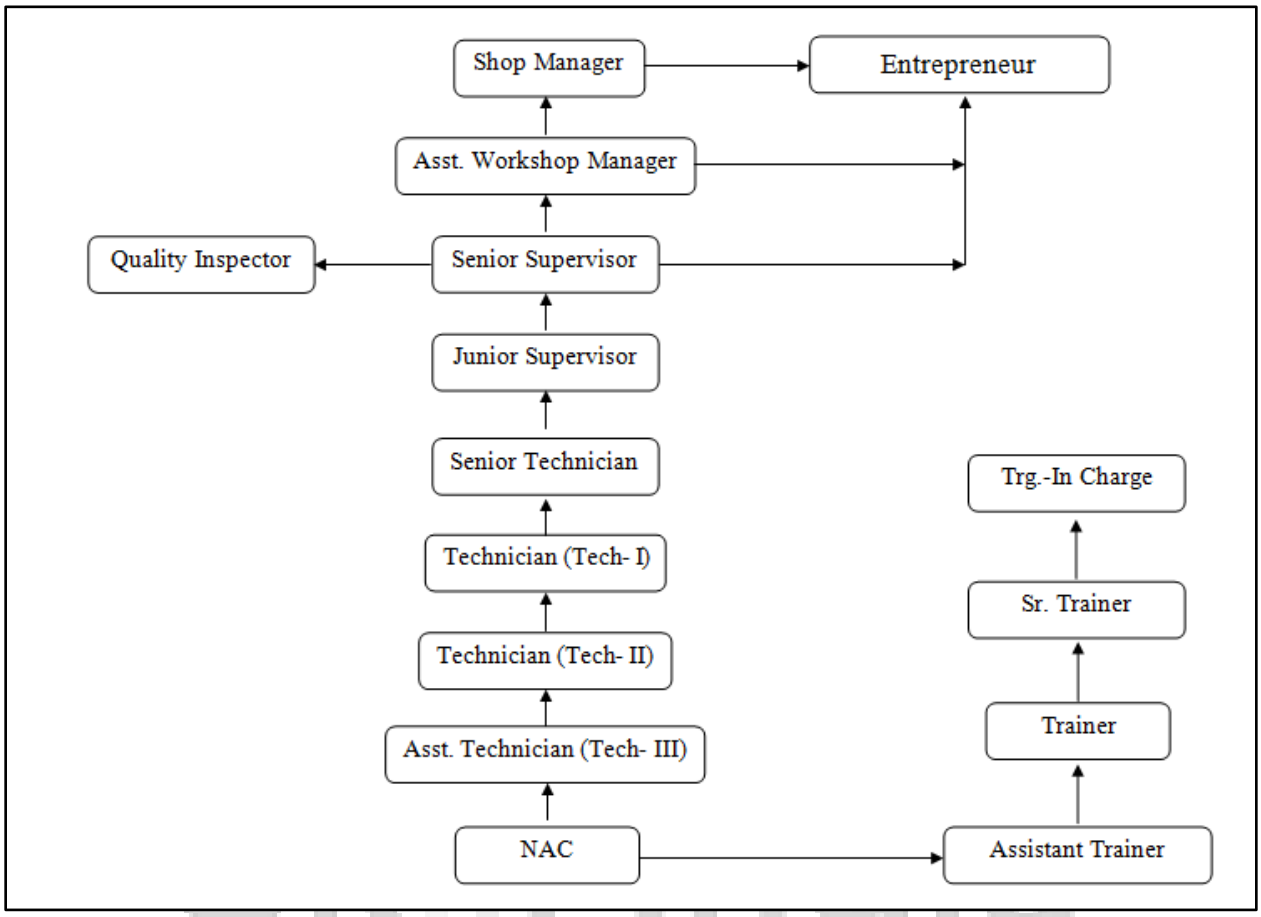
Battery Repairer trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of one year (01 Block) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, 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.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS:

- 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 one year (*Basic Training and On-Job Training*) : -

Total training duration details: -

Time (in months)	1-3	4 - 15
Basic Training	**Block– I**	**-----**
Practical Training (On - job training)	**----**	**Block – I**

A. Basic Training

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

For 01 yr. course (Engg) : (**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. Course (Engg) : (**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. course (Engg) : (**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 yrs. course (Engg)	1000 hrs.	3120 hrs.	4120 hrs.
For 01 yr. course (Engg)	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 OSHE 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
(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 above75% - 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.

