

## MEDICAL ELECTRONICS

<b>Subject Title</b>	:	<b>Medical Electronics</b>
<b>Subject Code</b>	:	<b>EC</b>
<b>Hours Per Week</b>	:	<b>04</b>
<b>Hours Per Semester</b>	:	<b>64</b>

### **TOPIC ANALYSIS**

<b>SL. No</b>	<b>Major Topics</b>	<b>Hours Allotted</b>
<b>UNIT I</b>		
1	Bio medical system and bio electric potentials	06
2	Bio potential measurements	13
<b>UNIT 2</b>		
3	Human assist devices	12
4	Measurement and analysis techniques	08
<b>UNIT 3</b>		
5	Patient monitoring and imaging systems	11
6	Bio telemetry	04
7	Patient safety	04
8	E waste	02
	Tests and revision	04
	<b>Total</b>	<b>64</b>

#### **On the completion of the course the students should be able to:**

1. Understand bio medical system and bio electric potential
2. Study the ECG, EEG, EMG & ERG and related bio medical measurements
3. Familiarization with human assist devices
4. Understand the measurement and analysis techniques
5. Appreciate the patient monitoring and imaging
6. To know bio telemetry
7. Understand the patient safety aspects.
8. To know the management of E waste

### COURSE CONTENTS

#### **1 Biomedical system and bio electric potential**

Introduction to bio medical system . Man instrument system. Characteristic of human cell. Bio electric potential- Origin- Resting and action potential. Propagation of action potential and its wave form. Electrodes- need- types

#### **2 Bio potential measurement**

Generalized recorders. Heart -. Electro Cardio Gram- waveform - Electrodes for Electro cardio gram- block diagram and explanation-lead system for ECG-Artefacts. Brain -Neuronal activity. Electro Encephalogram - electro encephalogram waveform, EEG -block diagram and explanation- electrodes for EEG- Evoked potential. The muscle action- waveform - working of EMG system with block diagram. Applications of Biomedical recordings

### **3.0 Human assist devices**

Muscles stimulators. Defibrillators .Pacemaker . Diathermy. Ventilators, oxygenerator. Blood pump – Haemo dialysis. Prosthetic devices- Hearing aid . Endoscopy.

### **4.0 Measurement and analysis techniques**

Blood constituents-blood tests. Blood cell counter-PH meter- spectro photometer. BP measurement..Blood flow meter

### **5.0 Patient monitoring and imaging system**

X-Rays- properties- Generation.X-ray machine. Computerized tomography. Magnetic resonance imaging. Diagnostic Ultra sound. Foetal monitoring instrument- cardio tocograph. Echocardiograph. Patient monitoring . Laser-Principle and application in medical field.

### **6.0 Bio telemetry**

Introduction. The components of a biotelemetry system. single channel bio telemetry system. Medical data communication through telephone lines and wire less .Telemedicine

### **7.0 Patient safety**

Physiological effect of electric current. Micro and macro shock- preventive measures. Safety standards. Radiation exposure.

### **8.0 Disposal of E waste**

E waste. Disposal of E waste

#### **TEXT BOOKS:**

- 1 Hand book of Bio Medical Instrumentation( 2<sup>nd</sup> edition)- R.S. Khandpur
- 2 Biomedical Instrumentation –Dr.M. Arumugam
- 3 Medical instrumentation Application and design J.G.Webster(Wiley India)

#### **REFERENCE BOOKS**

- 1 Introduction to Medical Electronic- S.K. Guha
- 2 Introduction to Biomedical Instrumentation –Mandeep Singh

## **SPECIFIC INSTRUCTIONAL OBJECTIVES**

### **1.0 Understand the biomedical system and bio electric potential**

- 1.1 Introduction to bio medical system
- 1.2 Discuss the man instrument system with block diagram(section1.4 of Khandpur)
- 1.3 Brief discussion on PC based medical instruments(section1.6.5 of Khandpur)
- 1.4 Constraints in design of medical instrument system(section1.7 of Khandpur)
- 1.5 Discuss the origin of Bio electric signals- resting and action potential typical cell potential waveform. (section 2.1 of Khandpur)
- 1.6 Explain the need for electrodes
- 1.7 Describe the types of bio potential electrode -surface electrode, needle electrode and micro electrodes

