

MECHANIC MEDICAL ELECTRONICS

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5



SECTOR – HEALTH AND WELLNESS



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

MECHANIC MEDICAL ELECTRONICS

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)



NSQF LEVEL - 5

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Developed By

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Directorate General of Training
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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.



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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.

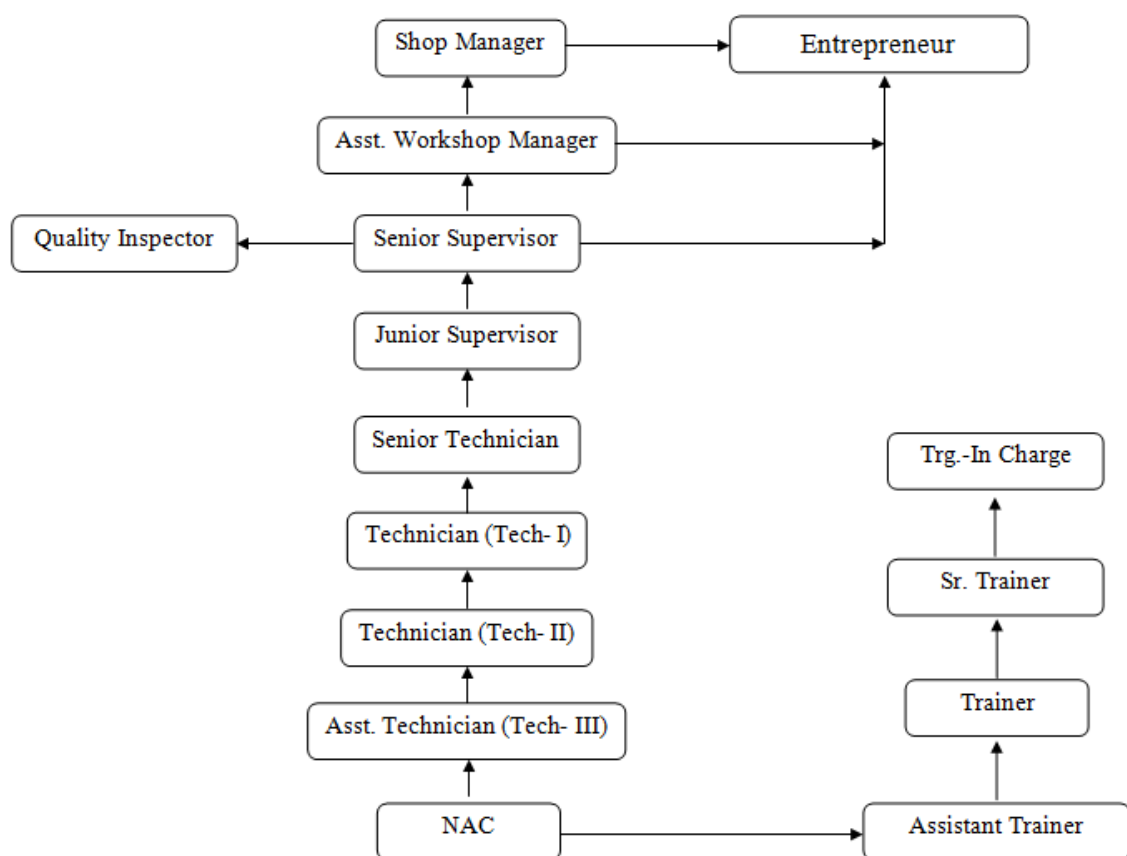
Mechanic Medical Electronics trade under ATS is one of the courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, 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	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment

and practices, 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 above 75% - 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.

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 Fitter, other include all other workers engaged in fitting, assembling, repairing and maintaining electronic equipment, machinery, appliances etc.

Electronics Mechanic; Electronic Equipment Mechanic, Mechanic Medical Electronics repairs electronic equipment, such as computers, industrial controls, 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.

