

## Advanced Diploma in Bio Medical Instrumentation & Maintenance (Certified Bio Medical Instrumentation Technician)

### Preamble:

With the advancement of technology, various biomedical equipment are being used by doctors, hospitals as well as industries. Even now a days, people are having some BP, Sugar etc measuring devices at homes. With the huge demand of such devices, more trained and certifies manpower is required by the biomedical industry.

### Objective:

The course is designed to make the participants capable of testing, calibration & repairing of various medical electronics equipment's. After completing the course the participants will:

- Have knowledge about the working of different Biomedical Instruments.
- Able to troubleshoot different Bio Medical machine / Instruments and repair it.

### Expected Job Roles:

- Technical Executive
- Jr. Technician
- Biomedical Technician

### Duration:

**480 Hours - (Theory: 220 hrs + Practical: 260 hrs)**

**This course shall be offered as full time intensive course.**

### Course Outline:

Sl. No	Module Title	Duration (Hours)		
		Theory	Lab	Total
1	Basic of Electronics and Overview of Biomedical Industries	20	20	40
2	Human anatomy and physiology	30	10	40
3	Concepts, Principles and Fundamentals of Medical Instrumentation	50	30	80
4	Bio Medical Equipment's Repair and Maintenance	40	60	100
5	Patient Monitoring System	30	10	40
6	Test, Measurement and Calibrating of Instruments	30	50	80
7	Study of Internal Parts in Open Condition	20	40	60
8	Project Work	0	40	40
	<b>Total Duration/Credits</b>	<b>220</b>	<b>260</b>	<b>480</b>
	<b>Total Credits</b>	<b>15</b>	<b>9</b>	<b>24</b>

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### Prerequisites:

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### Eligibility:

10+2 (Science)

### Detailed Syllabus and Learning Outcome:

S. No	Module Title	Topics	Duration (Hours)		Learning Outcome
			Theory	Lab	
1	<b>Module-1</b>  <b>Basic of Electronics and Overview of Biomedical Industries.</b>	1.0 Basic Electronics 1.0.1 Resistors 1.0.2 Capacitors 1.0.3 Inductors 1.0.4 Conductor 1.0.5 Insulator 1.0.6 Semiconductors 1.0.7 Diodes 1.0.8 Kirchoff's Law 1.0.9 Ohms Law 1.0.10 Parallel Series Connection 1.0.11 Rectifier 1.0.12 Transistors 1.0.13 Power and Energy 1.0.14 Primary and Secondary cell 1.0.15 Logic gates 1.0.16 Half adder and Full adder 1.0.17 Multiplexer & De-multiplexer 1.0.18 Encoder & Decoder 1.0.19 Voltage & Current 1.0.20 Faradays Law of Electromagnetism 1.0.21 Self and Mutual Inductance 1.0.22 Basic of magnetism and Electromagnetism 1.0.22 Types of Filters. 1.1 Biomedical Careers in	20	20	After completion of this module, the candidate will be able to : <ul style="list-style-type: none"> <li>• Know about Basic of electronics.</li> <li>• Both Analog and Digital Equipment's</li> <li>• To design and work on power supply.</li> <li>• The importance of Biomedical careers in Industry.</li> <li>• How to work with a team.</li> </ul>

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		Industry. 1.2 Effective Communications 1.3 Transitioning from Academic to Industrial Science. 1.4 To be a team player.			
2	<b>Module-2</b>  <b>Human anatomy and physiology</b>	2.0 Introduction to Human Body 2.1 Cell Structure and Function 2.2 Skeletal System 2.3 Muscular System 2.4 Nervous System 2.5 Nervous System 2.6 Endocrine System 2.7 Lymphatic System 2.8 Respiratory System 2.9 Digestive System 2.10 Reproductive System	30	10	After learning this module the participant will be able to <ul style="list-style-type: none"> <li>• Know the functions of various body parts.</li> <li>• Identify the equipment to be used for examining on different body parts.</li> </ul>
3.	<b>Module -3</b>  <b>Concepts, Principles and Fundamentals of Medical Instrumentation</b>	3.0 Electrodes- Bio-electric Signals 3.0.1 Bio Electrodes 3.0.2 Electrode Tissue Interface 3.0.3 Contact Impedance 3.1 Types of Electrodes 3.1.1 Uses of Electrodes 3.1.2 ECG 3.1.3 EEG 3.1.4 EOG 3.1.5 EMG 3.2 Transducers 3.2.1 Typical signals from physiological parameters 3.2.2 Pressure Transducer 3.2.3 Temperature Transducer 3.3 Sensors- 3.3.1 Pulse Sensor 3.3.2 Respiration Sensor 3.3.3 Recording System 3.4 PC Based Instrumentations 3.5 Type of medical equipment 3.5.1 Diagnostic 3.5.2 Therapeutic and	50	30	After completion of this module the participants will be able to <ul style="list-style-type: none"> <li>• Know different sensors.</li> <li>• Study and analyze different sensor signals.</li> <li>• Knowledge and usage of ECG, EEG, EOG, EMG.</li> <li>• Knowledge of Rules &amp; Regulations regarding Patient safety.</li> </ul>

