MECHANIC MEDICAL EQUIPMENT FOR HOSPITAL AND OCCUPATIONAL HEALTH CENTRES

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – HEALTHCARE

सत्यमेव जयते

GOVERNMENT OF INDIA

MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP

DIRECTORATE GENERAL OF TRAINING

Directorate General of Training

Skill India
कौशल भारत-कुशल भारत

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(Revised in 2019)

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Version 1.0

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
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Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

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CONTENTS

1. BACKGROUND

1.1 Apprenticeship Training Scheme under Apprentice Act1961

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 Director General of Training(DGT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate (engineers), technician (diploma) and technician (vocational) apprentices.**

Entry 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 DGT and those successful in the trade tests are awarded the National Apprenticeship Certificate (NAC) by DGT having worldwide recognition.

The period of apprenticeship training for graduate (engineers), technician (diploma) 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. It will ensure stronger collaboration between industry and the trainees which will augment supply of skilled workforce and enable 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 through various schemes.

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 Directorate General of Training (DGT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of DGT for propagating vocational training.

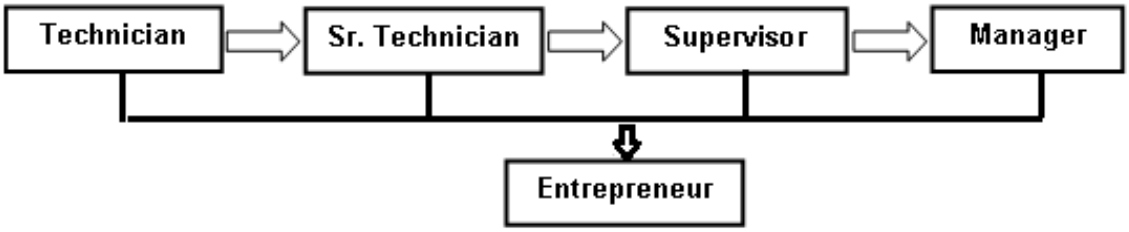
Mechanic Medical Equipment for Hospital and Occupational Health trade under ATS is one of the courses delivered nationwide through different industries. The course is of two years duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - 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 DGT 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	**BT– I**	**-----**	**BT – II**	**------**
Practical Training (On - job training)	**----**	**OJT – I**	**------**	**OJT – II**

A. Basic Training

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

S No.	Course Element	Total Notional Training Hours (For 02 Yrs. Course)
1.	Professional Skill (Trade Practical)	550
2.	Professional Knowledge (Trade Theory)	240
3.	Workshop Calculation & Science	40
4.	Engineering Drawing	60
5.	Employability Skills	110
	Total (Including formative assessment)	**1000**

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.

C. Total training hours:-

Duration	Basic Training	On-Job Training	Total
For 02 yrs. course (Engg.)	1000 hrs.	3120 hrs.	4120 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.

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. 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 DGT 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 before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percentage is 40% for each Theory Examination (except for Employability Skill it is 34%) and 60% marks for each Trade practical Examination. The candidate should 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 examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60%- 70% 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% 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% 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:

Medical Equipment Technician; in the Healthcare Industry is also known as a Biomedical Equipment Technician (BMET), Service Technician, Biomedical Electronics Technician, and Biomedical Engineering Technician (BMET). Medical Equipment Technicians install, maintain and repair patient care equipment. They perform inspection, installation, and preventative maintenance of general clinical equipment, including appropriate documentation for all service activities and training the hospital staff.

Biomedical Equipment Technician Electronics 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, anaesthesia apparatus, pacemakers, blood-pressure transducers, spirometers, sterilisers, diathermy equipment, in-house television systems, patient-care computers, and other 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. Consults with medical or research staff to ascertain that equipment functions properly and safely, utilizing knowledge of electronics, medical terminology, human anatomy and physiology, chemistry, and physics.

Reference NCO code 2015:

i) 3211.0501- Medical Equipment Technician
ii) 3211.0200 - Bio-Medical Equipment Technician

4. NSQF LEVEL COMPLIANCE

NSQF level for **Mechanic Medical Equipment for Hospital & Occupational Health** 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
e. Responsibility.

