

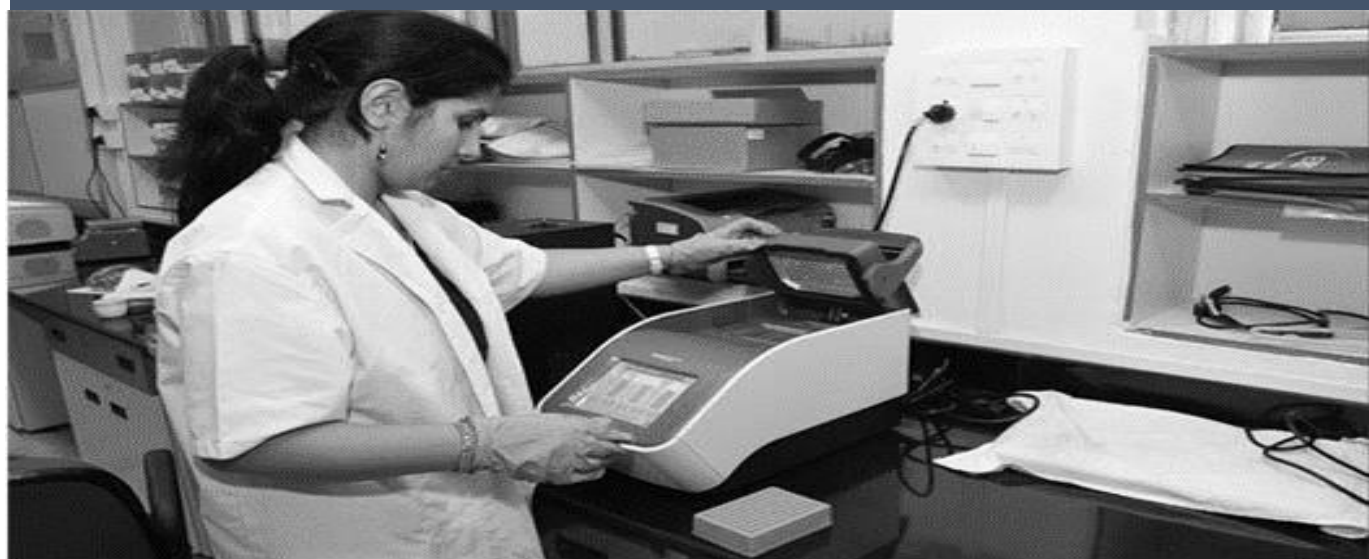
Ministry of Health and Family Welfare 2017



सत्यमेव जयते

Short Term Training Curriculum Handbook

MEDICAL EQUIPMENT TECHNOLOGY ASSISTANT



**Standards in accordance with
The National Skills Qualifications Framework (NSQF)
Ministry of Skill Development and Entrepreneurship**

Ministry of Health and Family Welfare
2017



सत्यमेव जयते

Short Term Training Curriculum
Handbook
**MEDICAL EQUIPMENT
TECHNOLOGY ASSISTANT**

Standards in accordance with
The National Skills Qualifications Framework (NSQF)
Ministry of Skill Development and Entrepreneurship

Contents

INTRODUCTION TO THE SKILLS BASED TRAINING CURRICULA.....	3
Who is a Medical Equipment Technology Assistant?	3
Scope of practice	3
Minimum Entry requirement	4
Minimum Course duration.....	4
Teaching faculty and infrastructure	4
Medium of instruction:	4
Attendance:.....	4
TRAINING CURRICULA FOR SKILL CERTIFICATION.....	6
MODULE – 1: FOUNDATION MODULE: INTRODUCTION TO THE MEDICAL EQUIPMENT TECHNOLOGY ASSISTANT PROGRAM	6
MODULE- 2: INTRODUCTION TO MEDICAL EQUIPMENT TECHNOLOGY- CONCEPTS.....	9
MODULE – 3: UNDERSTANDING THE WORKING OF BASIC EQUIPMENTS	12
MODULE – 4: CALIBRATION AND MAINTENANCE OF BASIC EQUIPMENTS.....	15
MODULE – 5. KNOWLEDGE OF EQUIPMENT AND DEPARTMENTAL PRACTICUM	17
CONTRIBUTORS TO DRAFTING AND REVIEW OF SKILL BASED CURRICULA	20
REFERENCES.....	22

INTRODUCTION TO THE SKILLS BASED TRAINING CURRICULA

The Skill based training courses are the training content developed for enhancing the specific skills of existing professionals or provide for a platform for imparting skills to candidates with no formal qualification.

To undertake the skill based training programme, it is mandatory that the candidate must fulfil the entry criteria provided for the job profile. The training and assessment will certify that the candidate is able to undertake specific set of activities. **This must not be equated with the formal qualifications-diploma/ degrees which are given by a University.**

It is recommended that the employer must help the candidate in continuing the studies to degree level and formal qualification, if the candidate is willing to gain knowledge and wants to move up the traditional career pathway.