### **2.0 Bio potential measurements**

- 2.1 Block diagram description of basic recording system (4.1 of Khandpur)
- 2.2 Brief discussion isolation amplifier(4.3.5 of Khandpur)
- 2.3 Explain the Electrical activity of heart -origin of ECG w/f, typical ECG waveform explanation.
- 2.4 Block diagram description of ECGraph.
- 2.5 ECG lead configurations-Bipolar, Unipolar, limb leads and chest leads.
- 2.6 Effects of artifacts on ECG recording(5.1.3 of Khandpur)
- 2.7 Describe briefly the central nervous system and explain the Neural activity of brain(1.2.3 of Khandpur)
- 2.8 Explain Electro Encephalogram waveform for various states
- 2.9 Explain the block diagram of EEGraph
- 2.10 Explain placement of electrodes(10-20 system) for EEG
- 2.11 Explain Evoked potential
- 2.12 Describe typical EMG signal(2.1.3 of Khandpur)
- 2.13 Explain working of EMG system with block diagram
- 2.14 Brief discussion of biomedical recorders like Apexcardiograph,BCG,EOG & ERG(5.6 of Khandpur)
- 2.15 List the Applications of ECG, EEG, EMG & ERG

### **3.0 Human assist devices**

- 3.1 Electrotherapy-Typical waveforms used, block diagram description of Electrotherapeutic stimulator(29.5.2,29.5.4 of khandpur)
- 3.2 Need for defibrillator . internal & external. Working of AC, and DC Defibrillators, their advantages and disadvantages
- 3.3 Pacemakers-their need, Explain external, implantable pacemakers, types of implantable Pacemakers, working of ventricular synchronous demand pacemaker(25.1,25.2,25.3.1,25.3.3 of Khandpur )
- 3.4 Diathermy-Definition Working of Short wave and Ultrasonic Diathermy units.(29.1,29.2&29.4 of Khandpur)
- 3.5 Ventilators-their need-Block diagram description of Microprocessor controlled ventilator(33.3 & 33.8 of khandpur),
- 3.6 Oxygenator-its need, working of rotating disc film and membrane oxygenators(Ref:Armugam)

- 3.7 Blood pump-Characteristics of ideal blood pump, pulsatile and non pulsatile blood pumps(Armugam)
- 3.8 Dialysis-its need, block diagram description of haemodialyser
- 3.9 Block diagram description of digital and conventional hearing aids(17.9.1& 17.9.2 of Khandpur)
- 3.10 List the types of endoscopes and their uses

#### **4.0 Measurement and analysis techniques**

- 4.1 Types of blood cells, calculation of size of cells- MCV, MCH, MCHC, MPV, RDW,& P DW(16.1,16.1.1 of Khandpur)
- 4.2 Methods of blood cell counting – working of optical method & Coulter’s method counters(16.2.2,16.3 of Khandpur)
- 4.3 Explain the working of Glass-Electrode PH meter
- 4.4 Explain the operation of Spectrophotometer-its advantages
- 4.5 BP measurement-systolic & diastolic pressure, Direct method –Typical set up(6.7.1 of Khandpur) , Indirect method –korotkoff’s technique ,advantages & disadvantages of both methods.
- 4.6 Blood Flow meters-Working principle of electromagnetic and ultrasonic type blood flow meters.(figure 11.3 &11.5 of Khandpur).

#### **5.0 Patient monitoring and imaging system**

- 5.1 Explain the generation and properties of X-Rays
- 5.2 Explain the working of X-ray machine
- 5.3 Uses, advantages and disadvantages of radiography.
- 5.4 Explain the principle of computerized tomography
- 5.5 Explain CT scan machine with block diagram
- 5.6 Uses, advantages and disadvantages of CT scan.
- 5.7 Magnetic resonance imaging-its principle. Block diagram description of MRI equipment. Uses, advantages and disadvantages of MRI.
- 5.8 Ultra sound Imaging-Properties of ultrasound ,Basic pulse echo apparatus (23.4 of Khandpur)
- 5.9 Working of echocardiograph(23.6 of Khandpur),advantages,disadvantages & applications of Ultrasound imaging
- 5.9 Foetal monitoring instrument- cardio tocograph –direct & indirect methods (8.1of Khandpur) FHR measurement using doppler(fig 8.7 of Khandpur)
- 5.10 Patient monitoring-Its objectives,Block diagram,description of bedside patient monitor(6.3 of Khandpur)
- 5.11 Explain principle components of Laser system (28.1.1 of khandpur)
- 5.12 List different types of LASERS with their characteristics and applications in medicine(table 28.1 of Khandpur)

