MECHANIC RADIO AND RADAR AIRCRAFT

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – ELECTRONICS AND HARDWARE

सत्यमेव जयते

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

Directorate General of Training

Skill India
कौशल भारत-कुशल भारत

MECHANIC RADIO AND RADAR AIRCRAFT

(Revised in 2018)

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NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
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CONTENTS

1. BACKGROUND

1.1 Apprenticeship Training Scheme under Apprentice Act 1961

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

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

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

1.2 Changes in Industrial Scenario

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

1.3 Reformation

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

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

2. TRAINING SYSTEM

2.1 GENERAL

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

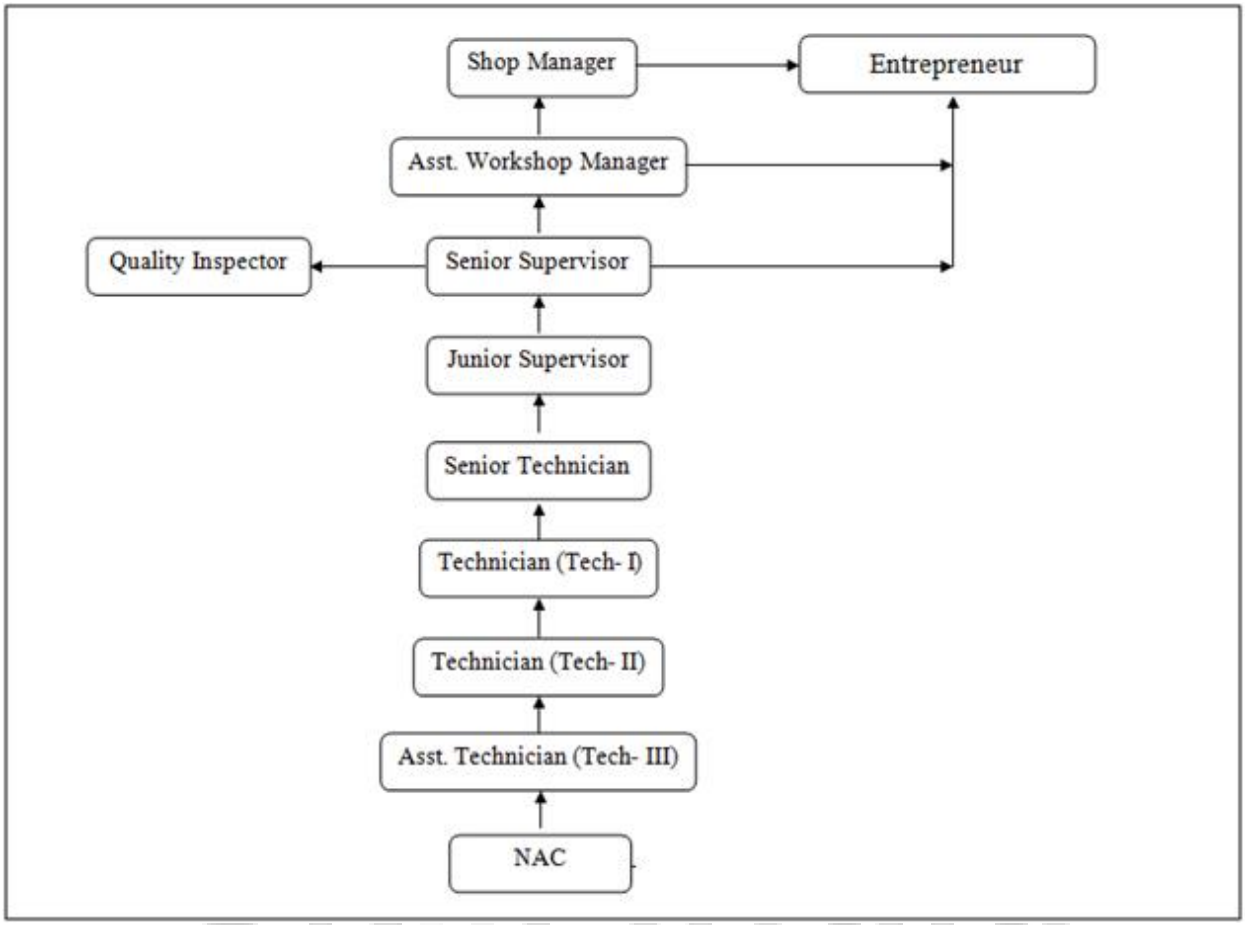
Mechanic Radio and Radar Aircraft trade under ATS is one of the courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge,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

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge, core skills & employability skills while performing jobs and solve problem during execution.
- Check the job/assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS:

- Indicative pathways for vertical mobility.



