CURRICULUM

FOR THE TRADE OF

ELECTRICIAN AIRCRAFT

UNDER

APPRENTICESHIP TRAINING SCHEME

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

CONTENTS

1. 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 to the following industries/organizations who have contributed valuable inputs in revising the curricula through their expert members:

1. Air India Engineering Services, Hyderabad
2. HAL, Bangalore
3. HAL, TAD, Kanpur

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

Co-ordinator for the course: BN Sridhar, Dy Director, FTI, Bangalore.

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
1.	Shri. L.K. Mukherjee, Dy Director	CSTARI, Kolkata	Expert Member
2.	Shri.Parveen Kumar Assistant Director	ATI-EPI Hyderabad	Expert member
3.	Shri.V V Sateesh Reddy, Training Officer	ATI, Hyderabad	Expert member

2. BACKGROUND

2.1 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.

2.2 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 2. have been taken.

3.3 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.

3. RATIONALE

(Need for Apprenticeship in Electrician Aircraft trade)

Aviation is one of the greatest wonders of modern science. There has been tremendous growth in the field of both civil aviation and military aviation sector.

India is presently among the top 10 civil aviation markets in the world. The airlines industry of India served over 16 million customers in 2013. According to reports, India is poised to become one of the top 5 civil aviation markets by 2020. There is dearth of properly trained technicians necessary for quick expansion of aviation services.

Though several centers for the training of technicians have already been opened they are patently inadequate to meet the requirements of even the existing volume of air traffic.

The Technician plays a stellar role in Aviation sector as they are the ones who ensure that the aircraft is in a perfect condition before take-off. A technician needs to be completely focused on safety as the casual attitude can pose a danger to the lives of people on board.

The Aircraft maintenance technician will get it certify from aircraft engineer to declare the aircraft fit for release. The job ensures the availability of safe aircraft at the best possible cost. The Engineering and Maintenance department of an airline performs scheduled and unscheduled tasks, leading to restoration of the expected airworthiness.

The job includes diagnostic and mechanical duties covering maintenance, repair, trouble shooting and overhaul, in addition to performing inspection and modification on an aircraft.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

Electrician, Aircraft installs and services electrical wiring and equipment in aircraft. Tests electrical installation and equipment, supply of current, and continuity of electrical circuit in aircraft, using megger, voltmeter, avo meter etc. and locates faults. Repairs or replaces defective wiring, connector plunge, blown fuses, defective parts and electrical fittings and fixtures and maintains them in working order. Adjusts voltage regulators, actuators etc. as scheduled. Ensures that all connections to various lighting system such as landing light, anti-collision lights, wink tip lights etc. are intact covered and insulated. Ensures that storage battery in aircraft is kept fully charged and that acid level is above batter plates. Checks voltage, polarity, phase rotation etc. and supplies electric power from ground power trolley (ground generator) to start aircraft engine before taking off. Tests defective motors, generators etc. using testing equipment and gets burnt coils or armature re-wound by Armature Winder. May repair batteries.

Reference NCO: **7241.60**

5. GENERAL INFORMATION

1. **Name of the Trade** **: Electrician Aircraft**

2. **N.C.O. Code No.** : **NCO-2004: 7241.60**

3. **Duration of Apprenticeship Training (Basic Training + Practical Training):**2years

3.1 **For Freshers**: **Duration of Basic Training**: -

a) Block –I : 3 months

b) Block – II : 3 months

Total duration of Basic Training: 6 months

Duration of Practical Training (On -job Training): -

a) Block–I: 9 months

b) Block–II : 9 months

Total duration of Practical Training: 18 months

3.2 For ITI Passed: Duration of Basic Training: - NIL

Duration of Practical Training (On-job Training): 12 Months

4. **Entry Qualification** : Passed 10th Class under 10+2 System of Education

5. **Selection of Apprentices:** The apprentices will be selected as per Apprenticeship Act amended time to time.

6. . **Rebate for ITI passed trainees** : **One year rebate** for those who have passed **CTS- ELECTRICIAN** Trade.
They will undergo One year On-job Training

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.

6. COURSE STRUCTURE

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

Components of Training	Duration of Training in Months →																							
↓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Basic Training Block - I																								
Practical Training Block - I																								
Basic Training Block - II																								
Practical Training Block - II																								

7. SYLLABUS

7.1 BASIC TRAINING
(BLOCK – I & II)
DURATION: 06 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** : **ELECTRICIAN AIRCRAFT**
2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3) **Batch size** : 20
4) **Power Norms** : 5.0 KW for Workshop
5) **Space Norms** : 90 Sq.m.

6) **Examination** : The internal assessment will be held on completion of each Block.
7) **Instructor Qualification** :

i) Degree/Diploma in Electrical and Electronics Engg. from recognized university/Board with one/two year post qualification experience respectively in the relevant Field.

