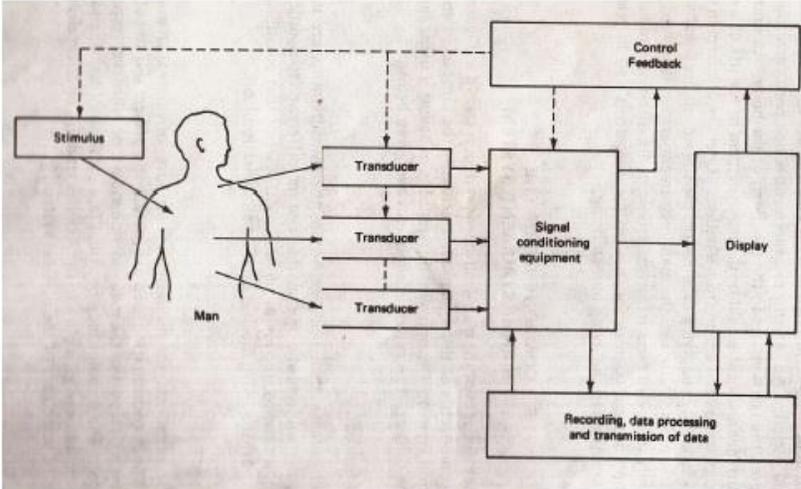




Important Instructions to examiners:

- 1) The answers should be examined by keywords and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance. (Not applicable for subject English and Communication Skills.)
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Question & its Answer	Remark	Total Marks
Q.1 A)	Attempt ant THREE of the following		12
i)	Draw a neat labeled diagram of MAN-INSTRUMENT system. State the function of any 2 blocks.	04	
Ans.	<p>Diagram:</p>  <p>Fig: Block diagram of Man – Instrument system</p> <p>Function of Man – Instrument system : (Any two block) The basic components of the man instrument system are:</p> <p>Subject: The subject is the human being on whom the measurements</p>	02 marks for Diagram	



	<p>are made.</p> <p>Stimulus: Stimulus generates response. The instrumentation used to generate and present this stimulus to the subject is the vital part of man-instrument system whenever responses are measure. E.g. visual (flash of light), auditory (a tone), etc.</p> <p>Transducer: A transducer is device used to produce an electrical signal that is an analog of the phenomenon being measured.</p> <p>Signal conditioning equipment: This part of the system amplifies, modifies, or in any other ways changes the electric output of the transducer to satisfy the functions of the system and to prepare signals suitable for operating the display or recording equipment that follows.</p> <p>Display equipment: The input to the display device is the modified electric signal from the signal conditioning equipment which is converted into a form that can be perceived by one o the human's senses in a meaningful way. E.g. graphic pen recorder for recoding ECG signal.</p> <p>Recording, Data processing, and Transmission: Recording instruments are required to record the desirable information that can be used to transmit or for possible later use. E.g. on line digital computer, recording equipment etc.</p> <p>Control devices: Where it is necessary or desirable to have automatic control of the stimulus, transducers, or any other part of the man instrument system, a control system is incorporated which uses control devices.</p>	<p>02 marks for function of any two block</p>	
ii)	<p>Name any 2 electrodes each used for measurement of:</p> <p>1) ECG 2) EEG</p>	<p>04</p>	
Ans.	<p>1)Electrodes for ECG:</p> <p>i) Limb Electrodes ii) Floating Electrodes iii) Pasteless Electrodes iv) Pre-jelled Disposable Electrodes v) Air-Jet ECG Electrodes</p> <p>2) Electrodes for EEG</p> <p>i) Surface Electrodes ii) Chlorided Silver discs Electrodes iii)Skin surface Electrodes</p>	<p>02 marks for Any two electrodes</p> <p>02 marks for Any two relevant electrodes</p>	

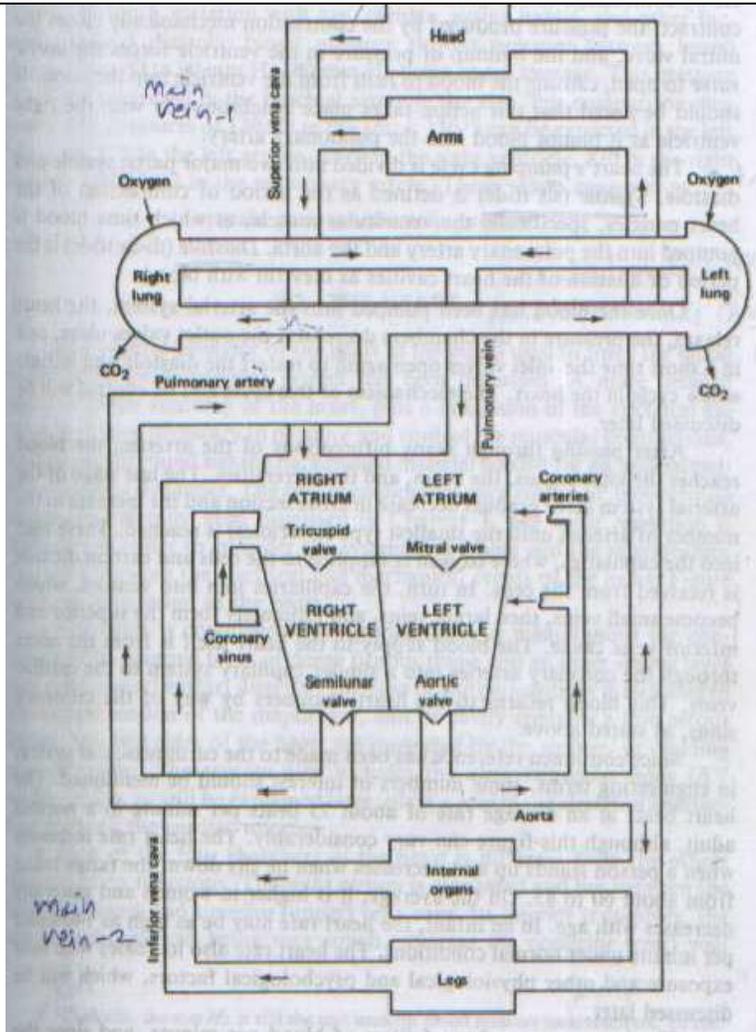


	iv) Needle Electrodes v) Scalp Electrodes		
iii)	Explain the need of dialysis machine.	04	
Ans.	Need of dialysis machine There is need when the original kidneys of patient are: <ul style="list-style-type: none">• Unable to form urine.• Unable to removal of waste products from blood plasma.• Unable for the regulation of the composition of blood plasma.• Unable to regulates volume, osmotic pressure in the blood vessels .• Unable to Balance pH and electrolyte composition of the body fluids.	04 marks (Any four points)	
iv)	State one application each of the following. 1) Centrifuge 2) Autoclave 3) Deionizer 4) Incubator	04	
Ans.	1)Centrifuge 1) laboratory-scale centrifuges are used in chemistry, biology, biochemistry and clinical medicine for isolating and separating suspensions and immiscible liquids. 2)Centrifuges are use in nuclear power and nuclear weapon programs to separate isotopes. 3) Centrifuges are use in the chemical industry for Synthesis of materials. 4) In washing Machines. 5) Used to separate cream (remove fat) from milk. 2)Autoclave It is used to sterilize medical equipment such as <ul style="list-style-type: none">1. Surgical instruments (scissors, needles etc)2. Glass ware3. Pathogenic hospital waste etc4. Used in food industry5. Used in dentistry 3)Deionizer <ul style="list-style-type: none">1. Medical2. Laboratory3. Pharmaceutical	01 mark for stating any one applicatio n each	