3. JOB ROLE

Brief description of Job roles:

- Inspect electrical connections, wiring charging relays, charging resistance box, and storage batteries, following wiring diagram.
- Remove and disassembles cells and cathode assembly, using tension handles, pry bars, and hoist, and cuts wires to faulty cells.
- Inspect battery for defects, such as dented cans, damaged carbon rods and terminals, and defective seals.
- Test condition, fluid level, and specific gravity of electrolyte cells, using voltmeter, hydrometer, and thermometer.
- Position and levels, or signals worker to position and level, cell, anode, or cathode, using hoist and levelling jacks.
- Installs recharged or repaired battery or cells, using hand tools.
- Cleans cells, cell assemblies, glassware, leads, electrical connections, and battery poles, using scraper, steam, water, emery cloth, power grinder, or acid.
- Disconnects electrical leads and removes battery, using hand tools and hoist.
- Carryout UPS / INVERTER wiring.

Plan and organize assigned work and detect & resolve issues during execution in his own work area within defined limit. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Reference NCO -2015 : 8212.0300 -Battery Repairer

4. NSQF LEVEL COMPLIANCE

NSQF level for Battery Repairer trade under ATS: **Level 4**

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 Battery Repairer trade under ATS mostly matches with the Level descriptor at Level- 4.

The NSQF level-4 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 4	Work in familiar, predictable, routine, situation of clear choice.	Factual knowledge of field of knowledge or study	Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts	Language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment.	Responsibility for own work and learning.

5. GENERAL INFORMATION

Name of the Trade	**Battery Repairer**
NCO - 2015	8212.0300
NSQF Level	Level – 4
Duration of Apprenticeship Training (Basic Training + On-Job Training)	3 months+ One year (01 Blocks of 15 month duration).
Duration of Basic Training	a) Block –I : 3 months **Total duration of Basic Training: 3 months**
Duration of On-Job Training	a) Block–I: 12 months **Total duration of Practical Training: 12 months**
Entry Qualification	Passed 10th class examination 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.
Infrastructure for basic Training	As per related trade of ITI
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.
Rebate to Ex-ITI Trainees	Nil
CTS trades eligible for Battery Repairer Apprenticeship	Battery Repairer

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.*
- *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 Battery Repairer course of 01 years duration under ATS.

Block I:-

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 - ,Unit,,Basic Mathematics, Percentage, Material Science, Mass, Weight and Density, Mensuration, Elasticity , Heat & Temperature, Basic Electricity.]*

3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Lines, Free hand drawing , Drawing of Geometrical Figures , Sizes and Layout of Drawing Sheets, Method of presentation of Engineering Drawing, Drawing of Solid figures, Free hand Drawing of Solid figures, Free Hand sketch, Projections, Drawing of Orthographic projection in 3rd angle.]*

