

**ST. JOSEPH COLLEGE OF ENGINEERING**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**EC6001 MEDICAL ELECTRONICS**

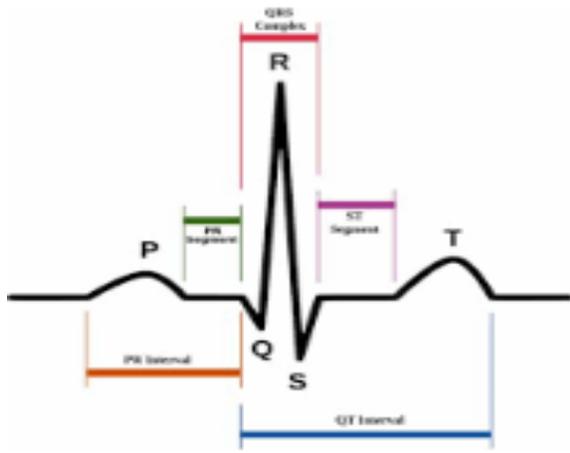
**PART A**  
**UNIT 1**

**1. Define resting potential and action potential? [APR/MAY 15]**

Resting potential : The charge of a membrane during resting potential is  $-70\text{mV}$ , which means that the charge within the cell membrane is negative to the outside charge.

Action potential : Is the state of the cell membrane while conducting an impulse, meaning the rapid depolarization and repolarization of the cell membrane.

**2. Give the ECG signal characteristics. [APR/MAY 15]**



\*The ECG signal consists of low amplitudes voltages in the presence of high amplitude of offsets and noise.

\*The large offsets present in the system are due to half cell potential developed at the electrodes

\*Ag/AgCl (Silver-Silver chloride) is the common electrode used in ECG system and has a maximum offset voltage of  $\pm 300\text{mV}$ .

\*The actual desired signal is  $\pm 0.5\text{mV}$  superimposed on the electrode offset.

\*In addition, the system also picks up the 50/60 Hz noise from the power line which forms the common mode signal.

\*The amplitude of the power line noise may be very high. So it has to be filtered.

**3. What is bioelectric potential? [NOV/DEC 15]**

An electric potential that is measured between points in living cells, tissues and organisms which can be transformed into kinetic energy.

**4. Define latency in EMG? [NOV/DEC 15]**

Latency is the time period between the stimulus and muscle movement. It represents the time, in milliseconds, it takes to transfer the message of the movement to the muscle, i.e., neural conduction. Whereas the amplitude measures the extent of the muscle contraction.

A decrease in amplitude and/or an increase in latency are signs of disease.

**5. List the characteristics needed for bio amplifier. [APR/MAY 16]**

\* The voltage gain of the amplifier should be more than 100 dB as to amplify the bio signal properly to drive the recorder.

\* The gain frequency response should be unified throughout the required bandwidth.

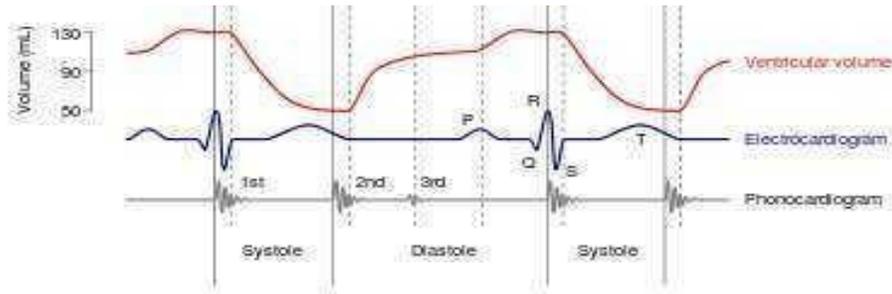
\* It should have low frequency response from dc to required frequency of the particular bio signal.

\* There is no drift in the amplifier.

\*The output impedance of the amplifier should be very small.

