

# JEPPIAAR ENGINEERING COLLEGE

Jeppiaar Nagar, Rajiv Gandhi Salai – 600 119

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

### QUESTION BANK



### VI SEMESTER

EC64001 – MEDICAL ELECTRONICS

Regulation – 2013(Batch: 2015 -2019)

Academic Year 2017 – 18

*Prepared by*

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### QUESTION BANK

**SUBJECT : EC6001 – MEDICAL ELECTRONICS**

**YEAR /SEM: III /VI**

<b>SEM / YEAR: VI / III year B.E.</b>				
<b>UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING</b>				
The origin of Bio-potentials; bio-potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, lead systems and recording methods, typical waveforms and signal characteristics.				
<b>PART A</b>				
Q. No	Questions	BT Level	Competence	POs
1	State all or none law in respect of cell biopotential. (Apr/May 2008)	BTL 1	Remembering	PO1
2	Define the term Conduction Velocity. (Apr/May 2008) &(May/June2007)(Nov/Dec 2009)	BTL 1	Remembering	PO1
3	BTL 3 Apply Draw a typical ECG waveform. (May/June2007)(Nov/Dec 2009)	BTL 4	Analyzing	PO1
4	How a phonocardiogram and an electrocardiogram signals differ in their clinical information. (AP/MAY 2008)	BTL 1	Remembering	PO1
5	Define resting and action potential. (NOV/DEC 2008) (May /June 2009) (April/May 2015)	BTL 1	Remembering	PO1
6	Define Latency as related to EMG. (NOV/DEC 2008)(Nov/Dec 2015)	BTL 1	Remembering	PO1
7	List the names and frequency bands of EEG signals(May 2007)(Nov/Dec 2014)	BTL 1	Remembering	PO1,PO2
8	What is the importance of PCG Signal?(May/June 2009)	BTL 1	Remembering	PO1.PO2. PO3
9	Mention the importance of biological amplifier.(Apr/May 2010)	BTL 1	Remembering	PO1
10	Mention the various lead systems used in ECG recording. (Apr/May 2010)	BTL 1	Remembering	PO1,PO2
11	What is half cell Potential? (Apr/May 2011)	BTL 1	Remembering	PO1
12	Give the EMG Signal Characteristics. (Apr/May 2011)	BTL-1	Remembering	PO1

13	What is EOG? (Nov/Dec 2011)	BTL 1	Remembering	PO1
14	Compare the signal characteristics of ECG and PCG. (Nov/Dec 2011)(May/June 2013)	BTL 2	Understanding	PO1
15	What is PCG? (Apr/May 2012)(Nov/Dec 2012)	BTL 1	Remembering	PO1
16	What are the different types of electrodes used in bipolar measurement? (Apr/May 2012)	BTL 1	Remembering	PO1
17	Give the ECG Signal Characteristics.(April/May 2015)	BTL-1	Remembering	PO1
18	What is bio electric potential?(Nov/Dec 2015)	BTL 1	Remembering	PO1
19	The contraction of skeletal muscle is termed as What? Give its specification. (May/June 2014)	BTL 1	Remembering	PO1,PO2
20	List the electrodes used for recording EEG.(May/June 2014)	BTL 1	Remembering	PO1
21	Define CMRR. Give its importance in physiological signal amplifiers.(Nov/Dec 2014)	BTL 1	Remembering	PO1,PO2,
22	List the characteristics needed for Bio Amplifier.(May/June 2013)	BTL 1	Remembering	PO1
23	What are the requirement of a biological amplifier?(Nov/Dec 2013)	BTL 1	Remembering	PO1
24	BTL 3 Apply Draw the wave form of a typical PCG signal and label its components. ( Nov/Dec 2013)	BTL 4	Analyzing	PO1
25	Name the electrode used for recording ECG and EMG.(Nov/Dec 2012)	BTL-2	Understanding	PO8
26	What are the different types of bio potential electrodes? (Nov/Dec 2010)	BTL 1	Remembering	PO1,PO2
27	Mention the normal amplitude and frequency of EMG signal ? (Nov/Dec 2010)	BTL 1	Remembering	PO1
28	What is the range of resting potential?	BTL 1	Remembering	PO1
29	What are artifacts?	BTL 1	Remembering	PO1
30	Differentiate between heart sound and murmurs.	BTL 4	Analyzing	PO1,PO2
31	List the important characteristics required for bio-amplifier.(May/June 2016)	BTL 1	Remembering	PO1
32	Mention the electrodes used to record bio-potential from a single muscle fibre.(May/June 2016)	BTL 1	Remembering	PO1
33	State all none law (dec 2016)	BTL 1	Remembering	PO1
34	What is ment by conduction velocity(dec 2016)	BTL 1	Remembering	PO8,PO9
35	Define absolute and relative refractory period (june 2017)	BTL 1	Remembering	PO8
36	Mention the cause of first and second heart sounds(june 2017)	BTL 1	Remembering	PO8
37	List the important characteristics required for bioamplifier(june 2016)	BTL 1	Remembering	PO8
38	Mention the electrodes used to record bio potential from a single muscle fiber(june 2016)	BTL 1	Remembering	PO8,PO9
<b>PART B&amp;C</b>				

Q. No	Questions	BT Level	Competence	PO
1	i) Discuss in detail about Action Potential and Resting Potential.(Apr/May 2011)(Nov/Dec 2014)	BTL 2	Understanding	PO8,PO9
	ii) Write short notes on bio potential electrodes. (MAY/JUNE2007)(May/June 2013) (May/June 2012)(May/June 2016)	BTL 1	Remembering	PO8
2	i) Explain the working principle of a ECG machine with a neat block diagram.(Nov/Dec 2015)	BTL 2	Understanding	PO8
	ii) What is Phonocardiography? (MAY/JUNE2007) (May/June 2014)	BTL 1	Remembering	PO8
3	i) Explain in detail various types of bio potential electrodes.(May/June2012)(Nov/Dec2011) (April/May 2015)	BTL 2	Understanding	PO8,PO9
	ii) Write a short note on electromyogram. (AP/MAY 2008) (Nov/Dec 2015)	BTL 4	Analyzing	PO8
4	i) Draw an action potential waveform and Discuss in detail about polarization and repolarization.	BTL 3	Apply	PO8,PO9
	ii) Draw the bipolar limb lead system of an ECG. (AP/MAY 2008) (April/May2015)(May/June 2014)(Nov/Dec 2014)(May/June 2016)	BTL 3	Apply	PO8
5	i) What is Half cell potential?	BTL 1	Remembering	PO8
	ii) What are the three types of electrodes and Mention its use.	BTL 1	Remembering	PO8,PO9
	iii) Discuss Microelectrodes in detail. (NOV/DEC 2008) (Nov/Dec 2013)	BTL 2	Understanding	PO8,PO9
6	i) Bring out the salient features of phonocardiography. .(Apr/May 2011)	BTL-2	Understanding	PO8
	ii) With suitable diagram, Explain the method of measurement of conduction velocity in peripheral nerves. (NOV/DEC 2008)(May/June 2016)	BTL 2	Understanding	PO8
7	Explain the working principle of EEG recording machine.(April/May2015)(Nov/Dec 2013)	BTL 2	Understanding	PO8
8	A) (i) Explain the international standard 12 lead system used to record ECG(10) (may/june 2016)	BTL 2	Understanding	PO8,PO9
	(ii) List and Discuss the important characteristics and frequency bands of EEC signal(6)	BTL 1	Remembering	PO8
9	(i) Discuss in detail about the origin potential and resting potential with necessary equations.(10)	BTL 2	Understanding	PO8,PO9
	(ii) describe the typical recording setup of EMG (6) (may/june 2016)	BTL 2	Understanding	PO8
10	a) Discuss the genesis of ECG and Explain the working of an ECG machine which is block diagram along with its various lead configuration(16) (Nov/Dec 2016)	BTL 2	Understanding	PO8
11	What is know as biopotential electrodes? Draw its equivalent circuit Explain various types of biopotential electrodes with suitable example(16) (Nov/Dec 2016)	BTL 1	Remembering	PO8,PO9
12	(i) Explain the international standard 12 lead system used to record ECG(10) (may/june 2017)	BTL 2	Understanding	PO8,PO9
	(i) List and Discuss the important characteristics of bioamplifier(6) (may/june 2017)	BTL 1	Remembering	PO8
13	(i) Discuss in detail about the 10 – 20 lead system.(10) (may/june 2017)	BTL 2	Understanding	PO8
	(ii) describe the typical EMG waveform and its characteristics(6) (may/june 2017)	BTL 2	Understanding	PO8

<b>UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT</b>				
pH, PO <sub>2</sub> , PCO <sub>2</sub> , colorimeter, Auto Analyzingr, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood Cell Counters.				
<b>PART A</b>				
<b>Q.No</b>	<b>Questions</b>	<b>BT Level</b>	<b>Competence</b>	<b>PO</b>
1	What are cardiac output and phonocardiogram?	BTL 1	Remembering	PO1
2	What is cardiac output . Mention the methods of measurement of cardiac output .	BTL 1	Remembering	PO1
3	What are demerits of electromagnetic blood flow meter?	BTL 1	Remembering	PO1
4	Name any two methods of respiration rate measurement?	BTL-2	Understanding	PO1
5	What is residual volume? (May/June 2007)	BTL 1	Remembering	PO1
6	Mention the application of flame photometer. (May/June 2007) (Nov/Dec 2009)	BTL 1	Remembering	PO1
7	What is meant by Mean Arterial Pressure (MAP)? (Apr/May 2008) (Nov/Dec 2007)	BTL 1	Remembering	PO1,PO2
8	What are Korotkoff's sounds? (Nov/Dec 2008)	BTL 1	Remembering	PO1
9	What is a colorimeter? State its uses? (Nov/Dec 2008)(May/June 2009)	BTL 1	Remembering	PO1
10	Name the four physical principles based on which blood flow meters are Constructed? (Nov/Dec 2007)	BTL 3	Apply	PO1.PO2
11	Name the instrument used to measure PO <sub>2</sub> and PCO <sub>2</sub> ? (May/June 2009)	BTL 2	Understanding	PO1
12	How is the pulse rate measured?(Apr/May 2011)	BTL 1	Remembering	PO1
13	What is Stroke Volume? (Apr/May 2011)(May/June 2013)	BTL 1	Remembering	PO1
14	What is systolic and diastolic pressure? (Nov/Dec 2011)	BTL 1	Remembering	PO1
15	How is respiration rate measured? (Nov/Dec 2011)	BTL 1	Remembering	PO1
16	Which transducer is used for measuring temperature? Why?(Apr/May 2012)	BTL 1	Remembering	PO1
17	What is the principle used in pulse rate measurement? (Apr/May 2012)	BTL 1	Remembering	PO1
18	Which flow meters are used to measure pulsatile flow of blood?(April/May 2015)	BTL 1	Remembering	PO1
19	Draw lung volume diagram. (April/May 2015)	BTL 4	Analyzing	PO1
20	How does the pH value determine the acidity and alkalinity in blood fluid?(Nov/Dec 2015)	BTL 1	Remembering	PO1,PO3
21	List the various indirect methods for the measurement of blood pressure.(Nov/Dec 2015)	BTL 1	Remembering	PO1
22	Write the principle behind electromagnetic blood flow meter.(May/June 2014)	BTL 1	Remembering	PO1
23	What Nitrogen washout technique is meant for measurements? (May/June 2014)	BTL 1	Remembering	PO1
24	What is Fick's Principle? Give its advantages.(Nov/Dec 2014)	BTL 1	Remembering	PO1

25	Define cardiac output. Find the cardiac output of a person if his heart rate is 72 BPM and stroke volume is 70ml. (Nov/Dec 2014)	BTL 1	Remembering	PO1
26	What are the components of Blood? (May/June 2013)	BTL 1	Remembering	PO1
27	Calculate If systolic and diastolic blood pressures are given as 110mmHg and 82 mm Hg . mean arterial Pressure.(Nov/Dec 2013)	BTL 6	Creating	PO1
28	Mention the basic principle behind electrochemical pH determination.(Nov/Dec 2013)	BTL 1	Remembering	PO1
29	What is an auto Analyzingr? What are the essential units in it? (Nov/Dec 2012)(May/June 2010)	BTL 1	Remembering	PO1
30	Give the typical values of blood pressure and pulse rate of an adult.(Nov/Dec 2012)	BTL-1	Remembering	PO1
31	Mention the applications of auto Analyzingr?(Nov/Dec 2010)	BTL 1	Remembering	PO1
32	Calculate the stroke volume in millilitres if the cardiac output is 5.2 litres/minute and heart rate is 76 beats/minute?(Nov/Dec 2009)	BTL 6	Creating	PO1
33	Define cardiac output. Find the cardiac output of a person if his heart rate is 70BPM and stroke volume is 70ml.(May/June 2016)	BTL 1	Remembering	PO1,PO2
34	What are the different types of test performed using auto Analyzingr?(May/June 2016)	BTL 1	Remembering	PO1
35	What is blood pressure State the normal values of blood pressure(june 2017)	BTL 1	Remembering	PO1
36	State the different types of test performed using auto analyser(june 2017)	BTL 1	Remembering	PO1
37	Define cardiac output(dec 2016)	BTL 1	Remembering	PO1
38	State beer's law(dec 2016)	BTL 1	Remembering	PO1
39	Define cardiac output find the cardiac output of person if his heart beat rate is 70 BPM and stroke volume is 70 ml(june 2016)	BTL 1	Remembering	PO1
40	Sate the different types of test performed using auto analyser(june 2016)	BTL 1	Remembering	PO1
<b>PART B&amp;C</b>				
1	a) i) Discuss the working principle of a colorimeter with a neat block Diagram.	BTL 2	Understanding	PO1
	ii) How will you measure blood pressure using Sphygmomanometer? (May/June 2007) (April/May 2015)(Nov/Dec 2015)(May/June 2013)	BTL 1	Remembering	PO1
2	a) i) Explain the working principle of a electromagnetic type blood flow Meter.(April/May 2015)	BTL 2	Understanding	PO1
	ii) Define Cardiac output .BTL 2 Understanding Discuss a technique to determine cardiac Output. (May/June 2007) (Apr/May 2012)(Nov/Dec 2011)	BTL 1	Remembering	PO1
3	a) i) Explain the working principle of a electromagnetic type blood flow Meter.(May/June 2016)	BTL 2	Understanding	PO1,PO2
	ii) Describe the operation of a blood cell counter. (April/ May 2008)(Nov/Dec 2014)	BTL 2	Understanding	PO1
4	a) i) Define the terms : residual volume , tidal volume ,vital capacity and Total lung capacity.	BTL 1	Remembering	PO1
	ii) Discuss Fick's method for determining cardiac output. (April/ May 2008)(May/June 2013)	BTL 2	Understanding	PO1.PO2
5	a) Describe the measurement of pH in blood.(Nov/Dec2011)(May/June 2016)	BTL 2	Understanding	PO1