OR

ii) NTC/NAC in the trade of Electrician with three year post qualification Experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

8) **Tools, Equipments & Machinery required** : - As per Annexure – I

7.1.1 DETAIL SYLLABUS OF CORE SKILL

A. Block– I
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
		30		**20**
1	**Engineering Drawing:** Introduction and its importance - Viewing of engineering drawing sheets. Method of Folding of printed Drawing Sheet as per BIS SP:46-2003 Drawing Instruments : their Standard and uses - Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.		**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units.	
2	**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		**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.	
3	**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.		**Square Root** : Square and Square Root, method of finding out square roots, Simple problem using calculator	

4	**Lettering and Numbering** as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case. **Free hand drawing :** - Lines, polygons, ellipse, etc. - Geometrical figures and blocks with dimension. - Transferring measurement from the given object to the free hand sketches.		**Ratio &Proportion:** Simple calculation on related problems.	
5	**Free Hand sketch:** Hand tools and measuring instruments used in electrician/ Aircraft electrician trade		**Percentage:** Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	
6	**Projections** Orthographic projections from isometric/3D view of blocks Sectional view of parts		**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, Aircraft Materials-Ferrous and Non-Ferrous metals and Alloys. Corrosion and its prevention.	

B. Block- II
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
		30		**20**
1	**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		**Mass ,Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,	
2	**Sign and symbol Trade Related** Drawing simple electrical circuits using electrical symbols Drawing sine and triangular wave Diagram of battery Charging circuit		**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.	
3	**Electronic Circuits** UJT, FET, MOSFET, DIAC, TRIC, SCR, IGBT symbols and circuits o SCR using UJT triggering, snubber circuit, light dimmer circuit using TRIAC, symbols symbols of Logic gates			
4	Reading of Electrical diagrams		**Friction:** Laws of friction ,co efficient of friction,Lubrication. specific gravity of metals.	
5	Drawing the schematic Diagram of Aircraft power generation and distribution Drawing the schematic diagrams of AC motors with DOL Srater and Star Delta Starters Sequencial control of three motors Layout arrangement of DC machine(Motor/generator) onboard Aircraft.		**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. **Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding height and distance by trigonometry.	

7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

A. Block –I

Basic Training

Week No.	Professional Skills	Professional Knowledge
1	Demonstration on elementary first aid. Artificial Respiration. Practice on use of fire extinguishers. **Occupational Safety & Health** Health, Safety and Environment guidelines, Basic safety introduction, Personal protective Equipment(PPE):- 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.	**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. 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	Familiarization with signs and symbols of Electrical accessories. • Demonstration of Trade hand tools. Identification of simple types- screws, nuts & bolts, chassis, clamps, rivets etc. Use, care & maintenance of various hand tools. Familiarization with signs and symbols of Electrical accessories. • Practice in using cutting pliers, screw drivers etc. skinning the cables, and joint practice on single strand.	Fundamental of electricity: Identification of Trade-Hand tools-Specifications Electron theory- free electron, Fundamental terms- Current, Voltage definitions, AC, DC, Phase, Neutral, Earth. Units & effects of electric current.
3	Skinning the cables Demonstration & Practice on bare conductors joints--such as pig tail , 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.	Solders, 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 & co axial Cables-insulation & voltage grades- Low , medium voltage.Selection of cable as per voltage and current rating.

4	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. Concept three-phase Star and Delta connection. power in a 3 phase circuits with balanced and unbalanced load.	**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.
5	Grouping of Dry cells for a specified voltage and current, Ni cadmium & Lithium cell. Practice on Battery Charging, Preparation of battery charging, Testing of cells, Installation of batteries, Routine care & maintenance of Batteries Lead acid and Nickel Cadmium batteries, composition of electrolytes and plates. Effect of temp. on specific gravity and resistivity of electrolytes. Charging of a Lead acid cell, filling of electrolytes- Testing of charging checking of discharged and fully charged battery, capacity test of the battery. Precautions during charging and mixing & neutralization of electrolytes common battery defects and their rectification	**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, Ni-cadmium, fuel cell & Lithium cell, Cathodic protection. Electroplating, Anodising. Rechargeable dry cell, description advantages and disadvantages. Grouping of cells of specified voltage & current, Sealed Maintenance free Batteries, Solar cell/panel. Nickel Alkali Cell-description charging. Power & capacity of cells.
6	• Marking use of chisels and hacksaw on flats, sheet metal filing practice, filing true to line. Sawing and planning practice. Practice in using firmer chisel and preparing simple half lap joint. • Drilling practice in hand drilling & power drilling machines. Grinding of drill bits. Practice in using taps & dies, threading hexagonal & square nuts etc. cutting external threads on stud and on pipes, riveting practice. • Practice in using snips, marking & cutting of straight & curved pieces in sheet metals.	Introduction of fitting trade. Safety precautions to be observed Description of files, hammers, chisels hacksaw frames & blades-their specification & grades. Care & maintenance of steel rule try square and files. Marking tools description & use. Description of carpenter's common hand tools such as saws planes, chisels mallet claw hammer, marking, dividing & holding tools-their care and maintenance. Types of drills description & drilling machines, proper use, care and