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 availab**le 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 industry works. Practice providing First Aid/Artificial respiration. Practice safe operational procedures for breakdown/preventive maintenance.
2. Identify & use trade hand tools.
3. Carryout chipping, filing, grinding, hack sawing, fitting & carpentry jobs. Drill and tap holes. Carry out Cutting and riveting. Make single and double rectangular boards
4. Measure voltage, current, resistance power & energy in DC & AC(1ph & 3ph) circuits
5. Troubleshoot, repair & maintain lights, fans and power appliances. Wire up in PVC casing & capping.
6. Connect, test, repair& maintain domestic appliances.
7. Test wiring installations by meggar.
8. Troubleshoot power supply parts such as rectifiers, filters, voltage stabilizers, controlled rectifiers. Check the thyristors in circuits
9. Select suitable battery for specified application. Identify different parts of storage batteries, cells i.e. Plates, Electrolyte, container. Bottom grooved support blocks, Connecting bar, Terminal/Pillar, Vent plug/Filler caps, External connecting strips.
10. Test the battery for specific gravity, terminal voltage by High rate discharge tester, capacity etc.
11. Prepare electrolyte for battery.
12. Top up the battery with distilled water, clean the terminals& vent plug.
13. Inspect the container of batteries for leakage, cracks and sediment.
14. Charge and discharge the battery with specified charging and discharging currents.
15. Charge battery by use of fast charger
16. Overhaul batteries by removing acid, removing scaling pitch with gas torch, remove plates from container, inspect parts, clean, replace the defective parts&reassemble.
17. Measure the internal resistance & capacity of cell.
18. Test the battery for charging status.
19. Dismantle Ni-Cd Batteries & Assembling of the same.
20. Connect the power and control wiring of Diesel Generating set. Troubleshoot, repair and maintain the diesel engine coupled alternator and switchgear.
21. Connect & test the power supply changeover switches of single or three phase supplies in manual or automatic mode of operation.
22. Maintain the Solar cells by voltage tests, scheduled inspection of terminal connections and operate other non-conventional energy generation system.

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

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 Productive 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 and explain different mathematical calculation & science in the field of study including basic	2.1 Explain concept -Unit,, Basic Mathematics, Percentage , Material Science , Mass, Weight and Density , Mensuration , Elasticity , Heat & Temperature , Basic Electricity ,

electrical.*[Different mathematical calculation & science-Unit, Basic Mathematics, Percentage, Material Science, Mass, Weight and Density, Mensuration, Elasticity , Heat & Temperature, Basic Electricity.]*	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 Lines, Free hand drawing, Drawing of Geometrical Figures , Sizes and Layout of Drawing Sheets, Method of presentation of Engineering Drawing, Drawing of Solid figures, Free hand Drawing of Solid figures, Free Hand sketch, Projections, Drawing of Orthographic projection in 3rd angle]*	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, verniercalipers, 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 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 productivity & quality.	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.
	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 (Section:10 in the competency based curriculum)	
*Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under **Block – I**(section: 10) must ensure that the trainee works in familiar, predictable, routine, situation of clear choice. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, etc.); **Execution** apply factual knowledge of field of knowledge, recall and demonstrate practical skill during performing the work in routine and repetitive in narrow range of application, using appropriate rule and tool, complying with basic arithmetic and algebraic principles and language to communicate in written or oral with required clarity; **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for his/her own work and learning.*	

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	Implementation of various safety measures in the shop floor. Visit to different sections of the Institute. Demonstration of elementary first aid. Artificial Respiration. Practice on use of fire extinguishers. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Identification of safety signs for Danger, Warning and Caution. Safe operational procedure for breakdown maintenance.	**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
2	Familiarization with signs and symbols of Electrical accessories. Description of properties of insulating material. Demonstration of trade hand Tools. Use, care & maintenance of various hand tools.	Fundamental of electricity: Electron theory- free electron, protons & neutrons. Fundamental terms- Current, Voltage definitions, AC, DC, Phase, Neutral, Earth. Units & effects of electric current. Common insulating material Identification of Trade-Hand tools- Specifications.
3.	Practice on Soldering, Use of flux, Uses of resign and soldering equipment. Skinning the cables Demonstration & Practice on bare conductors joints--such as rat tail, Britannia, straight, Tee, Western union Joints Practice in soldering & Tinning. Practice on crimping thimbles, Lugs. Demonstration and identification of types of cables. Demonstration & practice on using standard wire gauge &micrometer.	Soldering, flux and soldering technique. Resistors types of resistors & properties of resistors. Introduction of National Electrical Code. 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.	Identify & select different type of Instruments. Use of **-P**MMC , MI meter, Multi-	**Electrical Measuring Instruments -** -types, indicating types PMMC & MI meter (Ammeter, Voltmeter)

