Program : **Diploma in Electronics Engineering / Electronics and Communication Engineering**	
Course Code : **6041A**	Course Title: **Medical Electronics**
Semester : **6**	Credits: **4**
Course Category: **Program Elective**	
Periods per week: **4 (L:4, T:0, P:0)**	Periods per semester: **60**

Course Objectives:

- To familiarize the applications of Electronics in Biomedical field
- To explain Analytical equipments, Therapeutic Equipments, Biotelemetry, and Imaging systems used in biomedical applications.
- To describe the safety considerations in the medical field.

Course Prerequisites:

Topic	Course code	Course name	Semester
Transducers, actuators		Electronic and Measurements and Instrumentation	3
Amplifiers and oscillators		Linear Integrated Circuits	4

Course Outcomes:

On completion of the course, the student will be able to:

COn	Description	Duration (Hours)	Cognitive Level
CO1	Illustrate ECG, EEG, and EMG.	14	Understanding
CO2	Describe blood parameter measurements and applications of LASER in medical field.	15	Understanding
CO3	Summarize various Therapeutic equipments.	15	Understanding
CO4	Explain various medical imaging systems and precautions while handling biomedical equipments.	14	Understanding

	Series Test	2	

CO-PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2						
CO2	2						
CO3	2						
CO4	2						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline:

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Illustrate ECG, EEG, and EMG.**		
M1.01	Explain cardio vascular, respiratory and nervous systems, biopotentials	4	Understanding
M1.02	Illustrate ECG with cardio vascular functions	4	Understanding
M1.03	Explain the working of EEG measurement with the help of block diagram	3	Understanding
M1.04	Explain the working of EMG measurement with the help of block diagram	3	Understanding
Contents: Anatomy of human body - various physiological systems – cardio vascular system, nervous system- respiratory system- Sources of bio-electric potentials - resting and action potentials - types of electrodes used for ECG,EEG,EMG measurements- surface electrodes- needle electrodes- micro electrodes- origin and significance of ECG wave form – lead systems- Block diagram of ECG recorder. Electrical activity of brain - Block diagram of EEG machine -Block diagram of EMG recorder			
CO2	**Describe blood parameter measurements and applications of laser in medical field.**		
M2.01	Explain Blood cells and Hematology	4	Understanding
M2.02	Illustrate Blood Pressure monitoring	4	Understanding
M2.03	Summarize Blood gas analyzers	3	Understanding

M 2.04	Illustrate LASER in medical field	4	Understanding
	Series Test 1	1	

Contents:

Blood cells and their classification - different methods of Blood cell counting.- micro scopic method- optical method- coulter counter method-Blood pressure - Direct and Indirect methods of measurement of BP - Sphygmomanometer-Blood gas analyzers –PO2, PCO2 analyzers-Pulsoxy meter- Laser in Medical Field: Principle of Laser - properties of Laser - applications of Laser in medical field.

CO3	**Explain various Therapeutic equipments.**		
M3.01	Summarize Pacemaker and Defibrillator	5	Understanding
M3.02	Illustrate Hemo Dialysis	4	Understanding
M3.03	Explain Ventilators	3	Understanding
M 3.04	Illustrate Diathermy	3	Understanding

Contents:

Therapeutic Equipment: Pace maker - need of pacemakers - pacing modes - types of pacemakers - internal - external - ventricular synchronous demand pacemaker - Defibrillator - need of defibrillators –types of defibrillators- Dialysis machine - functions - types of hemo-dialysis machine - portable hemo dialysis machine. - Respirators - classification of ventilators - pressure cycling and volume cycling- Diathermy - types of diathermy equipments - shortwave diathermy - microwave diathermy.

CO4	**Explain various medical imaging systems and precautions in handling biomedical equipments.**		
M4.01	Illustrate X- ray machine and C T scan	4	Understanding
M4.02	Summarize M R I scanning and Ultra sonic imaging	4	Understanding
M4.03	Illustrate Bio Telemetry	2	Understanding
M4.04	Summarize electrical safety in medical field	4	Understanding
	Series Test 2	1	

Contents:

Imaging systems: Operation of X-ray machine - working principle of CT scanner, Ultrasonic imaging, Echo cardio graphy; Nuclear Magnetic Resonance imaging.

Bio-telemetry: need of biotelemetry - block diagram - application of bio-telemetry system.

Electrical Safety: effects of electricity on human body - macro shock and micro shock - importance of grounding. - Electrical safety measures with respect to machine, operator and patients - precautions while handling bio-medical instruments - precautions while handling x-ray machines

Text / Reference Books:

T/R	Book Title/Author
T1	Biomedical Instrumentation and Measurements - Leslie Cromwell, Fred J Weibell and Erich A Pfeiffer - PHI Learning Private Limited.
T2	Handbook of Biomedical Instrumentation - R S Khandpur - Tata McGraw Hill Publishing Company Limited.
R1	Principles of Medical Electronics and Biomedical Instrumentation-CRaja Rao & S K Guha
R2	Medical Instrumentation -John. G. Webster
R3	Biomedical Instrumentation -Dr. Arumugham

Online Resources:

Sl. No	Website Link
1	https://www.electrical4u.com/electrical-engineering-articles/biomedical-instrumentation/
2	https://lecturenotes.in/notes/31-notes-for-biomedical-instrumentation-bi-by-verified-writer
3	http://www.eeeuniversity.com/2013/08/ei2311-biomedical-instrumentation.html