6	b) Explain the following : Auto Analyzingr (May/June 2014)(may/June 2012)	BTL 2	Understanding	PO1
7	Draw a block diagram of ultrasonic blood flow meter . Explain the method of measuring the velocity of blood flow using (i) Transit time principle (2) Doppler effect.(Apr/May 2011)	BTL 4	Analyzing	PO1
8	Explain the function of a human respiratory system and the possible measurement and inferences made out of them.(Nov/Dec 2015)(Nov/Dec 2014)(May/June 2016)	BTL 2	Understanding	PO1
9	A) (i) Describe the measurement of PH of blood using pH meter (8) (may/june 2016)	BTL 2	Understanding	PO1
	(ii) Explain the measurement of respiration rate using impedance technique.(8) (may/june 2016)	BTL 2	Understanding	PO1
10	(i) State and Explain the working principal of electromagnetic blood flow meter. (Nov/Dec2007)(May/June 2013)(Nov/Dec 2013)	BTL 2	Understanding	PO1
	(ii) describe the working of coulter counter. (may/june 2016)	BTL 2	Understanding	PO1
11	a) How ultra sound principles are used in measuring the flow of blood With suitable diagram ?(16) (Nov/Dec 2016)	BTL 1	Remembering	PO1
12	(i) Define blood pressure How it can be measured using sphygmomanometer?(8) (Nov/Dec 2016)	BTL 1	Remembering	PO1,PO3
	(ii) How the lungs volume can be measured ? Explain with necessary diagram.(8) (Nov/Dec 2016)	BTL 1	Remembering	PO1
13	A) (i) Describe the measurement of PO2 (8) (may/june 2017)	BTL 2	Understanding	PO1
	(ii) Explain the block diagram and working of colorimeter.(8) (may/june 2017)	BTL 2	Understanding	PO1
14	B) (i) Define the term cardiac output How is cardiac output measured by dye dilution technique? Explain(may/june 2017)	BTL 1	Remembering	PO1
	(ii)describe the working principal of electromagnetic blood flow meter. (may/june 2017)	BTL 2	Understanding	PO1

<b>UNIT III ASSIST DEVICES</b>				
Cardiac pacemakers, DC Defibrillator, Dialyser, Heart lung machine				
<b>PART A</b>				
<b>Q.No</b>	<b>Questions</b>	<b>BT Level</b>	<b>Competence</b>	<b>PO</b>
1	What is meant by Bradycardia and Tachycardia? (May/June 2015)	BTL 1	Remembering	PO1
2	When does the need for pacemaker arise? What is its function? (Nov/Dec 2015)	BTL 1	Remembering	PO1
3	List the typical ranges of pacemaker parameters. (Nov/Dec 2014)	BTL 1	Remembering	PO1
4	What are pacemakers?(May/June 2013)	BTL 1	Remembering	PO1
5	What is meant by demand pacemaker?( Nov/Dec 2013)	BTL 1	Remembering	PO1,P O2
6	What are the batteries used for implantable pacemakers.(Nov/Dec 2012)	BTL 1	Remembering	PO1
7	What is meant by Fibrillation?(May/June 2010)(May/June 2009)	BTL 1	Remembering	PO1
8	Calculate the energy stored in 16 $\mu$ F capacitor of a DC defibrillator that is charged to a potential of 5000 V dc.(Nov/Dec 2009)	BTL 6	Creating	PO1

9	Distinguish between internal pacemakers and external pacemakers.(April/May 2008) (Nov/Dec 2008) (May/June 2007)	BTL 4	Analyzing	PO1
10	Why should a patient susceptible to 'ventricular fibrillation' be watched continuously? (Nov/Dec2007)(May/June 2013)(Nov/Dec 2013)	BTL 1	Remembering	PO1,P O2,PO 3
11	Classify pacing modes. (NOV/DEC 2007)	BTL 2	Understanding	PO1,P O3
12	What is Defibrillator? State its use. (Nov/Dec 2007)	BTL 1	Remembering	PO1
13	Draw the circuit of DC Defibrillator and give its output specification. (Apr/May2011(May/June 2012)(May/June 2014)	BTL 4	Analyzing	PO1
14	What is heart – Lung Machine?	BTL 1	Remembering	PO1
15	What is Systole and Diastole?	BTL 1	Remembering	PO1
16	What are the types of oxygenators	BTL 1	Remembering	PO1
17	Define dialysis.	BTL 1	Remembering	PO1
18	Compare Hemodialysis and peritoneal dialysis?	BTL 2	Understanding	PO1
19	What are the three physical processes used in dialysis?	BTL 1	Remembering	PO1
20	What are the two types of procedures for doing dialysis?	BTL 1	Remembering	PO1
21	Which type of electrode is applied in the case of external stimulation and What is the current range?	BTL 1	Remembering	PO1
22	Which types of electrodes are used in internal stimulation and What is the current range?	BTL 1	Remembering	PO1
23	What is external stimulation employed?	BTL 1	Remembering	PO1
24	What is internal stimulation employed?	BTL 1	Remembering	PO1
25	What are the modes of operation of pacemakers?	BTL 1	Remembering	PO1
26	What are the types of defibrillator?	BTL 1	Remembering	PO1
27	Why are asynchronous pacemakers no longer used?(May/June 2016)	BTL 1	Remembering	PO1,P O2
28	When do you need heart lung machine?(May/June 2016)	BTL 1	Remembering	PO1
29	What is the systolic and diastolic pressure of Aorta? $MAP = \frac{1}{3}(\text{systolic} - \text{diastolic}) + \text{diastolic}$	BTL 1	Remembering	PO1
30	Differentiate internal and external defibrillator(june 2017)	BTL 4	Analyzing	PO1
31	What is dialysate mentation its composition (june 2017)	BTL 1	Remembering	PO1
32	Distinguish between endocardiac and myocrdiac electrodes. (dec 2016)	BTL 4	Analyzing	PO1
33	Mention few difference between internal and external defibrillator(dec 2016)	BTL 1	Remembering	PO1



34	Why are asynchronous pacemaker no longer used? (june 2016)	BTL 1	Remembering	PO1
35	When do you need heart lungs machine? (june 2016)	BTL 1	Remembering	PO1
<b>PART-B</b>				
1	Discuss with suitable block diagram the different modes of operation of Cardiac pacemakers. (Nov/ Dec 2008)(Apr/May 2011 & 2012) (Nov/Dec 2011)(Nov/Dec 2012)(May/June 2016)	BTL 2	Understanding	PO1,P O12
2	a) i) What is defibrillator? ii) Distinguish between Internal and External Defibrillator. iii) Draw block diagram describe the operation of synchronized D.C Defibrillator. (Nov/ Dec 2008) (Apr/May 2011)(April/May2015)(Nov/Dec 2015)(Nov/Dec 2013)	BTL 1	Remembering	PO1
3	Explain the operation of Dialyzer with a neat sketch.(May/June 2016)	BTL 2	Understanding	PO1
4	Explain the operation of Heart – Ling machine with a neat sketch.	BTL 2	Understanding	PO1
5	Discuss with suitable block diagram of atria and ventricle Cardiac pacemakers. (Nov/ Dec 2008)(Apr/May 2011 & 2012) (Nov/Dec 2011)(Nov/Dec 2012)(May/June 2016)	BTL 2	Understanding	PO1
6	With block diagram describe the operation of D.C Defibrillator.(Nov/Dec 2015)	BTL 1	Remembering	PO1,P O2
7	A (i) With a neat diagram Explain the block diagram of arterial and ventricular triggered pacemaker.(16) (May/June 2016)	BTL 2	Understanding	PO1
8	Explain in detail the principal and diagram working of hacmodialyser.(16) (May/June 2016)	BTL 2	Understanding	PO1
9	a) How pacemakers are classified based on the modes of operation Draw the block diagram of stand by and demand pacemakers and Explain its working principle.(16) (Nov/Dec 2016)	BTL 1	Remembering	PO1
10	Enumerate the following oxygenators perititionial dialysis(8+8) (Nov/Dec 2016)	BTL 2	Understanding	PO1
11	A) (i) With a neat diagram Explain the block diagram of DC defibrillator.(8) (ii) Describe the working of atrial synchronous pacemaker. (8) (May/June 2017)	BTL 4	Analyzing	PO1
12	Explain in detail the different types of oxygenators and pumps used in heart lung machine.(16) (May/June 2017)	BTL 2	Understanding	PO1

<b>UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY</b>				
Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy Telemetry principles, frequency selection, biotelemetry, radiopill, electrical safety				
<b>PART A</b>				
Q. No	Questions	BT Level	Competence	PO
1	Write the physiological effects of electricity.(April/May 2015)	BTL 1	Remembering	PO1
2	What is the principle of diathermy? (Nov/Dec 2015)(Nov/Dec 2014)	BTL 1	Remembering	PO1

3	Mention the situations which account for hazards from electric shock.(May/June 2014)	BTL 1	Remembering	PO1
4	Can pain be relieved through electrical stimulation? What is the equipment used for it?(May/June 2014)	BTL 1	Remembering	PO1
5	Define Let-go current. (Apr/ May 2008)(Nov/Dec2011) (Apr/May 2012)	BTL 1	Remembering	PO1,PO2
6	Distinguish between Micro shock and Macro shock. (Nov/Dec2007)(Nov/Dec2009) (Apr/May 2011)(Nov/Dec 2014)(May/June 2013)	BTL 4	Analyzing	PO1
7	What is diathermy? List its types. (Nov/Dec 2007) (Apr/May2010)(May/June 2010)	BTL 1	Remembering	PO1
8	What are the electrical safety methods used in hospitals? (Nov /Dec 2010)(May/June 2016)	BTL 1	Remembering	PO1
9	How electrical hazards do occurs due to medical equipments? (Nov /Dec 2010)	BTL 1	Remembering	PO1
10	What is the use of ultrasonic diathermy?(Nov/Dec 2011)	BTL 1	Remembering	PO1,PO2
11	What is tele- stimulation?(Nov/Dec2011)(Nov/Dec 2014)	BTL 1	Remembering	PO1
12	List the application of Bio- Telemetry.(Apr/May2011)(May/June 2013)	BTL 1	Remembering	PO1
13	List out any six bioelectric and physiological variables adaptable for biotelemetry Measurements	BTL 1	Remembering	PO1
14	What is radio pill?(Apr/May2012)(April/May 2015)(May/June 2010)(Nov/Dec 2010) (Nov/Dec 2009)(May/June 2016)	BTL 1	Remembering	PO1
15	List out the advantages of a Bio-telemetry system. (May/June 2007) (May/June 2009)	BTL 1	Remembering	PO1
16	Explain the principle of tele-stimulation. (Apr/May 2008)	BTL 2	Understanding	PO1
17	BTL 3 Apply Draw the block diagram of a Bio – Telemetry system. (Nov/Dec 2008)	BTL 4	Analyzing	PO1
18	What care must be taken while measuring responses to electrical stimulation?	BTL 1	Remembering	PO1
19	What is meant by single channel telemetry?(Nov/Dec 2015)	BTL 1	Remembering	PO1,PO2
20	List the two types of multiplexing involved in multi channel wireless telemetry?(Nov/Dec 2013)	BTL 1	Remembering	PO1
21	What are the precaution necessary to avoid micro shock?(Nov/Dec 2013)	BTL 1	Remembering	PO1
22	Specify the frequencies used for biotelemetry?(Nov/Dec 2012)	BTL 1	Remembering	PO1
23	Give the types and frequencies of operation of diathermy units.(Nov/Dec 2012)	BTL- 1	Remembering	PO1
24	Name the instrument needed for a bio-telemetry system.(Nov/Dec 2010)	BTL 2	Understanding	PO1
25	What is use of high frequency current in diathermy?	BTL 1	Remembering	PO1
26	Where is ultra sonic diathermy used?	BTL 1	Remembering	PO1
27	Name few diseases that can be cured by ultrasonic diathermy?	BTL 2	Understanding	PO1
28	What are the factors of leakage current flow?	BTL 1	Remembering	PO1
29	What are the two divisions in patient monitoring systems?	BTL 1	Remembering	PO1

30	What is the purpose of patient monitoring system?	BTL 1	Remembering	PO1
31	Define desiccation and hemostasis(june 2017)	BTL 1	Remembering	PO1
32	List the applications of biotelemetry(june 2017)	BTL 1	Remembering	PO1
33	What are the choices of radio carrier frequency for medical telemetry purposes(dec 2016)	BTL 1	Remembering	PO1,PO2
34	Define let go current. (dec 2016)	BTL 1	Remembering	PO1,PO2
35	List the devices used to safeguard against electrical hazards(june 2016)	BTL 1	Remembering	PO1,PO2
36	Which is radio pill mention the application of radio pill(june 2016)	BTL 2	Understanding	PO1
37	Explain working principle of a diathermy unit with a neat block diagram. (April/May2015) (May/June 2014)(May/June 2013)(May/June 2016)	BTL 2	Understanding	PO1
<b>PART B &amp; C (Unit-4)</b>				
1	a) i) Explain in detail the components of a Bio –telemetry system.(Nov/Dec 2015) ii) Discuss the various applications of telemetry in patient care.(April/ May 2008)	BTL 2	Understandi ng	PO1
2	a) i) Explain the physiological effects of electric current at 50Hz. (May/June 2016)	BTL 2	Understandi ng	PO1
	ii) With reference to electrical safety Explain (Nov/Dec 2015)	BTL 2	Understandi ng	PO1
	Ground fault circuit interrupter(Apr/May 2011)			
	Protection by low voltage (Nov/Dec 2007)			
3	Explain the single channel and multi channel bio telemetry system with neat diagram.(April/May 2015)(Nov/Dec 2014)(May/June 2013)	BTL 2	Understandi ng	PO1
	Write short notes on frequency selection for telemetry applications. (May/June 2016)	BTL 1	Rememberin g	PO1
4	Explain working principle of a surgical diathermy unit with a neat block diagram. (April/May2015) (May/June 2014)(May/June 2013)(May/June 2016)	BTL 2	Understandi ng	PO1
5	Explain about the electrical safety Instrumentation.	BTL 2	Understandi ng	PO1
6	A) (i) Explain the working and application techniques of short wave diathermy(10) (May/June 2016)	BTL 2	Understandi ng	PO1,PO2
7	(ii) Discuss the different operation performed using surgical diathermy treatment.(6) (May/June 2016)	BTL 2	Understandi ng	PO1
	B) (i) Describe the physiological effect of electricity on humans(8) (May/June 2016)	BTL 2	Understandi ng	PO1
8	(ii) write a short notes on frequency selection for telemetry applications .(8) (May/June 2016)	BTL 1	Rememberin g	PO1
	a) Define diathermy Draw the circuit diagram of a short wave diathermy unit and Discuss its impact on therapy purpose in details also brief describe How its can be applied to human subjects(16) (Nov/Dec 2016)	BTL 1	Rememberin g	PO1
9	(i) Explain the working of ground fault interrupter(8) (Nov/Dec 2016)	BTL 2	Understandi ng	PO1,PO2