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**6. Compare the signal characteristics ECG and PCG.**



**7. Define electrode and list its types [APR/MAY 16]**

The device that convert ionic potential into electronic potential are called as electrode.

The types of electrode are a) Micro electrode b) Depth and needle electrode c) Surface electrode

**8. State the importance of PCG signals.**

May/June 2009

The importance of PCG signals are

- a) Different types of heart sounds are measured.
- b) Additional sounds are heard between normal heart sound due to vibration setup in the blood inside the heart by sudden closure of valves.
- c) The presence of higher frequencies (murmurs) in the phonocardiogram indicates a possible hear disorder such as Aortic stenosis, Mitral regurgitation, mitral stenosis etc.

**9. What is PCG?**

PCG - Phono Cardio Gram. The graphical record of heart sound is known as phono cardiogram(PCG).

**10. What are the different types of electrodes used in bipolar measurements?**

Types of electrodes:

- \*Micro electrodes.
- \*Needle electrode.
- \*Depth electrode.
- \*surface electrode.

**11. Name the electrodes used for recording EMG and ECG.**

Surface electrode are used for recording EMG and ECG. The different types of surface electrodes are,

- \*Suction sup electrode.
- \*Multipoint electrode.
- \*Floating surface electrode.

**12. The contraction of skeletal muscle returned as what? Give its specification.**

The contraction of skeletal muscle is termed as 'periosterm' from which new bones are formed in the healing of fractures.

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**13. Enlist the electrodes used for recording EEG. What is channel? Give examples.**

- \*Surface electrode.
- \*Micro electrode.
- \*Depth electrode.
- \*Needle electrode.
- \*Chemical electrode.

**14. List the frequency bands of EEG waveforms.**

There are 4 waves is divided using frequency.

1. Alpha waves (8-13Hz).
2. Beta waves (13-30Hz.)
3. Theta waves (4-8Hz).
4. Delta waves (0.5-41Hz).

**15. Define CMRR. Give its importance in physiological signal amplifiers.**

CMRR value is used to find the degree which the bio amplifier is able to respect the common mode signal.

In physiological signal amplifiers it should have more than 80 dB.

**16. Name any two passive transducers.**

LVDT, Strain gauge, Electromagnet Transducer, Capacitance Transducer, Ultrasonic Transducer.

**17. What is a spinal cord?**

The spinal cord is present in central nervous system. It runs to the vertebral column or through the back bone. The working of entire body is linked with the spinal cord. It is connected to a large number of nerves.

**18. Define the term conduction velocity.**

The rate at which an action potential moves down a fiber or propagated from cell to cell is termed as propagation rate or conduction velocity.

**19. Which transducer is used as pulse sensor?**

Piezo electric transducer are basically used as pulse sensor which detects the arterial pressure pluses.

**20. Mention some active transducers.**

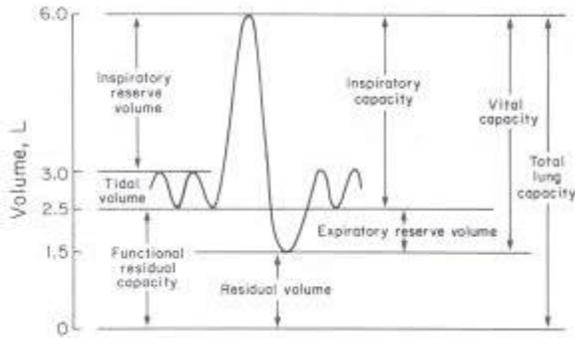
- \* Magnetic induction type transducer.
- \* Piezo electric type.
- \* Photo voltaic type.
- \* Thermo electric type.

## UNIT 2

**1. Which flow meters are used to measure pulsatile flow of blood? [APR/MAY 15]**

The results indicate that accurate measurements of pulsatile blood flow can be achieved in vitro with an electromagnetic flow meter.

**2. Draw lung volume diagram. [APR/MAY 15]**



**3. How does the pH value determine the acidity and alkalinity in blood fluid? [NOV/DEC 15]**

There are a variety of home test strips available that quickly and accurately measure the pH value of urine and saliva.

