CURRICULUM

FOR THE TRADE OF

MECHANIC RADIO RADAR AIRCRAFT

UNDER

APPRENTICESHIP TRAINING SCHEME

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

CONTENTS

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8. Scientech Technologies P. Ltd., Hyderabad
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Co-ordinator for the course: Shri L.K.Mukherjee, DDT & Shri P. G. Rajendran, ADT

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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 have been taken.

2.3 **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 Mechanic Radio Radar 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 play 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 Radio Radar Technician needs to be completely focused on safety as the casual attitude can pose a danger to the lives of people on board.

The technician will get it certify from aircraft engineer to declare the aircraft fit in communication and navigation 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 procedures for covering maintenance, repair, trouble shooting and overhauling of communication and navigational equipments, in addition to performing inspection and modification on an aircraft.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

Electronics Fitter, General fits, assembles and repairs various kinds of electronic equipment in factory or workshop or at place of use. Examines drawings and wiring diagrams; checks parts for accuracy of fit and minor adjustments; assembles parts or mounts them on chassis or panels with aid of hand tools; installs and connects wiring, soldering joints equipment, diagnoses faults with aid of electronic testing equipment; dismantles equipment if required and replaces faulty parts or wiring.

Electronics Mechanic; Electronic Equipment Mechanic repairs electronic equipment, such as computers, industrial controls, radar systems, transmitters and tele-metering control systems following blueprints and manufacturer's specifications and using hand tools and test instruments. Tests faulty equipment and applies knowledge of functional operation of electronic units and systems to diagnose cause of malfunction. Tests electronic components and circuits to locate defects, using instruments, such as oscilloscopes, signal generators, ammeters and voltmeters. Replaces defective components and wiring and adjusts mechanical parts, using hand tools and soldering iron. Aligns, adjusts and calibrates testing instruments. Maintains records of repairs, calibrations and test. May install equipment in industrial or military establishments and in aircraft.

Radio Craftsman, Installation; Radio Mechanic Installation (Aircraft) installs, tests and repairs aircraft radio equipment during test flights. Studies circuit diagrams, drawings and other specifications for installation of radio equipment in aircraft. Tests and replaces defective radio instruments, components and parts such as radio compass, maker, beacon receptor, radio tubes, transformer etc. using hand tools and electrical measuring instruments. Installs radio equipment in aircraft as specified and solders or tightens loose and broken connections. Operates and tests equipment during tests flights for output, audio quality, frequency, calibration etc. and does necessary repairs and adjustments to ensure efficient performance. Signals ground station and adjusts frequencies of radio sets by turning sets screws. May check batteries and keep them fully charged. May service battery charging set and generator. May conduct maintenance repairs of radio equip ment.

Radio Craftsman, Maintenance, Radio Mechanic Maintenace (Aircraft) tests, repairs, services and maintains aircraft radio receiving and transmitting sets in accordance with diagrams and prescribed specifications using hand tools and electrical measuring instruments. Examines equipment for damaged components and loose or broken connection and wires. Tests and replaces defective radio components etc. using appropriate tools. Makes necessary electrical connections according to diagrams and solders or tightens loose ones. Tests equipment for factors such as power output, frequency power, looseness of antennas and transmission lines, noise level, audio frequency and watt meters, ammeters, voltmeter, tube testers and other appropriate instruments, adjust receivers for sensitivity and transmitters for maximum output. Tests batteries with hydrometers, ammeter, etc., and maintains them fully charged. Performs scheduled test checks of radio equipment during test flights to ensure airworthiness of aircraft. Removes radio instruments and components for bench-checks, servicing, calibrating and over hauling of radio apparatus as and when necessary. May effect alternations and modifications to radio equipment under guidance of Radio Engineer, Telecommunication.

Radar Mechanic; Radar Craftsman install, services and overhauls radar units. Studies diagrams and manufacturer's specification and installs radar transmitting and receiving equipment. Tests equipment for continuity, frequency, performance, etc., detects faults by application of knowledge of functional operation of electronic units and systems and removes defects by replacing defective parts, soldering or tightening loose and broken connections, using oscilloscopes, signal generators, wave meters, pulse modulators, echolox, avometer, megger and other instruments and hand tools. Aligns, adjusts and calibrates equipment according to specifications. Operates and flight checks radar equipment on aircraft and makes necessary repairs and adjustments to ensure desired efficiency. May operate and repair other electronic and missile control systems. 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.