Biomedical Equipment Technician; electronics technician; biomedical engineering technician Repairs, calibrates, and maintains medical equipment and instrumentation used in health-care delivery field: Inspects and installs medical and related technical equipment in medical and research facilities for use by physicians, nurses, scientists, or engineers involved in researching, monitoring, diagnosing, and treating physical ailments or dysfunctions. Services various equipment and apparatus, such as patient monitors, electrocardiographs, blood-gas analysers, X-ray units, defibrillators, electrosurgical units, anesthesia apparatus, pacemakers, blood pressure transducers, spirometers, sterilisers, diathermy equipment, in-house television-related technical paraphernalia. Repairs, calibrates, and maintains equipment, using hand tools, power tools, measuring devices, and knowledge of manufacturers' manuals, troubleshooting techniques, and preventive maintenance schedules. Safety-tests medical equipment and health-care facility's structural environment to ensure patient and staff safety from electrical or mechanical hazards.

Medical Equipment Operators, other includes those who are engaged in controlling technical equipment used to diagnose or treat illnesses and disorders not elsewhere classified.

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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) 7421.0100 - Electronics Fitter, General
- ii) 7421.0200 - Electronics Fitters, Other
- iii) 3211.0200 - Bio-Medical Equipment Technician
- iv) 3211.9900 - Medical Imaging and Therapeutic Equipment Technicians, Other



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4. NSQF LEVEL COMPLIANCE

NSQF level for Mechanic Medical Electronics 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 Medical Electronics 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 MEDICAL ELECTRONICS
NCO-2015	7421.0100 , 7421.0200, 3211.0200 , 3211.9900
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 10 th 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 Medical Electronics Apprenticeship	Electronics Mechanic Mechanic Consumer Electronic Appliances Technician Power Electronics Systems Mechanic Medical 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 Medical Electronics 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, 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 circuits

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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. Study and understand the basics of human anatomy and physiology, origin of biopotential signals and their characteristics.
2. Usage, maintenance and testing of electrodes used with all the medical equipments
3. Install and commission / test and maintain the equipments in pathological laboratory like colorimeter, spectrophotometer, auto analyzer, centrifuge, microscopes blood cell counters, incubators etc
4. Install and commission / test and maintain the equipments in physiotherapy like diathermies, traction machine, laser therapy, phototherapy etc
5. Install and commission / test and maintain the equipments like ultra sound scanners, colour dopplers , fetal dopplers , X- ray machines dental X- ray machines , digital X- ray machines , dark room etc
6. Install and commission / test and maintain the equipments like autoclaves, instrument boilers, sterilization equipments etc
7. Install and commission / test and maintain the equipments like computed EMG machine, EEG, machine, audio meter , dialysis machine etc
8. Install and commission / test and maintain the equipments like ECG recorders, defibrillators, treadmill, blood pressure monitor, pulse oximeter, multiparamonitor, central nursing station, ventilators, nebulizers, holter machine, etc
9. Install and commission / test and maintain the equipments surgical diathermy, endoscope, operation theater setup, O.T. lamps, surgeon lamps, anaesthesia machine etc

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. <i>[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]</i>	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. <i>[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Sectional views, Estimation of material, Electrical & electronic symbol]</i>	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 X- Ray, ECG machines (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 resources 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>	
<i>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.</i>	

