ELECTRICAL WINDER

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

ELECTRICAL WINDER

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 5

Developed By
Ministry of Skill Development and Entrepreneurship
Directorate General of Training
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2. Naval Dockyard Apprentice Mumbai
3. Torrent Power, Ahmedabad
4. Kirloskar Electric co. ltd. Bangalore

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Co-ordinator for the course: Shri B N Sridhar, Dy Director, FTI, Bangalore

Sl.No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
1.	B N Sridhar, Dy Director	FTI, Bangalore	Expert Member
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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.

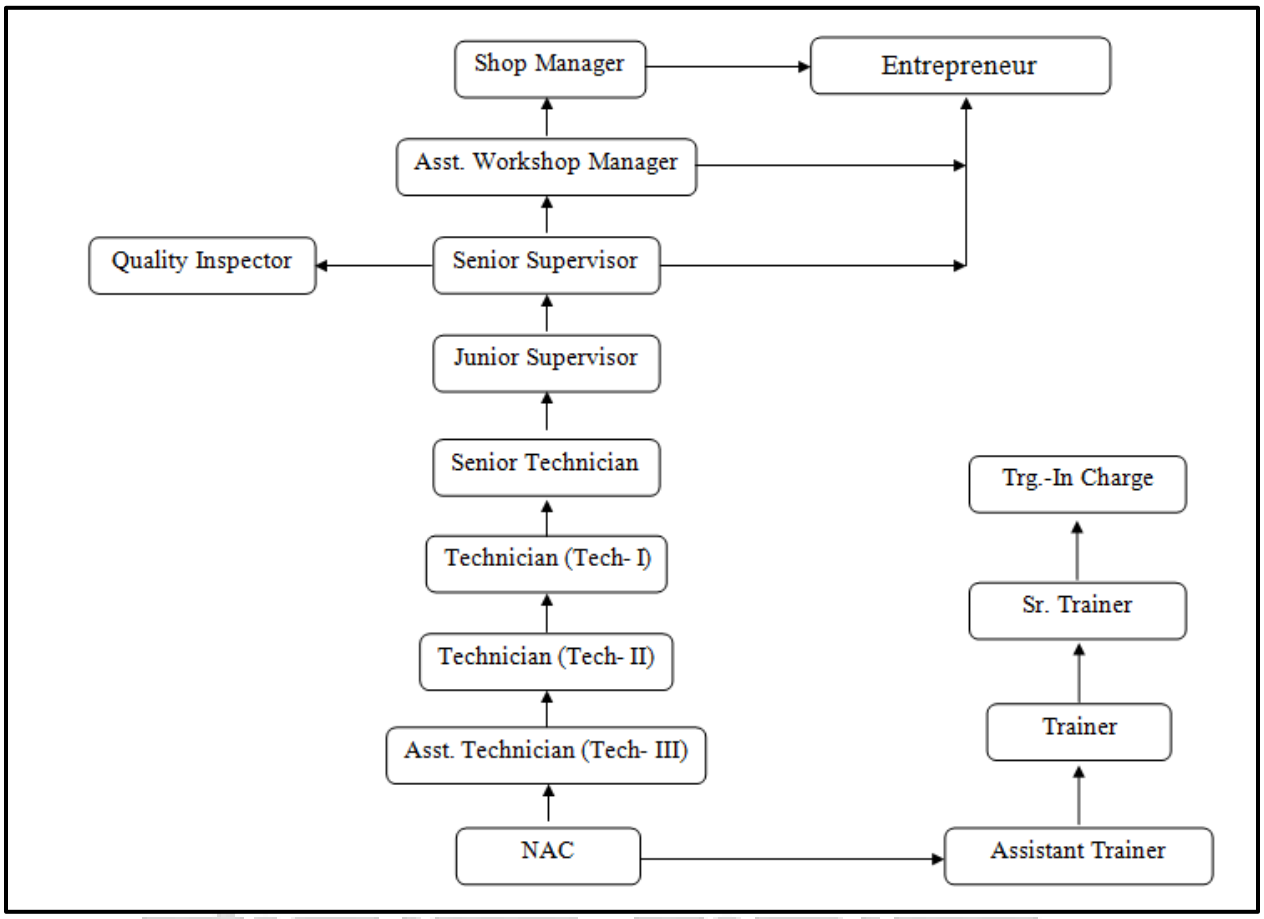
Electrical Winder trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, 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**