The Broad Learning outcome of trade **Mechanic Medical Equipment for Hospital & Occupational Health** 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 EQUIPMENT FOR HOSPITAL & OCCUPATIONAL HEALTH**
NCO – 2015	3211.0501, 3211.0200
Trade Code	DGT/3197
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years
Duration of Basic Training	a) BT –I : 3 months b) BT – II : 3 months **Total duration of Basic Training: 6 months**
Duration of On-Job Training	a) OJT –I: 9 months b) OJT –II : 9 months **Total duration of OJT: 18 months**
Entry Qualification	Passed 10th Class under 10+2 system of education or its equivalent.
Selection of Apprenticeship	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	Degree/ Diploma in Bio-Medical Engineering from recognized university/ institute with one/ two year's experiences in the relevant field.
Infrastructure for Basic Training	As detailed in Annexure - I
Examination	The internal examination/ assessment will be held on completion of each year. Final examination for all subjects will be held at the end of course and same will be conducted by DGT.
Rebate to Ex-ITI Trainees	NIL
CTS trades eligible for Medical Equipment For Hospital & Occupational Health Apprenticeship	NIL

Note:

- *Industry may impart training as per above time schedule for different OJT, 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 are compromised.*
- *For imparting Basic Training, the industry to tie-up with ITIs having such specific trade and affiliated to DGT.*

6. LEARNING OUTCOME

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

6.1 SPECIFIC LEARNING OUTCOME

1st Year:

1. Apply knowledge of hospital environment, medical equipment & their functions.
2. Plan and perform working with Sonometer, various Optical instruments like spectrometer, spectrophotometer, microscope etc. and heat & temperature measuring instruments.
3. Check and operate machines for Radio activity application, X-Ray and laser rays.
4. Plan and construct electronic circuits, regulator circuits, oscillator circuits etc. using transistor, multivibrators and amplifier.
5. Assemble, test and troubleshoot various digital circuits using A/U & D/U converter.
6. Plan and perform testing and troubleshooting of microprocessor based Medical programmable system.
7. Evaluate waveforms using CRO and check the result with standard level using multimeters, X-Y Recorders, Signal generator, strip - chart recorder etc.
8. Demonstrate use of strain gauge, capacitive & inductive transducer, thermocouple etc.
9. Apply basic knowledge of computer and test frequencies applying the principle of modulation and demodulation.

2nd Year:

10. Check setting of X-ray dark room, system processing, sterilization procedure and hospital hygiene.
11. Demonstrate purpose, usage and maintenance of critical care equipment in different operating sectors like O.T., Emergency, ICU, Clinical Lab (Diagnostic and operative) and CSSD.
12. Apply the knowledge of basic Anatomy and Physiology for operation of medical equipments.
13. Test and troubleshoot EGC, EUG machines, Doppler machine, Defibrillator (pasic and bi-pasic) etc.
14. Test various medical gas plant operation using suitable care and safety measures.

6.2 GENERIC LEARNING OUTCOME

YEAR I & II:-

15. Recognize & comply safe working practices, environment regulation and housekeeping.
16. Understand and explain different mathematical calculation & science in the field of study. *[Different mathematical calculation & science – Conversion of Units, Percentage& Mensuration -Area & Volume of different surfaces and solids, and Properties of materials, Ferrous & non-ferrous metals, Mass, weight , Density, Specific Gravity etc.]*
17. Interpret specifications, different engineering drawing and apply for different application in the field of work. [*Different engineering drawing-Geometrical figures like Triangles, Square, Rectangle, Rhombus, Parallelogram, Circle etc., Lettering & Numbering, Freehand sketching of Hand tools used for Mechanic Medical Equipment for Hospital and OHC trade, Signs & symbols for Electrical components used in electrical circuits and AC/DC systems, Electrical wiring diagram of different lamps.]*
18. Select and ascertain measuring instrument and measure dimension of components and record data.
19. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
20. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
21. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
22. Plan and organize the work related to the occupation.

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

SPECIFIC LEARNING OUTCOME	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
1st Year 1. Apply knowledge of hospital environment, medical equipment & their functions. 2. Plan and perform working with Sonometer, various Optical instruments like spectrometer, spectrophotometer, microscope etc. and heat & temperature measuring instruments. 3. Check and operate machines for Radio activity application, X-Ray and laser rays. 4. Plan and construct electronic circuits, regulator circuits, oscillator circuits etc. using transistor, multivibrators and amplifier. 5. Assemble, test and troubleshoot various digital circuits using A/U & D/U converter. 6. Plan and perform testing and troubleshooting of microprocessor based Medical programmable system. 7. Evaluate waveforms using CRO and check the result with standard level using Multimeters, X-Y Recorders, Signal generator, strip - chart recorder etc. 8. Demonstrate use of strain gauge, capacitive & inductive transducer, thermocouple etc. 9. Apply basic knowledge of computer and test frequencies applying the principle of modulation and demodulation. **2nd Year** 10. Check setting of X-ray dark room, system processing, sterilization procedure and hospital hygiene. 11. Demonstrate purpose, usage and maintenance of critical care equipment in different operating sectors like O.T., Emergency, ICU, Clinical Lab (Diagnostic and operative) and CSSD. 12. Apply the knowledge of basic Anatomy and Physiology for operation of medical equipments. 13. Test and troubleshoot EGC, EUG machines, Doppler machine, Defibrillator (pasic and bi-pasic) etc. 14. Test various medical gas plant operation using suitable care and safety measures.	*Assessment Criteria for each specific learning outcome mentioned under **1st year & 2nd year** (section: 10) ensures 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 the 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 also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.*

