

**Model Curriculum**

**NSQF Qualification File – Repair and Maintenance Assistant  
(X-Ray & Ultrasound Machine)**

## Section 1:

S. No	Module Title	Topics	Duration (Hours)		Learning Outcome
			Theory	Lab	
1.	a. Tools b. DC & AC Electricity c. Test & Measuring instruments	<ul style="list-style-type: none"> <li>Tools &amp; aids for servicing &amp; maintenance, Hard &amp; soft tools</li> <li>Fundamentals, concept of voltage current, power, AC waveform</li> <li>Use of Multi meter, Cathode Ray Oscilloscope, Logic Analyser, Signal generator, LCR meters.</li> </ul>	10	5	<p>After successful completion of the module, the students shall be able to:</p> <ul style="list-style-type: none"> <li>Understand Voltage and current waveforms.</li> <li>Use of Multi meters, CRO.</li> </ul>
2.	Passive components	<ul style="list-style-type: none"> <li>Resistance, value Calculation, different types of resistance, working and testing.</li> <li>Capacitors, value Calculation, different types of capacitors, working and testing.</li> <li>Inductors, magnetic materials, self &amp; mutual inductance, Transformers - Step Up &amp; Down.</li> </ul>	10	15	<p>After successful completion of the module, the students shall be able to:</p> <ul style="list-style-type: none"> <li>Identify and calculate values, use passive component.</li> <li>Idea about magnetism, transformer and its use.</li> </ul>
3.	Active Components	<ul style="list-style-type: none"> <li>Semiconductor theory, testing, working, use and identification various active components, linear and digital ICs.</li> </ul>	20	25	<p>After successful completion of the module, the students</p>

					shall be able to: <ul style="list-style-type: none"> <li>Identify, test and use various active components.</li> </ul>
4.	Soldering and Desoldering	<ul style="list-style-type: none"> <li>Soldering, Desoldering Techniques. Theory and practice.</li> </ul>	5	15	After successful completion of the module, the students shall be able to: <ul style="list-style-type: none"> <li>Perfectly Solder and Desolder on PCB's</li> </ul>
5.	Bio-Medical Instrumentation and Measurement	<ul style="list-style-type: none"> <li>Physiology and anatomy, bio-physics, biomedical engineering, development of bio-medical instrumentation, physiological systems of the human body</li> <li>Frequency spectrum- wavelength and frequency ranges of sound, ultrasound, radio waves, light-spectrum, X rays, Gama-Rays.</li> <li>Physics of Ultra-sound and X-Rays, snell's laws of reflection and reflection, diffraction, interference, scattering, acoustic impedance, Doppler effect, relation between velocity, frequency and wave length. Computer in bio-medical instrumentation- digital</li> </ul>	20	20	After successful completion of the module, the students shall be able to: <ul style="list-style-type: none"> <li>Know about Bio-medical engineering .</li> <li>Knowledge about physics of light spectrum, frequency, ultrasound waves and X-Rays.</li> </ul>

		computer, microprocessor, Interfacing computer			
6.	X-Ray Machine	<ul style="list-style-type: none"> <li>Radiation theory, diagnostic x-ray, terminology- time, distance, mA, mA-s, central-ray, wavelength, collimator, aluminum filtration, patient support. Installation Layout of x-ray room, safety features, types of x-ray machines, ratings, operation, panel controls. Block/ circuit diagrams, common PCBs, transformers, rectifier circuit, time control circuit, filament heat control circuit, types of x-ray tubes. Function tests- Exposure timers, measurement of mAs, ma output, kV available, focal-spot of x-ray tube, Trouble shooting, faults in x-ray tube, switches, interlocks, magnetic relay and circuit breakers and replacement. Precaution and safety- Main source of danger in use of x-ray machine, ICRP guidelines for safety includes- dose limits for radiation workers, members of public and occupational exposure of women.</li> </ul>	40	50	<p>After successful completion of the module, the students shall be able to:</p> <ul style="list-style-type: none"> <li>Use X-ray unit, knowledge about various section of X-ray Machine and its maintenance.</li> </ul>
7.	Ultrasound machine	<ul style="list-style-type: none"> <li>Physics of ultrasonic waves, transducers construction and uses, Mode of operation- 2D-mode, M-mode, Doppler</li> </ul>	15	20	<p>After successful completion of the module, the students</p>

		(color and spectral), Applications- Radiology, cardiology, vascular and OB/GYN, Basic ultrasound scanner and controls, Block diagram beam-former, transmitter, receiver, scan conversion, output, power. Basic scanning of body, image quality- axial and lateral resolution, dynamic range. Disassembly, parts location and identification and reassembly, power supply check, Diagnostic tool and menus.			shall be able to: <ul style="list-style-type: none"> <li>• Use ultrasound machine, knowledge about various section of ultrasound and its maintenance.</li> </ul>
8.	Total		120	150	
9.	Employability Skills	<ul style="list-style-type: none"> <li>• Introduction to Employability Skills</li> <li>• Career Development &amp; Goal Setting</li> <li>• Becoming a Professional in the 21st Century</li> <li>• Basic English Skills</li> <li>• Communication Skills</li> <li>• Financial and Legal Literacy</li> <li>• Entrepreneurship</li> <li>• Diversity &amp; Inclusion</li> <li>• Constitutional values - Citizenship</li> <li>• Essential Digital Skill</li> </ul>	30		
10.	On Job Training		30		

**Total Course Theory: 120 Hours**

**Total Course Practical: 150 Hours**

**Employability Skills: 30 Hours**

**On Job Training: 30 Hours**

**Total Course Hours: 330**

**Section 2: List of Equipment**

<b>Description</b>		<b>Qty</b>	<b>Specifications</b>
1	Classroom	1	30 Sq M
2	Student Chair	20	
3	Student Table	20	
6	X-Ray Machine, Ultrasound Machine	1 Each	
7	Soldering and de-soldering station	4	
8	White Board	1	
9	Electronic components and tools	As per requirement	Resistance, Capacitors, Transistors, Diodes, Linear and Digital IC's, PCB's, Soldering material, Screw Driver sets, pliers, Cutters, wires, equipments for repair
10	Multimeters	4	
11	Power supply	4	

**Section 3: Trainer's profile**

Batch Size: 20 students

No of Trainers: 1

No of demonstrators: 1

Education Qualification	<p>Engineer / Diploma in Mechanical Engineering /10+2 with science</p> <ul style="list-style-type: none"> <li>● Preferably having experience in working and maintenance with Repair of Hospital equipment.</li> </ul>
Experience	<ul style="list-style-type: none"> <li>● Minimum 6 Months experience in working and maintenance with Repair of Hospital equipment.</li> </ul>
Technical Skills	<ul style="list-style-type: none"> <li>● Good understanding of Electronics</li> </ul>
Other Skills	<ul style="list-style-type: none"> <li>● Should be able to communicate well in English</li> <li>● Good command on regional language</li> <li>● Should be able to prepare lesson plan, deliver the courses through the specified media as per schedule</li> <li>● Should be able to inspire the trainees &amp; evaluate and assess the trainees</li> <li>● Should be able to monitor progress and give feedback to trainees</li> <li>● Should be able to maintain MIS related to training</li> </ul>