Who is a Medical Equipment Technology Assistant?

Medical Equipment technology Assistants are more commonly referred to as medical equipment repairers in the healthcare industry. They are also known as biomedical equipment assistants. These professionals spend much of their time working hands-on with machines. To adjust and repair equipment, they use both tools and computer applications. BMEAs also perform some office duties such as reviewing product manuals and record keeping.

Aspiring biomedical assistant should have a passion for machines and technology as well as a knack for troubleshooting and repairs. Because an equipment failure often creates an emergency situation, the assistant must work well in fast-paced, high-pressure situations. Finally, he/she must have excellent interpersonal skills in order to work effectively with medical professionals, hospital staff, administrators, patients and instruments.

Scope of practice

As a professionals, medical equipment technology assistant can work directly for a hospital, physician's office or long-term care facility. Opportunities are also available to work for a third party contractor, servicing the equipment of multiple facilities. It is the responsibility of the professional to keep medical equipment such as heart monitors, electric wheelchairs, operating tables and respirators etc. running properly. The work requires the professionals to have knowledge of electronics, hydraulics and computer technology.

A medical equipment technology program requires the candidate to gain basic knowledge of electronic circuitry, algebra, calculus, physics and chemistry. Coursework also include training on computer technology and microprocessors. Candidate also learns how to use equipment designed to diagnose and fix malfunctioning medical equipment. Contact sessions will teach the techniques used to calibrate and repair machinery that monitors patients. The course is designed with combination of contact knowledge session on the subject and intensive hands-on training thus providing the required experience. A certificate program in medical equipment technology is designed to teach these prospective workers how to install, troubleshoot, service, repair, and maintain sophisticated medical equipment. This course opens new avenues of specialization for allied health professionals and would offer better work opportunities in the field.

At the end of the course the candidate will have a certification of the skills attained and would be eligible to perform following activities:

- Explain the role of medical equipment technicians in health care settings.
- Solve basic circuit problems involving DC and AC circuits.
- Explain the structure and function of major organ systems in the human body, such as the cardio-vascular, nervous, endocrine, and renal systems.
- Describe the theory of operation, functioning and clinical application of medical devices such as heart monitors, blood pressure monitors, pulse oximeters, infusion pumps, suction devices, and centrifuges and carry out operational checks on such devices.
- He/She should be able to train and educate the hospital staff about operating the various installed medical equipment.
- To be able to calibrate and assist in equipment maintenance.
- To be able to provide on and off- site assistance with the functioning of the medical equipments.
- To be able to perform as a member of multidisciplinary team in a hospital setting.

Minimum Entry requirement

Applicants must have minimum BSc. qualification to enter into this program.

Minimum Course duration

It is recommended that any programme developed from this curriculum should have a minimum of the 1500 hrs duration to qualify as an entry level professional in the field of medical equipment technology. This includes 318 hrs of theory and 640 hrs of practical and 542 hours of internship.

Teaching faculty and infrastructure

This course will provide students with an overview of the role of the medical equipment technology Assistant and the role of Biomedical Engineering departments in hospitals and the hospital environment in general. Coursework provides a general overview of concepts and principles behind the use and operation of equipment used to diagnose and treat various health conditions. Emphasis needs to be placed on proper medical equipment inspection techniques and safety standards. The certificate-level curriculum provides coursework in the foundations of electronics, networking, troubleshooting, repair techniques, and basic human anatomy. Topics covered include:

- Biomedical instrumentation
- Medical terminology
- Electronic circuits
- Biomedical measurements
- Hospital safety standards

Medium of instruction:

English/ regional language shall be the medium of instruction for all the subjects of study and for examination of the course.

Attendance:

A candidate has to secure minimum 80% attendance in overall with at least-

1. 75% attendance in theoretical
2. 80% in Skills training (practical) for qualifying to appear for the final examination.

No relaxation, whatsoever, will be permissible to this rule under any ground including indisposition etc.

TRAINING CURRICULA FOR SKILL CERTIFICATION

MODULE – 1: FOUNDATION MODULE: INTRODUCTION TO THE MEDICAL EQUIPMENT TECHNOLOGY ASSISTANT PROGRAM

Learning Outcomes: At the completion of this module, the student should be able to:

1. Understand the healthcare scenario in India
2. Understand the duties and responsibilities of a Medical Equipment Technology Assistant
3. Learn the scope of work for a Medical Equipment Technology Assistant
4. Adhere to legislation, protocols and guidelines relevant to one's role and field of practice
5. Work within organizational systems and requirements as appropriate to one's role
6. Recognize the boundary of one's role and responsibility and seek supervision when situations are beyond one's competence and authority
7. Maintain competence within one's role and field of practice
8. Understand the art of effective communication with various stakeholders like patients, nurses, etc.
9. Be able to give facts and avoid opinions unless asked for
10. Learn how to identify rapidly changing situations and adapt accordingly
11. Be able to handle effective communication with patients & family
12. Have a basic working knowledge of computers
13. Understand the important of first aid and triage
14. Understand his/her role in disaster preparedness and management