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 (section-2.4.2). 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 (section-2.4.2) 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 of Electrical Winder:

- Check the gauges of wire & select suitable wires for the required current rating. Practice wire joints & providing cable glands. Soldering practice.
- Connect & measure voltage, current, resistance power & energy in DC & AC(1ph & 3ph) circuits
- Electrical wiring: Repair / replace switches, sockets, light points. Provide new points in PVC casing capping & PVC conduits. Make a test board.
- Carry out winding of armature
- Carry out winding of field poles
- Carry out Stator winding of AC motor
- Carry out winding of wound rotors
- Carry out transformer winding
- Testing of stator and Rotor windings
- Assemble & disassemble the motor
- Testing of motor and transformers
- Carry out impregnation
- Perform Soldering, brazing and simple welding.
- Perform mica under cut
- Carry out rotor balancing

In addition Electrical Winderhave the ability to visualize the job, good coordination, mechanical attitude, manual dexterity and perform work related mathematical calculations.

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

May be designated as Electrical Winder according to nature of work done.

Reference NCO: 7412.0400 - Armature Winder

4. NSQF LEVEL COMPLIANCE

NSQF level for Electrical Winder 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 Electrical Winder 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	ELECTRICAL WINDER
NCO - 2015	7412.0400
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 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent
Selection of Apprentices	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.
Rebate to Ex-ITI Trainees	Nil
CTS trades eligible for Electrical Winder Apprenticeship	Electrical Winder

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 Electrical Winder 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 and drilling jobs
5. Connect & measure voltage, current, resistance power & energy in DC & AC(1ph & 3ph) circuits
6. Electrical wiring: Repair / replace switches, sockets, light points. Provide new points in PVC casing capping & PVC conduits. Make a test board.
7. Install pipe & plate earth stations. Measure earth resistance, improve the same & maintain earth stations.
8. Providing power supply to motors, equipments& appliances. Crimping the lugs, providing cable glands & connections. Provide earthing.
9. Connecting a DC generator, voltage building and loading.
10. Connecting a AC generator, voltage building and loading.
11. Connecting a AC generator, voltage building and loading.
12. Identifying the parts of 3 phase motor, connecting through starters, starting, running, changing the direction of rotation, speed control and loading.
13. Single phase motors: connections and running.
14. Assembling and dis-assembling of motors and generators. Trouble shooting and overhauling.
15. Checking the polarity and ratio of transformers and instrument transformers. Connections.
16. Testing of transformers, cleaning, changing of oil and maintenance

Block – II

17. Observe & practice safety in all electrical works. Practice providing First Aid.
18. Dis-assembling, Dismantling and stripping the old winding
19. Preparation of core, coil and insulation for winding
20. Insertion of insulating materials in the slots
21. Insertion of coils and folding over the insulation and wedges driving.
22. End connections inclusive of commutator if involved
23. Soldering / brazing of coil ends of the winding wire and lead cables
24. Overhang banding with cord, steel wire or semi cured polyester glass tape
25. Impregnation of wound stator /rotor
26. Carrying out the inspection and testing of winding
27. Balancing the rotor
28. Final assembling of motor or generator
29. Transformer core assembly
30. Transformer LV and HV winding and Inserting in to the core
31. Finishing core assembly, connections, terminations
32. Oven drying, tanking and wiring. Oil filling. Testing

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, 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.

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, 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 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 productivity &	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.

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)

*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.*

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, Demonstration of elementary first aid. Artificial Respiration. Practice on use of fire extinguishers. Health, Safety and Environment guidelines, legislations & regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. 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.	Demonstration of trade hand tools. Use, care & maintenance of various hand tools. Practice on Earthing- different methods of earthing. Measurement of Earth resistance by earth tester. Testing of Earth Leakage by ELCB and relay. Familiarization with signs and symbols of Electrical accessories. Practice on installation and overhauling common electrical accessories as per simple Electrical circuit / Layout. Make test board.	Identification of Trade-Hand tools-Specifications **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). 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, MCB, ELCB, MCCB. Series –parallel testing board & use.
3.	Skinning the cables.	Solders, flux and soldering technique.