	<p>4. Cosmetics 5. Electronic manufacturing 6. Food processing</p> <p>4) Incubator 1) Incubator is used to grow and maintain microbiological cultures or cell cultures. 2) Reproduction of germ colonies with subsequent germ count in the food industry. 3) Reproduction of germ colonies and subsequent determination of biochemical oxygen demand (wastewater monitoring) 4) Reproduction of micro organisms such as bacteria, fungi, yeast or viruses 5) Breeding of insects and hatching of eggs in zoology 6) Controlled sample storage 7) Growing of crystals/protein crystals</p>		
Q.1 B)	Attempt any ONE of the following		06
i)	Draw a neat diagram of cardiovascular system analogous to a pump and hydraulic piping system. Also define heart rate and cardiac output.	06	

Ans.



04 marks
for
diagram

Heart rate: The number of heartbeats per unit of time, usually per minute. The heart rate is based on the number of contractions of the ventricles (the lower chambers of the heart). The heart rate may be too fast (tachycardia) or too slow (bradycardia). Normal heart rate in healthy human is 72 beats per minute.

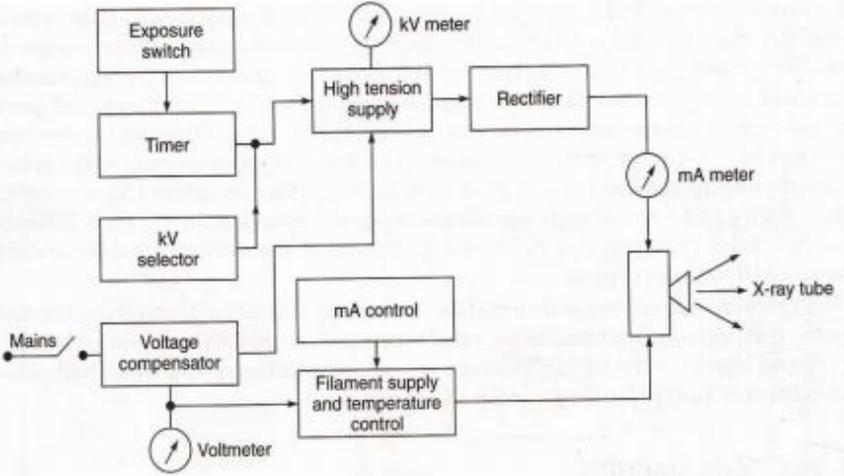
01 mark

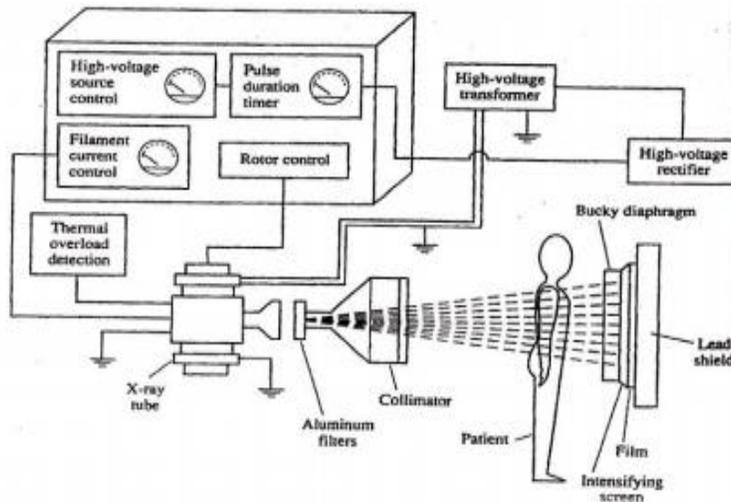
Cardiac output:- Cardiac output is the volume of blood pumped by the heart per minute (mL blood/min). Cardiac output is a function of heart rate and stroke volume. The heart rate is simply the number of heart beats per minute. The stroke volume is the volume of blood, in milliliters (ml), pumped out of the heart with each beat. Increasing either heart rate or stroke volume increases cardiac output.

01 mark

Cardiac Output in ml/min = heart rate (beats/min) X stroke volume (ml/beat)

An average person has a resting heart rate of 70 beats/minute and a

	<p>resting stroke volume of 70 ml/beat. The cardiac output for this person at rest is:</p> <p>Cardiac Output = 70 (beats/min) X 70 (ml/beat) = 4900 ml/minute.</p> <p>The total volume of blood in the circulatory system of an average person is about 5 liters (5000 ml). According to our calculations, the entire volume of blood within the circulatory system is pumped by the heart each minute (at rest). During vigorous exercise, the cardiac output can increase up to 5 fold (25 liters/minute).</p>		
<p>ii)</p>	<p>Explain the operation of an X-ray machine with a neat block diagram.</p>	<p>06</p>	
<p>Ans.</p>	<div style="text-align: center;">  <p>OR</p> </div>	<p>03 marks diagram</p>	



Explanation: X ray machine has two parts of the circuit.

i) One of them is to produce high voltage which is applied to tubes anode and cathode and comprises high voltage step up transformer followed by rectification. The current through the tube follows the high tension path way and is measured by mA meter.

A kV selector switch facilitates change in voltage between the exposures. The voltage is measured with the help of kV meter. The exposure switch controls the timer and thus the duration of application of kV. To compensate mains supply voltage variation a voltage compensator is included in the circuit.

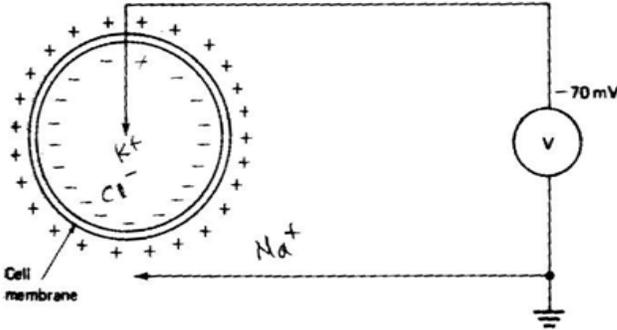
ii) Second part concerned the X-Ray tube filament; the filament is heated with 6-12 volts of AC Supply at current of 3-5 A.