	(ii) With suitable diagram Explain How ECG signal can be transmitted using single channel telemetry system.(8) (Nov/Dec 2016)	BTL 2	Understanding	PO1
10	A) (i) Explain the simplified circuit diagram of a microwave diathermy machine(10) (May/June 2017)	BTL 2	Understanding	PO1
11	(ii) Discuss the different methods of applying electrodes in shortwave diathermy treatment.(6) (May/June 2017)	BTL 2	Understanding	PO1
12	(i) Describe the single channel ECG telemetry system(8) (May/June 2017)	BTL 2	Understanding	PO1
	(ii) briefly Discuss about micro and macro shocks.(8) (May/June 2017)	BTL 2	Understanding	PO1

<b>UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION</b>				
Thermograph, endoscopy unit, Laser in medicine, cryogenic application, Introduction to telemedicine.				
<b>PART A</b>				
<b>Q. No</b>	<b>Questions</b>	<b>BT Level</b>	<b>Competence</b>	<b>PO</b>
1	List the parts of endoscope unit.(May/June 2013)	BTL 1	Remembering	PO1
2	Name the laser commonly used for ophthalmic application. Why? (April/May 2015)	BTL 2	Understanding	PO1
3	Bring out the clinical applications of endoscopy?(Nov/Dec 2015)	BTL 2	Understanding	PO1
4	What purposes Mammograms are used for?(May/June 2014)	BTL 1	Remembering	PO1
5	List out the properties of LASER. (May/June 2007)	BTL 1	Remembering	PO1
6	What is Thermograph? State its applications. (Nov/Dec 2008)(May/June 2009) (Apr/May2010)(May/June 2012)(Nov/Dec 2015)	BTL 1	Remembering	PO1
7	What are the functions of endoscopy unit? (Nov/Dec 2008)	BTL 1	Remembering	PO1,P O2
8	Mention the advantages of performing surgery using LASER. (Apr/ May 2008) (Nov/Dec 2009)	BTL 1	Remembering	PO1
9	Which laser is used for surgery? (Apr/May 2011)	BTL 2	Understanding	PO1
10	Mention the application of LASER in ophthalmology.(Nov/Dec 2012)	BTL 1	Remembering	PO1
11	What type of LASERs are used for patient treatment?(May/June 2009)	BTL 1	Remembering	PO1
12	What is Telemedicine?	BTL 1	Remembering	PO1
13	State the application of Telemedicine. (May/Jun 2016)	BTL 1	Remembering	PO1
14	What are essential parameters for Telemedicine?	BTL 1	Remembering	PO1
15	Name the technologies used in telemedicine.	BTL 2	Understanding	PO1
16	Name some uses of CO2 Laser in surgery?	BTL 2	Understanding	PO1
17	Mention few advantages of Laser Surgery.	BTL 1	Remembering	PO1

18	What are the diseases that can be diagnosed by thermograph?	BTL 1	Remembering	PO1
19	What are the classifications of thermograph?	BTL 1	Remembering	PO1
20	What are the characteristics of good thermograph equipment?	BTL 1	Remembering	PO1
21	List out the factors of photo physical event that depends on?	BTL 1	Remembering	PO1
22	List out the four photo biological Laser processes.	BTL 1	Remembering	PO1
23	Name the type of LASER used in Photo chemical processes.	BTL 2	Understanding	PO1
24	Name the type of LASER used in Photo thermal processes.	BTL 2	Understanding	PO1
25	Name the type of LASER used in Electro mechanical processes.	BTL 2	Understanding	PO1
26	List the types of pumping sources used in LASER. (May/June 2016)	BTL 1	Remembering	PO1
27	What is LASER?	BTL 1	Remembering	PO1
28	What factor LASER action depends?	BTL 1	Remembering	PO1
29	What properties LASER is determined?	BTL 1	Remembering	PO1
30	What is cryogenic surgery?	BTL 1	Remembering	PO1
31	What makes thermograph useful? (june 2017)	BTL 1	Remembering	PO1
32	List the properties of laser beam(june 2017)	BTL 1	Remembering	PO1
33	Define the physical factors which affect the amount of infrared radiation from human body(dec 2016)	BTL 1	Remembering	PO1
34	Mention few applications of lasers in medicine(dec 2016)	BTL 2	Understanding	PO1
35	State the application of telemedicine(june 2016)	BTL 2	Understanding	PO1
36	List the types of pumping sources used in LASER(june 2016)	BTL 1	Remembering	PO1
<b>PART - B</b>				
1	a) Discuss working principle of an infrared thermo graphic equipment. Mention applications of thermo graph (May/June 2007) (Apr/May 2011)(Nov/Dec 2011) (Nov/Dec 2014) (May/June 2013)(May/June 2016)	BTL 2	Understanding	PO1
2	a) Discuss in detail the different application of Laser in medicine. (Nov/Dec 2007)(Apr/May 2012) (April/May 2015)(May/June 2014) (May/June 2013)(May/June 2016)	BTL 2	Understanding	PO1
3	What is an endoscope? Discuss the working of an endoscopic unit. (Apr/ May 2008) (Nov/Dec11)(Apr/May 2012)(April/May2015)(Nov/Dec 2015)(May/June 2014)(May/June 2013)(May/June 2016)	BTL 1	Remembering	PO1
4	Explain about the importance of Telemedicine.	BTL 2	Understanding	PO1
5	What is cryogenic? List some cryogenics agents with its operating temperature and Explain How it is used to perform surgery?	BTL 1	Remembering	PO1

6	Explain the basic principle of LASER.	BTL 2	Understanding	PO1
7	A) (i) What is thermography ? Explain the block diagram of infrared imaging system(10)	BTL 1	Remembering	PO1
	(ii) Describe the different operation involved in endoscopy(6) (May/June 2016)	BTL 2	Understanding	PO1
8	(i) What is cryogenic List some cryogenics agents with its operating temperature and Explain How it is used to perform surgery(10) (May/June 2016)	BTL 1	Remembering	PO1
	(ii) write short notes on applications of LASER in medicine.(6) (May/June 2016)	BTL 1	Remembering	PO1
9	a) Explain the infrared thermography instrumentation with a suitable block diagram and What are the different medical applications(16) (Nov/Dec 2016)	BTL 2	Understanding	PO12
10	(i) Write a notes on cryogenic surgery(8) (Nov/Dec 2016)	BTL 1	Remembering	PO1
	(ii) Write a notes on endoscopy unit(8) (Nov/Dec 2016)	BTL 1	Remembering	PO1
11	A) (i) What is endoscope ? Explain the different types of operations performed using endoscopy(10) (May/June 2017)	BTL 1	Remembering	PO1
	(ii) Describe the working principle of thermograph(6) (May/June 2017)	BTL 2	Understanding	PO1
12	B) (i) Explain different typers of LASER(10) (May/June 2017)	BTL 2	Understanding	PO1
	(ii) write short notes on cryogenic applications.(6)	BTL 1	Remembering	PO1

## UNIT-1 ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING

### PART A

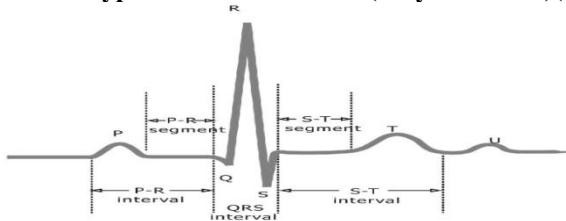
#### 1. State all or none law in respect of cell biopotential. (Apr/May 2008)

Regardless of the method of excitation of cells or the intensity of the stimulus, which is assumed to be greater than the threshold of stimulus, the action potential is always the same for any given cell. This is known as '**all or none law**'.

#### 2. Define the term Conduction Velocity. (Apr/May 2008) &(May/June2007)(Nov/Dec 2009)

The rate at which an action potential moves down a fiber of a nerve cell or is propagated from cell to cell is called the **propagation rate (or) conduction velocity**. The conduction velocity is defined as  $V = [(l_1 - l_2) / (t_1 - t_2)]$ . The conduction velocity in peripheral nerves is normally 50m/s.

#### 3. Draw a typical ECG waveform. (May/June2007)(Nov/Dec 2009)



#### 4. State how a phonocardiogram and an electrocardiogram signals differ in their clinical information.(AP/MAY 2008)

In electrocardiography, only the voltage generated by the electrical activity of the heart is recorded. Any form of arrhythmia (disturbance in the heart rhythm) can be easily diagnosed using electrocardiogram.

The graphic record of the heart sounds is called phonogram. Because the sound is from the heart, it is called as phonocardiogram. The basic aim of phonocardiograph is to pick up the different heart sounds, filter out the heart sounds and to display them.

<p><b>5. Define resting and action potential.(NOV/DEC 2008) (May /June 2009) (April/May 2015)</b> The membrane potential caused by the different concentration of ions is called as <b>resting potential</b> of the cell. The positive potential of the cell membrane during excitation is called as <b>action potential</b> and it is about 20mV.</p>
<p><b>6. Define Latency as related to EMG. (NOV/DEC 2008)(Nov/Dec 2015)</b> Latency is defined as the elapsed time between the stimulating impulse and the muscle's action potential.</p>
<p><b>7. List the names and frequency bands of EEG signals(May 2007)(Nov/Dec 2014)</b> The names and frequency bands of EEG signals are</p> <ul style="list-style-type: none"> <li>Alpha waves - 8-13 Hz</li> <li>Beta waves - 13-30Hz</li> <li>Theta waves - 4-8 Hz</li> <li>Delta waves - 05-4 Hz</li> </ul>
<p><b>8. What is the importance of PCG Signal ?(May/June 2009)</b> The importance of PCG signals are</p> <ol style="list-style-type: none"> <li>1. Different types of heart sounds are measured.</li> <li>2. Due to vibration setup in the blood inside the heart by sudden closure of valves</li> <li>3. Additional sounds are heard between normal heart sounds.</li> </ol>
<p><b>9. Mention the importance of biological amplifier.(Apr/May 2010)</b> Generally, Bio signal are having low amplitude and low frequency .so, amplifier are needed to boost the amplitude level of the bio signals. These amplifiers are known as bio- amplifiers.</p>
<p><b>10. Mention the various lead systems used in ECG recording. (Apr/May 2010)</b> The various lead system used in ECG recording are</p> <ul style="list-style-type: none"> <li>(i) Bipolar limb lead/standard lead</li> <li>(ii)Augmented unipolar limb lead</li> <li>(iii) Chest lead/precordial lead</li> <li>(iv)Frank Lead system/corrected orthogonal lead system.</li> </ul>
<p><b>11. What is half cell Potential? (Apr/May 2011)</b> The voltage developed at an electrode-electrolyte interface is designated as the half cell potential or electrode potential. A Characteristics potential difference established by the electrode and its surrounding electrolyte which depends on the metal, concentration of ions in solution and temperature.</p>
<p><b>12. Give the EMG Signal Characteristics. (Apr/May 2011)</b> The EMG signal ranges from 0.1mV to 0.5mV.The frequency components of the EMG signal vary from 20HZ to 10 KHz and they are restricted to the frequency range of 20HZ to 200HZ for Clinical purpose using a low pass filter.</p>
<p><b>13. What is EOG? (Nov/Dec 2011)</b> EOG –Electro oculography – It is the recording of the biopotential generated by the movement of eyes.</p>
<p><b>14. Compare the signal characteristics of ECG and PCG. (Nov/Dec 2011)(May/June 2013)</b> PCG related to mechanical events of heart while ECG related to electrical activity of heart. PCG has three different waves but ECG has only one wave from to analysis the function of heart.</p>
<p><b>15. What is PCG? (Apr/May 2012)(Nov/Dec 2012)</b> The graphic record of the heart sounds is called as phonogram. Because the sound is from the heart, it is called phonocardiogram. The instrument used to measure the heart sounds is called as phonocardiograph.</p>
<p><b>16. What are the different types of electrodes used in bipolar measurement? (Apr/May 2012)</b> The different types of electrodes used in bipolar measurement are</p> <ul style="list-style-type: none"> <li>a) Metal plate electrodes, b) Suction cup electrode, c) Adhesive tape electrode,</li> <li>d) Multipoint electrode, e) Floating electrode.</li> </ul>

**17. Give the ECG Signal Characteristics.(April/May 2015)**

The ECG signal characteristics is given below

Amplitude	P wave	0.25 mV
	R wave	1.60 mV
	Q wave	25% of R wave
	T Wave	0.1 to 0.5 mV
Duration	P-R interval	0.12 to 0.20 sec
	Q-T interval	0.35 to 0.44 sec
	S-T interval	0.05 to 0.15 sec
	P wave interval	0.11 sec
	QRS interval	0.09 sec

**18. What is bio electric potential?(Nov/Dec 2015)**

The ionic voltages produced as a result of the electrochemical activity of certain special type of cells are known as bio-electric potential.

**19. The contraction of skeletal muscle is termed as what? Give its specification. (May/June 2014)**

The contraction of skeleton muscle is termed as Twitch and Tetanic contractions. Twitch contraction is a short burst of stimulation causes the muscle to contract, but the duration is so short that the muscle begins relaxing even before reaching peak force. If the stimulation is long enough, the muscle reaches peak force and plateaus at this level, resulting in a Tetanic contraction.

**20. Enlist the electrodes used for recording EEG.(May/June 2014)**

Scalp electrodes: F<sub>p1</sub>, F<sub>p2</sub>, F<sub>z</sub>, F<sub>3</sub>, F<sub>4</sub>, F<sub>7</sub>, F<sub>8</sub>, C<sub>z</sub>, C<sub>3</sub>, C<sub>4</sub>, P<sub>z</sub>, P<sub>3</sub>, P<sub>4</sub>, O<sub>z</sub>, O<sub>1</sub>, O<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub>, T<sub>6</sub>  
 Nasopharyngeal electrodes: P<sub>g1</sub> and P<sub>g2</sub>,  
 Ear electrodes: A<sub>1</sub> and A<sub>2</sub>

**21. Define CMRR. Give its importance in physiological signal amplifiers.(Nov/Dec 2014)**

$$CMRR = \frac{\text{amplification of the differential voltage}}{\text{amplification of the common mode voltage}}$$

The common mode rejection ratio (CMRR) should be more than 80dB so as to eliminate the 50Hz interference from the mains.