	Demonstration & Practice on bare conductors joints--such as rat tail, Britannia, straight, Tee, Western union Joints Practice in soldering & brazing Practice on crimping thimbles, Lugs. Demonstration and identification of types of cables. Demonstration & practice on using standard wire gauge & micrometer.	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.
4-5	Verification of Ohm's Law, Measuring unknown resistance Verification of laws of series and parallel circuits. 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. Practice on three phase four wire system for understanding phase and line voltage & current.	Fundamental of electricity: Fundamental terms- Current, Voltage definitions, AC, DC, Phase, Neutral, Earth. Units & effects of electric 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.
6.	Identify & select different type of	**Electrical Measuring Instruments -**

	Instruments. Use of -PMMC , MI meter, Multi-meter(Digital/Analog) , Wattmeter, P F meter, Energy meter, Frequency meter, Phase sequence meter, Digital Instruments, etc Range extension of meters.	-types, indicating types PMMC & MI meter (Ammeter, 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.
7.	Identify basic Hand Tools for filing, chiseling, cutting, drilling, etc. Chipping practice and practice in grinding harding and tempering of chisels. Filing practice, filing true to line. Marking, sawing and drilling practice in hand drilling & power drilling machine. Practice in using taps and dies, threading hexagonal and square nuts etc. Cutting external threads on stud and on pipes and riveting practices. Practice in using sand paper and polishing.	Introduction to fitting trade. Descriptions , General Care & Maintenance of Hammer, Chisels, Try Square, etc Descriptions, General Care & Maintenance of different type of files. Descriptions, General Care & Maintenance of hacksaw, drilling machine, etc Description of taps and dies, types of rivets and riveted joints. Finishing and polishing materials and their process.
8-9	Identification of the parts of a D.C. generator. Connection, running and voltage build-up of DC generator. Load test. Connect, start, run and reverse direction of rotation of different type of DC motor. Speed control of DC motor by different method. Maintenance, troubleshooting & servicing of DC machines. Overhaul a DC machine.	**D.C. Machines** - General concept of Electrical Machines. **D.C. generator.** Parts: Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, Brushes, Laminated core. series, shunt and compound generators. Voltage build-up, loading. **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.
10	Identification of parts and terminals of	**AC Generator:**

	Alternator. Connection, starting, running of Alternator. Practice on alternators, voltage Building,, loading,	Explanation of alternator, working principle, voltage build-up, loading, Regulation. Efficiency. Types of prime mover, phase sequence, Specification of alternators.
11.	Identification of types of transformers single phase and 3 phase. Connection of transformers, Transformation ratio, testing of transformer, 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.	**Transformers 1ph and 3ph:** Working principle of **Transformer**. 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.
11-12.	Identification of parts and terminals of AC motors of Three phase Induction motor Connection, starting, running of AC motors using Starters. Load test & efficiency calculation. Rotor resistance starter, etc Speed control of Induction motors by various methods. Practical application of A.C. motors. Connection of single phase motor, identification, testing, running and reversing. Maintain service and trouble shoot the single phase motor. Install a single phase motor. 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.
	Internal 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.*

BASIC TRAINING (Block – II)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	Introduction to the complete product shop floor observation of fully completed products with special emphasis on assembly and disassembly of machines with part identification thereof. Procedure of job order filling forms, entry of name plate details. Recording the findings of visual and test inspection, Dismantling and recording winding data.	**Job documentation procedure:** Job order procedure for rewinding the machine, recording of name plate details, history of failure, visual inspection, and assessment of fault, initial tests, ***IR values, Dimension of Shaft & commutator, core damage &flash, Commutator riser width less*** dismantling and collecting winding data.
2-3	Shop floor instruction in the manufacture of electro-mechanical assemblies of ***AC & DC*** rotating electrical machines and transformers with special emphasis on the following: • Safety precautions • Layout for good handling and storing • Various equipment used as hydraulic press, armorpress, ***TIG*** welding equipment shrunk fit procedures. • Manufacture of special jigs and fixtures. • Commutator and skinning under cutting. • Reconditioning/replacing of the defective parts. Testing of magnetic core.	**Electro-Mechanical assemblies:** (1) Complete component identification. Knowledge of various mechanical and magnetic parts such as stampings, housings, keys, shafts, commutators, slipring assemblies, cooling fans, poles, etc. (2) Job instruction on handling and storing of the assemblies. (3) Concept of Jigs and fixtures as applicable in the winding job. (4) Details of shrink fit, welding as applicable in the winding job. ***(5) Reconditioning/replacing of defective parts, Testing of Magnetic core loss.***

