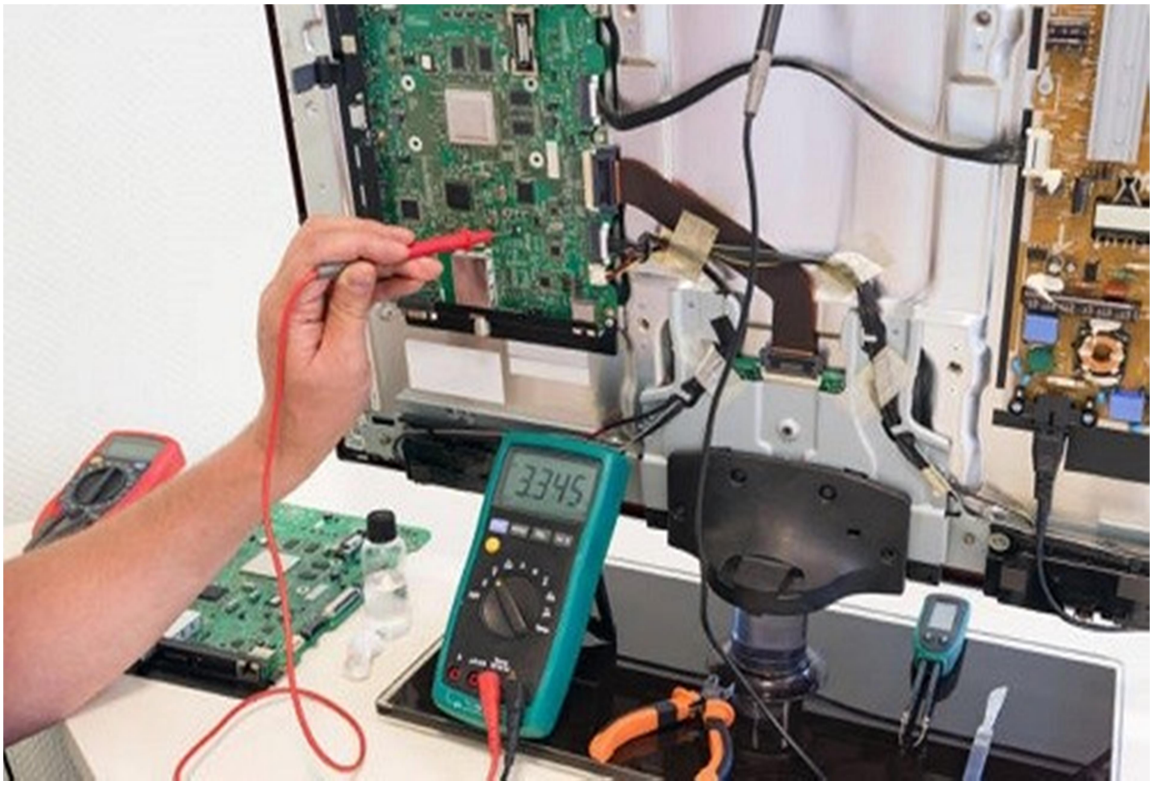

Model Curriculum

Biomedical Equipment Maintenance Assistant

QP Code: NIE/ELE/Q0802

Version: 1.0

NSQF Level: 3

Training Parameters

Sector	Electronics
Sub-Sector	Medical Electronics
Occupation	Electronics Equipment Services
Country	India
NSQF Level	3
Aligned to NCO/ISCO/ISIC Code	3211.0501
Minimum Educational Qualification and Experience	Grade 10th pass Or Grade 8th pass with two years of (NTC/ NAC) after 8th
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18
Last Reviewed On	31.01.2024
Next Review Date	31.01.2027
NSQC Approval Date	31.01.2024
QP Version	1.0
Model Curriculum Creation Date	31.01.2024
Model Curriculum Valid Up to Date	31.01.2027
Model Curriculum Version	1.0
Duration of the Course	300 hours

Program Overview

This section summarises the end objectives of the program along with its duration

Training Outcomes

- Holistic Healthcare Understanding: Develop a comprehensive understanding of the Indian healthcare delivery system, including its structure, services, and the distinction between private, public, and non-profit sectors.
- Medical Equipment Proficiency: Acquire proficiency in identifying and utilizing basic medical equipment and devices commonly used in healthcare settings.
- Electronics and Instrumentation Skills: Gain practical skills in electronics fundamentals, laboratory techniques, and semiconductor theory, including proficiency in soldering and de-soldering techniques.
- Biomedical Diagnostics Expertise: Acquire expertise in biomedical diagnostics, including the interconnected growth between human physiology and instrumental advancements. Develop skills in bio-electric potential measurement, cardiovascular analysis, microscopy, and the integration of digital computing in medical instruments.
- Safety Protocols and Practical Application: Implement safety protocols in electrical procedures and apply acquired knowledge and skills through hands-on experiences, such as preparing reports on healthcare observations, operating electronic testing equipment, and conducting practical diagnostic exercises.

Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the Qualification file.

NOS/Module Name	Training Duration (Hours)		
	Th.	Pr.	Total
NOS1: Introduction to healthcare delivery systems and role of medical equipment and devices NOS Code: NIE/ELE/N0808 NOS Version- 1.0 NSQF Level- 3	10	20	30
NOS2: Electronics Fundamentals and Laboratory Techniques NOS Code: NIE/ELE/N0809 NOS Version- 1.0 NSQF Level- 3	20	40	60
NOS3: Biomedical Diagnostics: Instrumentation and Analysis	60	60	120

NOS/Module Name	Training Duration (Hours)		
	Th.	Pr.	Total
NOS Code: NIE/ELE/N0807 NOS Version- 1.0 NSQF Level- 3			
NOS4: Employability Skills NOS Code: DGT/VSQ/N0101 NOS Version- 1.0 NSQF Level- 3	-	-	30
Project/ OJT	-	-	60
Grand Total	**90**	**120**	**300**

Module 1(NOS-1): Introduction to Healthcare Delivery Systems and Role of Medical Equipment and Devices

NOS Code: NIE/ELE/N0808

Terminal Outcomes:

After completion of the module, the students shall be able to:

- Describe the basic structure and function of the healthcare delivery system in India.
- Identify the basic medical equipment and devices.
- Distinguish between private, public, and non-profit healthcare delivery systems.
- Differentiate between various healthcare services.
- Prepare a report summarizing the observations about the basic structure and function of the healthcare delivery system in India.
- Spot the basic medical devices and medical equipment.

Key Learning Outcomes:

Duration: 10 hours	**Duration: 20 hours**
Theory	**Practical**
- Explain the historical evolution and key milestones in the development of healthcare delivery systems in India.	- Conduct hands-on exercises to operate common medical devices and equipment.
- Analyze the impact of socio-economic factors on healthcare accessibility and delivery.	- Demonstrate the proper usage and maintenance of medical equipment.

- Evaluate the role of technology in modern healthcare practices.	- Participate in field visits to healthcare facilities to observe real-world applications of medical devices.
- Examine the legal and ethical considerations in healthcare delivery.	- Collaborate in a team to create a mock healthcare delivery system, incorporating various services and technologies.
- Discuss the challenges and opportunities in the healthcare sector in India.	- Engage in discussions and case studies to analyze the effectiveness of medical equipment in different healthcare scenarios.
Classroom Aid	
Charts, Models, Video presentations, Simulation equipment, Whiteboard/Smart Board, Marker	
Tools, Equipment and Other Requirements	
Simulation equipment, basic medical devices, and a computer with internet access.	

Module 2(NOS-2): Electronics Fundamentals and Laboratory Techniques

NOS Code: NIE/ELE/N0809

Terminal Outcomes:

After completion of the module, the students shall be able to:

- Understand the fundamentals of voltage, current, power, and AC waveforms.
- Utilize tools for servicing, including hard and soft tools.
- Operate Multimeter, CRO, signal generator, LCR meter, etc.
- Perform calculations and testing for resistors and capacitors.
- Understand inductors, magnetic materials, self & mutual inductance, and Transformers.
- Comprehend semiconductor theory, test, and use active components like linear and digital ICs.
- Acquire soldering and de-soldering techniques.

Duration:

Key Learning Outcomes:

Duration: 20 hours	**Duration: 40 hours**
Theory	**Practical**
- Understand voltage, current, power, and AC waveforms.	- Utilize tools for servicing, including hard and soft tools.
- Operate Multimeter, CRO, signal generator,	- Perform calculations and testing for

LCR meter, etc.	resistors and capacitors.
- Explore inductors, magnetic materials, self & mutual inductance, Transformers.	- Comprehend semiconductor theory, test, and use active components.
- Acquire soldering and de-soldering techniques.	- Perfectly solder and de-solder on PCBs.
Classroom Aid	
Video presentations, Laboratory equipment, Whiteboard/Smart Board, Marker	
Tools, Equipment, and Other Requirements	
Tools & aids for servicing & maintenance, Hard & soft tools, Multimeter, CRO, signal generator, LCR meter, PCBs for soldering practice.	