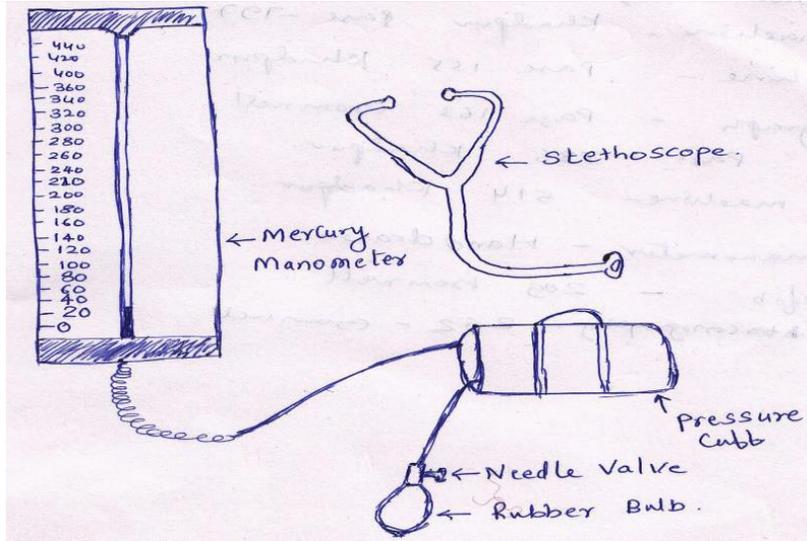
The filament temperature determines the tube current and therefore the filament temp control is attached with millimeter selector.

The filament current is controlled by using in the primary side of the filament transformer, a variable choke or rheostat. The rheostat provides a step wise control of mA and is most commonly used in modern machine. A preferred method of providing high voltage dc to the anode of X-Ray tube is by use a bridge rectifier using 4 valve tube or solid state rectifiers, which provide more efficient system than the half wave self rectification method.

03 marks for explanation

Q.2	Attempt ant TWO of the following		16
a)	Describe resting potential and action potential with neat diagrams and waveform.	08	
Ans.	i) Resting Potential:		

<p>Surrounding the cell of the body or body fluids. These fluids of conductive solutions containing charged atoms known as ions. The principle ions are sodium (Na^+), potassium (K^+) and chloride(Cl^-). The membrane of excitable cell readily permit entry of K^+ and Cl^- restricts flow of NaCl. The inability of sodium to penetrate the membrane results in two conditions. First, the concentration of sodium ion inside the cell much lower than in the intercellular fluid outside. Since the sodium ions are positive, these would tend to make the outside of the cell more positive than the inside. Second, in an attempt to balance the electric charge, additional potassium ions, which are also positive, enters the cell, causing a higher concentration of K^+ ions on the inside than on the outside. These charge balance can not be achieved, however because of the concentration imbalance of K^+ ions. Equilibrium is reached with the potential difference across the membrane, negative on the inside and positive on the outside.</p> <p>This membrane potential is called the resting potential of the cell and is maintained until some kind of disturbance upset the equilibrium</p>	<p>3 ½ marks for definition of resting potential with diagram</p>
<p>Diagram of resting potential:</p>  <p>ii)Action Potential:</p> <p>When cell is excited by any external excitation or stimulus then property of cell membrane changes, which allows entry of Na^+ ions. The large number of Na^+ ions tries to enter inside the cell than the number of Cl^- ions leaving the cell body. So after some time inside the cell body potential is more +ve than outside. This developed potential in the cell is called as “action potential”. A decrease in resting membrane potential difference is called Depolarization.</p>	
<p>Diagram of action potential :</p>	<p>3 ½ marks for definition</p>



(Note: any other relevant diagram may considered)

Description :

- The familiar indirect method of measuring blood pressure involves use of Sphygmomanometer and a stethoscope. Sphygmomanometer consists of an inflatable pressure cuff and mercury manometer to measure the pressure in the cuff.
- The cuff consists of a rubber bladder inside an inelastic fabric covering that can be wrapped around the upper arm and fastened with either hook or a Velcro fastener. The cuff is normally inflated manually with rubber bladder and deflated slowly through a needle valve.
- The Sphygmomanometer works on the principle of that when the cuff is placed on the upper arm and inflated (filled with air pressure), arterial blood can flow past the cuff only when the arterial pressure exceeds the pressure in the cuff.
- So first pressure in cuff is increased by inflating cuff with the help of rubber bladder pumping manually above systolic pressure at this point no sound is heard through the stethoscope which is placed over the brachial artery. For that artery has been collapse by the pressure of the cuff.
- The pressure in the artery gradually reduced by opening needle valve slowly.
- As soon as cuff pressure falls below systolic pressure, small amount of blood Spurt past the cuff and KOROTKOFF sounds begin to be heard through stethoscope.

02 marks for diagram

04 marks for explanation

c) **Explain the working of an internal pacemaker with a neat block diagram.**

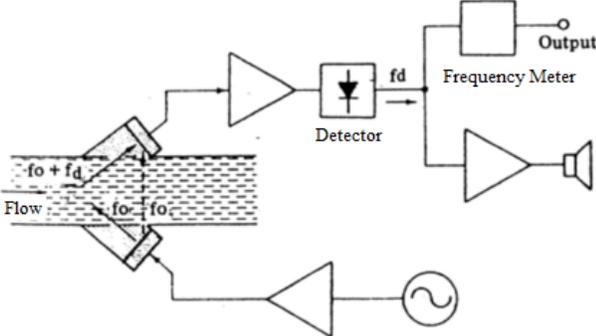
08

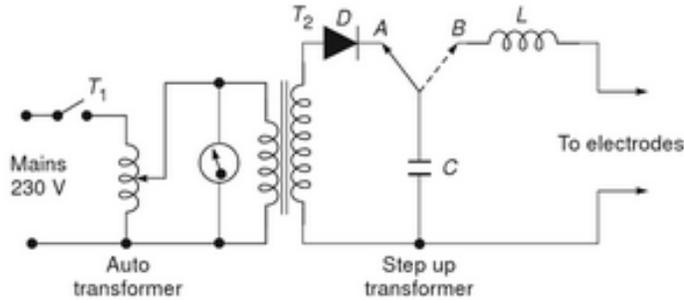


<p>Ans.</p>	<p>Diagram</p> <p>Explanation:</p> <p>In the given block diagram the timing circuit consists of an RC network, reference voltage source and a comparator that determines the basic pacing rate of the pulse generator. Its output signal is given to second RC network, the pulse width circuit which determines the stimulation pulse duration. A third RC network and the rate limiting circuit disable the comparator for a preset interval and thus limit the pacing rate to a maximum of 120 pulses per minute. The output circuit provides a voltage pulse to stimulate the heart. The voltage monitoring circuit senses cell depletion and then signals the rate slow down circuit and the energy compensation circuit of this event. The rate slow down circuit shuts off some of the current to the basic timing network to cause the rate slow down to 8+ 3 beats per minutes. When cell depletion has occurred the energy compensation circuit causes the pulse duration to increase as the battery voltage decreases to maintain nearly constant stimulation to the heart. There is a feedback loop from output circuitry to the refractory circuit which provides a period of time following an output pulse on sensed R wave during which the amplifier will not respond to the outside signals. The sensing circuit detects a spontaneous R wave and resets the oscillation timing capacitor. The reversion circuit allows the amplifier to detect a spontaneous R wave. In the absence of R wave this circuit allows the oscillator to pace at its present rate + beat per minute</p>	<p>04 marks for diagram</p> <p>04 marks for explanation</p>
<p>Q.3</p>	<p>Attempt ant FOUR of the following</p>	<p>16</p>
<p>a)</p>	<p>State functions of the following</p>	<p>04</p>