Content -

S. No.	Topics	Hours		
		Theory	Practical	Total
1.	Introduction to healthcare and hospitals	3	2	5
2.	Introduction to the Medical Equipment Technology Assistant program	2	3	5
3.	Professionalism and Values	2	1	3
4.	Communication	3	7	10
5.	Interpersonal skills and working with others	2	3	5
6.	Computers and information technology	2	8	10
7.	Basics of emergency care and life support skills	2	13	15
8.	Disaster preparedness and management	2	3	5
TOTAL		18	40	58

Detail of Topics

- 1. Introduction to healthcare and hospitals**
 - a. Healthcare delivery system in India at primary, secondary and tertiary care
 - b. Community participation in healthcare delivery system
 - c. Issues in Health Care Delivery System in India
 - d. Health scenario of India- past, present and future
 - e. Basic medical terminology
- 2. Introduction to the Medical Equipment Technology Assistant program**
 - a. Duties and responsibilities of a Medical Equipment Technology Assistant

3. Professionalism and Values

- a. Code of conduct, professional accountability and responsibility, misconduct
- b. Ethics in healthcare – Privacy, confidentiality, consent, medico legal aspects
- c. Understanding scope of work and avoiding scope creep
- d. Handling objections
- e. Gather information from observation, experience and reasoning
- f. Identification of rapidly changing situations and adapt accordingly
- g. Planning and organization of work

4. Communication

- a. Writing skills
 - i. Basic reading and writing skills, sentence formation, grammar and composition, how to enhance vocabulary
 - ii. Business communication like letters, e-mails
- b. Special characteristics of health communication
- c. Barriers of communication & how to overcome them
- d. Listening and Speaking skills
 - i. Structure brief and logical messages
 - ii. Speak clearly and slowly in a gentle tone
 - iii. Use the correct combination of verbal and non-verbal communication
 - iv. Use language familiar to the listener
 - v. Give facts and avoid opinions unless asked for

5. Interpersonal skills and working with others

- a. Goal setting, team building, team work, time management,
- b. Thinking and reasoning, problem solving
- c. Need for customer service and service excellence in medical care
- d. Communication with various stakeholders
 - i. Handling effective communication with patients & family
 - ii. Handling effective communication with peers/colleagues using medical terminology in communication
 - iii. Telephone and email etiquettes
- e. Manage work to meet requirements
 - i. Time management
 - ii. Work management and prioritization

6. Computers and information technology

- a. Use of computers, its input and output devices
- b. Use of basic software such as MS Office, operating systems (Windows) and internet
- c. Use of data –
 - i. Entry, saving and retrieving
 - ii. Scanning and copying medical records/documents
 - iii. Efficient file naming and uploading
 - iv. Printing, as needed
- d. Application of Computers in clinical settings

7. **Basics of emergency care and life support skills**
 - a. Vital signs and primary assessment
 - b. Basic emergency care – first aid and triage
 - c. Ventilations including use of bag-valve-masks (BVMs)
 - d. Choking, rescue breathing methods
 - e. One- and Two-rescuer CPR
 - f. Using an AED (Automated external defibrillator).
 - g. Managing an emergency including moving a patient

8. **Disaster preparedness and management**
 - a. Fundamentals of emergency management
 - b. Preparedness and risk reduction
 - c. Incident command and institutional mechanisms
 - d. Resource management

Equipment required/ teaching strategies for the above content-Videos and presentations, discussions, dialogues, short presentations, dummies, first aid kit, etc.

Assessment for the above content– The candidate should be assessed on his abilities to do the following activities

S. No.	Assessment Criteria for the Assessable Outcomes	Marks Allocation		
		Viva/ Theory	Skills Practical	Total
1.	Explain the role of a Medical Equipment Technology Assistant in a hospital	10	0	10
2.	Describe the major responsibilities of the job of a Medical Equipment Technology Assistant in a hospital	15	0	15
3.	Describe the need for customer service and service excellence in Medical service	10	10	20
4.	Describe and demonstrate how to communicate with patient with impaired hearing/ vision/ speech/ memory	5	25	30
5.	Enumerate the changes in the patient with abnormal behavior	5	0	5
6.	Identify the various contents of First Aid Kit	0	20	20
7.	Demonstrate Heimlich Maneuver	0	10	10
8.	Demonstrate the immediate action to be taken for a patient with nosebleed/ minor burns/ asthma attack/fainting/ sprain/ hypothermia/ bites – bee sting or snake bite	0	30	30
9.	Explain the importance of treating confidential information correctly	10	0	10
10.	Demonstrate basic first aid and CPR	0	30	30
11.	Describe precautions in the event of a disaster	5	5	10
12.	Demonstrate the basic use of computers and aspects related to data handling	0	10	10
Total		60	140	200