4-5	Coil and insulation preparation • Preparation of the core before winding. • Manufacture of formers. • Preparation of coils on different types of coil winding machines as applied. • Cutting operations on various types of insulating materials used for slot liner, layer. Separators, slot wedge, phase, separator etc. and shaping and binding of overhangs Extensive shop floor practice on actual winding, consisting of the following operations. • Insertion of insulating materials in the slots. • Insertion of coils and folding over the insulation and wedges driving. • End connection inclusive of commutator if involved . • Soldering / brazing of coil ends of the winding wire and lead cables and core. • Overhang banding with cord, steel wire or semicured polyester glass tape. Carrying out the inspection test equipment. **NOTE:** The above winding practice should also covers the use of various types of small hand tools and shop made accessories such as cutters, mallets , wedges, driving tool, overhang support, knives, tongs etc.	**Coil winding and insulation preparation:** (1) Insulating materials: Solid, Liquid and gaseous insulating materials ***H Class, kaptontape, Nomex paper, Tetroflourethelene tape, Fibre glass tape, mica tape, silicon tape,*** thermal classification, properties, typical schemes of insulation used in the windings. Methods of test of insulating materials. Reference to relevant Indian/International standards. (2) Conductors: Conductors materials such as copper, aluminium, brass etc. their shape, size and current carrying capacity. Insulation used on winding wires, their types, size, voltage and temperature ratings. End connection lead cables. Specification of relevant to Indian / international standard. (3) Windings: Different types of windings used in AC/DC rotating machines and Transformers .***winding terminology, Finding Armature winding data i.e calculate Speed, Pole, Pole pitch, coil pitch, parallel paths, Prepare winding Diagrams as per data given (LAP & WAVE) winding, AC & DC Machines winding.*** (4) Calculations for making forrmers for different types of windings.
6-7	Study the parts of armature. Check and test the armature. Preparation of winding data for given Motor , Prepare the winding former and the coils Method of stripping the old winding and preparing the winding former and the coils. Method of inserting coil in the slots. Procedure followed for re-winding of all kind of electric DC motor's armature winding.	**D.C. m/c Winding—** Introduction to armature winding, Winding terms - pole pitch, coil pitch, back pitch, front pitch , Types of winding - Lap & Wave winding , Progressive and retrogressive winding. Winding materials, winding hand tools, coil winding machine, winding calculations and tables. Conditions to be fulfilled for Lap & Wave winding. Growler –construction details & testing

	Method of dismantling the burnt winding wire. Strip the old winding from the armature. Prepare the armature for rewinding. Preparation of winding data for given armature. Wind the coils by hand insulate them. Connection of armature leads on raiser. Preparation of winding table, connection diagram, winding diagram for given armature. End connection, distinguishing start and finish ends of each. Impregnation methods of armature after rewinding and testing. Varnish the armature winding. High voltage test & Insulation resistance test.	of armature rewinding by growler. Impregnation / varnish & baking. High voltage test & Insulation resistance test.
8-9	Prepare the winding former and the coils. Method of stripping the old winding and preparing the winding former and the coils. Preparation of winding data for given Motor. Method of inserting coil in the slots. Procedure followed for re-winding of all kind of electric motors like 3 phase & single phase A./C. motors, pump motors, ceiling fan motors, table fan motors, washing machine motors etc. Various methods used for inserting coil into the slots. Making end connections Impregnation & Testing the motor after rewinding. Method of dismantling the burnt winding wire. Study the parts of armature. Check and test the armature. Strip the old winding from the armature Record the winding data AC/DC armature winding. Prepare the armature for rewinding. Preparation of winding data for given	**REWINDING OF AC MOTOR-** **A.C. m/c Winding -** Introduction to stator winding, Terminology used in single phase and three phase winding like pole pitch, coil pitch etc., rules for end connection of 3Ø & single phase motors. Winding materials, winding tools, coil winding machine, winding calculations and tables, Testing the motor before declaring for rewinding. Principle of different winding techniques / methods Impregnation methods of armature after rewinding. Varnish the armature winding