GENERIC LEARNING OUTCOME	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
15. Recognize & comply safe working practices, environment regulation and housekeeping.	15. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	15. 2. Recognize and report all unsafe situations according to site policy.
	15. 3. Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	15. 4. Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	15. 5. Identify and observe site policies and procedures in regard to illness or accident.
	15. 6. Identify safety alarms accurately.
	15. 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.
	15. 8. Identify and observe site evacuation procedures according to site policy.
	15. 9. Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	15. 10. Identify basic first aid and use them under different circumstances.
	15. 11. Identify different fire extinguisher and use the same as per requirement.
	15. 12. Identify environmental pollution & contribute to avoidance of same.
	15. 13. Take opportunities to use energy and materials in an environmentally friendly manner
	15. 14. Avoid waste and dispose waste as per procedure
	15. 15. Recognize different components of 5S and apply the same in the working environment.
16. Understand and explain different mathematical calculation & science in the field of study. *[Different mathematical calculation &*	16.1 Explain concept -Standard units for environmental studies, Role of Pollution control Equipment Operator the required knowledge base, Fundamental derived units, limits and tolerances, Properties of 'Co[1], A1[1]& insulating material.

science – Conversion of Units, Percentage, & Mensuration-Area & Volume of different surfaces and solids, and Properties of materials, Ferrous & non-ferrous metals, Mass, weight, Density, Specific Gravity etc.]	Resistance, inductance, capacitance & Series & Parallel circuits, Chemical bonding oxidation-Reduction of acids & bases.
	16.2 Measure dimensions as per drawing.
	16.3 Use scale/ tapes to measure for fitting to specification.
	16.4 Comply given tolerance.
	16.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	16.6 Ensure accuracy of measurements by using different instruments/gauges.
	16.7 Explain basic electricity, insulation & earthing.
17. Interpret specifications, different engineering drawing and apply for different application in the field of work. [*Different engineering drawing-Geometrical figures like Triangles, Square, Rectangle, Rhombus, Parallelogram, Circle etc., Lettering & Numbering, Freehand sketching of Hand tools used for Mechanic Medical Equipment for Hospital and OHC trade, Signs & symbols for Electrical components used in electrical circuits and AC/DC systems, Electrical wiring diagram of different lamps.]*	17. 1. Read & interpret the information on drawings and apply in executing practical work.
	17. 2. Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
	17. 3. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
18. Select and ascertain measuring instrument and measure dimension of components and record data.	18. 1. Select appropriate measuring instruments as per tool list.
	18. 2. Ascertain the functionality & correctness of the instrument.
	18. 3. Measure dimension of the components & record data to analyse with the given drawing/measurement.
19. Explain the concept in productivity, quality tools,	19.1 Explain the concept of productivity and quality tools and apply during execution of job.

and labour welfare legislation and apply such in day to day work to improve productivity & quality.	19.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	19.3 Knows benefits guaranteed under various acts
20. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	20.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	20.2 Dispose waste following standard procedure.
21. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	21.1 Explain personnel finance and entrepreneurship.
	21.2 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.
	21.3 Prepare Project report to become an entrepreneur for submission to financial institutions.
22. Plan and organize the work related to the occupation.	22. 1 Use documents, drawings and recognize hazards in the work site.
	22. 2 Plan workplace/ assembly location with due consideration to operational stipulation.
	22. 3 Communicate effectively with others and plan project tasks.
	22. 4 Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.