Module 3(NOS-3): Biomedical Diagnostics: Instrumentation and Analysis

NOS Code: NIE/ELE/N0807

Terminal Outcomes:

After completion of the module, the students shall be able to:

- Gain an understanding of the interconnected growth between human physiology and instrumental advancements in biomedical engineering.
- Identify sources and methods for measuring bio-electric potentials in living cells and tissues. Explain the concepts of resting and action potentials, including the application of bio-potential electrodes.
- Analyze the cardiovascular system, exploring blood pressure dynamics, heart sounds, and blood flow characteristics. Understand the utilization of electrodes and sensors in measuring various physical parameters of the heart.
- Explain the significance and usage of microscopes in biomedical diagnostics. Understand their role in analyzing biological samples for diagnostic purposes.
- Explore the integration of digital computing and microprocessors in medical instruments. Understand the diverse applications of computing in the biomedical field.
- Identify the physiological effects of electrical current and potential hazards. Implement safety measures to ensure patient and equipment safety.

Key Learning Outcomes:

Duration: 60 hours	**Practical: 60 hours**
Theory	**Practical**
- Understand the development of biomedical instrumentation and the relationship between man and instruments in understanding human physiological systems.	- Utilize bio-potential electrodes and measure bio-electric potentials within living cells and tissues.
- Study cardiovascular analysis, blood pressure dynamics, heart sounds, and methods to measure physical parameters of the heart.	- Use microscopes for biomedical diagnostics and analyze biological samples.

- Explore the integration of digital computers and microprocessors in medical instruments.	- Implement electrical safety protocols and ensure patient and equipment safety.
- Examine ECG signals, electrode placement, and types of leads.	- Perform pH measurement, including troubleshooting, testing, and calibration.
- Understand the working principles of pH meters, electrodes, and their block diagrams.	- Conduct patient monitoring using appropriate techniques.
- Describe the operation and terminologies associated with patient monitors.	- Understand the working principles, testing methodologies, and repair procedures for blood pressure apparatus and stethoscopes.
- Explain the basic principles and functionalities of centrifuges.	- Operate microscopes, understanding the different types of microscope optics and their components.
- Identify maintenance protocols and procedures for replacing faulty parts in microscopes.	- Perform maintenance tasks and identify repair procedures for centrifuges.
Classroom aids	
Models, Video presentations, Simulation equipment, Whiteboard/Smart Board, Marker, Microscopes, Computing Devices, Safety Equipment (related to electrical protocols), ECG machine demonstration, pH meters, Patient Monitoring devices.	
Tools, Equipment and Other Requirements	
Multimeters, Cathode ray oscilloscope, Signal generator, LCR meter, Soldering and de-soldering tools, Blood pressure apparatus, Stethoscope, Centrifuge, Various types of microscopes, Computers with internet access.	

Module 4: Employability Skills
NOS Code: DGT/VSQ/N0101

After completing this program, participants will be able to:

- Outline the importance of Employability Skills for the current job market and future of work.
- List different learning and employability-related GOI and private portals and their usage.
- Research and prepare a note on different industries, trends, required skills, and the available opportunities.

Key Learning Outcomes

Duration: 30:00
Key Learning Outcomes
Constitutional Values – Citizenship • Explain constitutional values, civic rights, duties, citizenship, responsibility towards society etc. that are required to be followed to become a responsible citizen. • Show how to practice different environmentally sustainable practices

Becoming a Professional in the 21st Century

- Discuss relevant 21st-century skills.
- Display positive attitude, self -motivation, problem solving, time management skills and continuous learning mindset in different situations.

Basic English Skills

- Use appropriate basic English sentences/phrases while speaking

Communication Skills

- Demonstrate how to communicate in a well -mannered way with others.
- Demonstrate working with others in a team.

Diversity and Inclusion

- Show how to conduct oneself appropriately with all genders and PwD.
- Discuss the significance of reporting sexual harassment issues in time.

Financial and Legal Literacy

- Discuss the significance of using financial products and services safely and securely.
- Explain the importance of managing expenses, income, and savings.
- Explain the significance of approaching the concerned authorities in time for any exploitation as per legal rights and laws.

Essential Digital Skills

- Show how to operate digital devices and use the associated applications and features, safely and securely.
- Discuss the significance of using internet for browsing, accessing social media platforms, safely and securely.

Entrepreneurship

- Discuss the need for identifying opportunities for potential business, sources for arranging money and potential legal and financial challenges.