	<p>(i) Medulla Oblongata (ii) Cerebellum (iii) Cerebrum (iv) Frontal Lobe</p>		
Ans.	<p>i) Medulla Oblongata: It is part of brain stem and its functions are as follows 1) It control blood pressure 2) Regulate breathing, heart and blood vessel function 3) reflex center of vomiting, 4) coughing, sneezing 5) Swallowing.</p> <p style="text-align: center;">OR</p> <p>It contain nuclei for regulating 1) Blood pressure 2) breathing 3) Also responsible for relaying information from sense organs that comes from cranial nerves.</p> <p>ii) Cerebellum: 1) The cerebellum receives information from the sensory systems, the spinal cord, and other parts of the brain and then regulates motor movements. 2) The cerebellum coordinates voluntary movements such as posture, balance, coordination, and speech, resulting in smooth and balanced muscular activity.</p> <p>iii) Cerebrum: The cerebrum or cortex is the largest part of the human brain, associated with higher brain function such as thought and action.</p> <p>iv) Frontal Lobe: The frontal lobes are essential for intelligence, constructive imagination & thought. Large quantities of information stored temporarily & correlated thus making basis of higher mental functions.</p>	<p>01 mark</p> <p>01 mark</p> <p>01 mark</p> <p>01 mark</p>	
b)	List the effects of leakage current on human body with increasing current intensity.	04	
Ans.	<p>Effect of leakage current on human i) Threshold of perception: It is at approximately 500 mA or 1 mA. ii) Accepted safe level: it is up to 5 mA. It is not considered harmful. iii) Maximum let go current: It is in excess of 10mA or 20mA. It can tentize the arm muscle. iv) Danger of ventricular Fibrillation : It is above 75 mA v) Contraction of heart (Sustained myocardial contraction): it is at excess of 1A or 2A current. vi) Severe burns and physical injury: It is at excess above 10A current.</p>	<p>01 mark each (any four points)</p>	

	<p>vii) Danger of respiratory paralysis: It is current excess at 100mA onwards.</p> <p>viii) Sustained Myocardial contraction: entire heart muscle contract at current in the range of 1A- 6A.</p>		
c)	With a neat diagram, explain the ultrasonic method for measurement of blood flow.	04	
Ans.	<p>Ultrasonic blood flow measurement</p>  <p>Ultrasonic blood flow measurement works on two principles</p> <ol style="list-style-type: none"> 1. Transit type ultrasonic flow meter. 2. Doppler shift type ultrasonic blood flow meter. <ul style="list-style-type: none"> • In the transit time ultrasonic flow meter, a pulsed beam of ultrasonic energy is used to measure the velocity of flowing blood. A pulsed beam is directed through the blood vessel at a shallow angle and its transit time is measured. When blood flows in the direction of the energy transmission, the transit time is shortened. If flows in the opposite direction, the transit time is lengthened. The transit time is proportional to the velocity of blood flow. • In Doppler principle an oscillator, operating at a frequency of several megahertz, excites a piezoelectric transducer. This transducer is coupled to the wall of an exposed blood vessel and sends an ultrasonic beam with a frequency F into the flowing blood. A small part of the transmitted energy is scattered back and is received by a second transducer arranged opposite the first one. Because of the scattering, due to moving blood cells the received frequency is either $F+F_d$ or $F-F_d$ depending on direction of flow. The Doppler frequency component (F_d) is proportional to velocity of blood. 	<p>02 marks for diagram</p> <p>02 marks for relevant explanation of any one method</p>	
d)	Describe the working of a d.c. defibrillator with a diagram and waveform.	04	
Ans.	DC Defibrillator:		

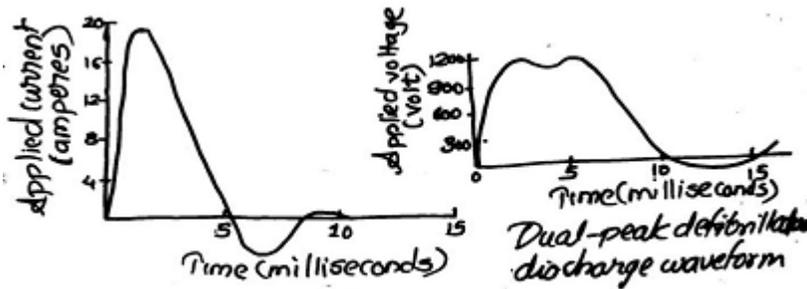


Schematic diagram of a defibrillator

01 mark

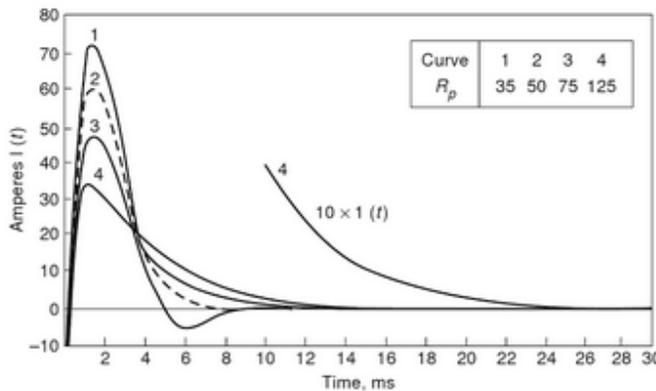
Explanation: In defibrillator a capacitor is charged to a high DC voltage and then rapidly discharged through the paddle electrodes across the chest of the patient. An inductor in the defibrillator is used to shape the waveform in order to avoid sharp current spike. Depending on the energy setting the amount of electrical energy discharged by the capacitor may of the range 100W and 400 W per second.

02 marks



01 mark for waveform

OR



e) State any two applications each of the following:

- (i) X-ray machine
- (ii) CAT scanner

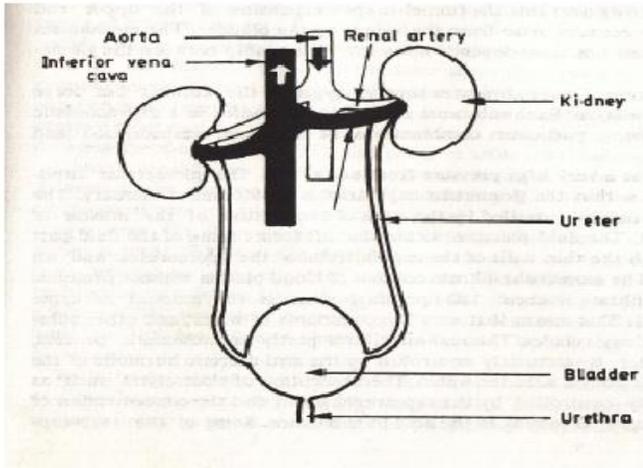
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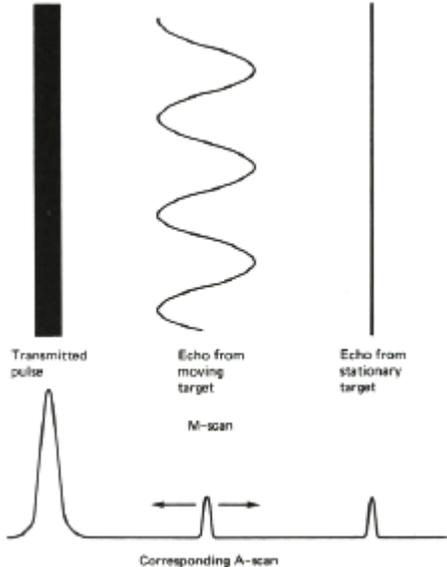