A saliva pH reading of 6.4-6.8 indicates the body's pH lies on the alkaline side and is on the and is balance.

Human blood pH should be slightly alkaline (7.35-7.45). A pH below 7.0 means that the body is acidic.

**4. List the various indirect method for the measurement of blood pressure. [NOV/DEC 15]**  
Sphygmomanometer (Indirect BP measurement)

1. Doppler ultrasound measurement
2. Standard oscillometry blood pressure measurement

**5. What are the components of blood?**

There are three components of blood they are:

- 1) Red blood cells.
- 2) White blood cells
- 3) Platelets.

**6. What is stroke volume?**

The graphic record of least sound is called "Phonogram". Because the sound is from heart, it is called phono cardiogram. The vibrants of the heart sound during stroke is called stroke volume (sound and murmurs).

**7. If systolic and diastolic blood pressures are given as 110mmHg and 82mmHg, calculate mean arterial pressure.**

Mean arterial pressure map.

Diastolic BP = 82 mmHg.

Systolic BP = 110mmHg.

MAP=[(2\*diastolic)+ systolic

$$=[(2*82)+110]/3$$

$$=[164+110]/3=274/3=91.33\text{mmHg.}$$

**8. Mention the basic principle behind electrochemical pH determination.**

The chemical balance of the body is identified by the measurement of pH of blood and other body fluids. The pH is defined as the logarithm of the reciprocal of the H ion concentration.

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$$\text{pH} = \log_{10} \frac{1}{[\text{H}^+]} = -\log_{10} [\text{H}^+]$$

**9. Which transducer is used for measuring temperature? Why?**

Thermocouple is used to measure the temperature because it can able measure the contact temperature between the junction of two dissimilar metals .

**10. What is the principle used in pulse rate measurement?**

When heart muscle contracts, blood is ejected from the ventricles and a pulse of pressure is transmitted through the circulatory system. The pulse can be measured at this condition by pulse can be measured at this condition by using transmittance or reflectance method.

**11. What is an auto analyzer? What are the essential units in it? [APR/MAY 16]**

Autoanalyser : It is used to measure blood chemistry and display that on a graphic recorder.

The essential units are:

- \* Dialyzer.
- \* Heating both.
- \* Colorimeter .
- \* Graphic recorder.

**12. Give the typical values of blood pressure and pulse rate of an adult.**

Typical blood pressure (for adult)-120/80mmHg.

Typical pulse rate (for adult)-72minute.

**13. Write down the principle behind electromagnetic blood flow meter.**

EMG is an instruments used for recording the electrical activity of the muscles to determine whether the muscle is contracting or not.

Muscular contractions are caused by the depolarization of muscles fibers.

**14. Nitrogen washout technique is meant for what measurement?**

Nitrogen washed techniques is used to measure dead space in the lung during a respiratory cycle, as well as some parameters related to the closure of airways.

**15. What is Fick's principle? Give its disadvantages.**

Cardiac output can be calculated by continuously infusing oxygen into the blood or removing it from the blood and measuring the amount of oxygen in the blood before and after passage.

$$I = C_A Q - C_V Q.$$

**16. What do you understand by electrophoresis?**

- \* Electrophoresis is defined as the movement of a solid phase with respect to a liquid
- \* Electrophoresis is used to measure the quantity of protein in plasma, urine ,etc.
- \* It is used to separate enzymes into their components is enzymes.
- \* It is used to identify antibodies.

**17. What is cardiac output? [APR/MAY 16]**

Cardiac output is the amount of blood delivered by the heart to the Aorta per minute. For normal adult, the cardiac output is 4 - 16 liters/min.

**18. What are the two types of BP measurement?**

1. Indirect method.
2. Direct method.

**19. What is Korotkoff sound?**

In the BP measurement, when the systolic pressure exceeds the cuff pressure, then the doctor can hear some crashing, snapping sound through the stethoscope. The sound is known as korotkoff sound.