MODULE- 2: INTRODUCTION TO MEDICAL EQUIPMENT TECHNOLOGY- CONCEPTS

Learning Outcomes: At the completion of this module, the student should be able to:

1. Measure given dimensions by using appropriate instruments accurately.
2. Select proper measuring instrument on the basis of range, least count & precision required for measurement.
3. Select proper material for intended purpose by studying properties of materials.
4. Identify good & bad conductors of heat.
5. Analyze relation among pressure, volume and temperature of gas & to interpret the results
6. Identify the effect of interference between light waves.
7. Represent the formation of molecules schematically.
8. Describe the mechanism of electrolysis.
9. Identify the properties of metals & alloys related to engineering applications.
10. Identify the properties of non-metallic materials, related to engineering applications.
11. Compare the effects of pollutants on environments & to suggest preventive measures & safety.
12. Develop basic knowledge of Medical computer usage and applications in imaging field.
13. Develop basic concept of suction apparatus.
14. Develop basic concepts of hydraulic systems.
15. Have understanding related to medical exposure of X- rays with basics of X-Ray.
16. Recognize the component & type of component.
17. Recognize the material used for the construction of component.
18. Understand the construction, working principle of the component.
19. Understand the specification of the component.
20. Identify the electronic components used in Household appliances, communication kits, and electrical appliances.
21. Identify and explain the concepts of quality of care and quality improvement techniques in the department.

Content -

S. No.	Topics	Hours		
		Theory	Practical	Total
1.	Introduction of medical equipment technology-I	20	30	50
2.	Basic Physics	20	30	50
3.	Computer Circuit and laboratory	20	30	50
4.	Basic Chemistry	20	30	50
5.	Basic Mathematics	20	30	50
6.	Introduction to quality and patient safety	10	10	20
TOTAL		110	160	270

Detail of Topics

1. **Introduction of medical equipment technology-I**
 - a. Basic theory of operation, function and clinical application of a range of medical devices, such as infusion pumps, heart monitors, blood pressure monitors, pulse oximeters, suction devices, and centrifuges

2. Basic Physics

- a. Units and measurements
- b. General properties of matter- elasticity, surface tension, viscosity
- c. Heat- gas laws and specific heat of gases
- d. Light- properties of light, Laser
- e. Sound- properties
- f. Photo electricity- concept, photoelectric field
- g. X-rays- Introduction to x-rays, types of x-ray spectra-continuous and characteristics, production of x-rays using Coolidge tube, minimum wavelength of x-rays, properties of x-rays

3. Basic Chemistry

- a. Atomic structures
- b. Electro- chemistry
- c. Metals and alloys
- d. Nonmetallic materials
- e. Environmental pollution- air, water and other

4. Basic Mathematics

- a. Algebra- Logarithms, partial fractions
- b. Trigonometry- ratios, factorization, inverse ratios
- c. Coordinate geometry- points and distance, straight lines, circles
- d. Vectors and applications

5. Introduction to Quality and patient safety

- a. Quality assurance and management - The objective of the course is to help students understand the basic concepts of quality in health Care and develop skills to implement sustainable quality assurance program in the health system.
 - i. Concepts of Quality of Care
 - ii. Quality Improvement Approaches
 - iii. Standards and Norms
 - iv. Quality Improvement Tools
 - v. Introduction to NABH guidelines

6. Computer circuit and laboratory

- a. Resistors And Capacitors
- b. Switches, Relays and Displays- Switch Specifications – voltage rating, contact current rating, contact resistance, life. Characteristics of switch & relay - operating time, release time, bounce time, electrical life, and mechanical life. Constructional diagram, application of Toggle, Rotary, push to on & push to off, Rocker switch, slide switch, thumbwheel switch.
- c. Relays- NO, NC contact, construction, working and application of General purpose relay, dry reed. Difference between switch & relay, types of displays.

Equipment required/ teaching strategies for the above content-Videos and presentations, discussions, dialogues, equipment dummies etc.

Assessment for the above content– The candidate should be assessed on his abilities to do the following activities

S. No.	Assessment Criteria for the Assessable Outcomes	Marks Allocation		
		Viva/Theory	Skills Practical	Total
1.	Interpret circuit diagrams and specifications of electronic systems in technical/service manuals for installation, testing and commissioning	20	30	50
2.	Proper selection of measuring instruments on the basis of range, least count, precision and accuracy required for measurement.	10	10	20
3.	Analyze properties of matter & their use for the selection of material.	20	10	30
4.	To verify the principles, laws, using given instruments under different conditions.	10	20	30
5.	To read and interpret the graph.	20	10	30
6.	To interpret the results from observations and calculations and to use these results for parallel problems.	20	10	30
7.	Measure the quantities Accurately	0	10	10
8.	Handle the apparatus carefully	0	10	10
Total		100	110	210