	meter(Digital/Analog) , Wattmeter, P F meter, Energy meter, Frequency meter, Phase sequence meter, Digital Instruments, etc Range extension of meters.	-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 -Tachometer.
5	Verification of Ohm's Law, Measuring unknown resistance Verification of laws of series and parallel circuits. Kirchoff's Law 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.	Ohm's Law – Kirchhoff's Law- Simple electrical circuits and problems. Reading of simple Electrical Layout. **Resistors -**Law of Resistance. Series and parallel circuits & related calculation. Measurement of resistance using Wheatstone Bridge. **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.
6.	**Diodes**-symbol - Tests - Construct & Test Half wave rectifier ckt. Full wave rectifier ckt. Bridge rectifier ckt. Single phase & three phase rectifier ckt Measurement & calculation of electrical parameters using C.R.O. Different wave shapes of rectifiers and their values using C.R.O. Identification of terminals, construction & Testing of transistor.	**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 DC, rectifier circuit. Half wave, Full wave and Bridge circuit. Filter circuits-passive filter. Working principle and uses of an

	Operation, maintenance & troubleshooting of inverter, Voltage stabilizer, DC regulated power supply, UPS, etc.	oscilloscope. Types of transistors & its application. Specification and rating of transistors.
7.	Prepare Electromagnet. Use of magnetic compass. Assembly / winding of a simple electro magnet Identification of different types of Capacitors. Charging and discharging of capacitor, Testing of Capacitors using DC voltage and lamp.	**Magnetism -** classification of magnets, methods of magnetising, magnetic materials. Properties, care and maintenance, methods of magnetising magnetic materials. Para and Diamagnetism and Ferro magnetic materials. Principle of electro-magnetism,
	Identification of types of Transformers. Connection of transformers, Transformation ratio, testing of transformer, calculates the losses & efficiency. 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.
8.	Identification of parts of battery. Types of Battery, Parts of Battery, Practice on Battery Charging, Preparation of battery charging, Testing of cells, Installation of batteries, Charging of batteries by different methods. Routine care & maintenance of Batteries	Theory of Chemical Reaction, Electrolysis (Faradays Law), Electro Chemical Equivalent. **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, Bond Theory & concept of ions. Different types of lead acid cells. Sealed Maintenance free Batteries, Solar battery. Load & back up time calculation
9	Practice of all types of test of battery Identify fully charged Battery Defects & remedies.	Principle of Storage Cell Chemical change on charging & discharging Indication of fully charged Battery. Testing of Battery i.e. using hydrometer, voltmeter, High rate discharge cell tester, Cadmium stick test
10.	Identify defects of battery, Ampere hour capacity. Prepare Electrolyte and use of	General defects of Lead Acid Battery- a. Sulphation, b. Sedimentation, c. Buckling of plates.

	special purpose batteries.	Battery defects like leakage, cracks, over charging & short circuiting of plates. Polarisation & back emf. Ampere Hour Capacity of Battery Process of Preparing Electrolyte Special Purpose Batteries-Steel Alkaline, Zinc Silver & motor cycle battery.
11	Practice on maintenance & upkeep of lead acid battery. Identify parts of Nickel Iron or Alkaline cell. Practice of charging battery using both methods.	General Maintenance and methods of upkeep of lead acid battery. Trickle charging Parts of Nickel Iron or Alkaline cell Difference between lead acid & Alkaline Cell Connection diagram of charging & lamp discharging board. Types of Charging a) constant voltage charging b) Constant current charging Precautions during charging of battery.
12	Practice to assemble new batteries. To find Internal resistance of lead acid Battery.	Methods of Assembly new Batteries. Process of Lead burning set& gas welding set Internal resistance of lead acid Battery.
13	Practice to connect cell in series, parallel, series-parallel. Calculate metal deposition on the basis of atomic weight/chemical equivalent.	Grouping of cells- series, parallel, series-parallel. Metal depositing on the basis of atomic weight/chemical equivalent.
	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	Introduction to Engineering Drawing and Drawing Instruments : - Conventions - Viewing of engineering drawing sheets. - Method of Folding of printed Drawing Sheet as per BIS SP:46-2003 - 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.	**Basic Mathematics** - BODMAS rule Fraction-Addition, Subtraction, multiplication and Division-Problem solving, Decimal-Addition. Simple calculation using Scientific Calculator.	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.	Conversion of Fraction to Decimal and vice-versa.	Free hand drawing of - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension

		Transferring measurement from the given object to the free hand sketches.
4.	**Percentage**: Introduction, Simple calculation. Changing percentage to fraction and decimal & vice-versa.	**Signs & Symbols of AC/DC System** Symbols used in electrical circuits. Electrical components.
5.	Square Root: Square and square root, method of finding out square roots. Simple problem using calculation.	Sizes and Layout of Drawing Sheets - Selection of sizes - Title Block, its position and content - Item Reference on Drawing Sheet (Item List)
6.	**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight. Density, unit of density. Relation between mass, weight & density. Simple problems related to mass, weight, and density.	Method of presentation of Engineering Drawing - Pictorial View - Orthographic View - Isometric view
7.	**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 of Solid figures (Cube, Cuboids, Cone) with dimensions. - Free hand Drawing of Solid figures (Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions. - Free Hand sketch of hand tools and measuring tools used in respective trades. -Free Hand Sketching of different shapes of Batteries & its component. -Circuit Diagram of charging circuit

9.2 EMPLOYABILITY SKILLS

Topic No.	Topic	Duration (in hours)
	English Literacy	**7**
1.	**Reading** Reading and understanding simple sentences about self, work and environment	
2.	**Writing** Construction of simple sentences Writing simple English	
3.	**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. 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.	
	I.T. Literacy	**10**
1.	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2.	**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. Use of External memory like pen drive, CD, DVD etc,	
3.	**Computer Networking and INTERNET** 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.	
	Communication Skill	**18**
1	**Introduction to Communication Skills** Communication and its importance Principles of Effective communication Types of communication - verbal, nonverbal, written, email, talking on phone. Nonverbal communication - components-Para-language Body - language Barriers to communication and dealing with barriers.	

2	**Listening Skills** Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.	
3	**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.	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
	Entrepreneurship skill	**8**
1.	**Concept of Entrepreneurship** Entrepreneurship- Entrepreneurship - Enterprises:-Conceptual issue. Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.	
2.	**Institutions Support** 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.	
	Productivity	
1.	**Productivity** Definition, Necessity.	
2.	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3.	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**6**
1	**Safety & Health** Introduction to Occupational Safety and Health importance of safety and health at workplace.	
2	**Occupational Hazards** Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	

3	**Accident & safety** Basic principles for protective equipment. Accident Prevention techniques - control of accidents andsafety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
	Labour Welfare Legislation	
1	**Welfare Acts** Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Employees Provident Fund Act.	
	Quality Tools	**6**
1.	**Quality Consciousness :** Meaning of quality, Quality Characteristic	
2.	**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.	
3.	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
4.	**Quality Tools** Basic quality tools with a few examples	

10. DETAILS OF COMPETENCIES (ON-JOBTRAINING)

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

Block – I

1. Observe & practice safety in all industry works. Practice providing First Aid/Artificial respiration. Practice safe operational procedures for breakdown/preventive maintenance.
2. Identify & use trade hand tools.
3. Carryout chipping, filing, grinding, hack sawing, fitting & carpentry jobs. Drill and tap holes. Carry out Cutting and riveting. Make single and double rectangular boards
4. Measure voltage, current, resistance power & energy in DC & AC(1ph & 3ph) circuits
5. Troubleshoot, repair & maintain lights, fans and power appliances. Wire up in PVC casing & capping.
6. Connect, test, repair& maintain domestic appliances.
7. Test wiring installations by meggar.
8. Troubleshoot power supply parts such as rectifiers, filters, voltage stabilizers, controlled rectifiers. Check the thyristors in circuits
9. Select suitable battery for specified application. Identify different parts of storage batteries, cells i.e. Plates, Electrolyte, container. Bottom grooved support blocks, Connecting bar, Terminal/Pillar, Vent plug/Filler caps, External connecting strips.
10. Test the battery for specific gravity, terminal voltage by High rate discharge tester, capacity etc.
11. Prepare electrolyte for battery.
12. Top up the battery with distilled water, clean the terminals & vent plug.
13. Inspect the container of batteries for leakage, cracks and sediment.
14. Charge and discharge the battery with specified charging and discharging currents.
15. Charge battery by use of fast charger
16. Overhaul batteries by removing acid, removing scaling pitch with gas torch, remove plates from container, inspect parts, clean, replace the defective parts& reassemble.
17. Measure the internal resistance & capacity of cell.
18. Test the battery for charging status.
19. Dismantle Ni-Cd Batteries & Assembling of the same.
20. Connect the power and control wiring of Diesel Generating set. Troubleshoot, repair and maintain the diesel engine coupled alternator and switchgear.
21. Connect & test the power supply changeover switches of single or three phase supplies in manual or automatic mode of operation.