Reference NCO: 7243.75, 7243.80, 7243.10, 7243.20, 7242.10

5. GENERAL INFORMATION

1. **Name of the Trade** : **MECHANIC RADIO RADAR AIRCRAFT**

2. **N.C.O. Code No.** : 7243.75, 7243.80, 7243.10, 7243.20, 7242.10

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 or its equivalent

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

6**. Rebate to ITI Passed out Trainees :** i)**One year** in the trade of Electronics Mechanic/ Mechanic Consumer Electronic Appliances/ Technician Power Electronics Systems

ii) **One year** in the trade of Mechanic Industrial Electronics

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** : **MECHANIC RADIO RADAR AIRCRAFT**

2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)

3) **Batch size** : 20

4) **Power Norms** : 4.04. KW for Workshop

5) **Space Norms** : 56 Sq.m.

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

7) **Instructor Qualification** :

a) B.E./B. Tech in Electronics/Electornics & Telecommunication/Electronics & Communication with one year expreience in the relevent field.

OR

b) Diplome in Elctronics/Electronics & telecomunication/Electronics & Communication from recognized board of technical education with two years experience in the relevent field.

OR

c) NTC/NAC in the trade with three years' experience respective in the relevent field.

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,		**Square Root** : Square and Square Root, method of finding out square roots, Simple problem using calculator	

	Parallelogram. - Circle and its elements.			
4	**Lettering and Numbering** as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.		**Ratio &Proportion:** Simple calculation on related problems.	
5	**Free Hand sketch:** Hand tools and measuring instruments used in electronics mechanics trades		**Percentage:** Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	
6	**Free hand drawing :** - Lines, polygons, ellipse, etc. - Geometrical figures and blocks with dimension. - Transferring measurement from the given object to the free hand sketches.		**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.	

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, specific gravity of metals	
2	**Construction of Scales and diagonal scale**		**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	LED, IRLED, photo diode, photo transistor, opto- coupler symbols symbols of Logic gates.			
4	Half adder, full adder, multiplexer and de-multiplexer		**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	
5	UJT, FET, MOSFET, DIAC, TRIC, SCR, IGBT symbols and circuits of FET Amplifier, SCR using UJT triggering, snubber circuit, light dimmer circuit using TRIAC, UJT based free running oscillator.		**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.	Importance of trade training, List of tools & Machinery used in the trade. Health & Safety: Introduction to safety equipments and their uses. Introduction of first aid, operation of Electrical mains. **Occupational Safety & Health** **Importance of housekeeping & good shop floor practices.** Basic safety introduction. Personal protective Equipments(PPE):- Use of Fire extinguishers.	Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. **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 e.g.; power failure, fire, and system failure.
2.	**Hand Tools and their uses** • Demonstration and uses of hand tools- screw drivers, pliers, tweezers, tester, wire stripper, electrician knife, steel rule, scriber, punches, hack saw, hammer, files, bench vice and drilling machine. • Simple mechanical fixtures • Identification of types of screws, bolts, nuts, washers, rivets, clamps, connectors • Fix screws of different sizes on wooden boards • Cutting of wooden blocks using hand/hack saw • Simple fitting practice and drilling practice	Identification, specifications, uses and maintenance of commonly used hand tools.
3.	**Basics of AC and Electrical Cables** Identify the Phase, Neutral and Earth on power Socket. Use a Tester to monitor AC power.	Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC. Terms such as +ve cycle, -ve cycle, Frequency, Time period,

