GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: THERAPEUTIC MEDICAL INSTRUMENTATION
(COURSE CODE: 3350304)

Diploma Programme in which this course is offered	Semester in which offered
Biomedical Engineering	5th Semester

1. RATIONALE

Therapeutic medical instruments are widely used in the field of biomedical engineering. The students studying the subject are supposed to learn the therapy for any disease after diagnosing it. The course in addition, will provide knowledge of principle and constructional features of various therapeutic medical equipments. The course will also deal with different advance Therapeutic Technology.

2. LIST OF COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- **Operate and maintain different therapeutic medical instruments.**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes. Understand the need of therapeutic equipment.

i. Maintain Laser in therapeutical instruments.
ii. Maintain Physiotherapy and Electrotherapy Equipment
iii. Maintain Haemodialysis Machine.
iv. Maintain Infusion and peristaltic pumps
v. Maintain different types of incubators

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	150
4	0	2	6	70	30	20	30	

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C**– Credit, **ESE** -End Semester Examination; **PA** - Progressive Assessment.

5. COURSE DETAILS

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
Unit – I Laser Therapy	1.a Define therapeutic instrumentation. Enlist different equipments. 1.b. Explain basic principle operation of LASER. 1.c.Explain main elements of LASER. 1.d.Draw and explain schematic diagram of HELIUM-NEON LASER.	1.1Introduction to therapeutic instrumentation 1.2 LASER 1.2.1 Basic Principle 1.2.2 Main elements of LASER. 1.2.3 Helium-Neon LASER.
Unit– II Physiotherapy and Electrotherapy Equipment	2.a.Explain principle of Short-Wave Diathermy. 2.b.Draw and explain circuit diagram of Short-Wave Diathermy. 2.c Elucidate application techniques of short wave diathermy. 2.d.Explain Ultrasonic Therapy Unit with using suitable diagram. 2.e Draw and explain therapeutic stimulating unit. 2.f Give Principle of Interferential Current Therapy. 2.g.Give Principle of Transcutaneous Electrical Nerve Stimulator (TENS).	2.1 high frequency heat therapy: 2.1.1 Short wave diathermy 2.1.2 Ultrasonic Therapy Unit. 2.2 Electrotherapy : including different types of waveforms such as galvanic current, faradic current, surging current, exponentially progressive current, biphasic stimulation 2.2.1 therapeutic stimulating unit 2.2.2Interferential Current Therapy. 2.3pain relief through electric stimulation : 2.3.1Transcutaneous Electrical Nerve Stimulator (TENS).
Unit– III Haemodialysis Machines	3.a. Give physiological functions of kidney. 3.b. Explain principle of Artificial Kidney 3.c. Describe working principle of Haemodialysis Machine. 3.d. Draw and explain block Diagram Of Haemodialysis Machine.	3.1 Function of Kidneys. 3.2Artificial Kidney 3.3 Dilaysers: such as parallel flow, coil, hollow fiber haemodialyser 3.4Haemodialysis Machine.
Unit –IV Automated Drug Delivery System	4.a. Give basic principle of Infusion pumps. 4.b. List various applications of Infusion Pumps in Hospitals. 4.c. Draw and explain working of Syringe pump. 4.d.Draw and explain working principle of Peristaltic Pumps.	4.1 Infusion pumps and its applications. 4.2 Components of Drugs infusion systems. 4.2.1Delivering of Drug 4.2.2 Syringe pumps. 4.2.3 Peristaltic Pumps
Unit – V Surgical	5.a Give principle of surgical diathermy 5.b.Describe various Electro-surgery Techniques with suitable diagram.	5.1surgical diathermy – 5.1.1 techniques- cutting ,coagulation,fulgaration,

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
Diathermy and Neonatal Therapy	5.c draw and explain block diagram of surgical diathermy machine 5.d describe electrodes used for cutting and coagulation 5.e describe safety aspects of electrosurgical machine 5.f draw and explain temperature controlled type incubator 5.g describe principle of radiant warmer type incubator	desccication, homeostasis 5.1.2 Electrodes – used for cutting and coagulation 5.1.3 Solid state electro-surgical unit. 5.1.4 safety aspects- of electrosurgical machine 5.2 neonatal therapy- 5.2.I physiological heat balance, heat production and heat loss methods, apnea detection and phototherapy devices

