GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3160303
Semester – VI
Therapeutic Instrumentation

Type of course: Professional Core Course

Prerequisite: Basic electronics, Human Anatomy and Physiology, Biopotential Measurement & Techniques.

Rationale: To impart in students detailed knowledge about various therapeutic equipment and familiarize students with their basic working principle, instrumentation, clinical significance and advancements.

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Contents	Total Hrs	% Weightage
1	**Cardiac Pacemakers**: Types of Pacemakers: External pacemakers and implantable pacemakers, Codes for Pacemakers, Packaging of implantable pacemakers, power sources of implantable pacemaker, Types of leads and electrodes of pacemakers. **Cardiac Defibrillators**: Needs of DC defibrillator, DC defibrillator, types of electrodes, Advisory External defibrillator (AED), Implantable defibrillator, Pacer-cardioverter-defibrillator, Defibrillator Analyzer.	**09**	20%
2	**Haemodialysis Machines**: Principle of Artificial Kidney, Types of Dialyzers, Performance analysis of Dialyzers, Membranes for Haemodialysis, Haemodialysis machine with various monitoring circuits.	**07**	15%
3	**Instruments for Surgery**: Principle, Techniques of Electrosurgical Diathermy, Electrosurgical diathermy machine, electrodes, Safety aspects of Electrosurgical Diathermy. **Heart Lung Machine:** Structure and function of heart lung machine, Study of various components of Heart lung machine. **Various types of Catheters, Working operation of Stents, Intra-aortic balloon pump (IABP).**	**08**	20%
4	**Physiotherapy and Electrotherapy Equipment:** High frequency Heat therapy, Shortwave Diathermy, Microwave Diathermy, Ultrasound therapy, Electrotherapy, Muscle stimulator, Transcutaneous electrical nerve stimulation (**TENS**), Functional Electrical Stimulation (FES), Deep brain stimulation, Vagus nerve stimulation.	**09**	20%

5	**Anesthesia Machine**: Need of Anesthesia, Anesthesia machine: Gas supply system, Vapour Delivery, Delivery system, Humidification, Patient Circuit. **Ventilators**: Artificial ventilation, ventilator terms and its types, modes of ventilators, classification of ventilators, pressure volume flow and time diagrams. Microprocessor controlled ventilator, high frequency ventilators, humidifiers, nebulizers, aspirators. **Drug delivery System:** Infusion Pump, Syringe Pump, Insulin Pump. **Construction and working of Baby Incubator.**	**12**	25%
	Total	**45**	**100%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15%	**25%**	**25%**	**15%**	**10%**	**10%**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. R. S. Khandpur "Handbook of Bio-Medical Instrumentation", Tata McGraw Hill.
2. Carr & Brown, "Introduction to Biomedical Equipment Technology" Pearson Education, Asia.
3. Medical Instrumentation, Application and Design: J G. Webster. (John Wiley).
4. Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol I- VI (PH Pub).
5. Springer handbook of medical technology : Rüdiger Kramme, Klaus-Peter Hoffmann, Robert Steven Pozos, Springer Science & Business Media.
6. Joseph Bronzino, "Biomedical Engineering and Instrumentation", PWS Engg ,Boston.
7. Leslie Cromwell, "Biomedical Instrumentation and Measurements".

Course Outcomes:

After learning this subject, students will be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Explain working principle, design, operating and necessary instrumentation of Cardiac Pacemakers and Cardiac Defibrillators.	20%
CO-2	Understand working principle, performance analysis, operating and various	15%

	monitoring circuit of Haemodialysis Machine**.**	
CO-3	Describe working principle, design, operating and instrumentation of Electrosurgical Unit, catheters, stents and Intra-aortic balloon pump.	20%
CO-4	Explain working principle, design, operating and instrumentation of Physiotherapy and Electrotherapy equipments.	20%
CO-5	Illustrate working principle, design, operating and instrumentation of Anaesthesia machine, Ventilators, drug delivery devices, and Baby incubator.	25%

List of Experiments:

Sr. No.	**Name of Experiments**	**Duration (Hours)**
1.	To study about different types of Pacemakers.	**2**
2.	To study about different types of Defibrillator along with its electrode and instrumentation system.	**2**
3.	To study about Haemodialysis Machine.	**2**
4.	To study about Electrosurgical Unit with its different modes.	**2**
5.	To study about Heart Lung machine and Intra-aortic balloon pump (IABP) .	**2**
6.	To study about Short Wave Diathermy.	**2**
7.	To study about Microwave and Ultrasound Diathermy.	**2**
8.	To study about Transcutaneous electrical nerve stimulation (TENS) and Muscle Stimulator.	**2**
9.	To study about Anesthesia Machine.	**2**
10.	To study about Ventilator.	**2**
11.	To study about Infusion Pump and Syringe Pump.	**2**

Major Equipment: Biomedical Trainer and demo kit