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 eg; power failure, fire, and system failure.
2.	Install, fault detection and repairing of Hospital Electrical appliances Dismantle and assemble electrical/electronic parts of various electronic appliances e.g. Iron box, Radiant warmer, Auto cut off multi coil, nebulizer, AC & DC motor. Prepare and test of silicon pipe sealer. Measure and test of clinical sterilizer. Practice testing/fault detection of autoclave (with & without auto cut off multi coil) Plan and prepare of incubator. Service and repair of radiant warmer. Prepare and mount for setup baby clinical incubator. Prepare and mount the proper nebulizer. Identify different terminals and parts of electrical wiring diagram for water pump with auto controller. Install, connect and determine performance of centrifuge.	Identification, specifications, uses and maintenance of commonly used hand tools. Concept of Time constant of a RC circuit. Concept of Resonance and its application in RC, RL & RLC series and parallel circuit. Wheatstone bridge circuits, Introduction, Balances, Hot plate and Magnetic Stirrer Centrifuges, Hot air oven, Incubator, Water bath, Nebulizer Construction & Testing of Baby / clinical Incubator, Radiant warmer Construction & Testing of Baby / clinical Incubator, Construction & Testing of Radiant warmer Electrical motors: AC Motor (single phase induction motor) construction, sub assemblies, type of winding used, interpretation of name plate specifications Conventional speed control methods. Types of AC motors and their applications.

	Install, connect and determine performance of single phase DC motors. Connect, set proper direction of rotation and run. Identify and test permanent magnet DC motor.	Starting of split phase motor and three phases AC motors. DC Motor construction, sub assemblies, carbon brushes interpretation of name plate Specifications, conventional speed control methods and applications. Types of DC motors and their applications.
3.	Identify the rated various types of cells output voltage and Ah capacity of given battery. Practice on grouping of cells for specified voltage and current under different conditions and care. Measure the specific gravity of the electrolyte using hydrometer. Practice on routine, care/maintenance and testing of batteries Measure the resistor value by colour code and verify the same by measuring with multimeter. Identify the different type of passive components with colour code SMD and DIP package. Identify the different type of active components of SMD and DIP package. Identify different types of transformers and test Verify terminals, identify HT and LT side and calculate transformation ratio of single phase transformers. Determine voltage regulation of single phase transformer at different loads. Identify different types of auto transformers and test	Battery /Cells: construction, types of primary and secondary cells, materials used specification of cells and batteries. Charging process, efficiency, shelf life, Selection of cells / Batteries etc Use of Hydrometer. Types of electrolytes used in cells and batteries. Propagation delay, power dissipation and noise immunity
4.	Identify the different controls on the CRO front panel and observe the function of each control Measure DC voltage, AC voltage, time period using CRO sine wave parameters. Construct and test a half wave, full wave and bridge rectifier circuit with and without filter. Construct and test voltage doubler's, tripler's and quadruple's.	Diode Bridge Modules. Rectifier configurations, their efficiency, Filter components and their role in reducing ripple +ve Voltage Regulator, -ve Voltage Regulator Specifications & block diagram of Linear power supplies. Front panel controls and features of various power supplies. Different types of power switches and heat sinks used in power supplies.

	Construct and test a dual power supply. Construct and test different regulated power supply and measure output voltage with load. Measure ripple voltage, ripple frequency and ripple factor of rectifiers for different load and filter capacitors.	Manual & automatic and servo voltage stabilizers-concept and block diagram, o/p voltage adjustment, voltage cutoff systems, study of different types of relays used in stabilizers, study of electronic circuit commonly used, buck and boost concept.
5.	Identify terminals verify the rubber cuff which is apply to the arms. Construct and test sphygmomanometer for measuring blood pressure. Execute planning setup for blood pressure monitor examination. Determine the thermal effect of electric current. Measure and test of stethoscope. Construct and test of BP operator/ Sphygmomanometers.	Sphygmomanometer: Names, Types (manual and digital), Operation, significance
6 - 7	Identify the different gas plant safety precaution while working. Measure & Test of Hospital Oxygen O_2 gas plant Construct & Test of Hospital nitrous (N_2O) plant Identify different types of diathermy and their system. Operate & Test of short wave diathermy. Operate & Test of micro wave diathermy.	Electric stimulation of Nerve & Muscle, Faradic-type current, Interrupted, Direct current, Iontophoresis, TNS or TENS, IFT, Methods of heating the tissues, Diathermy, Infra-Red radiation, LASER, Ultrasonic Therapy, Ultra-violet Radiation, Cold therapy, Mechanics
8 - 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.	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.