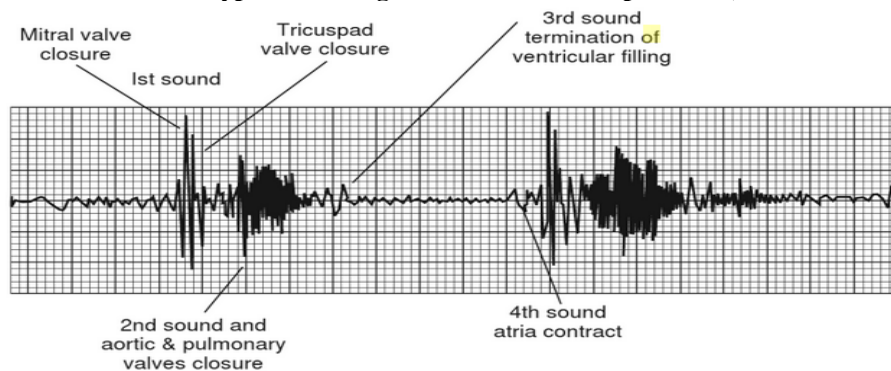
**22. List the characteristics needed for Bio Amplifier.(May/June 2013)**

- The voltage gain of the amplifier should be >100dB.
- It should have low frequency response.
- Gain and frequency response should be uniform throughout the Bandwidth.
- There is no drift in the amplifier.
- The output impedance should be very small.
- The common mode rejection ratio (CMMR) should be >80dB.

**23. What are the requirement of a biological amplifier?(Nov/Dec 2013)**

- The voltage gain of the amplifier should be more than 100dB so as to amplify the biosignal properly to drive the recorder.
- The gain and the frequency response should be uniform throughout the required bandwidth.
- There is no drift in the amplifier.
- The output impedance of the amplifier should be very small.

**24. Draw the wave form of a typical PCG signal and label its components. ( Nov/Dec 2013)**





<p><b>25. Name the electrode used for recording ECG and EMG.(Nov/Dec 2012)</b> Surface Electrode and Needle Electrodes are used for recording ECG and EMG.</p>
<p><b>26. What are the different types of bio potential electrodes? (Nov/Dec 2010)</b> There are three types of electrodes 1. Micro Electrodes – ( Metal micro electrode and Micropipet) 2. Depth and Needle Electrode 3. Surface Electrode – ( Metal Plate Electrode, Suction cup electrode , Adhesive tape electrode, Multipoint electrode ,Floating Electrode)</p>
<p><b>27. Mention the normal amplitude and frequency of EMG signal ? (Nov/Dec 2010)</b> The normal amplitude of EMG signal is about range from 0.1 to 0.5 mV The normal frequency of EMG signal is about 60 Hz</p>
<p><b>28. What is the range of resting potential?</b> The resting potential range from 70 to 90 mill volt.</p>
<p><b>29. What are artifacts?</b> The term artifacts refer to any component of a signal that is extraneous to the variable represented by a signal.</p>
<p><b>30. Differentiate between heart sound and murmurs.</b> Heart sound have a transient character and it is of short duration, whereas heart murmurs have a noisy characteristics and last for a longer time. Heart sounds are due to the closing and opening of the valves, murmurs are due to the turbulent flow of blood in the heart and larger vessels.</p>
<p><b>31. List the important characteristics required for bio-amplifier.(May/June 2016)</b> a. The voltage gain of the amplifier should be &gt;100dB. b. It should have low frequency response. c. Gain and frequency response should be uniform throughout the Bandwidth. d. There is no drift in the amplifier. e. The output impedance should be very small. f. The common mode rejection ratio (CMMR) should be &gt;80dB.</p>
<p><b>32. Mention the electrodes used to record bio-potential from a single muscle fibre.(May/June 2016)</b> Microelectrodes – i) Metal Microelectrodes ii) Micropipet.</p>
<p><b>33. State all none law (dec 2016)</b> The all-or-none law is the principle that the strength by which a nerve or muscle fiber responds to a stimulus is independent of the strength of the stimulus. If that stimulus exceeds the threshold potential, the nerve or muscle fiber will give a complete response; otherwise, there is no response.</p>
<p><b>34. What is ment by conduction velocity(dec 2016)</b> In modern EMG systems, nerve conduction time and nerve velocity are measured. For this measurement, initially nerve is stimulated and EMG is measured.This conduction velocitymeasurement is used to indicate the location and type of nerve lesion</p>
<p><b>35. Define absolute and relative refractory period (june 2017)</b> Absolute refractory period: During a short period after the generation of an action potential, the cell does not respond to any stimulus at all. This period is known as theabsolute refractory period. Relative refractory period: It is the time period between the instant when the membrane potential becomes negative again and the instant when the membrane potential returns to RMP. During this period, the cell responds to a stimulus but less strongly than usual.</p>
<p><b>36. Mention the cause of first and second heart sounds(june 2017)</b> Record of heart sounds – 1st and 2nd heart sounds are heard well but 3rd and 4th are not. Heart sounds are generally used for diagnosis of valverelated diseases. Such abnormal heart sounds are called murmurs. 1st heart sound: due to closure of AV valves – long, soft &amp; low-pitched sound – sounds like ‘lubb’ – 0.14-0.2 sec – 30-40 Hz. 2nd heart sound: due to closure of semilunar valves – short, sharp &amp; high-pitched sound –sounds like ‘dub’ – 0.08-0.1 sec – 50-70 Hz.</p>

**37. List the important characteristics required for bioamplifier(june 2016)**

The requirements for bio-potential amplifiers can often be more demanding than for a lot of electronic equipment as might be used in the entertainment or telecommunications sectors. When measuring electrical signals, such as the ECG, from the surface of the body typical requirements could be:

- Very High Input Impedance:
- Moderate Bandwidth:
- Sufficient Gain-Bandwidth Product:
- High Common-Mode-Rejection:

**38. Mention the electrodes used to record bio potential from a single muscle fiber(june 2016)**

single-fiber electromyography electrode within a motor unit used to record bio potential from a single muscle fiber

**UNIT-1 PART B & C**

1. i) Discuss in detail about Action Potential and Resting Potential.(Apr/May 2011)(Nov/Dec 2014) ii) Write short notes on bio potential electrodes. (MAY/JUNE2007)(May/June 2013) (May/June 2012)(May/June 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:4-8 &amp; 24-27.</b>
2. i) Explain the working principle of a ECG machine with a neat block diagram.(Nov/Dec 2015) ii) What is Phonocardiography? (MAY/JUNE2007) (May/June 2014) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:117-142.</b>
3. i) Explain in detail various types of bio potential electrodes.(May/June2012)(Nov/Dec2011) (April/May 2015) ii) Write a short note on electromyogram. (AP/MAY 2008) (Nov/Dec 2015) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:21-33 &amp; 153-156.</b>
4. i) Draw an action potential waveform and discuss in detail about polarization and repolarization. ii) Draw the bipolar limb lead system of an ECG. (AP/MAY 2008) (April/May2015)(May/June 2014)(Nov/Dec 2014)(May/June 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:4-8 &amp; 120-121.</b>
5. i)What is Half cell potential? ii) What are the three types of electrodes and mention its use. iii) Discuss Microelectrodes in detail. (NOV/DEC 2008) (Nov/Dec 2013) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 21, 24 -27.</b>
6. i) Bring out the salient features of phonocardiography. .(Apr/May 2011) ii) With suitable diagram, explain the method of measurement of conduction velocity in peripheral nerves. (NOV/DEC 2008)(May/June 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 133-142 &amp; 153-156.</b>
7. Explain the working principle of EEG recording machine.(April/May2015)(Nov/Dec 2013) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 144</b>
8. A) (i) explain the international standard 12 lead system used to record ECG(10) (may/june 2016) (ii) list and discuss the important characteristics and frequency bands of EEC signal(6) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 132,77</b>
9. (i) discuss in detail about the orgin potential and resting potential with necessary equations.(10) (ii) describe the typical recording setup of EMG (6) (may/june 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:89,123</b>
10. a) discuss the genesis of ECG and explain the working of an ECG machine which is block diagram along with its various lead configuration(16) (Nov/Dec 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 184</b>
11. What is know as biopotential electrodes? Draw its equivalent circuit explain various types of biopotential electrodes with suitable example(16) (Nov/Dec 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 192</b>
12. (i) explain the international standard 12 lead system used to record ECG(10) (may/june 2017) (i) list and discuss the important characteristics of bioamplifier(6) (may/june 2017) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 132, 98</b>
13. (i) discuss in detail about the 10 – 20 lead system.(10) (may/june 2017) (ii) describe the typical EMG waveform and its characteristics(6) (may/june 2017) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 126,67</b>

## UNIT-2 – BIO CHEMICAL & NONELECTRICAL PARAMETER MEASUREMENT

### PART A

<p><b>1. What are cardiac output and phonocardiogram?</b> Cardiac output is the amount of blood delivered by the heart to aorta per minute. Phonocardiogram is used to measure heart sounds in graphical manner</p>
<p><b>2. What is cardiac output .Mention the methods of measurement of cardiac output .</b> Cardiac output is the amount of blood delivered by the heart to aorta per minute various Methods to measure the cardiac output is Fick's method Indication dilution method By impedance change</p>
<p><b>3. What are demerits of electromagnetic blood flow meter?</b> i) The output voltage of the method is only few micro volts. ii) Change of magnetic field causes the transducer to act like a transformer and induces error Voltage.</p>
<p><b>4. Name any two methods of respiration rate measurement?</b> 1. Maximum mid expiratory 2. Maximal expiration flow rate 3. Maximal breathing capacity.</p>
<p><b>5. What is residual volume? (May/June 2007)</b> The Residual Volume (RV) is the volume of gas remaining in the lungs at the end of a maximal expiration.</p>
<p><b>6. Mention the application of flame photometer. (May/June 2007) (Nov/Dec 2009)</b> A flame photometer is used to Analyzing urine or blood in order to determine the concentration of potassium (K), sodium (Na), Calcium (Ca) and Lithium (Li).</p>
<p><b>7. What is meant by Mean Arterial Pressure (MAP)? (Apr/May 2008) (Nov/Dec 2007)</b> Mean Arterial Pressure is a weighted average of systolic and diastolic pressure. Generally, MAP falls about one-third of the way between the diastolic low and the systolic peak. A simple formula for computing MAP is: <math>MAP = 1/3 (\text{systolic} - \text{diastolic}) + \text{diastolic}</math></p>
<p><b>8. What are Korotkoff's sounds?(Nov/Dec 2008)</b> When an artery is partially occluded so that the blood velocity through the constriction is increased sufficiently, identifiable sounds can be heard downstream through a stethoscope. These sounds are called Korotkoff's sounds, are used in the common method of blood pressure measurement.</p>
<p><b>9. What is a colorimeter? State its uses?(Nov/Dec 2008)(May/June 2009)</b> The Colorimeter is used to measure the transmitted and absorbed light as it passes through a sample. The colorimeter uses light absorption to determine blood proteins and iron levels. Colorimeter can be in the filter photometer or spectrophotometer. When an interference filter is used to select a given wavelength it is called filter photometer. When a diffraction grating or prism is used as a monochromatic to get different spectral components or wavelength of interest in the colorimeter, then it is called spectrophotometer.</p>
<p><b>10. Name the four physical principles based on which blood flow meters are constructed?(Nov/Dec 2007)</b> 1. Electromagnetic induction 2. Ultrasonic principle(Transit time type, Doppler type) 3. Thermal convection 4. Radiographic Principle 5. Indicated dilution Principle.</p>
<p><b>11. Name the instrument used to measure PO<sub>2</sub> and PCO<sub>2</sub>?(May/June 2009)</b> Blood Gas Analyzingr</p>

**12. How is the pulse rate measured?(Apr/May 2011)**

The pulse rate is measured using one of the following methods

- a) Electrical Impedance Method
- b) Strain gauge Method
- c) Photoelectric Method
- d) Microphone Method

**13. What is Stroke Volume? (Apr/May 2011)(May/June 2013)**

Stroke Volume (SV) is the Volume of blood pumped from one ventricle of the heart with each beat.

**14. What is systolic and diastolic pressure? (Nov/Dec 2011)**

Contraction of heart muscle is called as systolic. The systolic pressure is 120 mm of Hg.

Relaxation of heart muscle is called as diastole. The diastolic pressure is 80 mm of Hg.

**15. How is respiration rate measured? (Nov/Dec 2011)**

The measurement of respiration rate provides ideas about relative respiratory activity .Various techniques are used for this measurement are

1. Displacement method
2. Thermistor Method
3. Impedance pneumography
4. CO<sub>2</sub> Method
5. Apnora Detector

**16. Which transducer is used for measuring temperature? Why?(Apr/May 2012)**

Thermoelectric type transducer is used for measuring temperature, because to store and carry plasma, antibiotics etc.

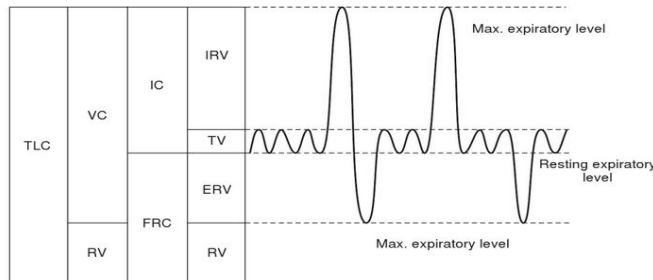
**17. What is the principle used in pulse rate measurement? (Apr/May 2012)**

Piezoelectric type transducer is the principle used in pulse rate measurement.

**18. Which flow meters are used to measure pulsatile flow of blood?(April/May 2015)**

Pulsed Doppler Blood flow meter

**19. Draw lung volume diagram. (April/May 2015)**



**20. How does the pH value determine the acidity and alkalinity in blood fluid?(Nov/Dec 2015)**

The pH is a measure of the acid – base balance of a fluid. A neutral solution has a pH of 7. Lower pH numbers indicate acidity , whereas higher pH values define a basic solution .

**21. List the various indirect methods for the measurement of blood pressure.(Nov/Dec 2015)**

The various indirect methods for the measurement of blood pressure are

1. Percutaneous insertion
2. Catheterization (Vessel cut down)
3. Implant of a transducer in a vessel or in the heart.

**22. Write the principle behind electromagnetic blood flow meter.(May/June 2014)**

Continuous measurement of blood velocity can be obtained by placing the electromagnetic flow probe around arteries and veins. This probe operates on Faraday's law of induced e.m.f. Blood is a conductor of electricity. When a magnetic field is applied to a blood vessel, the blood flow in the vessel causes an electric field to be induced in a direction mutually perpendicular to the direction of the applied magnetic field and the blood velocity.