MODULE – 3: UNDERSTANDING THE WORKING OF BASIC EQUIPMENTS

Learning Outcomes: At the completion of this module, the student should be able to:

1. Analyze different factors on which capacitance depends.
2. Differentiate between field intensity and potential.
3. List advantages of optical fiber.
4. Describe principle of working of optical fiber.
5. Differentiate between conductor, insulator and semiconductor on the basis of band Theory.
6. State the effect of variation of resistance of material at very low temperature.
7. Recognize the IC, packaging type of IC, & device depending upon series letter (L, LS, and LM).
8. Draw the layout of electronic circuits
9. Fault finding & troubleshooting of electronic circuits
10. Design the PCB & test the PCB
11. Read datasheets and interpret the values.
12. Develop the testing knowledge of computer and use of computer. Computer software to draw the circuits
13. Use instruments effectively in daily practice.
14. Analysis Technique, testing and assembly of electronic circuit build Confidence for handling instruments, tools analysis circuit.

Content -

S. No.	Topics	Hours		
		Theory	Practical	Total
1.	Electronic circuit- I	30	50	80
2.	Introduction to medical equipment technology- II	30	60	90
3.	Electronic component and application	20	40	60
4.	Biomedical instrumentation and measurement	20	30	50
5.	Digital Tech. & Micro Processor	20	40	60
6.	Familiarization and working with Ultrasound machine, ECG and x-ray equipments	30	40	70
TOTAL		150	260	410

Detail of Topics**1. Introduction to medical equipment technology- II**

- a. How to test various medical devices for proper operation.
- b. This course further explores the healthcare technology management.
- c. Computerized equipment control and record keeping
- d. Safety issues will be covered in relation to both patient safety and the safety of Biomedical Equipment Technology Assistants (BMEAs).
- e. Basic theory of operation, function, clinical application and operation testing of a range of medical devices.

2. Electronic circuit- I

- a. Linear circuit analysis and design.
- b. Theory and operation of diodes and bipolar and field-effect transistors with circuit analysis.

- c. Laboratory includes the design and evaluation of bipolar and FET linear circuits using the oscilloscope and curve tracer.
- d. Introduction of integrated circuits.

3. Electronic component and application

- a. Inductors and Cable Connectors- ferrimagnetic, B-H curve, Hard & soft Magnetic Materials, Concepts of Hysteresis , permeability, coercivity, reluctivity , Losses of magnetic material, Faradays laws of Electromagnetic Induction , Self & mutual induced EMF Inductor Specifications- Definitions and expressions of self-inductance , mutual inductance, coefficient of coupling , operation at low & high frequency, Q factor, Inductive Reactance. Construction and application of Air core, iron core, ferrite core inductor, and frequency range Inductors-A.F. R.F., I.F., toroidal Inductor, Construction, working, application of Slug tuned Inductor.
- b. Color coding of Inductor using color band system.
- c. Connectors- General specifications of connectors- contact resistance, breakdown voltage, insulation resistance Constructional diagram, applications of BNC, D series, Audio, Video, printer, edge, FRC, RJ 45 connectors. Constructional diagram and applications of Phone Plug & Jacks

4. Biomedical instrumentation and measurement

- a. Basics of Mechanical Foundry Equipments
- b. Working of Motor, Drilling.
- c. Basic concept of suction apparatus

5. Digital Tech. & Micro Processor

- a. Review of Combinational & Sequential Logic Circuits
- b. Data Converters
- c. Semiconductor Memories
- d. Microprocessor

6. Familiarization and working with Ultrasound machine, ECG and x-ray equipments

- a. Medical exposure of X-Rays
- b. Medical computer usage and applications in imaging field
- c. Basic Of active and passive components
- d. Types of components with its working.

Equipment required/ teaching strategies for the above content-Videos and presentations, discussions, dialogues, equipment dummies etc.

Assessment for the above content– The candidate should be assessed on his abilities to do the following activities

S. No.	Assessment Criteria for the Assessable Outcomes	Marks Allocation		
		Viva/Theory	Skills Practical	Total
1.	Have understanding related to medical exposure of X-Rays	10	10	20
2.	Working knowledge and hands on experience with designing of circuits	10	20	30
3.	Working knowledge of spectrum	10	10	20
4.	Identify types of cables and connectors.	10	10	20
5.	Familiarizing and working with components eg: USG machines, ECG machines, X-ray equipment etc.	10	30	40
6.	Identification and soldering of surface mounted devices	0	10	10
7.	To study design rules for fabrication of PCB and identify types of PCB.	10	10	20
8.	Mini project and troubleshooting of the circuit.	0	20	20
9.	Draw and describe the basic circuits of rectifier, filter, regulator and amplifiers.	10	20	30
10.	Read the data sheets of diode and transistors.	10	10	20
11.	Test diode and transistors.	0	10	10
12.	Understand working of Regulated DC power supply.	10	0	10
13.	Ability to test the components using multimeter	0	10	10
14.	Follow standard test procedures.	10	10	20
15.	Able to draw circuits	0	10	10
Total		100	190	290