	armature. Wind the coils by hand insulate them. Connection of armature leads on raiser. Preparation of winding table, connection diagram, winding diagram for given armature. Understand end connection, distinguishing start and finish ends of each. Impregnation methods of armature after rewinding. Varnish the armature winding Testing after rewinding.	Testing the motor after rewinding. Insulation Resistance & High voltage test.
10	Shop floor practice of different types of impregnating systems such as dip impregnation, flood impregnation, vacuum impregnation with full details of the process cycle involving preheating, impregnation and baking. Information on the working of the equipment involved. Practice of balancing the rotor by static and dynamic on dynamic balancing machine, by addition of balance weights and or scooping out materials. Full information on the working of the dynamic balancing machine.	**Impregnation:** Theoretical knowledge with reference to the process of ***preheating of armature, Vacuum Pressure impregnating plant*** and baking. Types of impregnating varnishes, thinners and solvents used. Types of air drying varnishes, details of equipment used. **Balancing:** Principle of static and dynamic balancing. Description of machine used.
11	Assembling of the final product by collecting together all sub-assemblies and loose components and doing final connections. Use of inspection and equipment to ensure that this product passes all necessary inspection and performance requirements.	*Final assembly test to be conducted after rewinding armature No load test, observe humming, commutator flashing, On load test(Hopkins test),IR value, HV test, High speed test, Temperature test.* Procedure of repairs of common electrical machines such as 3-phase and single phase motors, Alternators, welding generators, and transformers DC machines
12-13	Assembly for a round section and fit with yoke plates, core bolts, earthing the core. Winding L V coils (length and number of turns as per design) with oil circulating ducts. Winding HV coil over LV coil so that the terminations are diagonally opposite LV and HV coils insertion. Completing Core Assembly. Star –delta	**Transformer Winding:** CRGO silicon steel strips, Amorphous core. Shell or core type core assembly. Core weights for different transformer capacities. Assembly for a round section and fit with yoke plates, core bolts, earthing the core. Winding machines, forming LV coils (length and number of turns as per design) with oil circulating

	formations. Oven drying, tanking and wiring. Oil filling. Testing.	ducts. Winding HV coil over LV coil so that the terminations are diagonally opposite. Number of turns for correct transformation ratio Active part formation with removing top yoke plates, coils insertion for (Checking transformation ratio. Star &Delta formations of LV &HV coils. Oven drying Tanking and wiring. Oil filtering for enhancing BDV of oil. Oil filling to 30 degree levels of conservator ,testing for insulation resistance, ratio, open circuit and short circuit results name plate fixing etc.
	Internal 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
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.	**Drawing Instruments : their 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.
3.	**Square Root** : Square and Square Root, method of finding out square roots, Simple problem using 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.
4.	**Ratio &Proportion:** Simple calculation on related problems.	**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.
5.	**Percentage:** Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	**Lettering and Numbering** as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
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 sketch:** Hand tools and measuring instruments used in Electrician / Power electrician trade**.**
7.		**Free hand drawing :** - Lines, polygons, ellipse, etc. - Geometrical figures and blocks with dimension. - Transferring measurement from the given object to the free hand sketches.

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.		**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.	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	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.	**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.	**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 Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue 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.
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-JOBTRAINING)

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR **ELECTRICAL WINDER** TRADE:

1. Safety and best practices /Basic Industrial Culture (5S, KAIZEN, etc.).
2. Record keeping and documentation.
3. Making components observing different metal removing procedure and perform different fitting job.
4. Assembling of different components as per requirement and check functionality.
5. Carryout maintenance of different machines including hydraulics & pneumatics system.

Note: Actual training will depend on the existing facilities available in the establishments.