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	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. Identify the cables and network components. Making UTP cross cables and testing, Making straight cables and testing, Making cable layout drawing.	
11-12	Identify sensors used in process industries such as RTDs, Temperature ICs, Thermocouples, proximity switches (inductive, capacitive and photo electric), load cells, strain gauge. LVDT PT 100 (platinum resistance sensor), water level sensor, thermostat float switch, float valve 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 DC voltage of a LVDT. Identify different types of Electrodes. Identify the electrodes used in medical devices.	Bio potential Electrodes, Bio chemical electrodes & Other electrodes. Cells and their Structure, Bio-electric potentials, Sources of Bio-electric, potentials, Resting & Action potentials Study different IC Packages IR LEDS, Photo diode for photo transistor, its characteristics and application, optical sensor, opto-couplers, circuits with opto isolation, characteristics of LASER diodes.
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	Identify various ABD kits peripherals and connect it to the system of Blood Group using. Perform and execute PH Meter. Understand how to prepare and measure calorimeter digital / analog. Practically understand how to use Spectrophotometer. Practice and perform sugar testing using Quick check (TECO). Practice and perform the method of patient care and handling Semi Auto Analyzer. Perform how to calculate Blood Cell counter. Practically understand how to measure uro meter. Select and perform the appropriate syringe Destroyer & syringe Pump. Prepare the room apparatus and instrument for electro surgical Unit (surgical cut and coagulation).	Microscope, Colorimeter and Spectrophotometer (Both VIS & UV), Laboratory tests based on Colorimeter and Photometry, Flame photometry, Electrophoresis, Densitometry, pH meters, Semi auto analyzers, Blood, cell counter, Blood gas analyzer.
3-5	Identify various ICs & their functions on the given Microprocessor Kit. Measure the wave forms on different ICs and IC pins of the processor. Monitor the clock frequency. Write down the address range of different memory IC s and peripheral ICs on the kit. Enter data to different memory locations in RAM. Enter simple programs and execute using assembly language. Use assembler to assemble the programs and load them for execution by the processor. Use assembler to load them for execution by the processor.	Draw schematic diagrams for Microprocessor, Draw schematic diagrams for Micro-controller based circuits. Intro to 8085 Microprocessor, Architecture, pin details and Bus System of the processor. Function of different ICs such as decoders Function of different ICs such as buffers, latches etc used with 8085 processor Interfacing to memory ICs RAM, PROM / EEPROM Interfacing different peripheral ICs such as 8255. Instruction set covering data transfer, logical, Instruction set covering data transfer, Arithmetic.

	Program to Blink an LED using port pins of 8255. Program to Control a relay using the port pins of 8255. Program to read the data from memory to sequentially ON the LEDs.	Instruction set covering data transfer, serial communication etc.
5-6	Perform how to calculate Pulse Oximeter. Perform how to prepare a EMG. Practice and perform the method of patient care and handling ECG. Plan patient setup for EEG & ERG. Perform techniques of applications of Multi-Para monitor. Plan and perform the care of Ultrasound Doppler equipments. Plan patient setup for Fetal Monitor, Infusion Pump & Syringe Pump. Practice and perform the method of patient care and handling Endo scope & Colonoscopy. Plan and prepare of Kidney chart, eye chart, ear chart, Brain chart. Identify the internal procedure of heart chart, blood circulatory system. Practice and perform the skeletal system chart, respiratory system chart, nerve system chart, digestive system chart.) Prepare reproductive system chart.	Physiological system of the Body, Medical Terminology. Various departments in Hospital Classification of Hospitals, Introduction to anatomy, Human Physiology, Electro-physiology, Multi-Para monitor, Ultrasound Doppler, fetal Monitor Pulse Oximeter. Kidney chart, eye chart, ear chart, Brain chart, working of heart chart, blood circulatory system, skeletal system chart, respiratory system chart, nerve system chart, digestive system chart, reproductive system chart, History of Bio-medical Engineering Instrumentation, Man Instrumentation system,
7-9	Identify & test of Pulse Oximeter, EMG, ECG different controls of the related equipments. Understand calibration procedure or measuring and monitoring instruments. Understand care of applicators used infusion pump & syringe pump. Prepare the room, apparatus and instrument for Endoscope & Colonoscopy. Troubleshooting & Maintenance aspects. Understand the effect on image due to variation in focal object distance, object	Elements of Intensive-Care Monitoring, Patient monitoring displays, Defibrillators, Pacemakers, EMG, EEG, Monitors: Video monitors, Recorders: Strip chart recorders, Galvanometric recorders, Ultraviolet recorders, and other recorders Ventilator: The physiology of respiratory system, Instrumentation for the mechanics of breathing, Inhalators, Ventilators, Respirators, Humidifiers, Aspirators, Surgical diathermy. Different components of Dental X-ray machine. Collimator, Bucky Grids, Relays,