8. SYLLABUS

BASIC TRAINING (BT – I) **Duration: (03) Three Months**		
Week No.	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
1	Visit to different sections. Demonstration on various Medical equipment, operation, controls. Identification of various medical equipment & overall safety.	Familiarization with the trade-brief description of the duties & responsibilities of a Mechanic Medical Equipment. Organizational structure of the hospital. Familiarization with the Hospital environment, Medical Equipment & their functions.
2	Determination of surface tension of a liquid. Determination of viscosity of a liquid.	**General Properties of matter:** Surface tension, viscosity bornovlli's theorem. Diffusion & osmosis.
3	Study of sonometer. Study of resonance using air column. To compare the frequencies of two tuning forks by counting the beats.	**Sound –**Wave theory, ultrasonic wave generation, characteristics, Applications, Doppler effect. Perception of sound-mechanism and related organs.
4	To find the focal length of a lens. To find the RI of the material of a prism using spectrometer. Study of Interference using Newton's ring.	**Light-** Revision of lens formulae, interference of light, defects of vision and specification. Optional instruments –microscope, Telescopes, Dispersion of light, emission and absorption spectra, Spectromotor, Spectro-photometer. Infrared and ultraviolet radiation. Laser-Basic Theory
5	Study characteristics of Resistor.	**Heat & temperature:** Measurement of temperature
6	Testing of following components-Resistors, inductors, capacitors & transformers. Relays & Micro switches, conductors. Practice with the following machines-AC/DC Motor Insulator & H.V. Tester.	**Electricity:** Basic Circuit theory, R-L-C Circuit and its factors. Transformer and autotransformer. D.C. and A.C. Motor-Basic principles operation.
7	Study of G.M. Counter. Study of scintillation counter. Study of electro diode, photo cell, LED. Study of spectrum of light from a discharge tube.	**Modern Physics:** Radio activity applications X-Ray-Generation, applications. Photoelectric effect applications Laser, oasic concept
8	Study of characteristics of typical	**Basic electronics:**

	semiconductor devices. Testing of components using transistor tester, IC tester. Study of rectifier & regulated power supply. Study of amplifier Study of Multivibrators. Study of Op-Amp in different configurations. Study of instrumentation amplifiers & applications.	Diodes, zener, transistor, UJT, FET, SCR, Triac. Regulated power supplies, SMPS, voltage & power amplifier. Feedback concept & application. Oscillator – AF & RF, Multivibrators, Schmitt trigger Op – Amp Theory, common mode and differential gain Instrumentation amplifier applications.
9	Study of logic circuits Study of mux, demux Study of counters Study of registers Study of sss Study of A/D & D/A converter.	**Digital Electronics:** Combinational circuits Logic circuits, encoders, decoders, multiplexer, demultiplexer, sequential circuits, Flip Flops, counters, resistors, 555 Timer A/D & D/A Converter, Memory ROM, RAM, Eprom Display circuits, fault finding.
10	Writing simple programmes on 8085	Microprocessor-Basic principle
11	Study of waveforms using CRO. Study of Lissa-jous pattern. Study of recording system. Testing of some ICS using IC letter.	**Electronic Instruments:** Multimeter (Analog & digital), cathode ray oscilloscope, x-y recorder, AF & RF signal generator, L-C-R bridge I.C. Tester. Strip chart recorder.
12	Study of typical transducers using instrumentation tutorial. Basic principal of radio, A.M., F.M. Knowledge of computer and data base programming and communication system.	**Transducers** LVDT, Strain gauge, capacitive& inductive transducer, piezoelectric transducer, thermocouple, thermistor, LDR, Photodiode, photo transistor, photo emissive cell, flow meter, euro gauge. Ionization chamber. Preparation of data base, storing & editing & retrieval of data. Practice on word processing, spread sheet & data base programme Assemble and test a commercial A.M./F.M. Receiver, basic knowledge of computer and evaluate performance of communication. Radio frequency, high frequency microwave, principle of modulation and demodulation. A.M. F.M., D.M. Computer communication basic idea.
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 (BT – II) **Duration: (03) Three Months**		
Week No.	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
1-3	Practice on mode of use of safety appliances. Practice on use fire fighting equipment. Practice on maintenance up keep of visual & audio visual alarms systems. Practice on maintenance & up keep of panel Board**,** centralized grounding & Isolation transformer etc. Practice on maintenance of battery bank, voltage stabilizer. Practice on sterilization. Practice on maintenance of A/C plant & refrigeration & ventilation. Practice on artificial respiration.	<u>Health Service engineering</u> Organization of & Engg. Aspects pertaining to technical health service rules, mechanic medical equipments communication and clam`s systems, mechanical ventilation, refrigeration & Air condition, hospital illumination, general hospital lighting, Shadow less light fittings for O.T. Setting of X-Ray dark room. Laundries, automatic washing machine, system processing, sterilization procedure & hospital hygiene, electoral distribution system. Fire protection devices, safety handling & maintenance of electrical equipments. Electrical shock & its psycho digital effects, leakage current & voltage, earthing of building & equipment. Safety testing & performance testing of electro medical equipment as per IEC 6011. Power supply of medical equipment as per IEC 364 part-VII. Preventive maintenance schedule, necessity of daily, weekly, or monthly calibration of equipment. Complete description of an ideal service & calibration centre. Necessary equipment layout, servicing tools & equipment, addresses of servicing agency, layout & ergonomics. Record keeping & documentation.
4-9	Study of X-Ray Machine – different parts, their uses, maintenance & controls. Testing and calibration of X-Ray M/c. Developing process of X-Ray image (Dark room technique) Preparation for radiation protection. To measure the X-Ray exposure using a dosimeter.	General purpose medical & O.T equipment. Sphygmomanometer, stethoscope, chemical balance, sterilizers spirometer. Ventilators, Heart lung machine, boyle's apparatus, sucker machine, Clinical & operating Microscope, sterilizers (i) vertical (ii) Horizontal (iii) water sterilizer (iv)