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 and drilling jobs.
5. Connect & measure voltage, current, resistance power & energy in DC & AC(1ph & 3ph) circuits.
6. Electrical wiring: Repair / replace switches, sockets, light points. Provide new points in PVC casing capping & PVC conduits. Make a test board.
7. Install pipe & plate earth stations. Measure earth resistance, improve the same & maintain earth stations.
8. Providing power supply to motors, equipments& appliances. Crimping the lugs, providing cable glands & connections. Provide earthing.
9. Connecting a DC generator, voltage building and loading.
10. Connecting a AC generator, voltage building and loading.
11. Connecting a AC generator, voltage building and loading.
12. Identifying the parts of 3 phase motor, connecting through starters, starting, running, changing the direction of rotation, speed control and loading.
13. Single phase motors: connections and running.
14. Assembling and dis-assembling of motors and generators. Trouble shooting and overhauling.
15. Checking the polarity and ratio of transformers and instrument transformers. Connections.
16. Testing of transformers, cleaning, changing of oil and maintenance.

Block – II

17. Observe & practice safety in all electrical works. Practice providing First Aid.
18. Dis-assembling, Dismantling and stripping the old winding.
19. Preparation of core, coil and insulation for winding.
20. Insertion of insulating materials in the slots.
21. Insertion of coils and folding over the insulation and wedges driving.
22. End connections inclusive of commutator if involved.
23. Soldering / brazing of coil ends of the winding wire and lead cables.
24. Overhang banding with cord, steel wire or semi cured polyester glass tape.
25. Impregnation of wound stator /rotor.
26. Carrying out the inspection and testing of winding.
27. Balancing the rotor.
28. Final assembling of motor or generator.
29. Transformer core assembly.
30. Transformer LV and HV winding and Inserting in to the core.
31. Finishing core assembly, connections, terminations.
32. Oven drying, tanking and wiring. Oil filling. Testing.

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

ELECTRICAL WINDER			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-18 is required additionally)			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
1	Steel tape	3 Meter length	21
2	Plier insulated	150 mm	21
3	Plier side cutting	150 mm	21
4	Nose plier	150 mm	21
5	Screw driver	150 mm	21
6	Electrician connector screwdriver, insulated handle thin stem	100 mm	21
7	Heavy duty screwdriver	200 mm	21
8	Electrician Screwdriver, thin stem, insulated handle	250mm	21
9	Punch centre	150mmX9mm	21
10	Electrician knife	50 mm blade	21
11	Neon tester		21
12	Steel rule	300mm	21
13	Hammer, Cross peen with handle	250 gm	21
14	Hammer, ball peen with handle	750gm	21
15	Gimlet	6mm	21
16	Bradawl	150mm x 6mm	21
17	Pincer	150 mm	21
18	Scriber (knurled centre position)		21
19	Digital multimeter		21
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
20.	C- clamp	100mm, 150mm, 200mm	2 each
21.	Adjustable spanner	150mm, 300mm	2 each
22.	Blow lamp	0.5 ltr	01
23.	Melting pot		01
24.	Ladle		01

Electrical Winder

25.	Chisel cold firmer	25mm x 200 mm	02
26.	Chisel 25mm & 6 mm		2 each
27.	Hand drill machine		02
28.	Portable electric drill machine	012 mm capacity	01
29.	Pillar Electric Drill machine	012 mm capacity	01
30.	Allen key set		2 sets
31.	Oil can	0.12 ltr	01
32.	Grease gun		01
33.	Out side Micrometer		02
34.	Motorised Bench grinder		01
35.	Rawl plug tool & bit		02
36.	Pulley puller		02
37.	Bearing puller		02
38.	Pipe vice		02
39.	Thermo meter	0-100 deg C	01
40.	Scissors blade	0150mm	02
41.	Crimping tool		2 sets
42.	Wire stripper	20 Cm	02
43.	Chissel cold flat	12mm	02
44.	Mallet hard wood	0.5Kg	02
45.	Mallet hard wood	1 Kg	02
46.	Hammer extractor type	0.4 Kg	02
47.	Hacksaw frame	200mm & 300mm adjustable	2 each
48.	Try square	150 mm blade	02
49.	Outside & inside divider caliper		2 each
50.	Pliers flat nose	150mm	04
51.	Pliers round nose	100 mm	04
52.	Tweezers	100mm	04
53.	Snip straight & bent	150mm	2 each
54.	Double ended spanner set metric		2 sets
55.	HSS drill bit set	(2-12mm)	4 sets
56.	Plane, smoothing cutters	50mm	02