	Bending the edges of sheets metals. Riveting practice in sheet metal. Practice in making different joints in sheet metal in soldering the joints. • Use of different bench tools used by sheet metal worker. Soldering materials, fluxes and process	maintenance. Description of taps & dies, types in rivets & riveted joints. Use of thread gauge.
7	**Practice on Bonding**- screening, different methods of bonding- screening. Measurement of Bonding resistance by earth tester. Testing of Earth Leakage by ELCB and relay. • Trace the magnetic field. Assembly / winding of a simple electro magnet. Use of magnetic compass. Identification of different types of Capacitors. Charging and discharging of capacitor, Testing of Capacitors using DC voltage and lamp	**Bonding and screening**- Principle of different methods of bonding - screening Importance of bonding Improving of metal sheet resistance Earth Leakage circuit breaker (ELCB). **Magnetism** Classification of magnets, Types of magnetic materials. Principle of electro-magnetism, Maxwell's corkscrew rule, Fleming's left and right hand rules, Magnetic field of current carrying conductors, MMF, Flux density, reluctance. B.H. curve, Hysteresis, Eddy current. Principle of electro-magnetic Induction, Faraday's Law, Lenz's Law. Electrostatics: Capacitor- Different types, functions and uses.
8	• Fix the wiring accessories. • Practice in casing, Capping. Conduit wiring with minimum to more number of points. Use of two way switches Testing of wiring installation by meggar. -Fixing of calling bells/buzzers. -Making of test boards & extension boards Identification & demonstration on conduits and accessories & their uses, cutting , threading & laying Installation, Testing, Maintenance and Repairing of wiring. Application of fuses, relay, MCB, ELCB.	**Electric wirings**, CEA 2010 rules. Developments of domestic circuits, Alarm & switches, with individual switches, Two way switch, Fire alarm, MCB, ELCB, MCCB Types of wirings both domestic and industrial. Grading of cables and current ratings. Principle of laying out in domestic wiring. Voltage drop concept. **Wiring system -** P.V.C., concealed system. Maintenance and Repairing data sheet preparation. Specifications, standards for conduits and accessories - Power Wiring, Control Wiring - Information Communication - Entertainment Wiring. Testing of wiring installation by meggar
9	Identification of the parts of a D.C. machine. Connection of shunt Generators Voltages build up in DC Shunt Generator (OCC) Measurement of voltages, Demonstration on field excitation. Connection of compound Generator, Voltage	**D.C. Machines -** General concept of Electrical Machines. **Principle of D.C. generator.** Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring Brushes, Laminated core.

	measurement, cumulative and differential –No Load and Load characteristics of Series, Shunt and Compound Generator. Controlling and protecting DC Generator. Practicing dismantling and assembling in D.C. Machine.	Explanation of **D.C. Generators**-types, parts. **E.M.F**. equation-self excitation and separately excited Generators-Practical uses. Explanation of Armature reaction, inter poles and their uses, connection of inter poles, Commutation, Parallel Operation of D.C.Generator. Application of D.C. generators. Care, Routine & preventive maintenance.
10	Identification of parts and terminals of DC motors. Connection, starting, running of DC motors using Starters. Characteristics curve of DC motors. Practical application of D.C. motors. Speed control of DC motors by voltage , field, armature & Word-Leonard system	**DC Motors –** Terms used in D.C. motor-Torque, Brake Torque, speed, Back-e.m.f. etc. and their relations, Types of D.C.Motor. Starters used in D.C. motors Characteristics of D.C.Motor, Application of D.C. motors. Care, Routine & preventive maintenance Types of speed control of DC motors in industry. Control system. AC-DC, DC-DC control.
11	Identification of types of transformers. Connection of transformers, Transformation ratio, OC (No-load) and SC (short circuit) tests, testing of transformer, parallel operation 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. Single and three phase connection.	Working principle of **Transformer**. classification C.T., P.T. Instrument and Auto Transformer(Variac), Construction, Single phase and Poly phase. E.M.F. equation, parallel operation of transformer, their connections. Type of Cooling for transformer. Specifications, simple problems on e.m.f. Equation, turn ratio, Transformer –Classification of transformer. 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.
12	• Identify the type of Instruments. Use of **-P**MMC , MI meter, Multi-meter(Digital/Analog) , Wattmeter, P F meter, Energy meter, Frequency meter, Calibration of **-** Multi-meter Phase sequence meter, Digital Instruments, etc Calibration of Energy meter	**Electrical Measuring Instruments -** -types, indicating types. Deflecting torque, Controlling torque and Damping torque , 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.
13.		
	Internal Assessment 03days	