	Routine/preventive maintenance of X-Ray machine. Trouble shooting and minor repair of an X-Ray machine. C.T. Scanner Study of C.T. scanning machine – different parts, their uses, maintenance and controls. M.R.I. Study of MRI machine – different parts, control & maintenance. Ultrasound M/c Study of different parts. Use, care and maintenance	Distillation plant. Diathermy machines (ordinary, underwater-cutting & coagulation), cryosurgical equipment, operating Laparoscope with video connection, cautery machine. Operating practice with different equipments- mentioned aside- care & maintenance. Trouble shooting, repairing & Maintenance of different aside. Practice on disinfection, sterilization & cleaning using auto clave. Generation of X-ray, construction of X-Ray tube, installation and layout, details about different controls, high voltage generation, beam centering device, exposure timer, scattering problem, method of reducing scattering, Bucky grid and fixed grids, interlocks and safety devices, static, mobile and portable units, 50 m.A., 100 m.A., 300 m.A., 500 m.A. correlation between m.A, KV and Sec. (exposure) m.A.s. rating Radiation hazards and protection. AERB (Atomic energy Regulatory Board) regulations regarding radiation exposure. Specification, common manufacturers and peripherals and assorted items (accessories) <u>C.T. Scanner Machine</u> Basic principles, constructions and different parts, gantry couch and controls. Installation, layout, care and maintenance. <u>MRI</u> Basic working principal and construction. <u>Ultrasonography</u> Basic principle, construction and different parts, Ultrasonic transducer, different type of pro hood linear, sector, prismatic, basic modes of transmission pulsed, continuous. Doppler effect and ultrasonic imaging- A-scan display, M-scan display, B-scan

		display phased array, sector scanning, gray scaling imaging technique. Use of gel, camera (manual and auto) specification
10-12	Demonstration of Basic Anatomy & Physiology with models & A.V. show.	**Basic Anatomy & Physiology** Muscular skeletal system, skeletons, bones and joints, skull, spine, pelvis, bones of hand and foot.
	Demonstration of Thorax & abdomen with models & A.V. show.	Thorax & abdomen Structure of thorasic cage, abdominal cavity, diaphragm mediastinum.
	Study of ECG machine – different parts and functions and controls. Testing and calibration. Trouble shooting and maintenance Preparation of the patient, placement of the electrodes Practice on operation of the ECG machine Monitoring of the ECG and interpretation of the gross changes in the PQRST configuration. Study of effect of defective earthing. Computerized trade mill testing. Use, care and maintenance bedside monitor, central monitor- holter monitor – Study of different parts, function and controls Testing and calibration Troubleshooting and maintenance Placement of electrode and practice on operation of the machines. Monitoring of the machines and interpretation of the waveforms. Study of effect of effective earthing. Echo cardiograph - Study of different parts Use, care and maintenance Pacemaker (Temporary to permanent)- Use, care and maintenance Defibrillator – Use, care and maintenance	Cardio- vascular system Heart & vessels, structure & function, names of main arteries and veins. Sources of bio-electrical potential. Electro Cardiography Basic principal, lead configuration, the Einthoven triangle. Specifications, common manufacturers, peripherals and accessories ECG system for stress testing- Treadmill with automatic programmer, ECG Radio telemetry system. EUG monitor with CRT and heart rate meter recorder Holter monitor – Working principle, specification Bedside monitor - Working principle, specification Central monitor – Working technique (from patient to the central monitor) Echo Cardiography – Basic principle, construction of different parts and functions. Ultrasonic transducers, different types of probes sector, prismatic Basic modes of transmission – Pulsed, continuous. Doppler ultrasonic imaging - M-scan display, B-scan display Phased array, sector scanning. Gray scaling – Use of gel, placement of transducer Camera (manual and auto) Specifications and calibration.