	Measure the voltage between phase and ground and rectify earthing. Identify and test different AC mains cables. Skin the electrical wires /cables using the wire stripper and cutter. Prepare the mains cable for termination.	RMS, Peak, P-P, Instantaneous value. Single phase and Three phase supply. Terms like Line and Phase voltage/ currents. Insulators, conductors and semiconductor properties. Different type of electrical cables and their Specifications. Types of wires & cables, standard wire gauge (SWG). Classification of cables according to gauge(core size), number of conductors, material, insulation strength, flexibility etc.
4.	**AC & DC measurements** • Identify the meter for measuring AC & DC parameters. • Use the multi meter to measure the various functions (AC V, DC V, DC I, AC I, R). • Identify the different controls on the CRO front panel and observe the function of each control. • Identify the different controls on the function generator front panel and observe the function of each control. • Connect the function generator to CRO and observe the different wave forms.	Introduction to electrical measuring instruments, Importance of meter, classification of meters, forces necessary to work a meter. MC and MI meter, range extension, need of calibration, characteristics of meters and errors in meters. Multi meter, use of meters in different circuits. Care and maintenance of meters. Use of CRO, Function generator, LCR meter
5.	**Soldering & De-soldering and switches** • Identify different types of soldering guns and practice soldering of different electronic active and passive components and IC bases on lug boards and PCBs. • Join the broken PCB track and test • Demonstrate soldering and de-soldering using soldering and de-soldering stations. • Identify and use SPST, SPDT, DPST, DPDT, tumbler, push button, toggle, piano switches used in electronic industries.	Different types of soldering guns, related to Temperature and wattages, types of tips. Solder materials and their grading. Use of flux and other materials. Selection of a soldering gun for specific requirement. Soldering and De-soldering stations and their specifications. Different switches and their specification, uses.
6 &7	**Passive Components** • Identify the different types of resistors	Ohm's law and its variables. Resistor-definition, types of resistors, their

	• Measure the resistor values using colour code and verify the reading by measuring in multi meter • Verify ohms law • Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter • Identify different inductors • Identify the different capacitors and measure capacitance of various capacitors using LCR meter • Dismantle and identify the different parts of a relay. • Connect a relay in a circuit and test for its working	construction & specific use, color-coding, power rating. Equivalent Resistance of series parallel circuits. Distribution of V & I in series parallel circuits. KVL& KCL with applications. Principles of induction, inductive reactance, Capacitance and Capacitive Reactance, Impedance. Types of capacitors, construction, specifications and applications. Dielectric constant. Significance of Series parallel connection of capacitors. Electromagnetic Relays, types, construction, specifications- coil voltage and contact current capacity.
8 to 10	**<u>Computer Hardware, OS, MS office Networking</u>** • Identification of various indicators, Connectors, ports on the computer cabinet • Identify drives and their capacity. • Identify various connectors and cables inside the cabinet & Identify connections to rear side and front panel of the cabinet • Identify various parts of the system unit and motherboard • Configuring and troubleshooting display problems • Practice various features of OS • Install a Printer driver software and test for print outs • Install MS office software • Explore different Menu/Tool/ Format/status bars of MS word and practice the options: Editing the text, saving the text, changing the font and size of text. • Prepare a power point presentation on any three known topics with various design features • Invoke excel sheet from MS WORD and vice versa	Basic blocks of a computer, Hardware and software, I/O devices, keyboard, types of mouse and their working, Different types of printers, their function and inter-connection and their advantages HDD, CDD, DVD. Various ports in the computer. POST Booting concept.

	• Identify the cables and network components. • Making UTP cross cables and testing, Making straight cables and testing, Making cable layout drawing	
11-12	**<u>Electronic circuit simulation software</u>** • Prepare simple digital and electronic circuits using the software • Simulate and test the prepared digital and analog circuits • Convert the prepared circuit into a layout diagram. • Explore various troubleshooting and fault finding resources provided in the simulation software.	Study the library components available in the circuit simulation software. Various resources of the software.
13	**Assessment / Examination (03 days)**	