Ans.	X-ray machine: <ol style="list-style-type: none">1. Used in medicine to detect fractures in bones or presence of foreign body.2. Used in diagnosis of tuberculosis, ulcers, cancer etc.3. In industry they are used to test metal castings and moulds and also to detect cracks in them.4. They are used to test the genuineness of the diamonds and pearls.5. They are used to study the crystal structure. CAT scanner: <ol style="list-style-type: none">1. It is ideally suited for studying structures in the chest and abdomen.2. It can be used in the diagnosis of infectious conditions, heart disease, lung disease, diseases involving the bones and muscle.3. It can be used to diagnose disorders related to the central nervous system, more specifically the brain.4. It can also be used to confirm the presence of lesions such as cysts, solid tumors in different areas of the body.	02 marks for (any two applications)	
Q.4 A)	Attempt ant THREE of the following		12
i)	Describe the working of an image intensifier used with a X-ray machine with the help of a neat diagram.	04	
Ans.	Image intensifier: <ul style="list-style-type: none">• This is mostly used as instead of fluoroscopic screen as image is faint , viewed only in dark room• In Image Intensifier faint image of fluoroscopic screen can be made brighter with the help of electronic image intensifier• X-ray image intensifier is used for visual observation & reading of picture with movie camera or video recorder• Intensifier tube contain fluorescence screen act as photo cathode• The electron image thus obtained is projected on a photo phosphor screen at the end of tube by means of electronic system• There is increase in brightness due to acceleration of electron in the lens system.• But o/p image is smaller than primary fluorescent image• X ray image can be observed in normally illuminated room• This tube is heavy so require special type of suspension• Image can be seen from right side mirror• Or can be seen by video placed at suitable placed monitor• Moving camera can be used to record the image while examining the patient	02 marks for explanation	

		<p>02 marks for diagram</p>	
<p>ii)</p>	<p>Draw a neat labeled diagram of the cut section of a kidney.</p>	<p>04</p>	
<p>Ans.</p>	<p>Cut section of a kidney:</p> <p>OR</p>	<p>02 marks for diagram</p> <p>02 marks for labeling</p>	

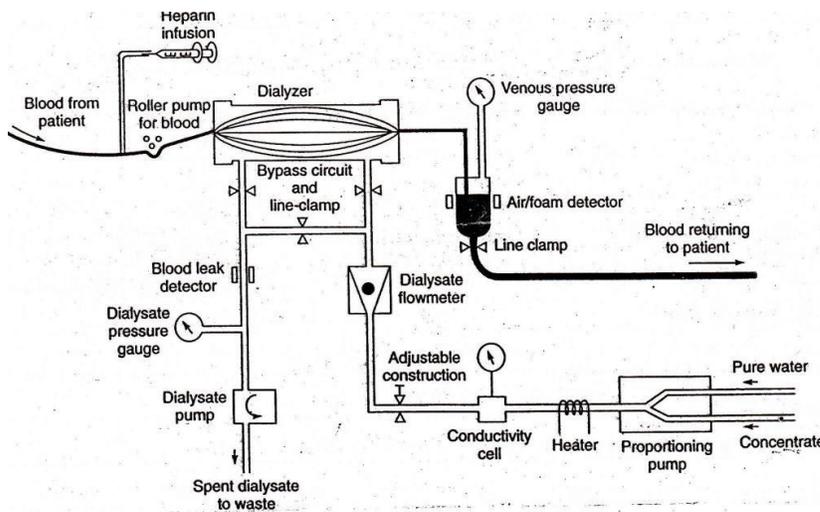


			
<p>iii)</p>	<p>Define the following (a) TV (b) RV (c) VC (d) IRV</p>	<p>04</p>	
<p>Ans.</p>	<p>(a) Tidal Volume (TV): The volume of gas inspired or expired (exchanged with each breath) during normal quiet breathing. OR The volume of air breathed in and out without conscious effort.</p> <p>(b) Residual Volume (RV): The volume of air remaining in the lungs after maximum exhalation or forced expiration.</p> <p>(c) Vital Capacity (VC): The greatest volume of gas that can be inspired by voluntary effort after maximum expiration irrespective of time. OR The total volume of air that can be exhaled after a maximum inhalation: $VC = TV + IRV + ERV$</p> <p>(d) Inspiratory Reserve Volume (IRV): The volume of gas which can be inspired from a normal end. OR The additional volume of air that can be inhaled with maximum effort after a normal inspiration.</p>	<p>01 mark</p> <p>01 mark</p> <p>01 mark</p> <p>01 mark</p>	
<p>iv)</p>	<p>Explain A Scan and M Scan display modes of ultrasound imaging.</p>	<p>04</p>	
<p>Ans.</p>	<p>• A scan: This mode is the simplest among other methods. The transmitted signals and echo signals are applied to the Y plates of CRT so that they are displayed as vertical deflections on</p>	<p>02 marks</p>	

	<p>the CRT screen. The vertical sweep is calibrated in units of distance and provides vertical deflections in various ranges depending upon the distance of the interface. Echoencephalogram is typical example of A scan display.</p> <ul style="list-style-type: none"> • M scan: M scan is very useful in monitoring moving structure inside the body. M scan is basically a combination of A scan and B scan. In this system intensity or brightness of the beam is modulated using received echoes and displayed on horizontal axis with the help of horizontal timing information, that is horizontal sweep. 	<p>for explanation</p> <p>02 marks for diagram</p>	
<p>Q.4. B)</p>	<p>Attempt any one of the following</p>		<p>06</p>
<p>i)</p>	<p>List the precautions to be taken to minimize electric shock hazards.</p>	<p>06</p>	
<p>Ans.</p>	<p>Precautions to minimize electric shock hazards:</p> <ol style="list-style-type: none"> 1. In the vicinity of the patient, appliances with three wire power cords should be used. 2. Provide isolated input circuits on monitoring equipment. 3. Have periodic checks of ground wire continuity of all equipment. 4. Connectors for probes and leads should be standardized so that current intended for powering transducers are not given to the leads applied to pick up physiologic electric impulses. 5. Ground fault circuit interrupters should be used to disconnect the source. 6. Reducing leakage current inside the chasis of instruments by using layout. 7. The solid state electronic diagnostic equipment to be so selected that they work on low voltage. 	<p>06 marks for (any six points)</p>	