field distance, exposur angle. Understand the technical aspect of quality assurance. Understand the quality assurance of the related equipments and its benefits with respect to visual assessment. Operating & maintenance of Dental chair with suction & air compressor. Dental x-ray clarification Intra oral Dental x-Ray & Extra oral Dental x-ray. Identification Dentist handling tools. Basic level of Dental X ray calibration. Assembling and disassembling of chair & compressor. Assembling and disassembling of X-Ray. Identification of control Panel of Ultrasound scanners. Identification of Types Probe of Ultrasound scanners. Identification of Modes imaging of Ultrasound scanners. Operating Process of Ultrasound scanners. Identification of control Panel of X-ray. Identification & difference In CR & DR. Identification & difference In Manual process of x-Ray expose & film Development. Calibration of X-ray Beam and tube head. Digital X-ray imaging process. Identify General fault finding of X-ray Equipment's. Calibration of table alignment. Identification of CT scanner parts. Identification of CT scanner control panel parts. Digital Image conversion of CT scanner. General fault finding of CT Scanner. Calibration of table alignment. Identification of MRI parts. Identification of MRI control panel parts. Digital Image conversion of MRI.	contactors, Switches, Interlocking circuits, Ultrasound scanners: Basic physics, Block diagram of Ultrasound scanner, Transducer theory & types, Ultrasound scanner, transducer theory & types, Different modes i.e. A, B, M- mode etc. Colour Doppler Ultrasound scanners X-Ray: Basic physics. Different components of X-ray machine, Block diagram of X-ray machine, H.T. Generator, X-ray tubes, Scattered radiation & Secondary radiation controls, Digital X-ray concepts, X-ray films, Screens, Darkroom system & Procedure, Collimator, Bucky Grids, Relays, contactors, Switches, Interlocking circuits, Dental X-ray machine. CT Scanner, MRI, mammography,, Bronchoscope
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	General fault finding of MRI. Calibration of table alignment. Identification of mammography parts. Identification of mammography control panel parts. Digital Image conversion of mammography. General fault finding of mammography. Identification of Bronchoscope parts. General fault finding of Bronchoscope.	
10-12	Identify various ICs & their functions on the given Microcontroller Kit. Identify the address range of RAM & ROM. Measure the crystal frequency, connect it to the controller. Identify the port pins of the controller & configure the ports for Input & Output operation. Use 8051 microcontroller, connect 8 LED to the port, blink the LED with a switch. Perform the initialization, load & turn on a LED with delay using Timer. Perform the use of a Timer as an Event counter to count external events. Demonstrate entering of simple programs, execute & monitor the results. Perform with 8051 microcontroller assembling language program, check the reading of an input port and sending the received bytes to the output port of the microcontroller, used switches and LCD for the input and output. Write a program to use on board ADC and convert the analog voltage signal into digital value and store it memory.	Differentiate Microprocessor and Micro controller, Architecture of 8051 family of Micro controllers, pin diagram and various on chip resources. Types of memory with 8051 such as On-chip, external code memory, External RAM Register Banks and their use Memory mapping of the bit addressable registers (bit memories). Instruction set and various types of instructions Special function registers (SFRs) and their configuration for various applications. Input / output ports and their configuration. Implementation of various Timer and counting functions, aspects of serial communication, Utilization of on-chip resources such as ADC etc. Assembly software and compilers for 8051 Micro-controllers. 8052 and its difference with 8051.
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.