B. Block –II
Basic Training

Week No.	Professional Skills	Professional Knowledge
1.	• Identification of parts and terminals of AC motors. • Connection, starting, running of AC motors using Starters. • Measurement of slip, P.F. at various loads. Practice on connection of D.O.L Starter, Star /Delta starter, Autotransformer starter, Rotor resistance starter, etc • Speed control of Induction motors by various methods. • Connection of single phase motor, identification, testing, running and reversing • Identification, connection, testing, running and reversing of universal motor. Repulsion motor, stepper motor.	**AC Motors** **(i)Three phase Induction motor** – Working principle –Production of rotating magnetic field, Squirrel Cage Induction motor, Slip-ring induction motor. Construction , characteristics and Speed control, Slip &Torque . Control & Power circuit of starters D.O.L Starter, Star /Delta starter, Autotransformer starter, Rotor resistance starter, etc Single phasing preventer. Application of Induction Motor Care, Routine & preventive maintenance. **(ii)Single phase 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, Hysteresis motor, Reluctance motor, universal motor ant its applications. Fault Location and Rectification.
2	Identification of parts and terminals of Synchronous motor. Connection, starting, running of Synchronous motor. Plot V curve. Practical application of Synchronous motor. Starting, running, building up voltage and loading of Motor Generator (MG) set. Maintenance of MG Sets. Solid state controller and Invertors- Operation and Use Identification of parts and terminals of **brush less** Alternator. Connection, starting, running of **Brushless** Alternator. Practical application of **Brushless** Alternator. Practice on alternators, voltage Building, load characteristic, voltage regulation and Parallel	**SYNCHRONOUS MOTOR & ALTERNATOR-** Working principle, effect of change of excitation and load.V curve. Method of power factor improvement. Rotary Converter- Inverter, M.G. Set description, Characteristics, specifications-running and Maintenance. Solid state controller and Invertor Explanation of alternator, types of prime mover, efficiency, regulations, phase sequence, Parallel operation. Specification of alternators and Brushless alternator. Verify the effect of changing the field excitation and Power factor correction of Industrial load.

	operation. Practice on installation, running and maintenance of Alternators -Merge price protection -Voltage regulations	
3	**Diodes**-symbol - Tests - Construct & Test Half wave rectifier ckt. Full wave rectifier ckt. Bridge 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. Operation, maintenance & troubleshooting of inverter, Voltage stabilizer, DC regulated power supply, UPS, etc Simple circuits containing U.J.T. for triggering, FET as an amplifier and Power control circuits by S.C.R. and Diac, triac, I.G.B.T	**Basic electronics**- Semiconductor energy level, atomic structure 'P' type and 'N' type. Type of materials –P-N-junction. Classification of Diodes – Reverse and Forward Bias, Heat sink. Specification of Diode PIV rating. Explanation and importance of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit. Filter circuits-passive filter. Working principle and uses of an oscilloscope. Types of transistors & its application. Specification and rating of transistors. Basic concept of power electronics devices e.g. S.C.R., Diac, Triac, power MOSFET, G.T.O and I.G.B.T. **Digital Electronics** -Binary numbers, logic gates and combinational circuits
4	Prepare the block diagrams of each system with the working of each block.	Basics of aircraft General Systems such as hydraulic system,fuel system,brake system,Heating System,Air conditioning system,pressurizing system,oxygen system,fire detection and control system etc
5	**Standard practices in avionics** operation and maintenance of air craft Fuel tank safety system	**DGQA regulations** for maintenance of Air craft Air craft maintenance manual(AMM) Air craft schematic manual(ASM) Electrical standard practice manual(ESPM)
6	**Electrical Power Distribution System** Test and construct Inverter Test and construct transformer rectifier	Priniciple of operation of static inverters ,rotator invertors and transformer rectifier units of Electrical Power Distribution System
7	Basics of Engines of the air craft Operation and maintenance of air craft engine controls Operation and maintenance of air craft General systems	**Air craft Engine Basics** Principle of operation and controls of Air craft engines Starting of engines Principle of operation of Air craft general systems