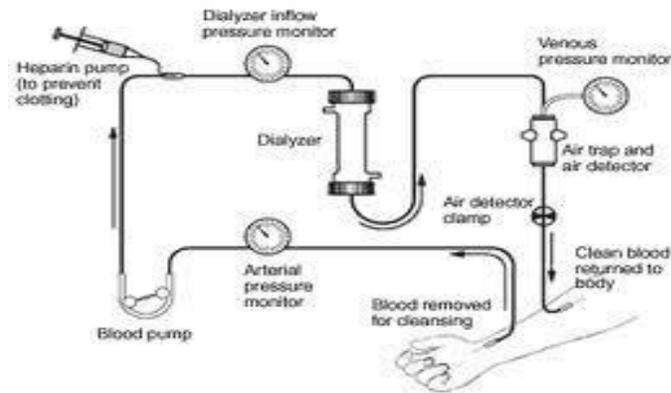
	<p>8. A separate (double) secondary layer of insulation between the chasis and the outer case is provided to protect personnel from ground fault.</p> <p>9. Double insulation reduces leakage current and also protects against both Macroshock and Microshock.</p>		
ii)	Explain the working of dialysis machine with a neat block diagram.	06	

Block diagram of dialysis machine:



03 marks for labeled diagram

OR

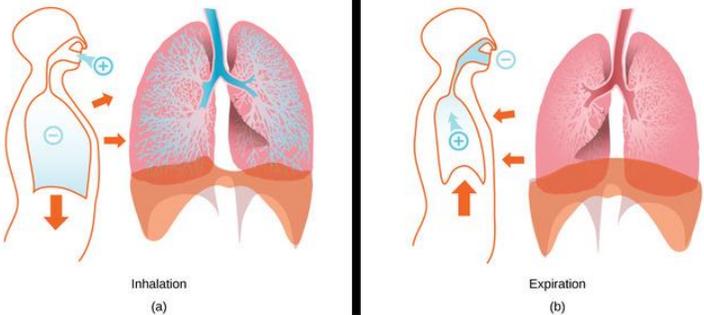


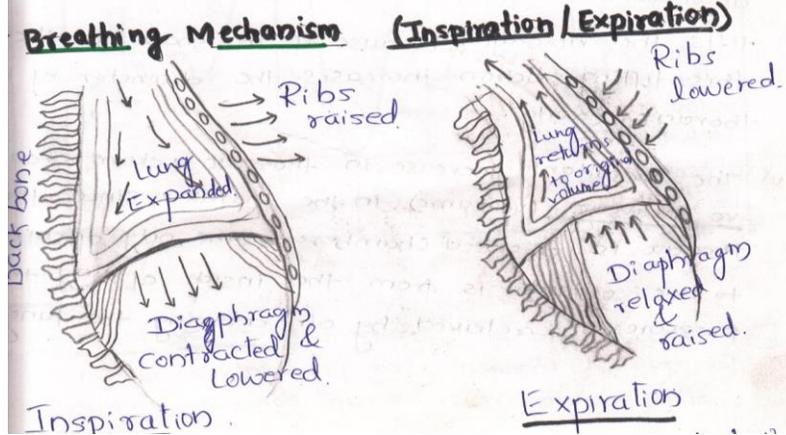
Explanation :

Dialysis machine works as artificial kidney which has following parts,

- 1. Dialyzer:** This is the part in which blood filtration actually takes place and urine is formed.
- 2. Proportionating Pump:** It produces steady flow of quality dialysate by having proper proportion of water and concentrated chemical.
- 3. Dialysate temp Control:** To achieve dialysis at body temperature the control of temperature is essential.

03 marks for explanation

	<p>4. Heparin infusion: It is done in order to avoid coagulation or clotting of blood, which is taken from the patient.</p> <p>5. Venous pressure gauge: It monitors the pressure of blood which is given back to the patient.</p> <p>6. Air/Foam Detector: It detects the presence of air / Foam in the blood to avoid danger.</p> <p>7. Blood leak detector: It detects the leakage of blood from the dialyzer</p> <p>8. Bypass circuit and line in clamp: It is used to bypass the dialysate flow, for replacement, maintenance or repair of dialyzer.</p>		
Q.5	Attempt any TWO of the following		16
a)	What is respiration? Describe the mechanism of breathing with a neat diagram.	08	
Ans.	<p>Respiration: Exchange of gases in any biological process is called respiration.</p> <p style="text-align: center;">OR</p> <p>The exchange of gases between blood and the external environment takes place in the lungs is termed as respiration</p> <p>Diagram</p>  <p style="text-align: center;">OR</p>	01 mark	02 marks for diagram



OR

Diagram of Respiratory system**Mechanism of Breathing:**

There are two main steps in breathing: inspiration and expiration:

Inspiration:

Inspiration (inhalation) is the process of breathing in, by which air is brought into the lungs.

Inspiration involves the following steps:

- i. The muscles attached to the ribs on their outer side contract. This causes the ribs to be pulled out, expanding the chest cavity.
- ii. The muscle wall between the chest cavity and the abdominal cavity, called diaphragm, contracts and moves downwards to further expand the chest cavity.
- iii. The abdominal muscles contract.

The expansion of the chest cavity creates a partial vacuum in the chest cavity. This sucks in air into the lungs, and fills the expanded alveoli.

Expiration:

After the exchange of gases in the lungs, the air has to be expelled. Expulsion of the air from the lungs is called expiration. In this process, muscles attached to the ribs on their inner side contract, and the diaphragm and the abdominal muscles relax. This leads to a

**05 marks
for
description**

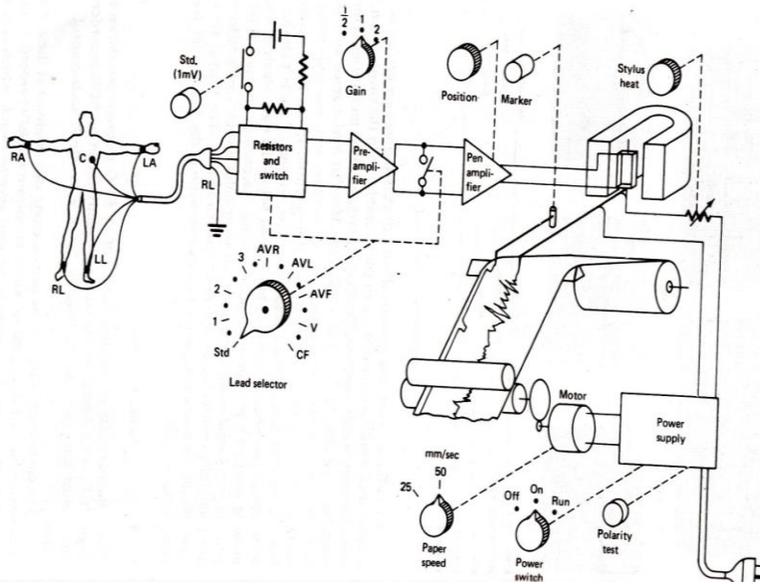
decrease in the volume of the chest cavity, which increases the pressure on the lungs. The air in the lungs is pushed out and it passes out through the nose.