MODULE – 4: CALIBRATION AND MAINTENANCE OF BASIC EQUIPMENTS

Learning Outcomes: At the completion of this module, the student should be able to:

1. Analysis Technique, testing and assembly of electronic circuit build Confidence for handling instruments, tools analysis circuit.
2. Learn systematic fault finding techniques, troubleshooting procedures, component replacement procedure for developing troubleshooting skills.
3. Bring awareness about common problems, operating conditions, precautions & installation procedures of medical equipment and patient safety
4. how the signals are obtained from the body that is to be measured by various machines
5. Give the knowledge about optimum performance tests, calibration tests, operating modes, front & rear panel controls of different medical equipments
6. Analyze different factors on which capacitance depends.
7. Differentiate between field intensity and potential.
8. Differentiate between conductor, insulator and semiconductor on the basis of band theory.
9. State the effect of variation of resistance of material at very low temperature.
10. Use techniques of acquisition of information from various sources
11. Draw the notes from the text for better learning.
12. Apply the techniques of enhancing the memory power.
13. Develop assertive skills.

Content -

S. No.	Topics	Hours		
		Theory	Practical	Total
1.	Electronic circuit- II	20	30	50
2.	Safety procedural guidelines	5	10	15
3.	Installation, Maintenance and Servicing of Medical Equipment	10	30	40
4.	Maintenance of records	5	10	15
5.	Industry internship	0	100	100
TOTAL		40	180	220

Detail of Topics**1. Electronic circuit- II**

- a. It includes lecture series in continuation of solid-state linear circuit analysis and design.
- b. Design details of cascade resistance and direct coupled amplifiers
- c. Integrated differential and operational amplifiers
- d. Power amplifiers and oscillators.
- e. Introduction to feedback and distortion.
- f. Laboratory sessions to practice in fabricating, trouble-shooting and testing solid-state linear circuits using the oscilloscope, generators and the distortion analyzer.

2. Safety procedural guidelines

- a. Precautions while handling the radioactive rays
- b. Precautions while handling the high voltage circuits
- c. Securing the equipments and surroundings while repairing the equipment son the spot
- d. Shock and vibrations

- e. Protection from electro-magnetic interference
 - f. Maintaining the safety of the patient in the vicinity.
- 3. Installation, Maintenance and Servicing of Medical Equipment**
- a. Introduction & Fundamental of Trouble Shooting
 - b. Installation Procedure for equipments
 - c. Performance Test & Calibration of Medical Equipment
 - d. Trouble Shooting & Fault Finding Procedure of Medical Equipment
 - e. Safety Instrumentation
 - f. Provide on call and on site assistance
- 4. Maintenance of records**
- a. Maintenance and coding of various types of the log book for the machines in various departments of the hospital.
- 5. DDT Directed Clinical Education – part I (studentship)**

This includes supervised field experience with a hospital Biomedical or Clinical Engineering Department or hospital-based Independent Service Organization. Students will carry out inspections of basic medical devices and maintain records as required by the work site, under the supervision of an experienced Biomedical Equipment Technician or Clinical Engineer. The course provides students the opportunity to learn about professionalism in the workplace. Internship sites may have specific requirements for participation, such as vaccinations, background checks, drug screening, and so on.

Equipment required/ teaching strategies for the above content-Videos and presentations, discussions, dialogues, equipment dummies etc.

Assessment for the above content- The candidate should be assessed on his abilities to do the following activities

S. No.	Assessment Criteria for the Assessable Outcomes	Marks Allocation		
		Viva/ Theory	Skills Practical	Total
1.	Awareness of the safety aspects of medical instruments.	10	0	10
2.	Measuring physical quantities accurately.	0	10	10
3.	Mini project and troubleshooting of the circuit.	10	30	40
4.	To adopt proper procedure while performing the experiment	10	10	20
5.	Applications of various instruments.	10	10	20
6.	Check graphs/ waveforms for accuracy and correctness.	10	10	20
7.	Demonstrate On call assistance by giving assistance to hospital staff regarding the fault	0	10	10
8.	Read and interpret the graph.	10	10	20
9.	Interpreting the results from observations and calculations.	0	10	10
10.	Proper handling of instruments	0	10	10
11.	Know installation procedure.	10	10	20
12.	Information search through internet.	0	10	10
Total		70	130	200

MODULE – 5. KNOWLEDGE OF EQUIPMENT AND DEPARTMENTAL PRACTICUM (INTERNSHIP)

Learning Outcomes: At the completion of this module, the student should be able to:

1. Show competence in the corrective and preventive maintenance of biomedical equipment.
2. Identify, analyze, and solve open-ended problems with medical relevance such as those encountered during installation, inspection, repair, and calibration.
3. Utilize information gathered through troubleshooting process and develop and communicate an action plan to correct medical equipment.