**20. What is muffling?**

The korotkoff sound disappears at some point. This is known as muffling.

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**UNIT 3**

**1. What is radio pill? Give it two uses. [APR/MAY 15], [APR/MAY 16]**

\* A device used in bio-telemetry for monitoring the physiologic activity of an animal, such as pH values of stomach acid. Example : Heidelberg capsule.

Use : Radio pill transmits information about internal condition (acidity, etc.,).

**2. What is meant by bradycardia and tachycardia? [APR/MAY 15]**

Bradycardia also known as bradyarrhythmia, is a slow heart rate, namely, a resting heart rate of under 60 beats per minute (BPM) in adults.

\*It sometimes results in weakness, dizziness and at very low rates fainting.

\*Bradycardia is used in explaining a heart rate that, although not actually below 60 BPM, is still considered too slow for rates fainting.

Tachycardia also called as tacharrhythmia, is heart rate that exceeds the normal resting rate.

\*In general, a resulting heart rate over 100 beats per minute is accepted as tachycardia in adults.

\* Heart rates above the resting rate may be normal (such as with exercise) or abnormal (such as with electrical problems within the heart).

\*The upper threshold of a normal human resting heart rate is based upon age.

**3. What is meant by single channel telemetry? [NOV/DEC 15]**

Single channel telemetry system consists of one transmitter and one receiver which is suitable for electro cardiogram for monitoring the patient's data base from anywhere.

**4. When does the need for pacemaker arise? What is its function? [NOV/DEC 15], [APR/MAY 16]**

When the patient gets the problem with (Arrhythmias) the rate (or) rhythm of heart beat, an artificial pacemaker is fitted to make the heart beat stable.

The function of pacemaker is to control abnormal heart rhythms.

**5. List the application of Bio Telemetry? [APR/MAY 16]**

1. They are used to record the bio signals over a long period and while the patient, i.e., engaged in his normal activities.

2. For recording in animals, particularly for research.

3. For monitoring the person who is in action, the bio telemetry is an ideal one.

4. It is used as medical attendant.

**6. What are pacemakers?**

Pacemakers mean electrical pulse generator for starting and/or maintaining the normal heart beat. The output of the pacemaker is applied either externally to the chest or internally to the heart muscle.

**7. List the two types of multiplexing involved in multichannel wireless telemetry.**

The two types of multiplexing involved in multichannel wireless telemetry are:

1. Frequency division multiplex system.

2. Time division multiplex system.

**8. What is meant by demand pacemaker?**

If the heart rate falls below a predetermined minimum, the pacemaker will turn on and provide the heart stimulus. For this reason they are called demand pacemaker.

**9. Draw the defibrillator output waveform and indicate the output energy level.**

(Defibrillator output waveform)

**10. What is radio pill?**

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It is used for telemetering continuous about one or various variables from lumen of the gut.

**11. Specify the frequencies used for biotelemetry.**

Frequencies used for biotelemetry are.

\* Radio frequency used is 100 to 200 MHz.

\* Frequency range is 0.01 Hz to 20 kHz.

**12. What are the batteries used for implantable pacemaker:**

Batteries are used for implementable parameter :

\* Mercury cell.

\* Lithium cell

\* Rechargeable battery.

\* Nuclear cell.

**13. What is 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.

**14. What are the essential requirements of the FM telemetry receiver.**

\* It should have a radio frequency large of 100 to 250 MHz.

\* Frequency range is 0.01 Hz to 20 kHz.

\* Input impedance is 300k to mega s.

\* Temperature and stability of carrier frequency is 0.05%/0C.

**15. List the typical ranges of pacemaker parameters.**

weight = 33 - 98 grams

reliability = 3.5 - 18 years

end of life = 2 - 10% drop in pulse rate

pulse rate = 25-155 pulse per minute.

pulse width = 0.1 - 2.3 milliseconds.

pulse amplitude = 2.5 to 10 volts.

battery capacity = 0.44 - 3.2 amplifier - hours.