		Common manufacturers, peripherals & accessories. Pacemaker (temporary and Permanent) – Working principle, specifications. Defibrillator – Working principle, specifications
	Demonstration of Alimentary system with models & A.V. show.	<u>Alimentary system</u> Mouth, tongue, salivary glands, pharynx, tonsils, esophagus, stomach, small & large intestine, livers & biliary tract, spleen, pancreas, mesentery, momentum.
	Demonstration of Respiratory system with models & A.V. show.	<u>Respiratory system</u> Accessory nasal sinuses, larynx, trachea, bronchi, lungs, pleura.
	Demonstration of Urinary tract with models & A.V. show.	<u>Urinary tract</u> Kidney, Ureters, Bladder, Urethra.
	Demonstration of Nervous system with models & A.V. show.	<u>Nervous system</u> General features, central nervous system, brain & spinal cord, peripheral nervous system, voluntary & involuntary nervous system. Ventricles, cerebrospinal fluid. Action potential.
	Demonstration of Basic Human Metabolism with models & A.V. show.	<u>Basic Human Metabolism</u> – Various organic constituency of human body- Protection, fat, salts (electrolyte & non-electrolytes), functions of special proteins enzymes, humans, antibodies.
	Test various gas plant operation using suitable care and safety. Analyse different types of medical gas required for patient treatment like Oxygen, Nitrous and Vacuum required in ICU, Wards and OT.	Test all machines related to gas bank Refilling of oxygen in LMO plant Repairing and maintenance of gas pipe line. Valve operation and monitoring and servicing.
13	**Assessment/Examination (03 days)**	

<u>Note: -</u> *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

Basic Training – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Unit:** Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	Introduction to Engineering Drawing. Its relevant to the trade. ▪ Relationship to the other technical drawing types ▪ Conventions ▪ Viewing of engineering drawing sets ▪ Method of folding of printed drawing sheet as per BIS SP: 46-2003 Use of Drawing Board, T-Square, Set Square, Protractor, and other draws Instrument.
2.	**Fractions:** Fractions, decimal fraction, L.C.M., H.C.F., Multiplication and division of fraction and decimal, conversion of fraction to decimal and vice versa. Simple problems using Scientific calculat1or	**Draw Instruments**: their uses Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.
3.	Force, Vector representation composition & resolution of forces. Moment of forces.	Free hand sketching simple solid such as cubes, rectangular blocks, cylinders, and cones etc. and their view when viewed perpendicular to their base as well as axes.
4.	**Algebra:** Revision of formulae identities and equation. Logarithm. Graphs and equation, addition, subtraction, multiplication, division, algebraic formula, linear equation	**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
5.	**Trigonometry:** Applied problems in height & distance, solution of triangle & applied problems	Drawing of Solid figure.
6.	**Heat and Temperature:** Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	**Drawing of Geometrical Figures:** • Definition, nomenclature and practice of angle measurement and its types, method of bisecting. • Triangle - different types • Rectangle, Square, Rhombus, Parallelogram. • Circle and its elements.

7.	**Basic Electricity:** Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of electrical energy.	**Lettering and Numbering as per BIS SP46-2003:** - • Single Stroke, Double Stroke, inclined, Upper case and Lower case.
8.	**Levers and Simple Machines:** levers and its types. Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.	**Dimensioning:** • Definition, types and methods of dimensioning (functional, nonfunctional and auxiliary) • Types of arrowhead • Leader Line with text
9.	**Friction:** Laws of friction, co- efficient of friction, angle of friction, simple problems related to friction. Lubrication Rectifier: RMS. Maximum, Average values of voltage and current in rectifiers form factor, ripple factor.	Method of presentation of Engineering Drawing • Pictorial View • Orthogonal View • Isometric view
10.	**Forces:** Resolution and composition of forces. Representation of force by vectors, simple problems on lifting tackles like jib wall, crane. Solution of problems with the aid of vectors. General condition of equilibriums for series of forces on a body. Law of parallelogram, Triangle Law, Lami's Law theorem.	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
11.	**Centre of gravity:** Centre of gravity concept and C.G. of different lamina. Equilibrium different kinds stable, unstable and neutral. Law of parallelogram force. Triangle law, Lami's theorem stable, unstable and neutral equilibrium.	Sectional drawing and various simple engineering item
12.	**Number system:** decimal and binary, Octal Hexa decimal. BCD code, conversion from decimal to binary and vice-versa, all other conversions. Practice on conversions.	Orthographic drawing from isometric figure of engineering items and vice versa
13.	Estimation & costing: Simple estimation of the requirement of materials etc. as applicable to the trade. Problems on estimation and costing. Further Mensuration: Volumes of frustums including conical frustums. Graph- Basics, abscissa, co-ordinate etc. Y = mz and Y= mx + c graph	Various mechanical symbols indicating material, surface, finish, hardness, symbol of various electrical and electronic components
14.	Simple Problems on Profit & Loss. Simple and compound interest.	Reading electrical layout and drawing
15.	**Magnetism:** Magnetic material, magnetic	**Generator:** Front panel control for function

	field, flux density, magnetic moment, m.m.f. Reluctance, permeability, susceptibility, electromagnet, solenoid and its practical applications. wavelength calculation and their relationship	generator, IC tester, power supply, remote control, in plane switching.
16.	Current electricity, Ohm's law, Kircheff's rule potentiometer. Wheatstone bridge & related problem.	Drawing the sketches of the components of hydraulic system. Block diagram of hydraulic systems Drawing the sketches of the components of pneumatic system. Block diagram of pneumatic systems.