When we breathe out, not all of the air in the lungs gets expelled. Some of it remains in the lungs. This keeps the lungs from collapsing and allows more time for the exchange of gases.

b) Explain the working of an ECG machine with a neat block diagram.

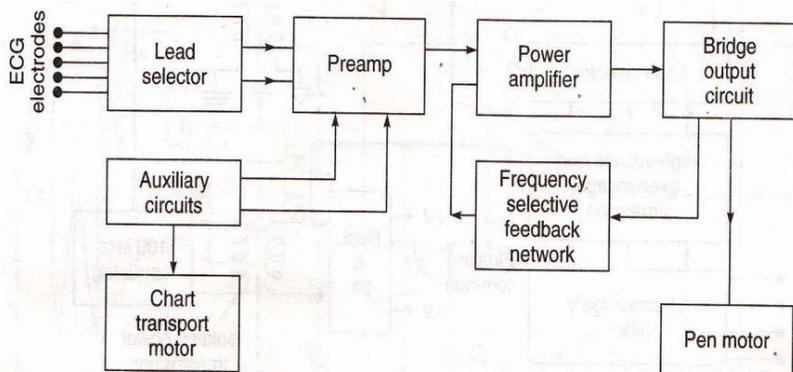
08

Ans.

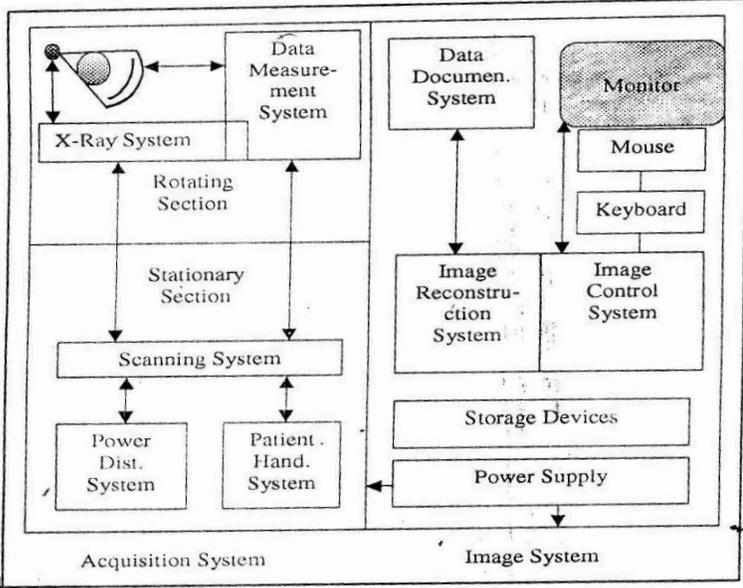


04 marks for diagram

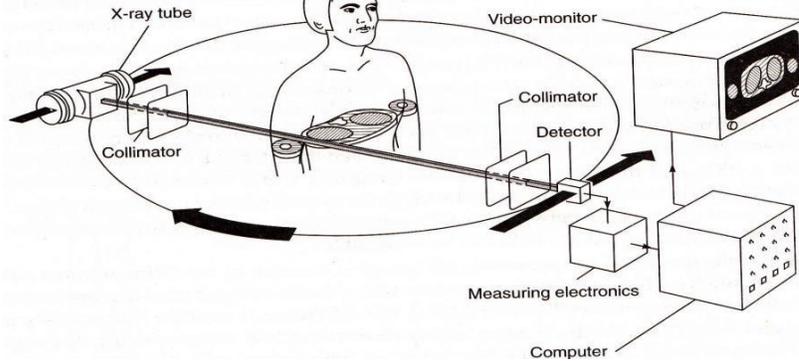
OR



Explanation :

	<p>The potential picked up by the electrodes are taken to the lead selector where lead whose output is required are selected as per lead wire configuration. By means of capacitive coupling the signal is connected to the differential pre amplifier.</p> <p>The preamplifier is usually a 3 or 4 stage differential amplifiers having sufficiently large negative current feedback.</p> <p>The amplified output signal is given to the power amplifier.</p> <p>The power amplifier is a push-pull type. The base of one input transistor is driven by pre amplified signal and the base of other is driven by feedback network.</p> <p>The output of power amplifier deflects the writing arm.</p> <p>Paper recording speed is 25 mm/s.</p> <p>Amplitude measurements are made vertically made in mV.</p> <p>Sensitivity of electrocardiograph is typically set to 10mm/mV.</p> <p>It includes speed control circuit for a chart drive motor.</p>	<p>04 marks for explanation</p>	
<p>c)</p>	<p>Describe the working of CAT scan machine with a neat block diagram.</p>	<p>08</p>	
<p>Ans.</p>	 <p>The diagram illustrates the components of a CAT scan machine, divided into two main sections: the Acquisition System and the Image System.</p> <ul style="list-style-type: none"> Acquisition System: <ul style="list-style-type: none"> Rotating Section: Contains the X-Ray System and the Data Measurement System. Stationary Section: Contains the Scanning System. Support Systems: Includes the Power Dist. System and the Patient Hand. System. Image System: <ul style="list-style-type: none"> Data Document. System: Receives data from the Data Measurement System. Image Reconstruction System: Processes data from the Data Document. System. Image Control System: Controls the Image Reconstruction System. Input Devices: Includes the Mouse and Keyboard, which interface with the Image Control System. Storage Devices: Store data from the Data Document. System. Power Supply: Provides power to the Image System components. <p>Arrows indicate the flow of data and control signals between these components.</p>	<p>04 marks for diagram</p>	

OR



Working of CAT scanner :

The CT scanner consists of gantry, patient table. X ray tube, detector assembly, computer and monitor. X ray tube and detector assembly mounted opposite each other in a rigid gantry rotates once around the patient. The x ray tube emits the x rays at short intervals so that during a full rotation a number of sets of absorption values are collected by detectors. Computer process this data and produces images of the measured values.

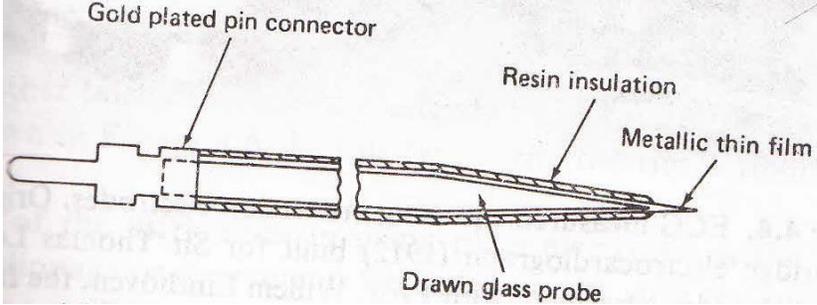
The image system controls the function of CT scan such as reconstruction, display and evaluates the CT image. The image control system is connected to monitor, keyboard, mouse and various storage devices such as disks, tape etc. The image reconstruction system receives measure data and performs the image reconstruction on it. These images are processed and displayed. The data documentation system is connected to the image reconstruction system and is used to photograph the reconstructed CT image.