**16. What is tele -stimulation? Give its biomedical applications.**

Tele stimulation is the measurements of biological signals over long distance. Example: Ultrasomography.

**17. What is counter shock?**

The phenomenon of application of an electrical shock to resynchronize the heart is known as counter shock.

**18. What is IPP?**

IIP means Intermittent Positive Pressure.

Positive pressure Ventilators are used to inflate the lungs with IIP.

**19. What is heart lung machine? [APR/MAY 16]**

The machine which can provide extra corporeal circulation to the patient is known as Heart Lung Machine.

**20. What is the use of proportioning pump?**

It is used to mix the pure water with dialysate. Usual ratio of water and concentrate is 34 : 1.

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**UNIT 4**

**1. Distinguish radiographic and fluorographic techniques. [APR/MAY 15], [NOV/DEC 15]**

<b>Radiography</b>	<b>Fluoroscopy</b>
1. X-ray images developed by photographic or photosensitive film	1. X-ray images developed by fluorescent principle effect on the fluorescent screen.
2. Patient dose is low	2. Patient dose is high.
3. More efficiency	3. Less efficiency
4. Patient is not exposed to X-rays during examination of x-ray image.	4. Patient is exposed to x-ray during examination

**2. Define let-go current.**

Let-go current is the minimum current to produce muscular contraction.

For men ----- About 16 mA

For women ----- About 10.5 mA

**3. Bring out the clinical application of endoscopy. [NOV/DEC 15]**

1. Gastrointestinal
2. The lower respiratory treatment (bronchoscopy).
3. The interior - joint treatment (arthoscopy).

**4. What are soft and hard x-rays?**

Sharpness or clarity of the edges of the images is often reduced due to distortion in the x-ray beam as it passes from the x-ray tube to the patient is called hard x-ray. The density or darkness of the images is proportional to the amount of alpha rays that penetrate the flow is called soft x-ray.

**5. Mention the characteristics required for the radio isotope to be used for medical imaging.**

The output from the microprocessor is displayed on an oscilloscope such that intensity of the image would correspond to the radiation intensity and in turn to the absorption characteristic of the tissue.

**6. State the components of ionizing radiation.**

The components of the ionization for radiation are:

1. GM counter
2. Ionization chamber

**7. Specify the need for SPECT.**

SPECT (SPE Computer Tomography)

\* They are used to scan multidirectional object, multiple data are collected.

\* Computer performs the calculations and obtain an information.

**8. Mention the different types of radiation generated from radio isotopes.**

Types of radiation from radio isotopes

- \* Alpha radiation.
- \* Beta radiation.
- \* Gamma radiation.

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**9. List the characteristics of x-rays.**

Characteristics of X-ray :

- \* It follows  $v = f$
- \* It propagates in a straight line.
- \* It follows the inverse square law.
- \* It is not deflected by magnetic fields
- \* It produces interference.

**10. What is meant by ionising radiation?**

**Ionising Radiation :** A type of particle accelerator that uses the electric field induced by a varying magnetic field to accelerate electrons to high speed in a circular orbit.

They are used in industrial radiography to examine concrete, steel and cast metal used for construction.

**11. Labelled sodium isotope is deployed in diagnosis of what impairment.**

Its targeting can be due to the chemical properties of isotope such as radio iodine that is mainly absorbed by the thyroid gland. Radio isotope can be used in imaging tests in diagnosing cancer.

**12. Mamograms are used for what purposes?**

It is the instrument used for recording the electrical activity of the muscular to determine whether the muscle is contracting or not.

**13. Give the hazardous effect of ionising radiation.**

The ionizing effect of X-ray is used for the treatment of tumors. Radiation therapy is used for the treatment of cancer patients. High radiation may cause loss of hair and some vital effects.

**14. What is the use of fluoroscopy?**

- \* Permanent record is made with the help of video tape recorder.
- \* Immediately the image can be seen and examination can be finished within short time.
- \* Movement of organs can be observed.