<p><b>23. Nitrogen washout technique is meant for what measurements? (May/June 2014)</b>  A nitrogen washout can be performed with a single nitrogen breath, or multiple ones. Both tests use similar tools, both can estimate functional residual capacity and the degree of non uniformity of gas distribution in the lungs, but the multiple-breath test more accurately measures absolute lung volumes</p>
<p><b>24. What is Fick's Principle? Give its advantages.(Nov/Dec 2014)</b>  The Fick's method is based on the determination of cardiac output by the analysis of the gas keeping of the organism. Thus the cardiac output can be calculated by continuously infusing oxygen in to the blood or removing it from the blood and measuring the amount of the oxygen in the blood before and after its passage.This method is complicated, difficult to repeat, necessitates catheterization, it is practiced at some places.</p>
<p><b>25. Define cardiac output. Find the cardiac output of a person if his heart rate is 72 BPM and stroke volume is 70ml. (Nov/Dec 2014)</b>  Cardiac output is the amount of blood delivered by the heart to aorta per minute.</p> $\text{Cardiac output} = \frac{\text{stroke volume} \times \text{Heart rate}}{1000}$ $\text{Cardiac output} = \frac{70 \times 72}{1000} = 5.04 \text{ ml / minute}$
<p><b>26. What are the components of Blood? (May/June 2013)</b>  The components of blood include:  Red blood cells, White blood cells, Platelets, and Plasma.</p>
<p><b>27. If systolic and diastolic blood pressures are given as 110mmHg and 82 mm Hg . Calculate mean arterial Pressure.(Nov/Dec 2013)</b>  <math>\text{MAP} = 1/3(\text{systolic} - \text{diastolic}) + \text{diastolic}</math>  <math>\text{MAP} = 1/3(110-82) + 82 = 36.66 \text{ mm Hg.}</math></p>
<p><b>28. Mention the basic principle behind electrochemical pH determination.(Nov/Dec 2013)</b>  The Principle is illustrated as below. Inside the glass bulb is a highly acidic buffer solution. Measurement of the potential across the glass interface is achieved by placing a silver- Silver chloride electrode in the solution inside the glass bulb and a calomel or silver – silver chloride reference electrode in the solution in which the pH is being measured.</p>
<p><b>29. What is an auto Analyzingr? What are the essential units in it? (Nov/Dec 2012)(May/June 2010)</b>  Auto Analyzingr is used to measure blood chemistry and display on a graphic recorder.</p>
<p><b>30. Give the typical values of blood pressure and pulse rate of an adult.(Nov/Dec 2012)</b>  Blood Pressure: 120/80 mmHg  Pulse Rate : 60 to 80 bpm</p>
<p><b>31. Mention the applications of auto Analyzingr?(Nov/Dec 2010)</b></p> <ol style="list-style-type: none"> <li>1. Clinical analysis – Determine levels of albumin, alkaline phosphates, aspartate transaminase(AST), blood urea nitrogen ,bilirubin ,calcium ,cholesterol ,creatinine , glucose , inorganic phosphorus , proteins and uric acid in blood serum or other bodily samples.</li> <li>2. Industrial analysis – Mainly for water ,soil extracts and fertilizer.</li> </ol>
<p><b>32. Calculate the stroke volume in millilitres if the cardiac output is 5.2 litres/minute and heart rate is 76 beats/minute?(Nov/Dec 2009)</b>  Cardiac output(ml/min) = Heart rate (beat/min)* Stroke Volume (ml/beat)  Stroke Volume = <math>5200/76 = 68.42 \text{ ml/beat}</math></p>

<p><b>33. Define cardiac output. Find the cardiac output of a person if his heart rate is 70BPM and stroke volume is 70ml.(May/June 2016)</b></p> <p>Cardiac output is the amount of blood delivered by the heart to aorta per minute.</p> $\text{Cardiac output} = \frac{\text{stroke volume} \times \text{Heart rate}}{1000}$ $\text{Cardiac output} = \frac{70 \times 70}{1000} = 4.9 \text{ ml / minute}$
<p><b>34. What are the different types of test performed using auto Analyzingr?(May/June 2016)</b></p> <p>1. Pipetting 2. Diluting 3. Incubating</p>
<p><b>35. What is blood pressure state the normal values of blood pressure(june 2017)</b></p> <p>The sphygmomanometer consists of (i) an inflatable rubber bladder called the “cuff”, (ii) a rubber squeeze ball pump and valve assembly and (iii) a manometer</p>
<p><b>36. State the different types of test performed using auto analyser(june 2017)</b></p> <p>An automated analyser is a medical laboratory instrument designed to measure different chemicals and other characteristics in a number of biological samples quickly, with minimal human assistance</p>
<p><b>37. Define cardiac output(dec 2016)</b></p> <p>Cardiac output is the quantity of blood delivered by the heart to the aorta per minutes. It is a major determinant of oxygen delivery to the tissues.</p>
<p><b>38. State Beer's law(dec 2016)</b></p> <p>If the path length or concentration increases, the transmittance decreases and absorbance increases. Absorbance is related to the nature of the absorbing substance and optical wavelength (known for a standard solution concentration).</p> <p>C: Concentration L: Cuvette path length</p>
<p><b>39. Define cardiac output find the cardiac output of person if his heart beat rate is 70 BPM and stroke volume is 70 ml(june 2016)</b></p> <p>Cardiac output is the product of two variables, stroke volume and heart beat. Heartbeat is simply a count of the number of times a heart beats per minute. Stroke volume is the amount of blood circulated by the heart with each beat. The formula for this is expressed as <math>CO = SV \times HR</math>.</p> <p><math>CO = 70 \times 70 = 4900</math></p>
<p><b>40. State the different types of test performed using auto analyser(june 2016)</b></p> <p>An automated analyser is a medical laboratory instrument designed to measure different chemicals and other characteristics in a number of biological samples quickly, with minimal human assistance</p>

### PART B & C

<p><b>1.</b> a) i) Discuss the working principle of a colorimeter with a neat block Diagram. ii) How will you measure blood pressure using Sphygmomanometer? (May/June 2007) (April/May 2015)(Nov/Dec 2015)(May/June 2013) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:284-286 &amp; Notes.</b></p>
<p><b>2.</b> a) i) Explain the working principle of an electromagnetic type blood flow Meter. (April/May 2015) ii) Define Cardiac output. Discuss a technique to determine cardiac Output. (May/June 2007) (Apr/May 2012)(Nov/Dec 2011) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:233-237 &amp; 246-253.</b></p>
<p><b>3.</b> a) i) Explain the working principle of an electromagnetic type blood flow Meter. (May/June 2016) ii) Describe the operation of a blood cell counter. (April/ May 2008)(Nov/Dec 2014) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 233-237 &amp; 274-277.</b></p>
<p><b>4.</b> a) i) Define the terms: residual volume, tidal volume, vital capacity and Total lung capacity. ii) Discuss Fick's method for determining cardiac output. (April/ May 2008)(May/June 2013) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:254&amp;246-247.</b></p>
<p><b>5.</b> a) Describe the measurement of pH in blood. (Nov/Dec 2011)(May/June 2016) b) Explain the following: Auto Analyzingr (May/June 2014)(May/June 2012) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:265-267 &amp; Notes.</b></p>

<p><b>6.</b> Draw a block diagram of ultrasonic blood flow meter .Explain the method of measuring the velocity of blood flow using (i) Transit time principle (2) Doppler effect.(Apr/May 2011) (Nov/Dec2007)(May/June 2013)(Nov/Dec 2013) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:237-244.</b></p>
<p><b>7.</b> Explain the function of a human respiratory system and the possible measurement and inferences made out of them.(Nov/Dec 2015)(Nov/Dec 2014)(May/June 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:253.</b></p>
<p><b>8.</b> A) (i) Describe the measurement of PH of blood using pH meter (8) (may/june 2016) (ii)Explain the meseremeent of respiration rate using impedencetechnique.(8) (may/june 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 208,211</b></p>
<p><b>9.</b> (i) state and explain the working principal of electromagnetic blood flow meter. (ii) describe the working of coulter counter. (may/june 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 200</b></p>
<p><b>10.</b> a) With suitable diagram describe how ultra sound principles are used in measuring the flow of blood?(16) (Nov/Dec 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 206</b></p>
<p><b>11.</b> (i)Define blood pressure how it can be measured using sphygmomanometer?(8) (Nov/Dec 2016) (ii)How the lungs volume can be measured ? explain with necessary diagram.(8) (Nov/Dec 2016) <b>Ans: Text book: Bio medical instrumentation , Notes</b></p>
<p><b>12.</b> A) (i) Deacribe the measurement of PO2 (8) (may/june 2017) (ii)Explain the block diagram and working of colorimeter.(8) (may/june 2017) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 204,215</b></p>
<p><b>13.</b> (i) Define the term cardiac output how is cardiac output measured by dye dilution technique? Explain(may/june 2017) (ii) describe the working principal of electromagnetic blood flow meter. (may/june 2017) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 230,222</b></p>

### UNIT-3 – ASSIST DEVICES

#### PART A

<p><b>1. What is meant by Bradycardia and Tachycardia? (May/June 2015)</b> The normal value of heart rate lies in the range of 60 to 100 beats per minute. A slower rate than this is called as <b>Bradycardia (Slow rate)</b> and a higher rate, <b>Tachycardia (fast heart)</b>.</p>																											
<p><b>2. When does the need for pacemaker arise? What is its function? (Nov/Dec 2015)</b> In cardiac diseases, where the ventricular rate is too low, it can be increased to normal rate by using pacemakers. The various arrhythmias ( rhythm disturbance) that result in heart block and Adams stokes attacks represent a serious pathological condition. During that time, the patient becomes invalid because of the constant risk of sudden losing consciousness. By fixing the artificial electronic pacemakers, the above defects in the heart can be eliminated.</p>																											
<p><b>3. List the typical ranges of pacemaker parameters. (Nov/Dec 2014)</b></p> <table> <tr> <td>Pulse rate</td> <td>-</td> <td>25-155pulses per minute</td> </tr> <tr> <td>Pulse width</td> <td>-</td> <td>0.1-2.3 ms</td> </tr> <tr> <td>Pulse amplitude</td> <td>-</td> <td>2.5-10 volts</td> </tr> <tr> <td>Battery capacity</td> <td>-</td> <td>0.44-3.2amp-hours</td> </tr> <tr> <td>Longevity</td> <td>-</td> <td>3.5-18 years</td> </tr> <tr> <td>End-of-life indicator</td> <td>-</td> <td>2-10% drop in pulse rate</td> </tr> <tr> <td>Weight</td> <td>-</td> <td>33-98 grams</td> </tr> <tr> <td>Size</td> <td>-</td> <td>22-80cm<sup>3</sup></td> </tr> <tr> <td>Encapsulization</td> <td>-</td> <td>Silicon rubber, Stainless steel, titanium</td> </tr> </table>	Pulse rate	-	25-155pulses per minute	Pulse width	-	0.1-2.3 ms	Pulse amplitude	-	2.5-10 volts	Battery capacity	-	0.44-3.2amp-hours	Longevity	-	3.5-18 years	End-of-life indicator	-	2-10% drop in pulse rate	Weight	-	33-98 grams	Size	-	22-80cm <sup>3</sup>	Encapsulization	-	Silicon rubber, Stainless steel, titanium
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<p><b>4. What are pacemakers?(May/June 2013)</b> Pacemaker is an electrical pulse generator for starting and maintaining the normal heart beat.</p>																											

**5. What is meant by demand pacemaker?( Nov/Dec 2013)**

If the R wave is missing for a preset period of time, the pace will supply a stimulus. Therefore if the heart rate falls below a pre- determined minimum the pacemaker will turn on and provide the heart a stimulus. For this reason it is called as Demand Pacemaker.

**6. What are the batteries used for implantable pacemakers.(Nov/Dec 2012)**

The batteries used for implantable pacemakers are

1. Mercury cells
2. Lithium cells
3. Rechargeable cells
4. Nuclear cells
5. Bio Fuel cells
6. Bio Mechanical power generation sources.

**7. What is meant by Fibrillation?(May/June 2010)(May/June 2009)**

The heart is able to perform its important pumping function only through precisely synchronized action of the heart muscle fibers. The rapid spread of action potential over the surface of the atria causes these two chambers of the heart to contract together and pump blood through the two atrio ventricular values in to the ventricles. After a critical time delay the powerful ventricular muscles are synchronously activated to pump blood through the pulmonary and systemic circulatory systems. A condition in which this necessary synchronism is lost is known as Fibrillation.

**8. Calculate the energy stored in 16μ F capacitor of a DC defibrillator that is charged to a potential of 5000 V dc.(Nov/Dec 2009)**

$$\text{Energy stored (E)} = \frac{1}{2} C V^2$$

$$E = \frac{1}{2} * 16 * 10^{-6} * 5000 * 5000 = 200 \text{ Joules.}$$

**9. Why should a patient susceptible to ‘ventricular fibrillation’ be watched continuously?**

Ventricular fibrillation is far more dangerous, for under this condition the ventricles are unable to pump blood and if the fibrillation is not corrected death will usually occurs with in a few minutes. So patient should be watched continuously.

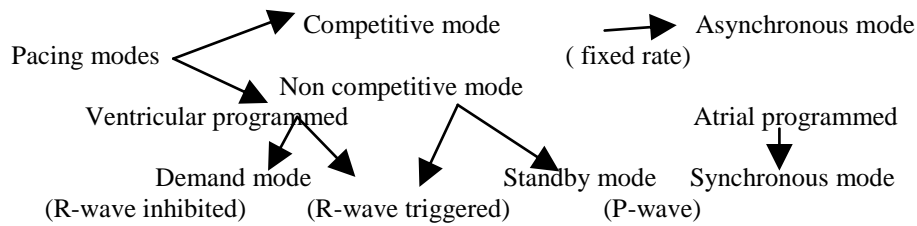
**10. Distinguish between internal pacemakers and external pacemakers.(April/May 2008) (Nov/Dec 2008) (May/June 2007)**

S.No	External Pacemaker	Internal Pacemaker
1.	The pacemaker is placed outside the body	The pacemaker is miniaturized and is surgically implanted beneath the skin near the chest or abdomen with its output leads are connected directly to the heart muscle.
2.	The electrodes are called endocardiac electrodes and are in contact with the inner surface of the heart chambers	The electrodes are called myocardiac electrodes and are in contact with the outer wall of the heart muscle.
3.	It does not required open chest surgery	It requires an open chest minor surgery to place the circuit
4.	The battery can be easily replaced	The battery can be replaced only by minor surgery
5.	During placement, swelling and pain do not arise due to minimum foreign body reaction.	During placement, swelling and pain arise due to minimum foreign body reaction.
6.	No safety for the pacemaker	Cent percent safety for the pacemaker
7.	Mostly used for temporary heart irregularities	Mostly used for permanent heart damages

**11.**



**12. Classify pacing modes. (NOV/DEC 2007)**

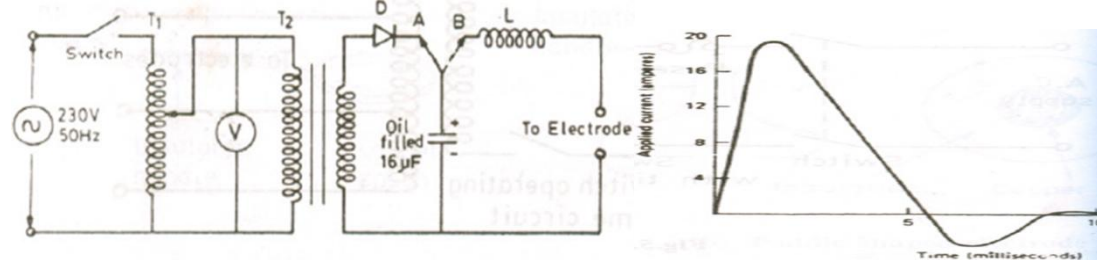


**13. What is Defibrillator? State its use. (Nov/Dec 2007)**

A Defibrillator is an electronic device that Creates a sustained myocardial depolarization of a patient's heart in order to stop ventricular fibrillation (or) atrial fibrillation .The instrument for administering the electric shock is called as defibrillator.