B. Block –II
Basic Training

Week No.	Professional Skills	Professional Knowledge
1-2	**Basic Gates and combination circuits** • Identify different Logic Gates (AND, OR, NAND, NOR, X-OR, X-NOR, NOT ICs) by the number printed on them and draw I/O pin-out numbers. • Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. • Construct and verify the truth table of all the gates using NAND and NOR gates • Use digital IC tester to test the various digital ICs (TTL and CMOS) • Construct Half Adder/Full adder circuit and verify the truth table. • Construct the Adder cum Subtractor and verify the result	Introduction to Digital Electronics. Difference between analog and digital signals, Logic families and their comparison, Logic levels of TTL and CMOS. Number systems (Decimal, binary, octal, Hexadecimal) BCD code, ASCII code and code conversions. Logic Gates and their truth tables. Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders, 2-bit and four bit full adders. Magnitude comparators. Half adder, full adder ICs and their applications for implementing arithmetic operations
3-5	**Flip Flops and Counters** • Identify different Flip-Flop (ICs) by the number printed on them. • Verify the truth tables of Flip-Flop ICs (RS, D, T, JK, MSJK) by connecting switches and LEDs. • Construct and test a four bit asynchronous binary counter using 7493. • Construct and test synchronous Decade counter. • Identify and test common anode and common cathode seven segment LED display using multi meter. • Display the two digit count value on seven segment display using decoder/driver ICs. • Construct a shift register using RS/D/JK flip flop and verify the result. • Construct and test four bit SIPO register. • Construct and test four bit PIPO register	Introduction to Flip-Flop. S-R Latch, Gated S-R Latch, D- Latch. Flip-Flop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop, Master-Slave flip flops and Timing diagrams, Basic flip flop applications like data storage , data transfer and frequency division. Basics of Counters, types of counters, two bit and three bit Asynchronous binary counters and decade counters with the timing diagrams. Types of seven segment display, BCD display, BCD to decimal decoder. BCD to 7 segment display circuits,

	• Construct and test bidirectional shift registers.	
5-6	**Op – Amp & Timer 555 Applications:** • Use analog IC tester to test the various analog ICs • Construction and testing of various Op-Amp circuits Inverting, Non-inverting and Summing Amplifiers • Construct and test Differentiator and Integrator • Construct and test a zero crossing detector • Construct and test Instrumentation amplifier • Construct and test a Binary weighted and R-2R Ladder type Digital-to-Analog Converters. • Construct and test Astable timer circuit using IC 555. • Construct and test mono stable timer circuit using IC 555. • Construct and test VCO (V to F Converter) using IC 555. • Construct and test 555 timers as pulse width modulator.	Block diagram and Working of Op-Amp, importance, Ideal characteristics, advantages and applications. Schematic diagram of 741, symbol, Non inverting voltage amplifier, inverting voltage amplifier, summing amplifier, Comparator, zero cross detector, differentiator, integrator and instrumentation amplifier, other popular Op-Amps. Block diagram of 555, functional description w.r.t. different configurations of 555 such as mono stable, Astable and VCO operations for various application
7-9	**Microcontroller (8051)** • Identify various ICs & their functions on the given Microcontroller Kit • Identify the address range of RAM & ROM. • Write data into RAM & observe its volatility • Measure the crystal frequency, connect it to the controller. • Identify the port pins of the controller & configure the ports for Input & Output operation • Connect an input switch & control a lamp using necessary program • Demonstrate the initialization, load & turn on a LED with delay using Timer. • Demonstrate the use of a Timer as an Event counter to count external events.	Introduction to 8051 Microcontroller, architecture, pin details & the bus system. Function of different ICs used in the Microcontroller Kit. Differentiate microcontroller with microprocessor. Interfacing of memory to the microcontroller. Internal hardware resources of microcontroller. I/O port pin configuration. Different variants of 8051 & their resources. Register banks & their functioning. SFRs & their configuration for different applications. Utilization of on chip resources such as ADC. Availability of assembly software & complier for 8051. Application of microcontroller in domestic, consumer & industries.

	• Demonstrate entering of simple programs, execute & monitor the results	Comparative study of 8051 with 8052. Introduction to PIC Architecture.
10-12	**<u>Sensors ,Transducers and Applications</u>** • Identify sensors used in process industries such as RTDs, Temperature ICs, Thermocouples, proximity switches (inductive, capacitive and photo electric), load cells, strain gauge. LVDT by their appearance • Measure temperature of a lit fire using a Thermocouple and record the readings referring to data chart. • Measure temperature of a lit fire using RTD and record the readings referring to data chart. • Measure the strain of a given material using strain gauge • Measure the DC voltage of a LVDT • Detect different objectives using capacitive, inductive and photoelectric proximity sensors	Basics of passive and active transducers. Role, selection and characteristics. Working principles of RTD, PT-100 Thermocouple, Sensor voltage and current formats. Thermistors – salient features –operating range, composition, advantages and disadvantages. Thermocouples – basic principle – commonly used combinations, operating range, advantages and disadvantages. Strain gauges – principle, gauge factor, types of strain gauges. Load cell –definition, uses, working of strain gauge load cell Principle of operation of capacitive transducers,- advantages and disadvantages Principle of operation of inductive transducers,- advantages and disadvantages Principle of operation of LVDT-its advantages and disadvantages Proximity sensors – applications, working principles of eddy current , capacitive and inductive proximity sensors
13	**Assessment / Examination (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 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** : **MECHANIC RADIO RADAR AIRCRAFT**

2) **Batch size** : : a) Apprentice selection as per Apprenticeship Guidelines

b) Maximum 20 candidates in a group

3) **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.