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		laboratory equipment 3.5.3 Patient safety			
4.	<b>Module-4</b>  <b>Bio Medical Equipment's Repair and Maintenance</b>	4.0 Bio Medical Equipment 4.1 ECG Machine: 4.1.1 Basics & Block Diagram 4.1.2 Circuit Diagram 4.1.3 Repair and Maintenance 4.2 EEG Machine: 4.2.1 Basics & Block Diagram 4.2.2 Circuit Diagram 4.2.3 Repair and Maintenance 4.3 EMG Machine : 4.3.1 Basics & Block Diagram 4.3.2 Circuit Diagram 4.3.3 Repair and Maintenance 4.4 X-Ray: 4.4.1 Basics & Block Diagram 4.4.2 Circuit Diagram 4.4.3 Repair and Maintenance 4.5 Ultrasound : 4.5.1 Block Diagram and cards 4.5.2 Repair and Maintenance	40	60	After attending this module the participants will be able to <ul style="list-style-type: none"> <li>• Know the basic working principles of different bio medical equipment &amp; instruments.</li> <li>• Troubleshoot and repair different bio medical equipment &amp; instruments.</li> </ul>
5.	<b>Module-5</b>  <b>Patient Monitoring System</b>	5.0 Heart Rate Measurement 5.1 Pulse Rate Measurement 5.2 Respiration Rate Measurement 5.3 Blood Pressure Measurement 5.4 Principle of defibrillator and pace maker	30	10	After attending this module the participants will be able to <ul style="list-style-type: none"> <li>• To know the details on working, troubleshooting, and repairing of Patient Monitoring System</li> </ul>
6.	<b>Module-6</b>  <b>Test, Measurement</b>	6.0 Digital Multimeter 6.1 Analog Multimeter 6.2 Digital Storage Oscilloscope	30	50	After attending this module the participants will be able to <ul style="list-style-type: none"> <li>• Test, measure and</li> </ul>

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	<b>and Calibrating of Instruments</b>	6.3 Function Generator 6.4 Simulators 6.5 Test and Calibrating Instruments 6.6 Use of Test and Calibrating Equipment 6.7 Confirming Specifications 6.8 Measurement of Output Quantity, Testing Repeatability of Results.			calibrate different Bio medical Instruments.
7	<b>Module 7</b>  <b>Study of Internal Parts in Open Condition</b>  <b>(60 Hours)</b>	7.0 X-Ray (30 mA, 50 mA) 7.1 Pulse Oximeter 7.2 ECG 7.3 EEG 7.4 EMG 7.5 Multi Para Monitor 7.6 Defibrillator 7.7 Blood Pressure Meter 7.8 Physiotherapy Equipment 7.9 Surgical Diathermy 7.10 Colorimeter 7.11 Ultrasound Doppler 7.12 Ventilator 7.13 OT Lamp 7.14 Pace Maker 7.15 Oxygen Concentrator 7.16 Infusion Pump	20	40	After attending this module the participants will be able to <ul style="list-style-type: none"> <li>Study and repair all the Biomedical Instruments in open condition.</li> </ul>
8	<b>Module 8</b>  <b>Project</b>	8.0 Assembling and Testing of any of the following Instruments. 8.1 X-Ray/Portable X – Ray 8.2 Physiotherapy equipment 8.3 Blood pressure Machine 8.4 ECG 8.5 EEG 8.6 EMG 8.7 Multi Para Monitor	-	40	After completion of the project participants <ul style="list-style-type: none"> <li>Will have full confidence and can easily detect the problem related with any biomedical instrumentation and can repair it.</li> </ul>
<b>Total Hours = 480</b>			220	260	

### Examination & Certification:

**NIELIT's NSQF Examination pattern will be followed for Examination & Certification.**

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Sl No	Examination Pattern	Modules Covered	Duration in Minutes	Maximum Marks
1	Theory Paper – 1	1,2,3	90	100
2	Theory Paper – 2	4,5,6,7	90	100
5	Practical -1	All modules	180	90
6	Internal Assessment	-	-	50
7	Project/Presentation /Assignment	-	-	60
8	Major Project/Dissertation	-	-	100
	<b>Total</b>			<b>500</b>

Note:

1. Pass percentage would be 50% marks in each component, with aggregate pass percentage of 50% and above.
2. Grading will be as under:

Grade	S	A	B	C	D
<b>Marks Range (in %)</b>	$\geq 85\%$	$\geq 75\% - < 85\%$	$\geq 65\% - < 75\%$	$\geq 55\% - < 65\%$	$\geq 50\% - < 55\%$

3. Theory examination would be conducted online and the paper comprise of MCQ and each question will carry 1 mark.
4. Practical examination/Internal Assessment/ Project/Presentation/Assignment would be evaluated internally.
5. Major Project/Dissertation would be evaluated preferably by External / Subject Expert including NIELIT Officials.
6. Candidate may apply for re-examination within the validity of registration.
7. The examinations would be conducted in English Language only.

### Recommended hardware/software tools:

1. Electrical Safety Analyzer
2. IC Trainer Kit
3. SMPS Trainer Kit
4. X-Ray machine
5. Ultrasound
6. Multi para monitor
7. Dual Scope Oscillator
8. Leak Detector
9. Screw driver set

### Faculty & Support / Lab Instructor:

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1. Two Faculties with BE/ BTech (Biomedical Engineering/Electronics and Communication Engineering) or equivalent with Biomedical Instrumentation knowledge and relevant experience
2. One Support / Lab Instructor with at least Diploma in (Biomedical Engineering/Electronics and Communication Engineering) or equivalent with Biomedical Instrumentation knowledge and relevant experience

### References:

1. Biomedical Device Technology by Anthony Y.K Chan
2. Introduction to Biomedical Instrumentation by Barbara Christe
3. Basic Electronics Troubleshooting for Biomedical Technician by Nicholas Cram
4. Medical Instrumentation Application and Design by John G Webster

<b>Course Name</b>	Advanced Diploma in Bio Medical Instrumentation & Maintenance (Certified Bio Medical Instrumentation Technician)	<b>Vertical</b>	Medical Electronics
<b>Course Code</b>		<b>Rev No</b>	R4
<b>Prepared By</b>	Benti Wanth	<b>Proposed Level</b>	NSQF 5
<b>NIELIT Centre</b>	Kohima	<b>Last Revised on</b>	03.06.2019