Basic Training – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	Use of logarithms & antilogarithms tables & problems there on multiplication, division, fraction.	Orthographic projection I & III angle- simple machine elements, procedure for preparing a scale drawing.
2.	Newton's law of motion & related problems. Friction & its kinds - advantages & division, fractions.	Draw a plan, elevation & side view of prism, cylinder, frustum of cone, pyramid.
3.	Estimation & cost of finished products.	Draw a plan, elevation & side view of object having stepped blocks with curved surfaces in 1st&3rdangle.
4.	Classification of ferrous & nonferrous metals & alloys, physical &mechanical properties of metal.	Drawing isometric views out of orthographic views.
5.	Algebraic addition, subtraction, multiplication & division. Simultaneous equation, factors & related problems.	Draw the isometric projection of cube, hexagonal prism, cylinder, cone, objects/ blocks with curved surfaces.
6.	Meaning of HP, IHP, BHP, FHP, efficiency, problems on horsepower.	Visualize the shape of object from the given two views and add third view- simple machine element.
7.	Trigonometry- ratio, formulae, area of triangle, height & distance by using trigonometry. Pythagoras theorem.	Identify the lines missed in multi views and supply them, third view for the given two views of similar in shapes & size.
8.	Heat treatment - process of annealing, normalizing, hardening, tempering, case hardening, carburizing, nitriding.	Development of regular objects bounded by plane surfaces- cube, prism, cylinder & cones.
9.	Basic principles of electricity. Ohms law. Use of switch, fuse, conductor, insulator &semiconductor. Series & parallel circuits.	Draw the development of surfaces of a cube & prism, cylinder, cones.
10.	----------	Explanation of full- sectional view, half sectional view, aligned sections.
11.	----------	Conventions & symbols used on drawing, abbreviations used on engineering drawing, surface finish symbols, welding symbols & annotation.
12.	----------	Blueprint reading of various drawings; take out blueprint from blueprint machine.

9.2 EMPLOYABILITY SKILLS (DURATION: - 110 HRS.)

Basic Training – 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 cybercrimes.
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

Basic Training – 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)

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

OJT - I

1. Apply knowledge of hospital environment, medical equipment & their functions.
2. Plan and perform working with Sonometer, various Optical instruments like spectrometer, spectrophotometer, microscope etc. and heat & temperature measuring instruments.
3. Check and operate machines for Radio activity application, X-Ray and laser rays.
4. Plan and construct electronic circuits, regulator circuits, oscillator circuits etc. using transistor, multivibrators and amplifier.
5. Assemble, test and troubleshoot various digital circuits using A/D & D/A converter.
6. Plan and perform testing and troubleshooting of microprocessor based Medical programmable system.
7. Evaluate waveforms using CRO and check the result with standard level using Multimeters, X-Y Recorders, Signal generator, strip - chart recorder etc.
8. Demonstrate use of strain gauge, capacitive & inductive transducer, thermocouple etc.
9. Apply basic knowledge of computer and test frequencies applying the principle of modulation and demodulation.

OJT - II:

10. Check setting of X-ray dark room, system processing, sterilization procedure and hospital hygiene.
11. Demonstrate purpose, usage and maintenance of critical care equipment in different operating sectors like O.T., Emergency, ICU, Clinical Lab (Diagnostic and operative) and CSSD.
12. Apply the knowledge of basic Anatomy and Physiology for operation of medical equipments.
13. Test and troubleshoot EGC, EUG machines, Doppler machine, Defibrillator (pasic and bi-pasic) etc.
14. Test various medical gas plant operation using suitable care and safety measures.