8	knowledge of aircraft general systems maintenance practices Study on Electro static sensitive devices(ESD) Study on EMI/EMC effects Study GPS system of the air craft Use of the following: synchro system components- resolvers, differential , control and torque, transformers, inductance and capacitance transmitters. Defect rectification and maintenance of servo mechanism Reversal of synchro leads, hunting	**Servo-Control System** Principle of operation and construction of saturable reactors and magnetic amplifiers and phase sensitive amplifiers Principle of operation and construction of servo motors and rate of generators , system response to displacement (position) and rate (velocity)command signals and rate feedback signals and methods of damping , trouble shooting of servomechanism. Open and closed loop servo mechanism
9	Draw functional diagram of basic air frame systems	**Basic airframe-** Air craft system basics,Block diagram , different components involved in the systems and their functions
10-12	Operation and ,maintenance of electrical power generation and distribution system Operation and ,maintenance of various electrical sensors fitted in generator control and protection systems Operation and ,maintenance of sensors fitted in aircrafts systems Trouble shooting of the electrical generation systems. Test and operate voltage regulation system	**Electrical power generation and utilization on board aircraft** **Generation** Different type of generators Generator controls Generator protection Generator indications **Distribution of power** Different power system onboard aircraft AC/DC power systems Their control and indications Flight control system fly by wire
13.		
	Internal Assessment 03 days	

7.1.3 EMPLOYABILITY SKILLS

GENERAL INFORMATION

1)	**Name of the subject**	**:**	**EMPLOYABILITY SKILLS**
2)	**Applicability**	**:**	ATS- Mandatory for fresher only
3)	**Hours of Instruction**	**:**	**110 Hrs. (55 hrs. in each block)**
4)	**Examination**	**:**	The examination will be held at the end of two years Training by NCVT.
5)	**Instructor Qualification**	**:**	

i) MBA/BBA with two years experience or graduate in sociology/social welfare/Economics with two years experience and trained in Employability skill from DGET Institute.

And

Must have studied in English/Communication Skill and Basic Computer at 12th /diploma level

OR

ii) Existing Social Study Instructor duly trained in Employability Skill from DGET Institute.

7.1.3.1 SYLLABUS OF EMPLOYABILITY SKILLS

A. Block – I
Basic Training

Topic No.	Topic	Duration (in hours)
	English Literacy	**15**
1	**Pronunciation :** Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
2	**Functional Grammar** Transformation of sentences, Voice change, Change of tense, Spellings.	
3	**Reading** Reading and understanding simple sentences about self, work and environment	
4	**Writing** Construction of simple sentences Writing simple English	
5	**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.	
	I.T. Literacy	**15**
1	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2	**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.	
3	**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	
4	**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.	
	Communication Skill	**25**
1	**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. Case study/Exercise	
2	**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.	
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. Case study/Exercise	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
5	**Behavioral Skills** Organizational Behavior Problem Solving Confidence Building Attitude Decision making Case study/Exercise	

B. Block– II
Basic Training

Topic No.	Topic	Duration (in hours)
	Entrepreneurship skill	**15**
1	**Concept of Entrepreneurship** **Entrepreneurship**- 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.	
2	**Project Preparation & Marketing analysis** Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of Product Life Cycle (PLC), Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.	
3	**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.	
4	**Investment Procurement** Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
	Productivity	**10**
1	**Productivity** Definition, Necessity, Meaning of GDP.	
2	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3	**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.	
4	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**15**
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 and safety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	**Basic Provisions** Idea of basic provision legislation of India. of safety, health, welfare under legislation of India.	
6	**Ecosystem** Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	**Pollution** Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	**Energy Conservation** Conservation of Energy, re-use and recycle.	
9	**Global warming** Global warming, climate change and Ozone layer depletion.	
10	**Ground Water** Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	**Environment** Right attitude towards environment, Maintenance of in -house environment	
	Labour Welfare Legislation	**5**
1	**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.	
	Quality Tools	**10**
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	**Quality Management System :** Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
4	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
5	**Quality Tools** Basic quality tools with a few examples	

7.2 PRACTICAL TRAINING (ON-JOB TRAINING)
(BLOCK – I & II)
DURATION: 18 MONTHS (9 months in each block)

GENERAL INFORMATION

1) **Name of the Trade** : **ELECTRICIAN AIRCRAFT**
2) **Duration of On-Job Training** : As per Apprenticeship Act amended time to time.
3) **Batch size** : 20
4) **Examination** : i) The internal assessment will be held on completion of each block
   ii) NCVT exam will be conducted at the end of 2nd year.
5) **Instructor Qualification** :

i) Degree/Diploma in EEE/ECE/EIE Engg. from recognized university/Board With one/two year post qualification experience in the relevant field.

OR

ii) NTC/NAC in the trade of Electrician with three year post qualification experience in the relevant field.
Preference will be given to a candidate with Craft Instructor Certificate (CIC)

6) **Tools, Equipments & Machinery required** : - As per Annexure – II

7.2.1 BROAD SKILL COMPONENT TO BE COVERED DURING ON-JOB TRAINING

A. BLOCK – I

Safety and best practices (5S, KAIZEN etc.)