2.3 COURSE STRUCTURE:

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

Total training duration details: -

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

A. Basic Training

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

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

S No.	Course Element	Total Notional Training Hours	
		For 02 Yrs. course	**For 01 Yr. course**
1.	Professional Skill (Trade Practical)	550	275
2.	Professional Knowledge (Trade Theory)	240	120
3.	Workshop Calculation & Science	40	20
4.	Engineering Drawing	60	30
5.	Employability Skills	110	55
	Total (Including internal assessment)	**1000**	**500**

B. On-Job Training:-

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

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

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

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

C. Total training hours:-

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

2.4 ASSESSMENT & CERTIFICATION:

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

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual trainee portfolio as detailed in assessment guideline (section-2.4.2). The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NAC will be conducted by NCVT on completion of course as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline (section-2.4.2) before giving marks for practical examination.

2.4.1 PASS REGULATION

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

2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

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

Performance Level	Evidence
(a) Weightage in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices,	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment

has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b) Weightage in the range of above75% - 90% to be allotted during assessment	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A good level of neatness and consistency in the finish • Little support in completing the project/job
(c) Weightage in the range of above 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

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 equipment.

Radio Craftsman, Maintenance, Radio Mechanic Maintenance (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 2015:

i) 7422.1600 - Radio Craftsman, Installation
ii) 7422.1700 - Radio Craftsman, Maintenance
iii) 7421.0300 - Electronic Mechanic
iv) 7422.0900 - Radar Mechanic
v) 7421.0100 - Electronics Fitter, General

4. NSQF LEVEL COMPLIANCE

NSQF level for Mechanic Radio and Radar Aircraft trade under ATS: **Level 5**

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

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

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

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

The Broad Learning outcome of Mechanic Radio and Radar Aircraft trade under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

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

5. GENERAL INFORMATION

Name of the Trade	Mechanic Radio And Radar Aircraft
NCO-2015	7422.1600, 7422.1700, 7421.0300, 7422.0900,7421.0100
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years (02 Blocks each of one year duration).
Duration of Basic Training	a) Block –I : 3 months b) Block – II : 3 months **Total duration of Basic Training: 6 months**
Duration of On-Job Training	a) Block–I: 9 months b) Block–II : 9 months **Total duration of Practical Training: 18 months**
Entry Qualification	Passed 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent
Selection of Apprentices	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Infrastructure for Basic Training	As per related trade of ITI
Examination	The internal examination/ assessment will be held on completion of each block. Final examination for all subjects will be held at the end of course and same will be conducted by NCVT.
Rebate to Ex-ITI Trainees	01 year
CTS trades eligible for Mechanic Radio and Radar Aircraft Apprenticeship	Electronics Mechanic Mechanic Consumer Electronic Appliances Technician Power Electronics Systems 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.*
- *For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT.*

6. LEARNING OUTCOME

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Mechanic Radio and Radar Aircraft course of 02 years duration under ATS.

Block I & II:-

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

6.2 SPECIFIC LEARNING OUTCOME

Block – I

1. 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 and digital circuits.
6. Troubleshoot AF amplifier of PA system, fan regulator, light dimmer circuit, display systems, digital clock, digital timer and event counter.
7. Assemble various electronic circuits using SMD components and test them using suitable test equipment and perform the repair work on the PCB tracks.
8. Prepare, crimp, terminate and test various cables used in different electronics industries
9. Demonstrate the proficiency in the constructional features of AM/FM communication receiver circuits and devices and trouble shoot them.

Block – II

1. Knowledge of Basic principles of flight. Demonstrate Aircraft- its types, systems, terminology.
2. Knowledge of Aviation Rules and Regulations as Applicable to the System. Introduce to Avionics Systems
3. Demonstrate about types of receivers, transmitters in radio communication systems.
4. Assemble, test and repair of communication equipments and follow the procedures mentioned in the manufacturer's instruction manual.
5. Demonstrate types of RADARs and various sections in RADAR (like Transmitter Section and Receiver Section, Processing Section and Antenna Section)
6. Assemble, test and repair of RADAR equipments. Repair equipments as per procedures mentioned in the manufacturer's instruction manual.
7. Demonstration of Navigation system. Assemble, test and repair Navigation equipments. Follow procedures as per the manufacturer's instruction manual.
8. Demonstrate operation and working Feeders & Antennas. Identification and alignment location of antennas on aircraft, types of co-axial lines and wave guides as aerial feeder
9. Test, measure and analyze with Advanced Measuring Equipment, ATE's.
10. Interface, control, test and operation of aircraft installation and system maintenance.