22. Maintain the Solar cells by voltage tests, scheduled inspections of terminal connections and operate other non-conventional energy generation system.

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.

ANNEXURE – I

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

BATTERY REPAIRER			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 16 Apprentices)			
A. TRAINEES TOOL KIT			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
1	Steel rule	300mm	17Nos
2	Screw Driver	200mm	17Nos
3	Screw Driver	100mm	17Nos
4	Terminal screw Driver (Connector)	75 mm	17Nos
5	Knife Electrician D.B.	Double Blade	17Nos
6	Hammer Ball peen	0.25 Kg	17Nos
7	Combination pliers insulated	200 mm	17Nos
8	Neon tester pencil bit type	500 volt	17Nos
9	Try square	200 mm	17Nos
10	Wire stripper	1-6 sq.mm	17Nos
11	Wire crimping tool	1-6 sq.mm	17Nos
12	Spanner set DE Set of 6	from 6x7 to 16x7	17Nos
13	Screw driver set (set of 5)	100-300 mm	17Nos
14	File half round	2nd cut 250 mm	17Nos
15	File round	2nd cut 150 mm	17Nos
16	Soldering iron	35W/230 V	17Nos
17	Neon tester	230 v	17Nos
18	Digital Multimeter		17Nos
19	Spanner set		17Nos
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
20.	C- clamp	100mm, 150mm, 200mm	2 Nos.
21.	Adjustable spanner	150mm, 300mm	2 Nos.
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.
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	metric	2 sets
31.	Oil can	0.12 ltr	1
32.	Grease gun		1
33.	Outside Micrometer		2
34.	Motorised Bench grinder		1

BATTERY REPAIRER

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	(28adjustable)	2 sets
42.	Crimping tool for telephone/LAN cable		2
43.	Wire stripper	20 Cm	2
44.	Chisel cold flat	12mm	2
45.	Mallet hard wood	0.5Kg	2
46.	Mallet hard wood	1 Kg	2
47.	Hammer extractor type	, 0.4 Kg	2
48.	Hacksaw frame	200mm & 300mm	2 each
49.	Try square	150 mm blade	2
50.	Outside & inside divider calliper		2 each
51.	Pliers flat nose	150mm	4
52.	Pliers round nose,	100 mm	4
53.	Tweezers,	100mm	4
54.	Snip straight & bent	150mm	2 each
55.	Double ended spanner set metric		2 sets
56.	HSS drill bit set	(2-12mm)	4 sets
57.	Plane, smoothing cutters	50mm	2
58.	Gauge, wire imperial		2
59.	File, flat	200mm 2nd cut	8
60.	File half round	200 mm 2nd cut	4
61.	File round	200mm 2nd cut	4
62.	File flat	150mm rough	4
63.	File flat	250mm bastard	4
64.	File flat	250mm smooth	4
65.	File Rasp half round	200 mm bastard	4
66.	Soldering iron	25 W, 65 W	2 each
67.	Copper bit soldering iron	0.25 kg	2
68.	De-soldering gun		4
69.	Hand vice	50mm jaw	4
70.	Bench vice	100mm jaw	6
71.	Pipe cutter to cut pipes	upto 5cm dia	2
72.	Stock & die set	for 20mm to 50 mm GI pipe	1
73.	Stock & dies conduit		1
74.	Ohm meter; series & shunt type		2 each
75.	Multimeter (analog)	0-1000 M ohm, 2.5 to 500V	2
76.	Digital Multimeter		4
77.	AC voltmeter	MI 0-500V	2
78.	One pair of side cutting pliers	8 inch	1
79.	DC milli Ammeter	0-500 mA	1