1. The method of defibrillation is the application of an electric shock to the area of the heart.
2. Defibrillators are also used to convert other potentially dangerous arrhythmias to one that is easily managed – CARDIO VERSION.
3. Defibrillator discharge may used to convert a tachycardia (fast heart) arrhythmia to a normal rhythm.

**14. Draw the circuit of DC Defibrillator and give its output specification. (Apr/May2011(May/June 2012)(May/June 2014)**



**15. What is heart – Lung Machine?**

During open heart surgery for installation of a valve prosthesis or correction of a congenital mal formation, the heart cannot maintain the circulation. It is then necessary to provide extra- corporeal circulation with a special machine called Heart – Lung Machine .

**16. What is Systole and Diastole?**

Systole is the period of contraction of the ventricular muscles during that time blood is pumped in to the pulmonary artery and the aorta. Diastole is the period of dilation of the heart chambers as they fill with blood.

**17. What are the types of oxygenators?**

They are four types of oxygenators. They are

1. Bubble oxygenators
2. Film oxygenators
3. Membrane oxygenators
4. Liquid – Liquid oxygenators

**18. Define dialysis.**

Dialysis is a process by which the waste products in the blood are removed and restoration of normal pH value of the blood is obtained by an artificial kidney machine.

**19. Compare Hemodialysis and peritoneal dialysis?**

S.No	Hemodialysis	Peritoneal dialysis
1.	In this procedure, blood is purified by an artificial kidney machine called Hemodialysis in which the blood is taken out from the body and waste products diffuse through a semi permeable membrane which is continuously rinsed by a dialyzing solution or dialysate.	The peritoneal cavity in our body is used as a semi permeable membrane and by passing the dialysate into it waste products are removed from the blood by diffusion.
2.	More effective to separate the waste products	Less effective
3.	Technically complex and risk one because the blood is taken out from the body.	Simple and risk free
4.	Dialyzing time is about 3 to 6 hours	Dialyzing time is about 9 to 12 hours

**20. What are the three physical processes used in dialysis?**

The three physical process used in dialysis are i) Diffusion ii) Osmosis iii) Ultra filtration.

**21. What are the two types of procedures for doing dialysis?**

The two types of procedures for doing dialysis

1. Hemodialysis
2. Peritoneal dialysis

**22. Which type of electrode is applied in the case of external stimulation and what is the current range?**

The paddle shaped electrodes are applied on the surface of the chest and the current range is 20 -150 mA

**23. Which types of electrodes are used in internal stimulation and what is the current range?**

The electrodes in the form of fine wires of Teflon coated stainless steel , spoon like electrodes are used .The current range in 2 -15 mA

**24. What is external stimulation employed?**

The external stimulation is employed to restart the normal rhythm of the heart in case of cardiac stand still.

**25. What is internal stimulation employed?**

Internal stimulation is employed in cases requiring long term pacing because of permanent damage that prevents normal self triggering of heart.

**26. What are the modes of operation of pacemakers?**

The modes of operation of pacemakers are

1. Ventricular asynchronous pacemaker(Fixed rate pacemaker)
2. Ventricular synchronous pacemaker
3. Ventricular inhibited pacemaker(Demand pacemaker)
4. Atrial synchronous pacemaker
5. Atrial sequential ventricular inhibited pacemaker

**27. What are the types of defibrillator?**

The types of defibrillator are

1. A.C Defibrillator
2. D.C Defibrillator
3. Synchronized D.C Defibrillator
4. Square Pulse D.C Defibrillator
5. Double Square Pulse Defibrillator
6. Biphasic D.C Defibrillator

**28. Why are asynchronous pacemakers no longer used?(May/June 2016)**

A synchronous pacing is called competitive pacing because the fixed rate impulses may occurs along with natural pacing impulses and would therefore in competition with them in controlling the heart rate.

<p><b>29. When do you need heart lung machine?(May/June 2016)</b> During open heart surgery for installation of a valve prosthesis or correction of a congenital mal formation, the heart cannot maintain the circulation .It is then necessary to provide extra-corporeal circulation with a special machine called heart lung machine.</p>
<p><b>30. What is the systolic and diastolic pressure of Aorta?</b> Systolic Pressure/Diastolic pressure: 130/75</p>
<p><b>31. What is the systolic and diastolic pressure of different areas of heart?</b> Left Ventricle: 130/5 Right Ventricle: 25/0 Left Atrium: 9/5 Right Atrium: 3/0</p>
<p><b>32. Differentiate internal and external defibrillator(june 2017)</b> Momentary application of strong electrical stimulus to bring all the cardiac cells simultaneously into a refractory period thereby arresting their irregular, uncoordinated twitching is known as defibrillation. Types: (i) ac defibrillation &amp; (ii) dc defibrillation. The ac defibrillation: A brief (0.25 to 1 sec) burst of 60 Hz ac at an intensity of 6 A is applied to the chest of the patient. As an attempt to correct the atrial fibrillation using ac often results in even more serious ventricular fibrillation, ac defibrillation is no longer used. The dc defibrillation: Several volts of dc is momentarily applied across or through the chest – only fewer repetitions are required to correct ventricular fibrillation so less harm than ac defibrillation – successful in correcting atrial fibrillation.</p>
<p><b>33. What is dialysate mentation its composition (june 2017)</b> themake up of dialysate or the dialysis 'bath', is: sodium chloride, sodim bicarbonate or sodium acetate, calcium chloride, potassium chloride, and magnesium chloride. This is the general composition of dialysate, but other compounds such as glucose may also be included.</p>
<p><b>34. Distinguish between endocardiac and myocrdiac electrodes. (dec 2016)</b> The endocardial approach (Fig. 2) is to place electrodes at the apex of the right ventricle via any suitable superficial vein above the diaphragm. This may include use of either the external or the internal jugular, the cephalic, or the subclavian vein. It is not advisable to use any veins below the diaphragm for long-term endocardial stimulation. The cephalic and the subclavian are the most desirable veins in as much as they avoid "draping" the electrode catheters over the clavicle. As a practical matter it is wise, when surgically preparing the patient, that the entire side of the chest and neck on the side to be employed be made available for a surgical field.</p>
<p><b>35. Mention few difference between internal and external defibrillator(dec 2016)</b> EXTERNAL DEFIBRILLATOR: A unit based on computer technology and designed to Analyzing the heart rhythm itself, and then advise whether a shock is required. It is designed to be used by lay persons, who require little training. It is usually limited in their interventions to delivering high joule shocks for VF and VT rhythms</p>
<p><b>36. Why are asynchronous pacemaker no longer used? (june 2016)</b> Heart beat rate cannot be changed. If it is fixed in atrium, atrium beat at a fixed rate. If ventricle beat at a different rate, and then it leads to a severe problem. Ventricular fibrillation may be occurred.</p>
<p><b>37. When do you need heart lungs machine? (june 2016)</b> A machine that does the work both of the heart and of the lungs: pumping and oxygenating blood. Blood returning to the heart is diverted through a heart-lung machine before being returned to arterial circulation. Such machines may be used during open-heart surgery. Also known as pump-oxygenator or cardiopulmonary bypass machine.</p>
<p><b>PART B &amp; C</b></p>
<p><b>1. Discuss with suitable block diagram the different modes of operation of Cardiac pacemakers. (Nov/ Dec 2008)(Apr/May 2011 &amp; 2012) (Nov/Dec 2011)(Nov/Dec 2012)(May/June 2016)</b> <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:167-175.</b></p>
<p><b>2. a) i) What is defibrillator? ii) Distinguish between Internal and External Defibrillator. iii) With block diagram describe the operation of synchronized D.C Defibrillator. (Nov/ Dec 2008) (Apr/May 2011)(April/May2015)(Nov/Dec 2015)(Nov/Dec 2013)</b> <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:185-186 &amp;190-193.</b></p>
<p><b>3. Explain the operation of Dialyzer with a neat sketch.(May/June 2016)</b></p>

<b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:212.</b>
<b>4.</b> Explain the operation of Heart – Ling machine with a neat sketch. <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:202.</b>
<b>5.</b> Discuss with suitable block diagram of atria and ventricle Cardiac pacemakers. (Nov/ Dec 2008)(Apr/May 2011 & 2012) (Nov/Dec 2011)(Nov/Dec 2012)(May/June 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:167-175</b>
<b>6.</b> With block diagram describe the operation of D.C Defibrillator.(Nov/Dec 2015) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:185-186 &amp;190-193.</b>
<b>7.</b> A (i) With a neat diagram explain the block diagram of arterial and ventricular triggered pacemaker.(16) (May/June 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 210</b>
<b>8.</b> Explain in detail the principal and diagram working of hacmodialyser.(16) (May/June 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 285</b>
<b>9.</b> a)How pacemakers are classified based on the modes of operation draw the block diagram of stand by and demand pacemakers and explain its working principle.(16) (Nov/Dec 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 260</b>
<b>10.</b> Enumerate the following oxygenators peritonal dialysis(8+8) (Nov/Dec 2016) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 243</b>
<b>11.</b> A) (i) With a neat diagram explain the block diagram of DC defibrillator.(8) (ii) Describe the working of atrial synchronous pacemaker. (8) (May/June 2017) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 206, 241</b>
<b>12.</b> Explain in detail the different types of oxygenators and pumps used in heart lung machine.(16) (May/June 2017) <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 228</b>

**UNIT-4 – PHYSICAL MEDICINE AND BIO TELEMETRY  
PART A**

<b>1. Write the physiological effects of electricity.(April/May 2015)</b>																					
<table border="1" style="width: 100%;"> <thead> <tr> <th>Type of Current</th> <th>Current range (mA)</th> <th>Physiological effect</th> </tr> </thead> <tbody> <tr> <td>Threshold</td> <td>1-5</td> <td>Tingling Sensation</td> </tr> <tr> <td>Pain</td> <td>5-8</td> <td>Intense or painful sensation</td> </tr> <tr> <td>Let-go</td> <td>8-20</td> <td>Threshold of involuntary muscle contraction</td> </tr> <tr> <td>Paralysis</td> <td>&gt;20</td> <td>Respiratory paralysis and pain</td> </tr> <tr> <td>Fibrillation</td> <td>80-1000</td> <td>Ventricular and heart fibrillation</td> </tr> <tr> <td>Defibrillation</td> <td>1000-10000</td> <td>Sustained myocardial contraction, temporary respiratory paralysis and possible tissue burns</td> </tr> </tbody> </table>	Type of Current	Current range (mA)	Physiological effect	Threshold	1-5	Tingling Sensation	Pain	5-8	Intense or painful sensation	Let-go	8-20	Threshold of involuntary muscle contraction	Paralysis	>20	Respiratory paralysis and pain	Fibrillation	80-1000	Ventricular and heart fibrillation	Defibrillation	1000-10000	Sustained myocardial contraction, temporary respiratory paralysis and possible tissue burns
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Paralysis	>20	Respiratory paralysis and pain																			
Fibrillation	80-1000	Ventricular and heart fibrillation																			
Defibrillation	1000-10000	Sustained myocardial contraction, temporary respiratory paralysis and possible tissue burns																			
<b>2. What is the principle of diathermy? (Nov/Dec 2015)(Nov/Dec 2014)</b> High frequency currents ,apart from their usefulness for therapeutic applications , can also be used in operating rooms for surgical purposes involving cutting and coagulation .The frequency of current used in surgical diathermy units is in the range of 1-3MHz in contrast with much higher frequencies employed in short – wave therapeutic diathermy machines.																					
<b>3. Mention the situations which account for hazards from electric shock.(May/June 2014)</b> Many devices have a metal chassis and cabinet that can be touched by the medical attendants and patient. If they are not grounded, then short circuit leads to micro or macro shock. Other situations which may be hazards is due to <ul style="list-style-type: none"> <li>➤ Leakage currents</li> <li>➤ Static electricity</li> <li>➤ Interruption of power</li> <li>➤ Unequal ground potential</li> <li>➤ Broken ground wire, etc.,</li> </ul>																					