DURATION: 09 MONTHS (39 WEEKS)	
SL NO	**LIST OF OPERATIONS/SKILLS TO BE COVERED DURING INDUSTRIAL TRAINING**
1	Observe & practice safety in all industry works. Practice providing First Aid/Artificial respiration. Safe operational procedures for breakdown/preventive maintenance.
2	Carryout chipping, filing, grinding, hack sawing, fitting & carpentry jobs. Drill and tap hole. Cutting and riveting practice. Making single and double rectangular boards observing suitable care & safety.
3	Removing of insulation from assorted wires and cables. Check the gauges of wire & select suitable wires for the required current rating.
4	Practice wire joints & providing cable glands. Soldering practice observing suitable care & safety.
5	Prepare, cable glanding, crimp, terminate and test various power / instrumentation cables used in industries
6	Test, connect with devices, start and control and reverse the direction of rotation of DC motors.
7	Read and understand electrical (Single line diagrams& MCC Panel wiring) & circuits and drawings. Wiring Practice: Repair / replace switches, sockets, light points.
8	Preparation, Charging & maintenance of Batteries. Checking specific gravity, voltage etc
9	Applications of electrical measuring instruments. Finding faults and trouble shoot calibrate, connect common electrical measuring instruments, Continuity Testers, meggers, earth resistance testers and multi meters
10	Test basic electrical(MCBs, push buttons, relay, contactors)/electronic components (diodes, transistors, capacitors, coils, resistors etc.) using proper measuring instruments
11	Configure Trouble shooting rectifiers, filters, power supplies, voltage stabilizers, controlled rectifiers. Identifying faulty thyristors in circuits, replacing them
12	Testing the condition of transformer with multimeter and megger
13	Attending to minor faults in machines, their controls panel & appliances.
14	Carryout various tests like continuity test, insulation test on the cables. bonding and loop testing

B. BLOCK – II

Safety and best practices (5S, KAIZEN etc.)

DURATION: 09 MONTHS (39 WEEKS)	
SL NO	**LIST OF OPERATIONS/SKILLS TO BE COVERED DURING INDUSTRIAL TRAINING**
1	Basic principles of flight. Introduction to Aircraft- its types, systems, terminology.
2	Familiarization With Aviation Rules And Regulations As Applicable To The System
3	Test, connect with devices, start and control and reverse the direction of rotation of AC motors.Install, test and setup Alternator and Generator set.
4	Demonstrate and apply the principles of basic flight instrument – types
5	Demonstrate and apply the principles of Pneumatic and Electrical Instruments/sensors and their related use on aircraft
6	Demonstrate and apply the principles of maintenance of onboard electrical illumination system
7	Carryout testing and maintenance of Engine control system onboard aircraft as per maintenance manual
8	Installation of harness and repair on aircraft and engines
9	Carryout testing and maintenance of servo system onboard aircraft as per maintenance manual
10	Carryout wiring repairs onboard aircrafts (single core, multicore, screen, bar cables, antenna cables, RF cables). Crimping of cables with different pins/lugs/connectors/inline connectors etc
11	Carryout Discharging of the battery, cell balancing, capacity test, charging etc
12	Carryout testing maintenance of electrical breaking/hydraulic breaking onboard aircraft as per maintenance manual
13	Carryout testing and maintenance of static and rotary invertors onboard aircraft as per maintenance manual
14	Maintenance of different parameter field sensors and display of various system parameters in cockpit. Integrated display of parameters on CRT/LCD/LED displays on aircraft

8. ASSESSMENT STANDARD

8.1 Assessment Guideline:

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration to be given while assessing for team work, avoidance/reduction of scrape/wastage and disposal of scarp/wastage as per procedure, behavioral attitude and regularity in training.

The following marking pattern to be adopted while assessing:

a) Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For 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.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- many tolerances while undertaking different work are in line with those demanded by the component/job.
- 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 under following performance level:

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.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- the majority of tolerances while undertaking different work are in line with those demanded by the component/job.
- 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 under following performance level:

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.

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- tolerances while undertaking different work being substantially in line with those demanded by the component/job.
- a high level of neatness and consistency in the finish.
- minimal or no support in completing the project

8.2 FINAL ASSESSMENT- ALL INDIA TRADE TEST (SUMMATIVE ASSESSMENT)

SUBJECTS	Marks	Sessional Marks	Full Marks	Pass Marks	Duration of Exam.
Practical	300	100	400	240	**08 hrs.**
Trade Theory	100	20	120	48	3 hrs.
Workshop Cal. & Sc.	50	10	60	24	3 hrs.
Engineering Drawing	50	20	70	28	4 hrs.
Employability Skill	50		50	17	2 hrs.
Grand Total	**550**	**150**	**700**	**-**	

Note: - The candidate pass in each subject conducted under all India trade test

9. FURTHER LEARNING PATHWAYS

Employment opportunities:

On successful completion of this course, the candidates shall be gainfully Employed in the following industries:

1. Defence organisations.
2. MRO workshops of aircrafts
3. In public sector industries and private industries in India & abroad.