BATTERY REPAIRER

80.	Ammeter	MC 0-5A, 0-25A	1 each
81.	Ammeter	DC 0-5A, 0-25A	1 each
82.	Rubber apron		02
83.	Pair of rubber sleeve protectors		10
84.	Battery turntable		1
85.	Open-end wrench		1
86.	Center punch		2
87.	Hydrometer		5
88.	DC power supply	0-30V, 2 Amp	2
89.	Rheostats	0-1 ohm 5A, 0-10 ohm 5A,	1 each
90.	Cans of asphaltum paint		1
91.	D.C.Voltmeter		2
92.	AVO Meter		1
93.	Tong tester / clamp meter	0-100 A, AC	1
94.	Meggar	500V	1
95.	Rubber gloves	1000V	2 pairs
96.	Oscilloscope	dual trace, 30 MHz	1
97.	Function Generator		1
98.	Set of reamers		1
99.	Wood Saw,	250 mm	1
100.	Tenon Saw		1
101.	Battery carrier		1
102.	Set of hollow reamers		2
103.	Lead lined box for storing separators		1
104.	All types C.F.L. lamp sets	5W, 15W, 25W	2 each
105.	Distilled Water		20 liter
106.	Work Bench with vice		2
107.	Iron racks		2
108.	Bins for battery parts		10
109.	Set of reamers		1
110.	Wood Saw,	250 mm	1
111.	Rubber Mats		As
C : GENERAL MACHINERY INSTALLATIONS			
1.	Wheat stone Bridge.		1
2.	Battery (different type)	12V, 75Ah	2 Each
3.	Battery Charger	15V,constant voltage	1
4.	Solar street light lamp set	12v , 18 / 24 watts	1 each
5.	Lead welding outfit		1
6.	Transformer single phase	1 K.V.A. 250/110 v	2
7.	Transformer Three phase (oil cooled)	5 K.V.A. 440/220 v	1
8.	Autotransformer Single phase	0-300V 1kVA	2
9.	Autotransformer Three phase	0-500V 1kVA	1
10.	Current transformer	10/1, 20/1,30/1,50/5,	1 each
11.	Potential transformer	220/110, 300/110,	1 each

BATTERY REPAIRER

12.	Miniature circuit breaker(MCB)	220V/ 6 Amps	3
13.	Earth leakage circuit breaker (ELCB)	220V/25mA	2
14.	Braze Welding set		1
15.	Battery steamer		1
16.	Cadmium test set		1
17.	High rate discharge testers		1
18.	Battery Charger	constant Current controlled	1

BATTERY REPAIRER

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: BATTERY REPAIRER

LIST OF TOOLS& EQUIPMENTS FOR -16 APPRENTICES

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	As per standard	17set
2.	Set square celluloid 45^o	(250 X 1.5 mm)	17set
3.	Set square celluloid 30^o-60^o	(250 X 1.5 mm)	17set
4.	Mini drafter	As per standard	17set
5.	Drawing board IS: 1444	(700mm x500 mm)	17set
B : Furniture Required			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1	Drawing Board	As per standard	16
2	Models : Solid & cut section	As per standard	as required
3	Drawing Table for trainees	As per standard	as required
4	Stool for trainees	As per standard	as required
5	Cupboard (big)	As per standard	01
6	White Board	(Size: 8ft. x 4ft.)	01
7	Trainer's Table	As per standard	01
8	Trainer's Chair	As per standard	01

BATTERY REPAIRER

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.**		

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	**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	**Total internal assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														