**15. What are the types of biotelemetry?**

- \* Single channel telemetry.
- \* Multi channel telemetry

**16. What is macro shock?**

A physiological response to a current applied to the surface of the body that produces unwanted or unnecessary stimulation like muscle contractions or tissue injury is called macroshock.

**17. Define micro at a macro shock.**

**Macroshock :** A physiological response to a current applied to the surface of the body that produces unnecessary stimulation like muscle contractions or tissue injury is called macroshock.

A physiological response to a current applied to the surface of the heart that results in unwanted stimulation like muscle contractions or tissue injury is called micro shock.

**18. Give the types and frequencies of operation of diathermy units.**

Types of diathermy and its frequency.

- \* Short wave diathermy - 27.12 MHz.
- \* Microwave diathermy - 24.50 MHz.
- \* Ultrasonic diathermy - 800kHz to 1 MHz
- \* Surgical diathermy - 1 to 3 MHz.

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**19. What is the principle of diathermy?**

Diathermy is treatment process of which cutting, coagulation of tissues are obtained. In this method, the patient's body becomes a part of electric circuit, hence heat is produced within the body instead of transferring through the skin.

**20. What are the precautions necessary to avoid micro shock?**

Several devices are available to protect to patients and health care workers from hazardous electrical current. There range from devices to protect against high-voltage. Macroshock hazards to procedure that minimize.

**UNIT 5**

**1. Write the physiological effects of electricity. [APR/MAY 15]**

<b>Current</b>	<b>Effect</b>
0.001 Ampere (1 milliampere)	-----> "Tingling," threshold of perception.
0.20 amps(20 Ma)	-----> muscle spasms, hard to release grip
0.50 amps(50 Ma)	-----> pain, possible fainting, transient interruption of respiration
100 amps(100 Ma)	-----> Ventricular fibrillation
> 5 Amps	-----> Sustained myocardial contraction, possible burns, temporary respiratory paralysis.

**2. Name the laser commonly used for ophthalmic application. Why? [APR/MAY 15]**

Nd : YAG laser and its role in the treatment of ophthalmic disorders. There are numerous ophthalmic application for Nd : YAG lasers. They are most commonly used to treat posterior capsular opacification cataract surgery.

Nd : YAG lasers can be used to remove skin cancers.

**3. Define the term thermograph? [NOV/DEC 15]**

It is the process of recording true thermal images of the surface of object under study.

It is diagnostic aid for breast cancer, pneumatic disease (or) joint disease.

**4. Write the principle of haemodialysis.**

Blood is purified by an artificial kidney machine (Haemodialyser), in which blood is taken out from the body and waste products diffuse through a semipermeable membrane which is continuously rinsed by a dialysing solution.

**5. List the parts of endoscope unit.**

1. Power supply.
2. Lens systems.
3. Synchronous filter shutter.
4. Micro positioner.
5. Fibre guide.
6. Firing control and timing unit.

**6. What are the types of thermography?**

- \* Infrared thermography
- \* Liquid crystal thermography
- \* Microwave thermography

**7. Bring out the need for patient in surgical diathermy.**

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Diathermy is the treatment process by which cutting, coagulations etc. of tissues are obtained

It is found that when high frequency current in the range 1-3 MHz is applied, heating of the tissues take place. The evolving steam bubbles in the tissues at the surgical tip continuously rupture the tissue and by that way the cutting action is obtained.

**8. What are the medical applications of thermography?**

- \* Tumours
- \* Inflammation
- \* Brain diseases
- \* Burns
- \* Orthopedic diseases

**9. What are the advantages of laser surgery?**

- \* Highly sterile
- \* Highly localized and precise
- \* Non-contact and bloodless surgery
- \* Short period of surgical time
- \* Painless surgery

**10. Mention the applications of laser in ophthalmology.**

Applications of LASER in ophthalmology:

- \* Photo coagulation
- \* Photo disruption.
- \* Photo reflection.
- \* Retrieval and Glaucoma surgery.