4) **Instructor Qualification** :

a. B.E./B. Tech in Electronics/Electornics & Telecommunication/Electronics & Communication with one year expreience in the relevent field.

OR

b. Diplome in Elctronics/Electronics & telecomunication/Electronics & Communication from recognized board of technical education with two years experience in the relevent field.

OR

c. NTC/NAC in the trade with three years' experience respective in the relevent field.

5) **Infrastructure for On Job Training** : - As per Annexure – II

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

A. BLOCK – I

1. **Safety and best practices (5S, KAIZEN etc.)**
2. **Record keeping and documentation**
3. **Identification and testing of electronic components/devices**
4. **Repair & Maintenance work**

DURATION: 09 MONTHS (39 WEEKS)	
SL NO	**LIST OF OPERATIONS/SKILLS TO BE COVERED DURING INDUSTRIAL TRAINING**
1	Perform basic mechanical workshop operations using suitable tools for fitting riveting, drilling etc observing suitable care & safety.
2	Test various electrical/electronic components using proper measuring instruments
3	Configure, install, troubleshoot, upgrade, interconnect given computer system(s) and demonstrate &utilize application packages for different application.
4	Simulate and analyze the analog and digital circuits using Electronic simulator software
5	Assemble, test and repair the various analog circuits and apply this knowledge to troubleshoot AF amplifier of PA system, fan regulator, light dimmer circuit, display systems, digital clock, digital timer and event counter.
6	Assemble various electronic circuits using SMD components and test them using suitable test equipment and perform the repair work on the PCB tracks.
7	Prepare, crimp, terminate and test various cables used in different electronics industries
8	Demonstrate the proficiency in the constructional features of AM/FM communication receiver circuits and devices and trouble shoot them.

B. BLOCK – II

1. **Safety and best practices (5S, KAIZEN etc.)**
2. **Record keeping and documentation**
3. **Identification and testing of electronic components/devices**
4. **Repair & Maintenance work**

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	Basic introduction to Avionics Systems
4	Radio Communication – Basic concepts, demonstration of types of receivers, transmitters, communication equipment – Assembly methods, testing and repair procedures as per the manufacturer's instruction manual.
5	RADAR – Basic concepts, demonstration of types of RADARs, Transmitter Section, and Receiver Section, Processing Section and Antenna Section – Assembly methods, testing and repair procedures as per the manufacturer's instruction manual.
6	Navigation - Basic concepts, Assembly methods, testing and repair procedures as per the manufacturer's instruction manual.
7	Feeders & Antennas – Basic Principle of operation, location of antennas on aircraft, types of co-axial lines and wave guides as aerial feeder
8	Demonstration of testing with Advanced Measuring Equipment, ATE's
9	Interface, control, test and operation of aircraft installation and system maintenance.

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)

Marks Distribution

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

On successful completion of the course,

- The trainees will be employed in reputed Industries / Organizations.
- On successful completion of the course trainees can opt for Diploma course (lateral entry). {Applicable for candidates only who undergone ATS after CTS}

Employment opportunities:

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

1. Production & Manufacturing industries of aviation and navigational electronics equipments.
2. Defence organisations
3. In public sector industries like HAL, NAVAL DOCKYARD etc and private industries in India & abroad.