Content -

S. No.	Topics	Total Hours
1.	Educate hospital staff about equipment	60
2.	Laboratory Equipment: Clinical Centrifuges	35
3.	Aspiration and Suction Devices: Aspirators and Suction Pumps	40
4.	Humidity and Aerosol Therapy Devices: Humidifiers, Nebulizers and Medical Compressors	12
5.	Medical Temperature Measuring Devices: Handheld Digital Thermometers and Temperature Monitoring Sensors	10
6.	Infant Care: Infant Incubators and Warmers	35
7.	Sterilizing Equipment: Steam Sterilizers and Hot Air Ovens	25
8.	Hospital Ancillary Equipment: Beds, Tables, Stretchers, Examination lamps, surgery couch and Wheelchairs	25
9.	Cardiology Equipment: Defibrillators, ECG etc.	50
10.	Vascular/Fetal Doppler Monitoring Systems	25
11.	Respiratory Care Equipment: Ventilators	45
12.	Laboratory Equipment: Microscopes	15
13.	Physiotherapy devices: ultrasound, TENS, SWD, MWD, IFT, LASER,	35
14.	Anesthesia Machines	35
15.	Surgical devices -Laparoscopy system, endoscope, arthroscope etc.	35
16.	Imaging machines: CT-scanner, MRI, Mammograph etc.	60
TOTAL		542

Detail of Topics

1. Principles of medical device
2. Clinical use and principle of operation of different types and models
3. Hands-on experience in installation, set-up, operation, routine maintenance, internal components and functional verification testing,
4. Demonstration of Cleaning and safety measures, Features and Setup of equipment's and its routine use to hospital staff
5. Information to hospital staff about use of equipment
 - Risk Factor associated with the use of equipment
 - Complexity

- Manufacturer's instruction and specification
 - Effective use of instruments
6. Demonstration of documentation and recording of equipments to hospital staff
- Reading of instrument/equipment
 - Recording
 - Record maintenance

Equipment required/ teaching strategies for the above content-Videos and presentations, discussions, dialogues, short presentations, dummies, first aid kit, other equipments required, etc.

Assessment for the above content– The candidate should be assessed on his abilities to do the following activities

S. No.	Assessment Criteria for the Assessable Outcomes	Total
1.	Describe and demonstrate principles, installation, operation and repair of Laboratory Equipment	40
2.	Describe and demonstrate principles, installation, operation and repair of Aspiration and Suction Devices	40
3.	Describe and demonstrate principles, installation, operation and repair of Humidity and Aerosol Therapy Devices	40
4.	Describe and demonstrate principles, installation, operation and repair of Medical Temperature Measuring Devices	40
5.	Describe and demonstrate principles, installation, operation and repair of Infant Care devices	40
6.	Describe and demonstrate principles, installation, operation and repair of Sterilizing Equipment	40
7.	Describe and demonstrate principles, installation, operation and repair of Hospital Ancillary Equipment	40
8.	Describe and demonstrate principles, installation, operation and repair of Cardiology Equipment	40
9.	Describe and demonstrate principles, installation, operation and repair of Vascular/Fetal Doppler Monitoring Systems	40
10.	Describe and demonstrate principles, installation, operation and repair of Respiratory Care Equipment	40
11.	Describe and demonstrate principles, installation, operation and repair of Laboratory Equipment	40
12.	Describe and demonstrate principles, installation, operation and repair of Physiotherapy devices	40
13.	Describe and demonstrate principles, installation, operation and repair of Anesthesia Machines	40
14.	Describe and demonstrate principles, installation, operation and repair of Surgical devices	40
15.	Describe and demonstrate principles, installation, operation and repair of Imaging Machines	40
16.	Provide, or coordinate the provision of, appropriate information related to the set-up, features, routine use, trouble shooting, cleaning, and maintenance of all equipment provided	45
17.	Provide relevant information and/or instructions about infection control issues related to the use of all equipment provided	45

S. No.	Assessment Criteria for the Assessable Outcomes	Total
18.	Ensure that the hospital staff can use all equipment provided safely and effectively	30
19.	Make sure training and instructions provided to the hospital staff shall commensurate with the risks, complexity, and manufacturer's instructions and/or specifications for the equipment	40
20.	Document all training and communication in the providers record, including the date, time, and signature of the person providing the service	40
Total		800

CONTRIBUTORS TO DRAFTING AND REVIEW OF SKILL BASED CURRICULA

Officers from Ministry of Health and Family Welfare, Government of India

1. Mr. Arun Kumar Jha, Economic Advisor, MoHFW
2. Mr. B S Murthy, Director, MoHFW
3. Dr. (Capt) Kapil Chaudhary, Director, MoHFW
4. Dr. Anil Sain, ADG, DGHS
5. Dr. N. K. Dhamija, DC (Trg), MoHFW
6. Dr. Sangeeta Saxena, DC (Trg.), MoHFW
7. Dr. Josephine Little Flower G., Former Nursing Advisor, MoHFW
8. Dr. Rathi Balachandran, ADG, Nursing Division, MoHFW
9. Mr. Satish Kumar, US (AHS), MoHFW