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

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

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

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

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

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills	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. 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.	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, 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	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.

	industries.	
6 &7	**Passive Components** • Identify the different types of resistors • 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	Ohm's law and its variables. Resistor-definition, types of resistors, their 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	**Computer Hardware, OS, MS office Networking** • 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.	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.

	• Prepare a power point presentation on any three known topics with various design features • Invoke excel sheet from MS WORD and vice versa • Identify the cables and network components. • Making UTP cross cables and testing, Making straight cables and testing, Making cable layout drawing	
11-12	**Electronic circuit simulation software** • 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)**	

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

BASIC TRAINING (Block – II)

Duration: (03) Three Months

Week No.	Professional Skills	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 • Construct and test bidirectional shift registers.	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,

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. • Demonstrate entering of simple programs, execute & monitor the results	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. Comparative study of 8051 with 8052. Introduction to PIC

		Architecture.
10-12	**Sensors ,Transducers and Applications** • 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)**	

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

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block I

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
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.	**30**	**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units.	**20**
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

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
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	30	**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals	20
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 symbol 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.	

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

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

3. Communication Skills Duration : 15 Hrs.	Marks : 07
Introduction to Communication Skills	Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.
Motivational Training	Characteristics Essential to Achieving Success. The Power of Positive Attitude. Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning.
Facing Interviews	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.
Behavioral Skills	Problem Solving Confidence Building Attitude
Block – II **Duration – 55 hrs.**	
4. Entrepreneurship Skills Duration : 15 Hrs.	Marks : 06
Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. Management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.
Project Preparation & Marketing analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
Institutions Support	Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
Investment	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation

Procurement	& Costing, Investment procedure - Loan procurement - Banking Processes.
5. Productivity Duration : 10 Hrs.	Marks : 05
Benefits	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.
Comparison with developed countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
6. Occupational Safety, Health and Environment Education Duration : 15 Hrs.	Marks : 06
Safety & Health	Introduction to Occupational Safety and Health importance of safety and health at workplace.
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.
Accident & safety	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.
First Aid	Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. safety, health, welfare under legislative of India.
Ecosystem	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of Energy, re-use and recycle.
Global warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and Harvesting of water.
Environment	Right attitude towards environment, Maintenance of in -house environment.
7. Labour Welfare Legislation Duration : 05 Hrs.	Marks : 03
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.

8. Quality Tools Duration : 10 Hrs.	Marks : 05
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of House-keeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples.

10. DETAILS OF COMPETENCIES (ON-JOB TRAINING)

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR MECHANIC RADIO AND RADAR AIRCRAFT TRADE:

1. Safety and best practices /Basic Industrial Culture (5S, KAIZEN, etc.)
2. Record keeping and documentation
3. Fitting components using different metal fitting procedure and perform testing of the assembly.
4. Assembling of different components as per requirement and check functionality.
5. Carryout maintenance of different systems.

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

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

Block – I

1. 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 and digital circuits.
6. Troubleshoot AF amplifier of PA system, fan regulator, light dimmer circuit, display systems, digital clock, digital timer and event counter.
7. Assemble various electronic circuits using SMD components and test them using suitable test equipment and perform the repair work on the PCB tracks.
8. Prepare, crimp, terminate and test various cables used in different electronics industries
9. Demonstrate the proficiency in the constructional features of AM/FM communication receiver circuits and devices and trouble shoot them.

Block – II

1. Knowledge of Basic principles of flight. Demonstrate Aircraft- its types, systems, terminology.
2. Knowledge of Aviation Rules and Regulations as Applicable to the System. Introduce to Avionics Systems
3. Demonstrate about types of receivers, transmitters in radio communication systems.