**11. Mention the switches which account for hazards from electric shock.**

- \* Ground fault interrupter.
- \* Isolation transformer.

**13. Can pain be relieved through electrical stimulation? What is the equipment used for it?**

Pain is relieved through electrical stimulation and also will improve fatigue resistance endurance and increase force products.

**14. State the working principles of surgical diathermy.**

Apart from the thermal and therapeutically applications, the high frequency currents are also used for surgical purposes like cutting and co-agulation. The frequency of current used here is 1 to 3 MHz.

**15. What is Endoscopy?**

Endoscopy is one which is used to inspect (or) to view the body cavities which are not visible to the naked eye.

**16. What is meant by evoked response audiometry system?**

Evoked response audiometer is used to identify the disorder in the acoustic branch of the brain.

**17. Define endoscopes and mention some of its types.**

Endoscope is tubular optical instrument to inspect or view the body cavities which are not visible to the naked eye normally.

Types of endoscopes are cardio scope, bronchoscope, laparoscope, otoscope, gastro scope, etc.

**18. What is meant by diathermy? [NOV/DEC 15]**

Diathermy is the treatment process by which, cutting coagulation of tissues are obtained.

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**19. List the types of lasers used in medical field. [APR/MAY 16].**

The types of lasers used in medical fields are

- i). Pulsed Nd-YaG laser
- ii). Continuous laser. Co2 laser
- iii). Continuous wave organ ion laser

**20. What are the advantages of performing surgery using LASER? [A/M 2008][N/D 2009]**

The advantages of performing surgery using LASER are

- i) Highly sterile
- ii) Non-contact surgery
- iii) Highly localized and precise
- iv) prompt surgery

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**PART B**

**Unit I**

- 1 (i) Assess the characteristics and frequency bands of EEG signal.  
(ii) Conclude in detail about the origin of action potential and resting potential with necessary diagrams.
- 2 (i) Summarize the instrumentation amplifier with circuit diagram.  
(ii) Evaluate the origin of brain waves.
- 3 (i) Generalize the international standard 12 lead system used to record ECG.  
(ii) Formulate the list and discuss the important characteristics of bio-amplifier.
- 4 (i) Invent the different types of surface electrodes and discuss its applications.  
(ii) Prepare the typical recording setup of EMG.
- 5 (i) What should be the characteristics of bio potential amplifier?  
(ii) Show the origin of bio potential.
- 6 (i) Analyze in detail about the 10-20 lead system of recording EEG.  
(ii) List the typical ECG waveform and mark the important features and their associated function of the heart.
- 7 (i) Summarize the generation of PCG signals and discuss the measurement of PCG.  
(ii) Interpret about micro electrodes.
- 8 Identify and describe the different types of bio potential electrodes used in measurement of bio signals.
- 9 (i) Compare the signal characteristics of ECG and EMG.  
(ii) Measure the ECG recording system in detail.
- 10 (i) How a metal microelectrode is formed? Draw its electrical equivalent circuit and explain.  
(ii) Show the circuit diagram of Darlington pair isolation amplifier and explain.
- 11 (i) How a metal microelectrode is formed? Draw its electrical equivalent circuit and explain.  
(ii) Show the circuit diagram of Darlington pair isolation amplifier and explain.
- 12 (i) Examine the action potential waveform and discuss about polarization and repolarization  
(ii) With relevant graph explain the relationship between the action potential and muscle construction