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Thermo and Laser therapy	10	06	04	02	12
II	Physiotherapy and Electrotherapy Equipment	14	06	06	06	18
III	Haemodialysis Machines	12	06	06	02	14
IV	Automated Drug Delivery System	08	04	04	04	12
V	Surgical Diathermy and Neonatal Therapy	12	07	04	03	14
	Total	**56**	**29**	**24**	**17**	**70**

Legends: R = Remember; U= Understand; A= Apply and above levels (Bloom's Revised 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.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes (**as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes

S. No	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1.	I	Investigate the use of lasers as a means of transmitting information and determine the wavelength.	02
2.	II	Operate and test short wave diathermy in condenser/ inductive fields and operation of its control panel.	02
3.	II	Test 1MHz frequency ultrasound therapy using electronic circuit.	02
4.	II	Test nerve stimulation using TENS.	02
5.	II	Test nerve stimulation using IFT.	02
6.	II	Observe the performance and effect of electrotherapy equipment on human body and operation of its control panel.	02
7.	IV	Identify various applications of infusion pump in hospitals and observe their operation.	02
8.	V	Observe the performance of surgical diathermy equipment and its construction.	02
9.	I	Demonstrate the working of Helium-Neon laser.	02
10.	III	Demonstrate the working of artificial kidney.	02
11.	IV	Demonstrate the delivering of drug by infusion pump in dummy patient.	02
12.	V	Demonstrate different cutting methods of surgical diathermy.	02
13.	V	Demonstrate different coagulation methods of surgical diathermy.	02
14.	V	Demonstrate working of neonatal incubator.	02
Total (Note: Practical requiring visit to Hospital/Diagnostic Centre may be excluded from external exam, only oral may be taken for such practical)			**28**

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

i. Visit multi specialty Hospital and Therapy Center.

ii. Visit websites of reputed manufacturers of Therapeutic Medical Instruments to collect specifications and details of their products and prepare a comparative report of instruments of different makes.

9. SPECIAL INSTRUCTIONAL STRATEGIES

i. Class Test
ii. Assignment
iii. Seminar/Symposium
iv. Group discussion/Debate
v. Quiz Competition

vi. Continuous evaluation of lab activity
vii. Video/animation films on working of Therapeutic Instruments
viii. Technical Workshop

10. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Books	Author	Publications
1.	Handbook of Biomedical Instrumentation	R.S. Khandpur	Tata McGraw Hill - New Delhi
2.	Medical instrumentation Application and Design	John Webster	John Wiley and Sons, New Delhi
3.	Medical Lasers and their safe use	David H Shiney, Stephen and L. Trokel	Springer Publications
4.	Introduction to Biomedical Equipment and technology	Carr and Brown	Pearson Education-Asia, New Delhi
5.	Biomedical Instrumentation and Measurements	Leslie Cromwell, Fred J Weibell and Erich A. Pfeiffer	PHI Learning, New Delhi
6.	Medical Electrical Equipment	Robert Molloy	B.I. Publications

B) List of Major Equipment/ Instruments with Broad Specifications

i. Electro-surgical unit
ii. Short wave diathermy
iii. Ultrasound machine
iv. Apnea detection unit
v. Laser unit
vi. Muscle stimulator
vii. TENS
viii. Haemodialysis Machine
ix. Volumetric infusion pump
x. Syringe pump
xi. Digital Oscilloscope
xii. Incubator

C) List of Software/Learning Websites

- www.biodigitalhuman.com
- www.anatomic.us
- http://www.medindia.net/patients/patientinfo/health-encyclopedia.asp?
- http://www.surgical-tutor.org.uk/default-home.htm

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. M.H. Dave**, Lecturer ,Dept. of Biomedical Engineering, G. P. Gandhinagar
- **Prof. S.S. Malkan**, Lecturer, Dept. of Biomedical Engineering, G. G. P. Ahmedabad
- **Prof. A.K. Bula**, Lecturer, Dept. of Instrumentation Engineering, G. P. Gandhinagar

- **Prof. V. V. Makwana,** Lecturer, Dept of Biomedical engineering, A.V.P.T.I. Rajkot
- **Prof. N.D. Makwana**, Lecturer, Dept. of Biomedical Engineering, G.P. Gandhinagar

Faculty Members from NITTTR

- **Prof. (Mrs.) Susan S. Mathew,** Associate Professor, Dept. of Electrical and Electronics Engineering
- **Prof. Joshua Earnest,** Professor, Dept. of Electrical and Electronics Engineering