4. Assemble, test and repair of communication equipments and follow the procedures mentioned in the manufacturer's instruction manual.
5. Demonstrate types of RADARs and various sections in RADAR (like Transmitter Section and Receiver Section, Processing Section and Antenna Section)
6. Assemble, test and repair of RADAR equipments. Repair equipments as per procedures mentioned in the manufacturer's instruction manual.
7. Demonstration of Navigation system. Assemble, test and repair Navigation equipments. Follow procedures as per the manufacturer's instruction manual.
8. Demonstrate operation and working Feeders & Antennas. Identification and alignment location of antennas on aircraft, types of co-axial lines and wave guides as aerial feeder
9. Test, measure and analyze with Advanced Measuring Equipment, ATE's.
10. Interface, control, test and operation of aircraft installation and system maintenance.

Note:

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

ANNEXURE – I

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

MECHANIC RADIO AND RADAR AIRCRAFT			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-09 is required additionally)			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
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			
13.	Steel rule	300mm	4 Nos.
14.	Steel measuring tape-3 m		4 Nos.
15.	Tools makers vice 100mm (clamp)	100mm	1 No.
16.	Tools maker vice 50mm (clamp)	50mm	1 No.
17.	Crimping tool (pliers)		2 No.
18.	Magneto spanner set		2 Nos.
19.	File flat (bastard)	200mm	2 Nos.
20.	File flat (second cut)	200mm	2 Nos.
21.	File flat (smooth)	200mm	2Nos.
22.	Flat pliers	100mm	4 Nos.
23.	Round Nose pliers	100mm	4 Nos.
24.	Scriber straight	150mm	2 Nos.
25.	Hammer ball pen	0.5Kg	1 No.
26.	Allen key set	set of 9	1 No.
27.	Tubular box spanner	set of 6Nos	1 Set

28.	Magnifying lenses	75mm	2 Nos.
29.	Continuity tester		6 Nos.
30.	Hacksaw frame adjustable		2 Nos.
31.	Cold chisel	20mm	1 No.
32.	Scissors	200mm	1 No.
33.	Handsaw	450mm	1 No.
34.	Hand Drill Machine		2 Nos.
35.	First aid kit		1 No.
36.	Fire Extinguisher		2 Nos.
37.	Bench Vice		1 No.
38.	Dual DC regulated power supply	30-0-30 V, 2 Amps	4 Nos.
39.	DC regulated variable power supply	0-24 V, 1Amp	2 Nos.
40.	LCR meter (Digital)		1 No.
41.	CRO Dual Trace	20 MHz (component testing facilities)	2 Nos.
42.	Signal Generator,	0-100 KHz	2 Nos.
43.	Analog multimeter		4 Nos.
44.	Function generator (Triangular, square and sine wave)		2 Nos.
45.	Dimmer start	3 Amps,230V	2 Nos.
46.	Analog Component Trainer		2 Nos.
47.	Op Amp trainer		3 Nos.
48.	Digital IC Trainer		2 Nos.
49.	Digital IC Tester		1 No.
50.	Digital and Analog Bread Board Trainer		2 Nos.
51.	Rheostats various values and ratings		2 Nos.
52.	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.
53.	Laptops latest configuration		1 No.
54.	Laser jet Printer		1 No.
55.	Internet broadband connection		1 no.
56.	Electronic circuit simulation software		As required
57.	Different types of Analog electronic components, digital ICs, power		As required

	electronic components, general purpose PCBs, bread board, MCB, ELCB		
C.WORKSHOP FURNITURE:			
58.	Instructor's table		1 No.
59.	Instructor's chair		2 Nos.
60.	Metal Rack,	100cm x 150cm x 45cm	4 Nos.
61.	Lockers with 16 drawers standard size		2 Nos.
62.	Steel Almirah,	2.5 m x 1.20 m x 0.5 m	2 Nos.
63.	Black board/white board		1 No.

The specifications of the items in the above list have been given in Metric Units. The items which are available in the market nearest of the specification as mentioned above, if not available as prescribed should be procured Measuring instruments such as steel rule which are graduated both English and Metric Units may be procured, if available.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: Mechanic Radio and Radar Aircraft

LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES

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

2) Infrastructure:

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

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

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor :			**Year of Enrollment :**
Name & Address of ITI (Govt./Pvt.) :			**Date of Assessment :**
Name & Address of the Industry :			**Assessment location: Industry / ITI**
Trade Name :	**Semester:**		**Duration of the Trade/course:**
Learning Outcome:			

Sl. No	**Candidate Name**	**Father's/Mother's Name**	Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA	**Total internal assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														