<p><b>4. Can pain be relieved through electrical stimulation? What is the equipment used for it?(May/June 2014)</b>  Yes pain can be relieved through electrical stimulation. The equipment used for it is <b>Transcutaneous Electrical Nerve Stimulator (TENS)</b>.</p>				
<p><b>5. Define Let-go current. (Apr/ May 2008)(Nov/Dec2011) (Apr/May 2012)</b>  Let-go current is the minimum current to produce muscular contraction. Let-go current for men is about 16 mA and for women is about 10.5 mA.</p>				
<p><b>6. Distinguish between Micro shock and Macro shock. (Nov/Dec2007)(Nov/Dec2009) (Apr/May 2011)(Nov/Dec 2014)(May/June 2013)</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">MICRO SHOCK</th> <th style="text-align: center;">MACRO SHOCK</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">A physiological response to a current applied to the surface of the heart that results in unwanted stimulation like muscle contraction or tissue injury is called <b>Micro shock</b>.</td> <td style="padding: 5px;">A physiological response to a current applied to the surface of the body that produces unwanted or unnecessary stimulation like muscle contraction or tissue injury is called <b>Macro shock</b>.</td> </tr> </tbody> </table>	MICRO SHOCK	MACRO SHOCK	A physiological response to a current applied to the surface of the heart that results in unwanted stimulation like muscle contraction or tissue injury is called <b>Micro shock</b> .	A physiological response to a current applied to the surface of the body that produces unwanted or unnecessary stimulation like muscle contraction or tissue injury is called <b>Macro shock</b> .
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<p><b>7. What is diathermy? List its types. (Nov/Dec 2007) (Apr/May2010)(May/June 2010)</b>  Diathermy is the treatment process by which cutting, coagulation, etc., of tissues are obtained.  The various types are:</p> <ol style="list-style-type: none"> <li>1. Surgical diathermy</li> <li>2. Short wave diathermy</li> <li>3. Microwave diathermy</li> <li>4. Ultrasonic diathermy</li> </ol>				
<p><b>8. What are the electrical safety methods used in hospitals? (Nov /Dec 2010)(May/June 2016)</b>  The electrical safety methods used in hospitals</p> <ol style="list-style-type: none"> <li>1. Proper grounding of equipment.</li> <li>2. Double insulation</li> <li>3. Protection by Low voltage</li> <li>4. Ground Fault Interrupter</li> <li>5. Isolation Transformer.</li> </ol>				
<p><b>9. How electrical hazards do occurs due to medical equipments? (Nov /Dec 2010)</b>  One of the main hazards connected with the use of medical equipment is electrical shock.</p>				
<p><b>10. What is the use of ultrasonic diathermy?(Nov/Dec 2011)</b>  It is used for curing the diseases of peripheral nervous system, skeletal muscle system and skin ulcers.</p>				
<p><b>11. What is tele- stimulation?(Nov/Dec2011)(Nov/Dec 2014)</b>  Tele-stimulation is the measurement of biological signals over long distance. Tele- stimulation refers to study of diseases by stimulating into animals without killing them and to monitor them by receiving their bio – signals.</p>				
<p><b>12. List the application of Bio- Telemetry.(Apr/May2011)(May/June 2013)</b>  The application of Bio- Telemetry</p> <ol style="list-style-type: none"> <li>1. Monitoring ECG even under ergonomic conditions</li> <li>2. Monitoring the health of astronauts in space</li> <li>3. Patient Monitoring in an ambulance and other locations away from hospital</li> <li>4. Research on anaesthetized animals.</li> </ol>				
<p><b>13. List out any six bioelectric and physiological variables adaptable for biotelemetry Measurements</b></p> <p>Bioelectric variables---ECG, EEG, EMG and Physiological variables---blood pressure, gastrointestinal pressure, blood flow, temperature.</p>				
<p><b>14. What is radio pill?(Apr/May2012)(April/May 2015)(May/June 2010)(Nov/Dec 2010) (Nov/Dec 2009)(May/June 2016)</b>  Radio pill is used to monitor stomach pressure or pH. A pill consisting of a sensor and miniature transmitter is swallowed and the data are picked up by a receiver and recorded</p>				

**15. List out the advantages of a Bio-telemetry system.(May/June 2007) (May/June 2009)**

The advantages of a Bio-telemetry system

- Bio-telemetry helps us to record the bio-signals over long periods and while the patient is engaged in his normal activities.
- Computer or the medical attendants can easily diagnosis the nature of disease by seeing the telemetric bio-signals without attending the patient's room.
- Patient is in his room without any mechanical (or) physical disturbance during recording by means of Bio-telemetry
- For future reference (or) to study the treatment effect, the bio-telemetry is the essential one.
- For recording on animals, particularly for research, the bio-telemetry is greatly used.
- For monitoring the person who is in action, the bio-telemetry is an ideal one.

**16. Explain the principle of tele-stimulation. (Apr/May 2008)**

Tele-stimulation is the measurement of biological signals over long distance.

**17. Draw the block diagram of a Bio – Telemetry system. (Nov/Dec 2008)**



**18. What care must be taken while measuring responses to electrical stimulation?**

The care must be taken while measuring responses to electrical stimulation

1. Proper Grounding
2. Protection is provided by removing the power from the defective
3. Device by tripping the circuit breaker.

**19. What is meant by single channel telemetry?(Nov/Dec 2015)**

For a single channel system, a miniature battery operated radio transmitter is connected to the electrodes of the patients. This transmitter broadcasts the bio potential over a limited range to a remotely located receiver, which detects the Radio signals and recovers the signals for further processing.

**20. List the two types of multiplexing involved in multi channel wireless telemetry?(Nov/Dec 2013)**

The two types of multiplexing involved in multi channel wireless telemetry are

1. Time division Multiplexing
2. Frequency division Multiplexing

**21. What are the precaution necessary to avoid micro shock?(Nov/Dec 2013)**

1. In the vicinity of the patient, use only apparatus or appliances with three-wire power cords.
2. Provide isolated input circuits on monitoring equipment

**22. Specify the frequencies used for biotelemetry?(Nov/Dec 2012)**

The frequencies used for biotelemetry are of the order of 37,102,153,159,220 and 450MHz.

**23. Give the types and frequencies of operation of diathermy units.(Nov/Dec 2012)**

The types and frequencies of operation of diathermy units are

1. Fulguration -100Hz
2. Deciccation-100Hz
3. Electrotomy-500Hz
4. Coagulation-250Hz
5. Blending-500Hz

**24. Name the instrument needed for a bio-telemetry system.(Nov/Dec 2010)**

The instruments needed for a bio-telemetry system are

1. Tunnel Diode FM transmitter
2. Hartley type FM transmitter
3. Radio Telemetry with a sub-carrier
4. Pulsed Hartley oscillator

**25. What is use of high frequency current in diathermy?**

The use of high frequency current is to avoid the intense muscle activity and the electrocution hazard which occurs if low frequencies are used.

<p><b>26. Where is ultra sonic diathermy used?</b> Ultra sonic diathermy is used where short wave treatment is failed and in cases where localization of the heart effect is desired.</p>
<p><b>27. Name few diseases that can be cured by ultrasonic diathermy?</b> The few diseases that can be cured by ultrasonic diathermy are</p> <ol style="list-style-type: none"> <li>1. Neuritis</li> <li>2. Arthritis</li> <li>3. Skin ulcers.</li> </ol>
<p><b>28. What are the factors of leakage current flow?</b> The factors of leakage current flow are</p> <ol style="list-style-type: none"> <li>1. Ungrounded equipment</li> <li>2. Broken ground wire</li> <li>3. Unequal ground potential</li> </ol>
<p><b>29. What are the two divisions in patient monitoring systems?</b> The two divisions in patient monitoring systems are</p> <ol style="list-style-type: none"> <li>1. Intensive care unit</li> <li>2. Intermediate coronary care unit</li> </ol>
<p><b>30. What is the purpose of patient monitoring system?</b> The purpose of patient monitoring system is to follow the patient condition carefully by repeated measurement of many variables.</p>
<p><b>31. Define desiccation and haemostasis(june 2017)</b> Desiccation is the state of extreme dryness, or the process of extreme drying. A desiccant is a hygroscopic (attracts and holds water) substance that induces or sustains such a state in its local vicinity in a moderately sealed container Hemostasis or haemostasis is a process which causes bleeding to stop, meaning to keep blood within a damaged blood vessel (the opposite of hemostasis is hemorrhage). It is the first stage of wound healing. This involves coagulation, blood changing from a liquid to a gel</p>
<p><b>32. List the applications of biotelemetry(june 2017)</b> Motorracing Agriculture Water Management Rocketry Flight Test</p>
<p><b>33. What are the choices of radio carrier frequency for medical telemetry purposes</b> Use and Outcomes of Telemetry Monitoring on a Medicine Service. Telemetry is a powerful tool for real-time monitoring of a patient's heart rhythm and QRS pattern. Beds with telemetry monitoring are limited and expensive in most institutions; therefore, the use of this resource would ideally be evidence based. <b>(dec 2016)</b></p>
<p><b>34. Define let go current. (dec 2016)</b> The "Let Go" Threshold is the current level where we lose control of our muscles and the electricity causes muscles to contract until the current is removed</p>
<p><b>35. List the devices used to safeguard against electrical hazards(june 2016)</b> Ground Fault Interrupter (GFI) Line Isolation Monitor (LIM) Safety Analyzingr Receptacle Tester</p>
<p><b>36. Which is radio pill mentaion the application of radio pill(june 2016)</b> It contains transducer sensitive to pH, temperature and pressure. It is used for telemetering continuous informations about one or various variables from lumen of the gut. Temperaturesensitive pills are designed by the medical research council's bioengineering lab.</p>

#### PART B & C

<p><b>1. Explain working principle of a diathermy unit with a neat block diagram. (April/May2015) (May/June 2014)(May/June 2013)(May/June 2016)</b> <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:219</b></p>
<p><b>2. a) i) Explain in detail the components of a Bio –telemetry system.(Nov/Dec 2015)</b> <b>ii) Discuss the various applications of telemetry in patient care.(April/ May 2008)</b></p>

<b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:311&amp;320.</b>
<p><b>3.</b> a) i) Explain the physiological effects of electric current at 50Hz. (May/June 2016)  ii) With reference to electrical safety explain (Nov/Dec 2015)  a) Ground fault circuit interrupter(Apr/May 2011)  b) Protection by low voltage (Nov/Dec 2007)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 329</b></p>
<p><b>4.</b> Explain the single channel and multi channel bio telemetry system with neat diagram.(April/May 2015)(Nov/Dec 2014)(May/June 2013)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 312</b></p>
<p><b>5.</b> Write short notes on frequency selection for telemetry applications. (May/June 2016)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 313</b></p>
<p><b>6.</b> Explain working principle of a surgical diathermy unit with a neat block diagram. (April/May2015)  (May/June 2014)(May/June 2013)(May/June 2016)  <b>7.</b> Briefly explain about the electrical safety Instrumentation.  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:322-340.</b></p>
<p><b>8.</b> A) (i) Explain the working and application techniques of short wave diathermy(10) (May/June 2016)  (ii) Discuss the different operation performed using surgical diathermy treatment.(6) (May/June 2016)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 284, 291</b></p>
<p><b>9.</b> B) (i) Describe the physiological effect of electricity on humans(8) (May/June 2016)  (ii) write a short notes on frequency selection for telemetry applications .(8) (May/June 2016)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 290, 312</b></p>
<p><b>10.</b> a) Define diathermy draw the circuit diagram of a short wave diathermy unit and discuss its impact on therapy purpose in details also brief describe how its can be applied to human subjects(16) (Nov/Dec 2016)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 273</b></p>
<p><b>11.</b> (i) Explain the working of ground fault interrupter(8) (Nov/Dec 2016)  (ii) With suitable diagram explain how ECG signal can be transmitted using single channel telemetry system.(8) (Nov/Dec 2016)  <b>Ans: Text book: Bio medical instrumentation By Arumugam , notes</b></p>
<p><b>12.</b> A) (i) Explain the simplified circuit diagram of a microwave diathermy machine(10) (May/June 2017)  (ii) Discuss the different methods of applying electrodes in shortwave diathermy treatment.(6) (May/June 2017)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 261, 242</b></p>
<p><b>13.</b> (i) Describe the single channel ECG telemetry system(8) (May/June 2017)  (ii) briefly discuss about micro and macro shocks.(8) (May/June 2017)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .,notes</b></p>



**UNIT-5 – RECENT TRENDS IN MEDICAL INSTRUMENTATION  
PART A**

**1. List the parts of endoscope unit.(May/June 2013)**

The parts of endoscope unit are:

1. High power argon laser
2. Partial beam splitter
3. Power meter and heat sink
4. Lens system
5. Micropositioner
6. Encapsulated quartz fibreguide
7. Endoscope
8. Synchronous filter shutter
9. Firing control and timing unit

**2. Name the laser commonly used for ophthalmic application. Why? (April/May 2015)**

The Laser commonly used for ophthalmic application is Argon ion Laser and Nd-YAG Laser. Argon ion laser which emits blue green light that is readily absorbed by the blood are preferred for photocoagulation of small blood vessels in the eye.

**3. Bring out the clinical applications of endoscopy?(Nov/Dec 2015)**

Type	Range of Use	Diagnostic problem
1. Bronchoscope	Trachea larger airways	Foreign bodies infections, aspiration of mucus,
2. Cardioscope	Heart cavities	valvular defects and septal defect
3. Laparoscope	Abdominal cavity	Tumors, family planning operation
4. Cystoscope	Urinary bladder	Tumors ,inflammation,stones.

**4. Mammograms are used for what purposes?(May/June 2014)**

A mammogram is a low dose x-ray exam of the breast that is used to detect and evaluate breast changes (or) breast cancer. It is used to aid in the early detection and diagnosis of breast diseases in women.

**5. List out the properties of LASER. (May/June 2007)**

The properties of LASER are

1. Laser light is highly coherent
2. Laser is highly powerful
3. It is also directional and monochromatic
4. It is capable of propagation over long distance
5. It is extremely bright
6. Laser beams are not easily absorbed by the water.

**6. What is Thermograph? State its applications. (Nov/Dec 2008)(May/June 2009) (Apr/May2010)(May/June 2012)(Nov/Dec 2015)**

Thermograph is the process of recording true thermal images of the surfaces of objects under study. In medicine, Thermograph displays images representing the thermal radiation of skin areas.

- Application:
1. It is important diagnostic aid in Breast cancers
  2. Rheumatic diseases or joint diseases.
  3. Tumors
    4. Collagen and Orthopedic diseases
    5. Examination of placenta attachment
    6. Hormone, Brain and Nervous diseases.

**7. What are the functions of endoscopy unit?(Nov/Dec 2008)**

Endoscope is a tubular optical instrument to inspect or view the body cavities which are not visible to the naked eye normally. The endoscope is so designed for easy sterilization. In the endoscope, at the object end there is an assembly of objective lens and prism and at the viewing end, there is an eye lens. Endoscopic pictures can be recorded with color film and video tape recorder.