ANNEXURE – I

TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: ELECTRICIAN AIRCRAFT

LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity
1	Steel tape, 3 mt length	21 nos.
2	Plier insulated, 150mm	21 nos.
3	Plier side cutting 150mm	21 nos.
4	Nose plier, 150mm	21 nos.
5	Screw driver, 150 mm	21 nos.
6	Electrician connector screwdriver, insulated handle thin stem, 100mm	21 nos.
7	Heavy duty screwdriver, 200mm	21 nos.
8	Electrician Screwdriver, thin stem, insulated handle, 250mm	21 nos.
9	Punch centre, 150mmX9mm	21 nos.
10	Electrician knife, 50 mm blade	21 nos.
11	Neon tester	21 nos.
12	Steel rule, 300mm	21 nos.
13	Hammer, Cross peen with handle, 250 gm	21 nos.
14	Hammer, ball peen with handle, 750gm	21 nos.
15	Gimlet, 6mm	21 nos.
16	Bradawl, 150mm x 6mm	21 nos.
17	Pincer, 150 mm	21 nos.
18	Scriber (knurled centre position)	21 nos.
19	Digital multimeter	21 nos.

B : TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sl. No.	Name of the items	Quantity (Indicative)
1	C- clamp, 100mm, 150mm, 200mm	2 Nos. each
2	Adjustable spanner, 150mm, 300mm	2 Nos. each
3	Blow lamp, 0.5 ltr	1
4	Melting pot	1
5	Ladel	1
6	Chisel cold firmer, 25mm x 200 mm	2
7	Chisel 25mm & 6 mm	2 Nos. each
8	Hand drill machine	2
9	Portable electric drill machine, 12 mm capacity	1
10	Pillar Electric Drill machine, 12 mm capacity	1
11	Allen key set	2 sets
12	Oil can 0.12 ltr	1
13	Grease gun	1
14	Out side Micrometer	2
15	Motorised Bench grinder	1
16	Rawl plug tool & bit	2 sets
17	Pulley puller	2
18	*Rachets	2
18	Bearing puller	2
19	Pipe vice	2
20	Thermo meter 0-100 deg C	1
21	Scissors blade 150mm	2
22	*Inserter and extraction tool	2
22	Crimping tool	2 sets
23	Wire stripper 20 Cm	2
24	Chissel cold flat 12mm	2
25	Mallet hard wood 0.5Kg	2
26	Mallet hard wood 1 Kg	2
27	Hammer extractor type, 0.4 Kg	2
28	Hacksaw frame, 200mm & 300mm adjustable	2 each
29	Try square, 150 mm blade	2
30	Outside & inside divider caliper	2 each
31	Pliers flat nose 150mm	4
32	Pliers round nose, 100 mm	4
33	Tweezers, 100mm	4
34	Snip straight & bent, 150mm	2 each
35	Double ended spanner set metric	2 sets
36	HSS drill bit set(2-12mm)	4 sets

37	Plane, smoothing cutters 50mm	2
38	Gauge, wire imperial	2
39	File, flat 200mm 2nd cut	8
40	File half round 200 mm 2nd cut	4
41	File round 200mm 2nd cut	4
42	File flat 150mm rough	4
43	File flat 250mm bastard	4
44	File flat 250mm smooth	4
45	File Rasp half round 200 mm bastard	4
46	Soldering iron, 25 W, 65 W	2 each
47	Copper bit soldering iron 0.25 kg	2
48	Desoldering gun	4
49	Hand vice 50mm jaw	4
50	Bench vice 100mm jaw	6
51	Pipe cutter to cut pipes upto 5cm dia	2
52	Stock & die set for 20mm to 50 mm GI pipe	1
53	Stock & dies conduit	1
54	Ohm meter; series & shunt type	2 each
55	Multimeter (analog), 0-1000 M ohm, 2.5 to 500V	2
56	Digital Multimeter	4
57	AC voltmeter MI 0-500V	2
58	Milli Voltmeter centre zero 100-0-100 mV	1
59	DC milli Ammeter 0-500 mA	1
60	Ammeter MC 0-5A, 0-25A	1 each
61	AC Ammeter MI 0-5A, 0-25A	1 each
62	KiloWatt meter 0-1-3 KW	1
63	AC Energy meter, single phase 5A, 3 ph 15 A	1 each
64	Power factor meter, single phase	1
65	Frequency meter	1
67	DC power supply 0-30V, 2 Amp	2
68	Rheostats 0-1 ohm 5A, 0-10 ohm 5A, 0-25 ohm 1A, 0-300 ohm 1A	1 each
69	Digital Tachometer	1
70	Growler	1
71	Tong tester / clamp meter 0-100 A AC	1
72	Meggar 500V	1
73	Battery charger	1
74	Battery capacity testing kit	1
73	Oscilloscope dual trace, 30 MHz	1
74	Function Generator	1
75	Hygrometer	1
76	Lux meter	1
77	Hydro meter	1