57.	Gauge, wire imperial		02
58.	File, flat	200mm 2nd cut	08
59.	File half round	200 mm 2nd cut	04
60.	File round	200mm 2nd cut	04
61.	File flat	150mm rough	04
62.	File flat	250mm bastard	04
63.	File flat	250mm smooth	04
64.	File Rasp half round	200 mm bastard	04
65.	Soldering iron,	25 W, 65 W	2 each
66.	Copper bit soldering iron	0.25 kg	02
67.	Desoldering gun		04
68.	Hand vice jaw	50mm	04
69.	Bench vice jaw	100mm	06
70.	Pipe cutter to cut pipes upto 5cm dia		2
71.	Stock & die set for GI pipe	20mm to 50 mm	01
72.	Stock & dies conduit		01
73.	Ohm meter; series & shunt type		2 each
74.	Multimeter (analog),	0-1000 M ohm, 2.5 to 500V	02
75.	Digital Multimeter		04
76.	AC voltmeter MI	0-500V	02
77.	Milli Voltmeter centre zero	100-0-100 mV	01
78.	DC milli Ammeter	0-500 mA	01
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	01
82.	AC Energy meter, single phase	5A, 3 ph 15A	1 each
83.	Power factor meter, single phase		01
84.	Frequency meter		01
85.	Flux meter		01
86.	DC power supply	0-30V, 2 Amp	02
87.	Rheostats	0-1 ohm 5A, 0-10 ohm 5A, 0-25 ohm 1A, 0-300 ohm 1A	1 each

88.	Digital Tachometer		01
89.	Growler		01
90.	Tong tester / clamp meter	0-0100 A AC	01
91.	Meggar	500V	01
92.	Hygrometer		01
93.	Lux meter		01
94.	Hydro meter		01
95.	Current transformer	415 V, 50 Hz , CT Ratio 10/5A,	01
96.	Potential Transformer	415/110 V	01
97.	Wood Saw	250 mm	01
98.	Tenon Saw		01
99.	Guarded Test Lamp		01
C : GENERAL MACHINERY INSTALLATIONS			
100.	Voltage Stabilizer,	input 15-230 V AC, Output 220 V AC	01
101.	3 point DC starter		01
102.	4 point DC starter		01
103.	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		01
104.	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		1 set

	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		
105.	Used DC generators – series, shunt & compound type, (for overhauling practice)		1 each
106.	DC shunt motor	2 – 2.5 KW, 220V	01
107.	DC series motor coupled with mechanical load,	2 KW, 220V	01
108.	DC compound motor with starter & switch	2.5 KW, 220V,	01
109.	Single phase Transformer, core type, air cooled,	1 KVA, 240/415 V, 50Hz	03
110.	3 phase transformer, shell type, oil cooled with all mounting,	3 KVA, 415/240V, 50 Hz (Delta /Star)	02
111.	Starters for 2 to 5 HP AC motors. a. Resistance type starter. b. Direct on line starter. c. Star delta starter – Manual, semi-automatic & Automatic. d. Auto Transformer type starter		1 each
112.	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
113.	AC squirrel cage induction motor with star delta starter & triple pole Iron clad switch fuse.	2 to 3 HP, 3 ph, 400V, 50 Hz	01
114.	AC 3 ph wound slipring motor with starter & switch,	5 HP, 400V, 50 Hz	01
115.	Single phase capacitor motor with starter switch,	1 HP, 230 V, 50 Hz	01

Electrical Winder

116.	Universal motor with starter / switch,	230 V, ¼ HP, 50 Hz	01
117.	3 ph Synchronous motor,	3 HP, 415 V, 50 Hz, 4 pole, with accessories	01
118.	Ceiling fan		01
119.	Mixer & Grinder		01
120.	1 Ph variable Auto Transformer		01
121.	Load bank, 5 KW. lamp / heater type		01
122.	Brake test arrangement with 2 spring balance	0 to 25 Kg rating	01

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: ELECTRICAL WINDER

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		21 set
2.	Set square celluloid 45^o	250 X 1.5 mm	21 set
3.	Set square celluloid 30^o-60^o	250 X 1.5 mm	21 set
4.	Mini drafter		21 set
5.	Drawing board	700mm x500 mm IS: 1444	21 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	size: 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
2.	UPS - 500VA	10
3.	Scanner cum Printer	1
4.	Computer Tables	10
5.	Computer Chairs	20
6.	LCD Projector	1
7.	White Board 1200mm x 900mm	1
***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														