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

	- Triangle -different types - Rectangle, Square, Rhombus, 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.	

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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		Algebra: Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	
4	Half adder, full adder, multiplexer and de-multiplexer		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.	
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.		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 Procurement	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.
5. Productivity Duration : 10 Hrs. Marks : 05	
Benefits	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.
Comparison with developed countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
6. Occupational Safety, Health and Environment Education Duration : 15 Hrs. Marks : 06	
Safety & Health	Introduction to Occupational Safety and Health importance of safety and health at workplace.
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.
Accident & safety	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.
First Aid	Care of injured & Sick at the workplaces, First-Aid & Transportation of

	sick person.
Basic Provisions	Idea of basic provision legislation of India. safety, health, welfare under legislative of India.
Ecosystem	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of Energy, re-use and recycle.
Global warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and Harvesting of water.
Environment	Right attitude towards environment, Maintenance of in -house environment.
7. Labour Welfare Legislation	
Duration : 05 Hrs. Marks : 03	
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.
8. Quality Tools	
Duration : 10 Hrs. Marks : 05	
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of House-keeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples.

10. DETAILS OF COMPETENCIES (ON-JOB TRAINING)

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR MECHANIC MEDICAL ELECTRONICS

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 .
6. *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 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. Study and understand the basics of human anatomy and physiology, origin of biopotentials signals, and their characteristics.
2. Usage, maintenance and testing of electrodes used with all the medical equipments
3. Apply / install and commission / test and maintain the equipments in pathological laboratory like colorimeter, spectrophotometer , auto analyzer, centrifuge, microscopes blood cell counters, incubators etc

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4. Install and commission / test and maintain the equipments in physiotherapy like diathermies, traction machine, laser therapy, phototherapy etc
5. Install and commission / test and maintain the equipments like ultra sound scanners, colour dopplers , fetal dopplers , X- ray machines dental X- ray machines , digital X- ray machines , dark room etc
6. Install and commission / test and maintain the equipments like autoclaves, instrument boilers, sterilization equipments etc
7. Install and commission / test and maintain the equipments like computed EMG machine, EEG, machine, audio meter , dialysis machine etc
8. Install and commission / test and maintain the equipments like ECG recorders, defibrillators, treadmill, blood pressure monitor, pulse oximeter, multiparamonitor, central nursing station, ventilators, nebulizers, holter machine, etc
9. Install and commission / test and maintain the equipments surgical diathermy, endoscope, operation theater setup, O.T. lamps, surgeon lamps, anesthesia machine etc

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.

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INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

MECHANIC MEDICAL ELECTRONICS			
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: TOOL, MEASURING INSTRUMENTS & GENERAL SHOP OUTFIT FOR UNIT			
Sl. No.	Name of the items	Specification	Quantity (indicative)
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 Nos.
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	2 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		2Nos.
48.	Digital IC Trainer		2 Nos.
49.	Digital IC Tester		1 No.
50.	Digital and Analog Bread Board Trainer		6 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 electronic components, general purpose PCBs, bread board, MCB, ELCB		As required

C. WORKSHOP FURNITURE

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



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**INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING
DRAWING**

TRADE: Mechanic Medical Electronics

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°	(250 X 1.5 mm)	20+1 set
3.	Set square celluloid 30°-60°	(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.
<i>Note: - Above Tools & Equipments not required, if Computer LAB is available in the institute.</i>		

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