78	Current transformer, 415 V, 50 Hz , CT Ratio 10/5A,	1
79	Potential Transformer, 415/110 V	1
80	Wood Saw, 250 mm	1
81	Tenon Saw	1
82	Guarded Test Lamp	1

C : GENERAL MACHINERY INSTALLATIONS:-

Sl. No.	Name of the items	Quantity
1	Voltage Stabilizer, input 15-230 V AC, Output 220 V AC	1
2	3 point DC starter	1
3	4 point DC starter	1
4	Electrical Machine Trainer: suitable for demonstrating the construction & functioning of different types of DC machines & AC machines (single phase & 3 phase). Should be fitted with brake arrangement, Dynamometer, Instrument panel & power supply unit	1
5	Motor generator (AC to DC): consisting of : Squirrel cage induction motor with star delta starter & directly coupled to DC shunt generator & switch board mounted with regulator, air breaker, ammeter, voltmeter, knife blade switches & fuses, set complete with case iron & plate, fixing bolts, foundation bolts & flexible coupling. Induction motor rating: 5 KW, 400V, 50 Hz, 3 ph. DC shunt generator rating: 3.5 KW, 220V	1 set
6	Used DC generators – series, shunt & compound type, (for overhauling practice)	1 each
7	DC shunt motor 2 – 2.5 KW, 220V	1
8	DC series motor coupled with mechanical load, 2 KW, 220V	1
9	DC compound motor with starter & switch, 2.5 KW, 220V,	1
10	Single phase Transformer, core type, air cooled, 1 KVA, 240/415 V, 50Hz	3
11	3 phase transformer, shell type, oil cooled with all mounting, 3 KVA, 415/240V, 50 Hz (Delta /Star)	2
12	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
13	Motor generator (DC to AC) set consisting of Shunt motor with starting compensator & switch directly coupled to AC	1 set

	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	
14	AC squirrel cage induction motor with star delta starter & triple pole Iron clad switch fuse. 2 to 3 HP, 3 ph, 400V, 50 Hz	1
15	AC 3 ph wound slipring motor with starter & switch, 5 HP, 400V, 50 Hz	1
17	Single phase capacitor motor with starter switch, 1 HP, 230 V, 50 Hz	1
18	Universal motor with starter / switch, 230 V, ¼ HP, 50 Hz	1
19	Stepper Motor with digital controller,	1
20	Shaded pole motor,	1
21	3 ph Synchronous motor, 3 HP, 415 V, 50 Hz, 4 pole, with accessories	1
22	Inverter, 1 KVA with 12 V battery, input 12 V DC, Output 220V AC	1
23	Thyristor /IGBT controlled DC motor Drive, with tachogenerator feed back arrangement, 1 HP	1 set
24	Thyristor / IGBT controlled AC motor Drive with VVVF control, 3 ph, 2 HP,	1 set
25	Battery charger	1
26	1 Ph variable Auto Transformer	1
27	Load bank, 5 KW. lamp / heater type	1
28	Brake test arrangement with 2 spring balance, 0 to 25 Kg rating	1
29	Discreet component trainer	2
30	Oil testing kit	1

Note: In case of basic training setup by the industry the tools, equipment and machinery available in the industry may also be used for imparting basic training.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: ELECTRICIAN AIRCRAFT

LIST OF TOOLS& EQUIPMENTS FOR 20 APPRENTICES

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

2) Infrastructure:

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Draughtsman drawing instrument box	20
2.	Set square celluloid 45^0 (250 X 1.5 mm)	20
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	20
4.	Mini drafter	20
5.	Drawing board (700mm x500 mm) IS: 1444	20.

B : FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
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

ANNEXURE – II

INFRASTRUCTURE FOR ON-JOB TRAINING

TRADE: ELECTRICIAN AIRCRAFT

For Batch of 20 APPRENTICES

Actual training will depend on the existing facilities available in the establishments. However, the industry should ensure that the broad skills defined against On-Job Training part (i.e. 9 months + 9 months) are imparted. In case of any short fall the concern industry may impart the training in cluster mode/ any other industry/ at ITI.

ANNEXURE-III

GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

1. Due care to be taken for proper & inclusive delivery among the batch. Some of the following some method of delivery may be adopted:

A) LECTURE
B) LESSON
C) DEMONSTRATION
D) PRACTICE
E) GROUP DISCUSSION
F) DISCUSSION WITH PEER GROUP
G) PROJECT WORK
H) INDUSTRIAL VISIT

2. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. may be adopted.

3. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.