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

LIST OF TOOLS & EQUIPMENT (Basic Training) (For 16 Apprentices)			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
i) Trainees kit:			
1.	Screw driver (Electrician ordinary)	150 mm	16 nos.
2.	Screw driver	Philips nos. 860, 861, 862	16 sets.
3.	Watch maker's screw driver (set of six)		16 sets.
4.	Long nose plier. Insulated	15 cm	16 nos.
5.	Diagonal cutter insulated	15 cm.	16 nos.
6.	Combination plier insulated	150 mm.	16 nos.
7.	Adjustable spanner or slide wrench	15-16 cms.	16 cms.
8.	Tweezer		16 nos.
9.	File flat	200 mm.	16 nos.
10.	File triangular	150 mm.	16 nos.
11.	Soldering Iron	10W	16 nos.
12.	Soldering Iron	35 W	16 nos.
13.	Soldering Iron	65 W	16 nos.
14.	De-soldering Iron		16 nos.
15.	Knife	100 mm.	16 nos.
16.	Scissors	150 mm.	16 nos.
17.	Hammer small	250 gm.	16 nos.
18.	Neon Tester		16 nos.
19.	Apron		16 nos.
20.	Gloves		16 nos.
General Installation Equipment:			
1.	Multimeter		4 nos.
2.	CRC	50 MHZ	2 nos.
3.	Transistor Tester		2 nos.
4.	Linear IC tester		2 nos.
5.	Digital IC tester		2 nos.
6.	Insulation tester (Megger)		2 nos.
7.	Frequency meter		2 nos.
8.	LCR Bridge		2 nos.
9.	AF Signal generator		2 nos.
10.	RF signal generator		2 nos.
11.	Electric drill	10 mm. with bits all sizes	2 nos.
12.	Vernier caliper		2 nos.
13.	Screw gauge		2 nos.

14.	Discrete component trainer		2 nos.
15.	Linear IC trainer		2 nos.
16.	Digital IC trainer		2 nos.
17.	Micro processor trainer		2 nos.
18.	Instrumentation tutor		2 nos.
19.	Potentiometric recorder		2 nos.
20.	Strip chart recorder		2 nos.
21.	Apparatus for determination of surface tension		1 No.
22.	Sonometer		1 No.
23.	Resonance water column		1 No.
24.	Tuning forks		6 nos.
25.	Apparatus for focal length of lens		1 set.
26.	Insulation tester (Megger)		2 nos.
27.	Spectrometer		1 No.
28.	Apparatus for demonstration of Newton's ring		1 No.
29.	Discharge tube		1 No.
30.	G.M. counter		1 No.
31.	P.C. - AT		1 No.
32.	Stethoscope		1 No.
33.	Digital sphygmomanometer		1 No.
34.	Spirometer		1 No.
35.	thermometer		1 No.
36.	Ventilator electrically operated with tidal volume variable respiratory mts.& I : E ratio	10 cc to 300 cc	1 No.
37.	Heart lung machine		1 No.
38.	Boyle's apparatus ½ lit.		1 No.
39.	Sucker machine	220 V AC, EM-16 ¼ HP	1 No.
40.	Clinical microscope		1 No.
41.	Operating microscope		1 No.
42.	Fibre optic light supply		1 No.
43.	D.V. Stabilizer		1 No.
44.	Autoclave		1 No.
45.	Diathermy machine (ordinary)		1 No.
46.	Diathermy machine (under water for cutting)	500W	1 No.
47.	Diathermy machine (under water for coagulation)		1 No.
48.	Cryosurgical equipment		1 No.
49.	Operating laparoscope with video		1 No.

	connection		
50.	Cautery machine		1 No.
51.	Central alarm system		1 No.
52.	Fire extinguisher		1 No.
Note: - *All the tools and equipment are to be procured as per BIS specification.*			

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: Mechanic Medical Equipment and For Hospital and Occupational Health

LIST OF TOOLS & EQUIPMENT FOR - 16 APPRENTICE

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		16
2.	Set square celluloid 45^o	250 X 1.5 mm	16
3.	Set square celluloid 30^o-60^o	250 X 1.5 mm	16
4.	Mini drafter		16
5.	Drawing board IS: 1444	700mm x500 mm	16
B : Furniture Required			
1	Drawing Board		16
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 & EQUIPMENT 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	08 Nos.
2.	UPS - 500VA	08 Nos.
3.	Scanner cum Printer	1 No.
4.	Computer Tables	08 Nos.
5.	Computer Chairs	16 Nos.
6.	LCD Projector	1 No.
7.	White Board 1200mm x 900mm	1 No.
Note: - Above Tools & Equipment not required, if Computer LAB is available in the institute.		

ANNEXURE-II

FORMATIVE ASSESSMENT

Name & Address of the Assessor :		**Year of Enrollment :**
Name & Address of BTP/Establishment (Govt./Pvt.) :		**Date of Assessment :**
Name & Address of the Industry :		**Assessment location: Industry / ITI**
Trade Name :	**Examination:**	**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 formative assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														