ANNEXURE – I

10. TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: MECHANIC RADIO RADAR AIRCRAFT
LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

A: TRAINEES TOOL KIT:-

Sl. No.	Names of the Items	Quantity (Indicative)
1.	Connecting screwdriver 100 mm	10 Nos.
2.	Neon tester 500 V.	6 Nos.
3.	Screw driver set (set of 5)	10 Nos.
4.	Insulated combination pliers 150 mm	6 Nos.
5.	Insulated side cutting pliers 150 mm	8 Nos.
6.	Long nose pliers 150 mm	6 Nos.
7.	Soldering iron 25 W. 240 V.	10 Nos.
8.	Electrician knife	6 Nos.
9.	Tweezers 100mm	10 Nos.
10.	Digital Multimeter (3 ½ digit)	10 Nos.
11.	Soldering Iron Changeable bits 10 W	6 Nos.
12.	De- soldering pump	10 Nos.

B: TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sl. No	Name of the items	Quantity (Indicative)
1.	Steel rule 300mm	4 Nos.
2.	Steel measuring tape-3 m	4 Nos.
3.	Tools makers vice 100mm (clamp)	1 No.
4.	Tools maker vice 50mm (clamp)	1 No.
5.	Crimping tool (pliers)	2 No.
6.	Magneto spanner set	2 Nos.
7.	File flat 200mm bastard	2 Nos.
8.	File flat 200mm second cut	2 Nos.
9.	File flat 200mm smooth	2Nos.
10.	100mm flat pliers	4 Nos.
11.	100mm round Nose pliers	4 Nos.
12.	Scriber straight 150mm	2 Nos.
13.	Hammer ball pen 0.5Kg	1 No.

14.	Allen key set (set of 9)	1 No.
15.	Tubular box spanner (set of 6Nos)	1 Set
16.	Magnifying lenses 75mm	2 Nos.
17.	Continuity tester	6 Nos.
18.	Hacksaw frame adjustable	2 Nos.
19.	Cold chisel 20mm	1 No.
20.	Scissors 200mm	1 No.
21.	Handsaw 450mm	1 No.
22.	Hand Drill Machine	2 Nos.
23.	First aid kit	1 No.
24.	Fire Extinguisher	2 Nos.
25.	Bench Vice	1 No.
26.	Dual DC regulated power supply 30-0-30 V, 2 Amps	4 Nos.
27.	DC regulated variable power supply 0-24 V, 1Amp	2 Nos.
28.	LCR meter (Digital)	1 No.
29.	CRO Dual Trace 20 MHz (component testing facilities)	2 Nos.
30.	Signal Generator, 0-100 KHz	2 Nos.
31.	Analog multimeter	4 Nos.
32.	Function generator (Triangular, square and sine wave)	2 Nos.
33.	Dimmer start 3 Amps	2 Nos.
34.	Analog Component Trainer	2 Nos.
35.	Op Amp trainer	3 Nos.
36.	Digital IC Trainer	2 Nos.
37.	Digital IC Tester	1 No.
38.	Digital and Analog Bread Board Trainer	2 Nos.
39.	Rheostats various values and ratings	2 Nos.
40.	Computers in the assembled form (including cabinet, motherboards, HDD, DVD, SMPS, Monitor, KB, Mouse, LAN card, Blue-Ray drive and player), MS Office education version.	2 Nos.
41.	Laptops latest configuration	1 No.
42.	Laser jet Printer	1 No.
43.	Internet broadband connection	1 no.
44.	Electronic circuit simulation software	As required
45.	Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB	As required

C.WORKSHOP FURNITURE:

Sl. No.	Name of the items	Quantity (Indicative)
1	Instructor's table	1 No.
2	Instructor's chair	2 Nos.
3	Metal Rack, 100cm x 150cm x 45cm	4 Nos.
4	Lockers with 16 drawers standard size	2 Nos.
5	Steel Almirah, 2.5 m x 1.20 m x 0.5 m	2 Nos.
6	Black board/white board	1 No.

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: MECHANIC RADIO RADAR AIRCRAFT

LIST OF TOOLS& EQUIPMENTS FOR 20 APPRENTICES

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

A: TRAINEES TOOL KIT:-

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

B: FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
1	Drawing Board	20 Nos.
2	Models : Solid & cut section	As required
3	Drawing Table for trainees	As required
4	Stool for trainees	As required
5	Cupboard (big)	1 No.
6	White Board (size: 8ft. x 4ft.)	1 No.
7	Trainer's Table	1 No.
8	Trainer's Chair	1 No.

ANNEXURE – II

11. INFRASTRUCTURE FOR ON JOB TRAINING

TRADE: MECHANIC RADIO RADAR 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

12. 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.