**PART B**

**Unit II**

- 1 Examine the principle of following: (i) Filter Photometer, (ii) Auto analyzer.
- 2 Explain the following techniques with necessary diagram: (i) pCO<sub>2</sub> measurement principle (ii) Dye dilution
- 3 (i) Discuss the working principle of a colorimeter with a neat diagram. (ii) How will you measure the blood pressure using sphygmomanometer?
- 4 Explain the working principle of electromagnetic blood flow meter. What are its advantages and disadvantages
- 5 State in your own words about respiratory measurement using respiratory apparatus.
- 6 Can you recall the principle of operation of blood cell counter types and its applications?
- 7 Evaluate the measurement of cardiac output using direct and indirect methods.
- 8 Inspect the parameter with suitable figures and explain how pH, pCO<sub>2</sub> and pO<sub>2</sub> are measured?
- 9 (i) Which device is used to measure the Lung capacity and volume with neat diagram and explain its operations? (ii) Show the measurement of heart sound with suitable diagram.
- 10 (i) How is the pulse rate measured? (ii) How would you use the ultrasonic waves in measuring Blood Flow & Blood pressure.

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**PART B**  
**Unit III**

- 1 Evaluate the different types of pacemaker with its stimulation methods.
- 2 Explain the Dialyzers with respect to the functions of kidney.
- 3 Design the Cardiovascular circulation and Heart Lung Machine model.
- 4 Estimate the various types of Oxygenators and State its advantages and disadvantages.
- 5 (i) Construct the circuit diagram of fixed rate parameters and explain its working principle.  
(ii) Develop the working model of synchronized dc defibrillator.
- 6 (i) Explain the block diagram of DC defibrillator with a neat diagram? (ii) Describe the working of atrial synchronous pacemaker
- 7 Examine the following (i) Demand pacemaker with a diagram (ii) DC defibrillator with synchronizer.
- 8 What is pacemaker? Describe the different types of pacemakers? Explain the R-wave inhibited pacemaker with neat block diagram.
- 9 Analyze the different modes of operation of cardiac pacemakers with suitable block diagram.
- 10 With a neat diagram, illustrate the working of (i) Heart Lung machine (ii) Dialyzer

**PART B**  
**Unit IV**

- 1 Define diathermy. Determine the circuit diagram of a short-wave diathermy unit and discuss its impact on therapy purpose in detail. Also briefly describe how it can be applied to human subjects.
- 2 With suitable diagram, Explain how the ECG signal can be transmitted using single channel telemetry system.
- 3 Discuss the various Electrical safety and physiological effects on humans
- 4 Elaborate the different methods of applying electrodes in shortwave diathermy treatment
- 5 (i) State the multiple channel biotelemetry systems with neat diagrams. (ii) Write short notes on E-health.
- 6 Define Leakage current. Explain the impact of leakage in cardiac patient and discuss the prevention methods.
- 7 Explain the working and construction of radio pill with an example?
- 8 With a neat block diagram, show the operation of a combined single channel telemetry system for ECG signal and respiration rate.
- 9 Discuss the following with respect to electrical safety (i) Ground fault interrupter (ii) Isolation transformer (iii) Line Isolation monitors (iv) Grounding (v) Important aspects of hospital architecture.
- 10 (i) Examine the problems associated with the implant telemetry circuits? (ii) Analyze about the subcarrier biotelemetry.

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**EC6001 MEDICAL ELECTRONICS**

**PART B**

**Unit V**

- 1 i) Explain the various applications of lasers in different fields of medicine. (ii) Conclude the specific advantages of Laser Surgery
- 2 (i) Summarize the benefits and limitations of telemedicine. (ii) Assess the importance of cryogenic techniques in medicine.
- 3 Elaborate the principle of operation and application of medical thermography.
- 4 Discuss the operation of endoscopy unit and mention few applications.
- 5 Explain about the evolution and technologies involved in telemedicine. Discuss the application areas of telemedicine.
- 6 A bloodless surgery is being planned using laser. Find which type laser would be suitable to achieve this. Examine the process involved in the laser production and application.
- 7 Write brief notes on the working principle of: (i) Argon Laser (ii) CO2 Laser
- 8 (i) What are the medical applications of thermography? (ii) Show the biological effects of radiation exposure & safe dose equivalent limits.
- 9 (i) Write a note on endoscopy unit. (ii) Write a note on cryogenic surgery.
- 10 Explain the infrared thermographic instrumentation with a suitable block diagram and what the different medical applications are.