#### **6.0 Bio telemetry**

- 6.1 Introduction to Biotelemetry
- 6.2 Explain single channel telemetry system (9.2.1 of Khandpur)
- 6.3 Explain medical data communication through telephone lines(9.6 of Khandpur)
- 6.4 Uses of Bio-telemetry(armugam)
- 6.5 Tele medicine –Applications,Concepts, essential parameters (9.7,9.7.1,9.7.2,9.7.3 of Khandpur)
- 6.6 Telemedicine using Mobile communication(9.7.7 of Khandpur)

## **7.0 Patient safety**

- 7.1 Explain physiological effect of electric current
- 7.2 Describe micro and macro shock- preventive measures to reduce shock hazards
- 7.3 Describe the accident preventive methods (11.5 of Mandeep Singh)
- 7.4 Classification of medical devices and their safety standards (11.4 of Mandeep Singh)
- 7.5 Physiological effect of radiation exposure..(Armugam)

## **8.0 Disposal of E waste**

- 8.1 List E waste -its ill effects
- 8.2 Explain the methods employed for disposal of E waste

MODEL QUESTION PAPER

**DEPARTMENT OF TECHNICAL EDUCATION**  
**DIPLOMA COURSE IN ELECTRONICS AND COMMUNICATION ENGINEERING**  
**V SEM E&C**  
**MEDICAL ELECTRONICS**

TIME: 3 Hrs

Max. Marks: 100

**INSTRUCTIONS:**

1. Section I is compulsory
2. Answer any two full questions each from the remaining sections.

**SECTION: I**

- 1a) fill in the blanks with appropriate words:- 5
- 1) Electromagnetic blood flow meters are based on \_\_\_\_\_ law
  - 2) The \_\_\_\_\_ interval represents repolarization of both ventricles
  - 3) P<sup>H</sup> indicates the concentration of \_\_\_\_\_ ions in a solution
  - 4) Laser is used as \_\_\_\_\_ knife in surgery
  - 5) In deep sleep \_\_\_\_\_ pattern is observed
- b) Explain the working of Echocardiograph 5

**SECTION: II**

- 2 a) What is bio potential? - Name three sources of bio potential. 5
- b) Draw a neat waveform of action potential, label amplitude and time values. 10
- 3 a) Draw the block diagram of an ECG system and explain the function of each block. 8
- b) Draw the block diagram of an EMG system and explain the function of each block 7
- 4 a) Explain evoked Potential. 5
- b) Write a note on isolation amplifier 5
- c) List the applications EOG, ERG and BCG 5

**SECTION: III**

- 5 a) What is pacemaker? Explain external pacemaker with diagram 8
- b) Differentiate AC and DC defibrillators 7
- 6 a) Explain working of ultrasonic type blood flow meter 7
- b) Explain ultrasonic diathermy with diagram 6
- c) List applications of diathermy 2
- 7 a) Explain the operation of spectrophotometer 6
- b) Define MCV & MCH 4
- c) Write a note on blood pumps 5

**SECTION: IV**

- |       |  |    |
|-------|--|----|
| 8 a)  | Mention the effects of Micro and Macro electric shock on Human body. | 5  |
| b)    | i) Explain principle components of Laser system                      | 6  |
|       | ii) List the applications of LASER in medical field                  | 4  |
| 9 a)  | Write a note on E waste.   | 5  |
| b)    | Explain X- ray generation with neat block diagram                    | 10 |
| 10 a) | Explain single channel telemetry system                              | 10 |
| b)    | List the precautions to be taken to prevent shock hazards            | 5  |

\*\*\*\*\*