Special acknowledgement for detailed review – Dr. Himanshu Bhushan, Advisor, NHSRC and Dr. J K Das, Director, NIHF

Subject Experts

1. Dr. Alka Mohan Chutani, AIIMS, Delhi
2. Dr. Anita Singh, Becton Dickinson India Private Limited
3. Dr. Akshay Kumar, AIIMS, Delhi
4. Mr. A. Vaidheesh, GSK India
5. Mr. Arumugam Kalimuthu, WASH Institute
6. Ms Anuja Agarwala, Indian Dietetic Association
7. Ms. Amuda Sundari, CMC Vellore
8. Dr. Chawi Sawney, AIIMS, Delhi
9. Dr. Dharini Krishnan, Indian Dietetic Association
10. Dr. Devdas Shetty, Amar Shanth Paramedical College
11. Dr. G.S.Bhuvaneshwar, FBSE, IIT Madras
12. Dr. GV Ramanan Rao, GVK EMRI
13. Dr. Ghate, All India Institute of Local Self Government, Mumbai
14. Mr. Giri, Goutham Paramedical, Bangalore, Karnataka
15. Dr. Kesavadas, Sree Chitra Tirunal Institute for Medical Sciences and Technology
16. Mr. Kaptan Singh Sehrawat, Joint Forum of Medical Technologists of India (JFMTI)
17. Dr. Maneesh Singhal, AIIMS Delhi
18. Dr. Malkit Singh, PGIMER, Chandigarh
19. Dr. Nitish Naik, AIIMS Delhi
20. Dr. Namita Nadar, Fortis Hospital
21. Dr. Niranjana D. Khambete, Deenanath Mangeshkar Hospital and Research Centre, Pune
22. Dr. Nitin Kapoor, CMC Vellore
23. Ms. Neelanjana Singh, Indian Dietetic Association
24. Dr. Piyush Ranjan, AIIMS Delhi
25. Prof. Pandia Rajan, WASH Institute
26. Dr. Rakesh Garg, AIIMS

27. Dr. Reena Nakra, Dr Lal Path Labs
28. Dr. Rekha Sharma, Indian Dietetic Association
29. Dr. Satish Govind, Narayana Health
30. Ms. Seema Puri, Indian Dietetic Association
31. Ms. Sheela Krishnaswamy, Indian Dietetic Association
32. Dr. Tej Prakash Sinha, AIIMS
33. Dr. U.S Hanagarga, Karnataka Institute of Medical Sciences, Hubli, Dharwad, Karnataka
34. Dr. V. Desai, GSK India
35. Dr. Veena Kamath, Manipal College of Allied Health Sciences, Manipal University
36. Dr. Veenu Seth, Lady Irwin College, Delhi University

Representatives from Health Sector Skill Council and National Skill Development Agency

1. Ms. Yogita Daulatani, NSDA
2. Ms. Deepali, NSDA
3. Mr. Ashish Jain, HSSC
4. Dr. Zainab Zaidi , HSSC
5. Dr. Megha Aggarwal, HSSC

**Coordinated and compiled by the National Human Resources for Health (HRH) Cell,
MoHFW**

1. Ms. Kavita Narayan, Technical Advisor
2. Ms. Shivangini Kar Dave, Sr. Consultant
3. Ms. Natasha D'Lima, Sr. Consultant
4. Ms. Namita Gupta, Consultant
5. Ms. Utplakshi Kaushik, Consultant
6. Ms. Tanu Sri Sahu, Consultant
7. Mr. Vivek Bhatnagar, Consultant
8. Mr. Anirooddha Mukherjee, Consultant
9. Ms. Nupur Chaurasia, Technical Assistant
10. Ms. Anuja Joshi, Technical Assistant

REFERENCES

1. Qualifications pack - occupational standards for allied healthcare, Medical Equipment Technology, Health sector skills council
2. Diploma for biomedical courses, Sri Ramachandra University
3. Curriculum Documents for Medical Electronics, Maharashtra State Board of Technical Education, Mumbai
4. WHO's Medical Equipment maintenance programme:
<http://apps.who.int/medicinedocs/documents/s21566en/s21566en.pdf>
5. EU's Common core syllabus for medical equipment: http://cordis.europa.eu/project/rcn/49985_en.html
6. http://nielit.gov.in/sites/default/files/ESDM_Courses_nSyllabbi64_020715.pdf
7. http://nielitchennai.edu.in/Products/Large/advnt_jan_2014/bio.pdf
8. <C:\Users\bp\Desktop\medical equipement technician\Biomedical.pdf>