<p><b>8. Mention the advantages of performing surgery using LASER. (Apr/ May 2008) (Nov/Dec 2009)</b></p> <ol style="list-style-type: none"> <li>1. Highly sterile</li> <li>2. Highly localized and precise</li> <li>3. Noncontact surgery</li> <li>4. Dry – field ,almost bloodless surgery</li> </ol>
<p><b>9. Which laser is used for surgery? (Apr/May 2011)</b> LASER is used for surgery are : Argon Iron, CO2 and Nd-YAG laser.</p>
<p><b>10. Mention the application of LASER in ophthalmology.(Nov/Dec 2012)</b></p> <ol style="list-style-type: none"> <li>1. Photocoagulation of retinal bleeding</li> <li>2. Retinal Reattachment</li> <li>3. Iridectmies</li> <li>4. Glaucoma</li> <li>5. Senile macular degeneration</li> <li>6. Lens capsule surgery</li> </ol>
<p><b>11. What type of LASERs are used for patient treatment?(May/June 2009)</b> The types of LASERs used for patient treatment are</p> <ol style="list-style-type: none"> <li>1. Pulsed Nd-Yag Laser</li> <li>2. Continuous Wave CO<sub>2</sub> Laser</li> <li>3. Continuous Wave Argon ion Laser</li> </ol>
<p><b>12. What is Telemedicine?</b> Telemedicine is the application of telecommunication and computer technology to deliver health care from one location to another.</p>
<p><b>13. State the application of Telemedicine. (May/Jun 2016)</b> The applications of Telemedicine are</p> <ol style="list-style-type: none"> <li>1. Tele-radiology – Radiological images like X-ray , CT or MRI Scan etc</li> <li>2. Tele-pathology- microscopic images of pathology slides and biopsy reports</li> <li>3. Tele-cardiology – Transmission of ECG , Echo ,Color Doppler</li> <li>4. Tele-education – Delivery of medical education programmes to the physicians</li> </ol>
<p><b>14. What are essential parameters for Telemedicine?</b> The essential parameters for telemedicine relating to a patient are</p> <ol style="list-style-type: none"> <li>1. Primary patient data</li> <li>2. Patient History</li> <li>3. Clinical Information</li> <li>4. Investigation</li> <li>5. Data and Reports</li> </ol>
<p><b>15. Name the technologies used in telemedicine.</b> The technologies used in telemedicine are :</p> <ol style="list-style-type: none"> <li>1. Transmission of Medical Images</li> <li>2. Transmission of Video Images</li> <li>3. Transmission of digital Audio</li> <li>4. Video Conferencing</li> <li>5. Digital Communication Systems</li> <li>6. Telemedicine using Mobile Communication</li> <li>7. Use of Internet resources for telemedicine</li> </ol>
<p><b>16. Name some uses of CO<sub>2</sub> Laser in surgery?</b> The CO<sub>2</sub> Laser are used for the distruction of tumors by coagulation whereas CO<sub>2</sub> Laser functions as a nonmaterial, light knife for performing tissues incisions and tumor nodule excisions.</p>
<p><b>17. Mention few advantages of Laser Surgery.</b> The advantages of Laser Surgery are</p> <ol style="list-style-type: none"> <li>1. Highly sterile</li> <li>2. Highly localized and precise</li> <li>3. Non Contact Surgery</li> <li>4. Dry-Field ,almost bloodless surgery</li> <li>5. Short periods of surgical time.</li> </ol>

<p><b>18. What are the diseases that can be diagnosed by thermograph?</b> Thermograph is an important diagnostic in many diseases especially in breast cancers in rheumatic diseases or joint diseases.</p>
<p><b>19. What are the classifications of thermograph?</b> The classifications of thermograph</p> <ol style="list-style-type: none"> <li>1. Infrared thermograph</li> <li>2. Liquid crystal thermograph</li> <li>3. Microwave thermograph</li> </ol>
<p><b>20. What are the characteristics of good thermograph equipment?</b> The characteristics of good thermograph equipment</p> <ol style="list-style-type: none"> <li>1. Short frame time</li> <li>2. High resolution</li> <li>3. A small size and light weight optical head</li> <li>4. Absolute temperature can be measurable</li> </ol>
<p><b>21. List out the factors of photo physical event that depends on?</b> The factors of photo physical event that depends on</p> <ol style="list-style-type: none"> <li>1. Wavelength of Laser</li> <li>2. Energy density</li> <li>3. Pulse duration</li> <li>4. Irradiation time</li> <li>5. Absorption characteristics of target molecule</li> </ol>
<p><b>22. List out the four photo biological Laser processes.</b> The four photo biological Laser processes are</p> <ol style="list-style-type: none"> <li>1. Photo chemical processes</li> <li>2. Thermal processes</li> <li>3. Photoablative processes</li> <li>4. Electromechanical processes</li> </ol>
<p><b>23. Name the type of LASER used in Photo chemical processes.</b> The LASER used in Photo chemical processes are He-Ne .Nd-YAG.</p>
<p><b>24. Name the type of LASER used in Photo thermal processes.</b> The LASER used in Photo Thermal processes are CO<sub>2</sub> andNd-YAG.</p>
<p><b>25. Name the type of LASER used in Electro mechanical processes.</b> The LASER used in Electro mechanical processes are Nd-YAG.</p>
<p><b>26. List the types of pumping sources used in LASER. (May/June 2016)</b> Stimulated Emission</p>
<p><b>27. What is LASER?</b> LASER is Light Amplification by Stimulated Emission of Radiation.</p>
<p><b>28. On What factor LASER action depends?</b> LASER action depends upon the phenomenon of stimulated emission.</p>
<p><b>29. On what properties LASER is determined?</b></p> <ol style="list-style-type: none"> <li>1. The gain of the medium</li> <li>2. The pumping Mechanism</li> <li>3. The resonator design</li> </ol>
<p><b>30. What is cryogenic surgery?</b> It is based on the development of heat at the operating site during irradiation. Tissues are killed when their temperature is below 20 degree C. When the tissue are at 20 degree C ,there is no formation of ice crystals and increase of salt concentration within the cells. Thus necrosis of the tissue takes place. This method of killing diseased cells is called as cryogenic surgery which is painless and it is taking place without blood shedding.</p>
<p><b>31. What makes thermograph useful? (june 2017)</b></p> <ul style="list-style-type: none"> <li>● Get a visual picture so that you can compare temperatures over a large area</li> <li>● It is real time capable of catching moving targets</li> <li>● Able to find deteriorating components prior to failure</li> <li>● Measurement in areas inaccessible or hazardous for other methods</li> <li>● It is a non-destructive test method</li> </ul>

<p><b>32. List the properties of laser beam(june 2017)</b>  Characteristics of Laser Light  A laser generates a beam of very intense light. Laser light has three distinct characteristics that distinguish it from ordinary light: Laser light is:  Collimated  Monochromatic  Coherent</p>
<p><b>33. Define the physical factors which affect the amount of infrared radiation from human body(dec 2016)</b>  All objects, including human bodies, emit electromagnetic radiation. The wavelength of radiation emitted depends on the temperature of the objects. Such radiation is sometimes called thermal radiation. Most of the radiation emitted by human body is in the infrared region, mainly at the wavelength of 12 micron.</p>
<p><b>34. Mentation few applications of lasers in medicine(dec 2016)</b>  Angioplasty cancer diagnosis cancer treatment cosmetic dermatology such as scar revision, skin resurfacing, laser hair removal, tattoo removal dermatology to treat melanoma frenectomy lithotripsy laser mammography medical imaging microscopy ophthalmology (includes Lasik and laser photocoagulation) optical coherence tomography optogenetics prostatectomy plastic surgery, in laser liposuction surgery to ablate and cauterize issue</p>
<p><b>35. Sate the application of telemedicine(june 2016)</b>  Telemedicine is the use of telecommunication and information technology to provide clinical health care from a distance. It has been used to overcome distance barriers and to improve access to medical services that would often not be consistently available in distant rural communities.  Blood Pressure  Interstitial Fluid Pressure (IFP)  Pressure-Volume Loop Studies  Telemetry Biopotential  Telemetry Pressure and Biopotential  Specialized Telemetry</p>
<p><b>36. List the types of pumping sources used in LASER(june 2016)</b>  Optical pumping · Pumping cavities · Flashlamp pumping · External laser pumping</p>

**PART B & C**

<p><b>1.</b> a) Discuss working principle of an infrared thermo graphic equipment. Mention applications of thermo graph (May/June 2007) (Apr/May 2011)(Nov/Dec 2011) (Nov/Dec 2014) (May/June 2013)(May/June 2016)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:367-373.</b></p>
<p><b>2.</b> a) Discuss in detail the different application of Laser in medicine. (Nov/Dec 2007)(Apr/May 2012) (April/May 2015)(May/June 2014) (May/June 2013)(May/June 2016)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:347.</b></p>
<p>What is an endoscope? Discuss the working of an endoscopic unit. (Apr/ May 2008) (Nov/Dec11)(Apr/May 2012)(April/May2015)(Nov/Dec 2015)(May/June 2014)(May/June 2013)(May/June 2016)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:219-223 &amp;356-359.</b></p>
<p><b>3.</b> Briefly explain about the importance of Telemedicine.  <b>Ans: Text book: Bio medical instrumentation By R.S.Khandpur .pg.no:303</b></p>
<p><b>4.</b> What is cryogenic? List some cryogenics agents with its operating temperature and explain how it is used to perform surgery?  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:359.</b></p>
<p><b>5.</b> Explain the basic principle of LASER.  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no:347.</b></p>
<p><b>6.</b> A) (i) What is thermography ? explain the block diagram of infrared imaging system(10)  (ii) Describe the different operation involved in endoscopy(6) (May/June 2016)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 310,295</b></p>
<p><b>7.</b> (i) what is cryogenic list some cryogenics agents with its operating temperature and explain how it is used to perform surgery(10) (May/June 2016)  (ii) write short notes on applications of LASER in medicine.(6) (May/June 2016)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 324,290</b></p>
<p><b>8.</b> a)Explain the infrared thermographic instrumentation with a suitable block diagram and what are the</p>

<p>different medical applications(16) (Nov/Dec 2016)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 320</b></p>
<p><b>9.</b> (i) Write a notes on cryogenic surgery(8) (Nov/Dec 2016)  (ii) Write a notes on endoscopy unit(8) (Nov/Dec 2016)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 336, 314</b></p>
<p><b>10.</b> A) (i) What is endoscope ? explain the different types of operations performed using endoscopy(10) (May/June 2017)  (ii) Describe the working principle of thermograph(6) (May/June 2017)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 290, 298</b></p>
<p><b>11.</b> B) (i) Explain different typers of LASER(10) (May/June 2017)  (ii) write short notes on cryogenic applications.(6)  <b>Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 318,338</b></p>

**B.E/B.Tech. Degree Examination, April/May 2017**

Sixth Semester

Electronics and Communication Engineering

**EC6601 – MEDICAL ELECTRONICS**

(Regulation 2013)

Answer all Questions

**PART –A (10\*2=20Marks)**

**1. Define absolute and relative refractory period**

**Absolute refractory period:** During a short period after the generation of an action potential, the cell does not respond to any stimulus at all. This period is known as the **absolute refractory period**.

**Relative refractory period:** It is the time period between the instant when the membrane potential becomes negative again and the instant when the membrane potential returns to RMP. During this period, the cell responds to a stimulus but less strongly than usual.

**2. Mention the cause of first and second heart sounds**

Record of heart sounds – 1st and 2nd heart sounds are heard well but 3rd and 4th are not. Heart sounds are generally used for diagnosis of valverelated diseases. Such abnormal heart sounds are called murmurs.

1st heart sound: due to closure of AV valves – long, soft & low-pitched sound – sounds like ‘lubb’ – 0.14-0.2 sec – 30-40 Hz.

2nd heart sound: due to closure of semilunar valves – short, sharp & high-pitched sound – sounds like ‘dub’ – 0.08-0.1 sec – 50-70 Hz.

**3. What is blood pressure state the normal values of blood pressure**

The sphygmomanometer consists of (i) an inflatable rubber bladder called the “cuff”, (ii) a rubber squeeze ball pump and valve assembly and (iii) a manometer

**4. State the different types of test performed using auto analyser**

An automated analyser is a medical laboratory instrument designed to measure different chemicals and other characteristics in a number of biological samples quickly, with minimal human assistance

**5. Differentiate internal and external defibrillator**

Momentary application of strong electrical stimulus to bring all the cardiac cells simultaneously into a refractory period thereby arresting their irregular, uncoordinated twitching is known as defibrillation. Types: (i) ac defibrillation & (ii) dc defibrillation.

The ac defibrillation: A brief (0.25 to 1 sec) burst of 60 Hz ac at an intensity of 6 A is applied to the chest of the patient. As an attempt to correct the atrial fibrillation using ac often results in even more serious ventricular fibrillation, ac defibrillation is no longer used.

The dc defibrillation: Several volts of dc is momentarily applied across or through the chest – only fewer repetitions are required to correct ventricular fibrillation so less harm than ac defibrillation – successful in correcting atrial fibrillation.

**6. What is dialysate mention its composition**

themake up of dialysate or the dialysis 'bath', is: sodium chloride, sodim bicarbonate or sodium acetate, calcium chloride, potassium chloride, and magnesium chloride. This is the general composition of dialysate, but other compounds such as glucose may also be included.

**7. Define desiccation and haemostasis**

Desiccation is the state of extreme dryness, or the process of extreme drying. A desiccant is a hygroscopic (attracts and holds water) substance that induces or sustains such a state in its local vicinity in a moderately sealed container

Hemostasis or haemostasis is a process which causes bleeding to stop, meaning to keep blood within a damaged blood vessel (the opposite of hemostasis is hemorrhage). It is the first stage of wound healing. This involves coagulation, blood changing from a liquid to a gel

**8. List the applications of biotelemetry**

Motorracing Agriculture Water Management Rocketry Flight Test

**9. What makes thermograph useful?**

- Get a visual picture so that you can compare temperatures over a large area
- It is real time capable of catching moving targets
- Able to find deteriorating components prior to failure
- Measurement in areas inaccessible or hazardous for other methods
- It is a non-destructive test method

**10. List the properties of laser beam**

Characteristics of Laser Light

A laser generates a beam of very intense light. Laser light has three distinct characteristics that distinguish it from ordinary light: Laser light is:

Collimated

Monochromatic

Coherent

**PART B**

**11. A) (i) explain the international standard 12 lead system used to record ECG(10)**

**(i) list and discuss the important characteristics of bioamplifier(6)**

Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 132, 98

**Or**

**B) (i) discuss in detail about the 10 – 20 lead system.(10)**

**(ii) describe the typical EMG waveform and its characteristics(6)**

Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 126,67

**12. A) (i) Describe the measurement of PO<sub>2</sub> (8)**

**(ii) Explain the block diagram and working of colorimeter.(8)**

Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 204,215

**Or**

**B) (i) Define the term cardiac output how is cardiac output measured by dye dilution technique? Explain**

**(i) describe the working principal of electromagnetic blood flow meter.**

Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 230,222

**13. A) (i) With a neat diagram explain the block diagram of DC defibrillator.(8)**

**(ii) Describe the working of atrial synchronous pacemaker. (8)**

Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 206, 241

**Or**

**B) Explain in detail the different types of oxygenators and pumps used in heart lung machine.(16)**

Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 228

**14. A) (i) Explain the simplified circuit diagram of a microwave diathermy machine(10)**

**(ii) Discuss the different methods of applying electrodes in shortwave diathermy treatment.(6)**

Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 261, 242

**Or**

**B) (i) Describe the single channel ECG telemetry system(8)**

**(ii) briefly discuss about micro and macro shocks.(8)**

Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 260,288

**15. A) (i) What is endoscope ? explain the different types of operations performed using endoscopy(10)**

**(ii) Describe the working principle of thermograph(6)**

Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 290, 298

**Or**

**B) (i) Explain different typers of LASER(10)**

**(ii) write short notes on cryogenic applications.(6)**

Ans: Text book: Bio medical instrumentation By Arumugam .pg.no: 318,338