Customer Service

- Differentiate between types of customers.
- Explain the significance of identifying customer needs and addressing them.
- Discuss the significance of maintaining hygiene and dressing appropriately.

Getting ready for Apprenticeship & Jobs

- Create a biodata
- Use various sources to search and apply for jobs.
- Discuss the significance of dressing up neatly and maintaining hygiene for an interview.
- Discuss how to search and register for apprenticeship opportunities.

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training/Assessment Experience		Remarks
		Years	Specialization	Years	Specialization	
3 Years Diploma after class 10th /12th	Electronics/ Electrical	01	Electronics repair/maintenance	-	-	--
12th Pass	-	02 in the relevant domain				-

Trainer Certification	
Domain Certification	**Platform Certification**
Certified for ToT for Job Role: **NIE/ELE/Q0802** "**Biomedical Equipment Maintenance Assistant**" or equivalent as per NCrF. Minimum accepted score is 80%	Recommended that the Trainer is certified for the Job Role: "Trainer (VET and skills)", mapped to the Qualification Pack: "MEP/Q2601, v2.0" or equivalent as per NCrF. Minimum accepted score is 80%

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training/Assessment Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
3 Years Diploma after class 10th /12th	Electronics/ Electrical	5	Electronics repair/maintenance	-	-	--
12th		6				

		experience in the relevant domain				

Assessor Certification	
Domain Certification	**Platform Certification**
Certified for ToA for Job Role: **NIE/ELE/Q0802"Biomedical Equipment Maintenance Assistant"** as per NCrF. Minimum accepted score is 80%	Recommended that the assessor is certified for the Job Role: "Trainer (VET and skills)", mapped to the Qualification Pack: "MEP/Q2701, v2.0" or equivalent as per NCrF. Minimum accepted score is 80%

Assessment Strategy

- Assessment of the qualification evaluates candidates to ascertain that they can integrate knowledge, skills and values for carrying out relevant tasks as per the
- defined learning outcomes and assessment criteria.
- The underlying principle of assessment is fairness and transparency. The evidence of the outcomes and assessment criteria. competence acquired by the candidate
- can be obtained by conducting Theory (Online), Practical assessment, Internal assessment, Project/Presentation/ Assignment, Major Project. The emphasis is on the
- practical demonstration of skills & knowledge gained by the candidate through the training. Each OUTCOME is assessed & marked separately. A candidate is
- required to pass all OUTCOMES individually based on the passing criteria.
- About Examination Pattern:
- The question papers for the theory and practical exams are set by the Examination wing (assessor) of NIELIT HQS.
- The assessor assigns roll number
- The assessor carries out theory online assessments through remote proctoring methodology. Theory examination would be conducted online and the paper comprise of MCQ. Conduct of assessment are through trained proctors. Once the

test begins, remote proctors have full access to candidate's video feeds and computer screens. Proctors authenticate the candidate based on registration details, pre-test image captured and I- card in possession of the candidate. Proctors can chat with candidates or give warnings to candidates. Proctors can also take screenshots, terminate a specific user's test session, or re-authenticate candidates based on video feeds.

- An External Examiner/ Observer may be deployed including NIELIT officials for evaluation of Practical examination/ internal assessment / Project/ Presentation/. Major Project (if applicable) would be evaluated preferably by external/ subject expert including NIELIT officials.
- Pass percentage would be 50% marks in each component.
- Candidates may apply for re-examination within the validity of registration (only in the assessment component in which the candidate failed).
- For re-examination prescribed examination fee is required to be paid by the candidate only for the assessment component in which the candidate wants to reappear.
- There would be no exemption for any paper/module for candidates having similar qualifications or skills.
- The examination will be conducted in English language only.

References

Glossary

Term	Description
Declarative Knowledge	Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem.
Key Learning Outcome	Key learning outcome is the statement of what a learner needs to know, understand and be able to do in order to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical application).
OJT (M)	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on site
OJT (R)	On-the-job training (Recommended); trainees are recommended the specified hours of training on site
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work, or produce a tangible work output by applying cognitive, affective or psychomotor skills.
Training Outcome	Training outcome is a statement of what a learner will know, understand and be able to do upon the completion of the training.

Terminal Outcome	Terminal outcome is a statement of what a learner will know, understand and be able to do upon the completion of a module. A set of terminal outcomes help to achieve the training outcome.

Acronyms and Abbreviations

Term	Description
QP	Qualification Pack
NSQF	National Skills Qualification Framework
NSQC	National Skills Qualification Committee
NOS	National Occupational Standards