Acquisition system acquires the data. The data measurement system belongs to the rotating part of the gantry and contains all the elements to measure the attenuated radiation and to transfer this to image system for reconstruction and display of CT image. X ray system also belongs to the rotating part of gantry. The scanning system contains the function of gantry rotation, gantry tilt, to exchange data with X ray system and data measurement.

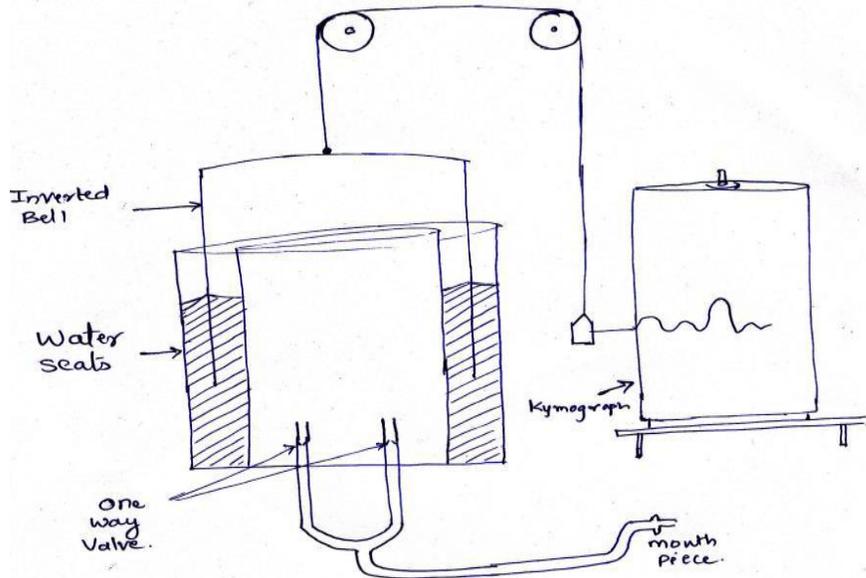
The patient handling system consists of patient table, motor for vertical and horizontal drive and system controller. The power distribution system provides power supply to all the various systems shown in figure.

04 marks for explanation

Q.6	Attempt any FOUR of the following		16
a)	Explain the construction of a micro electrode with a neat	04	

	diagram.		
Ans.	<p>Diagram:</p>  <p>Construction :</p> <p>Micro Electrode is used to measure bioelectric potentials near or within a single cell. In this a metal needle is prepared in such a way as to produce a very fine tip so as to penetrate a cell to read the bioelectric potential inside the cell. Metal microelectrodes are formed by the electrolytic etching of a thin fine tungsten or stainless steel wire. In addition to etching, the wire is coated with an insulating material except at the thin tip. The impedance of the electrode can be lowered by doing some electrolytic process on the tip, where the metal ion interface is taking place. Micropipette type is made up of glass. The tip is drawn to a desirable diameter about 1 micrometer. The metallic thin film coating is provided outside the thin tip. Resin insulation is provided above this thin film except at the tip.</p>	<p>02 marks for diagram</p> <p>02 marks for explanation</p>	
b)	What do you understand by micro shock and macro shock ?	04	
Ans.	<p>Microshock & Macroshock: Electrical accidents are caused by the interaction of electric current with the tissues of the body. For an accident to occur, current of sufficient magnitude must flow through the body in such a way that it impairs the functioning of vital organ. The physiological effects of the current depends not only on their magnitude but also on the current pathway through the body, which in turn depends on the location of the two contacts.</p> <p>Microshock: When an interaction of electric current takes place with human body or human body tissues in such a way that one contact is applied directly to the heart & other to body surface, the</p>	02 marks each	

	<p>effect of current applied to the heart is often referred to as microshock.</p> <p>Macroshock:</p> <p>When an interaction of electric current takes place with human body or human body tissues in such a way that current applied to the surface contacts, the effect of current applied to the heart is called as macroshock.</p>	<p>Diagram optional</p>	
<p>c)</p>	<p>Explain the working of spirometer with a neat diagram.</p>	<p>04</p>	
<p>Ans.</p>	<p style="text-align: center;">OR</p>	<p>02 marks for Diagram</p>	



(Note: Any other relevant diagram should be considered)

Working of Spirometer :

Figure shows the diagram for Spirometer. Spirometer is a device which is used to determine all lung volumes and capacities.

The standard Spirometer consists of a movable bell inverted over a chamber of water. Inside the bell is the gas that is to be breathed.

The bell is counterbalanced by a weight to maintain the gas inside the atmospheric pressure so that its height above the water is proportional to the amount of gas in the bell.

A breathing tube connects the mouth of the patient to the Spirometer. Thus as the patient breathe gas from the tube there are changes in internal volume of Spirometer which causes proportional displacement of bell downwards.

Similarly, as the patient breaths back into the tube, the bell moves up proportional to the change in internal volume.

The motion is recorded on a rotating drum i.e. kymograph through a pen that is attached to a counter balancing mechanism.

The change in bell pressure changes the volume inside the bell, which also causes the position of the counter weight to change. We may record the volume changes on the piece of graph paper by attaching a pen to the counter weight or a tension string.

Some spirometer also offers an electrical output that is the electrical analog of the respiration waveform. Most frequently the electrical output is generated by connecting the pen and weight assembly to a linear potential if precise and negative potentials are connected to

**02 marks
for
explanatio
n**



	<p>the end of the potentiometer, then the electrical signal will present the same data as the pen when no one is breathing in to the mouthpiece, E0 will be zero, but when the patient is breathing in to the tube, E0 will take the value proportional to the volume and a polarity that indicates in inspiration or expiration.</p> <p>Thus all lung volumes and capacities can be determined by measuring the amount of gas inspired or expired under a given set of condition or during a specified time interval can obtained by the use of spirometer.</p>		
d)	List the four heart sounds. How do they originate?	04	
Ans.	<p>i) 1st Heart sound(lub sound): caused due to closure of the Atrioventricular valves</p> <p>ii) 2nd Heart sound (dub sound) : caused due to the closing of the semilunar valves.</p> <p>iii) 3rd Heart sound: Occurs due to rush of blood from the atria into the ventricles, which causes turbulence & some vibrations of ventricular walls.</p> <p>iv) Atrial Heart sound: Occurs when the atria actually do contract, squeezing the remainder of the blood into the ventricles.</p> <p>v) Murmur: Abnormal heart sound due to improper opening of heart valves.</p> <p>The heart sounds are originating due to flow of blood through heart valves in heart chamber.</p>	02 marks for listing heart sound (Any four)	
e)	State the functions of : i) SA node ii) Hypothalamus iii) Nephron iv) Tricuspid valve	04	
Ans.	<p>i)SA node: It is natural pacemaker of human heart. It controls the heart rate by generating electrical impulses at regular interval and then sending electrical signals through the heart muscle, causing the heart to contract and pump blood throughout the body.</p> <p>ii)Hypothalamus</p> <p>The hypothalamus acts as the 'head ganglion' of the autonomic nervous system. The basic drives of life - hunger, thirst and sex, originate in the hypothalamus. The hypothalamus is central to the maintenance of homeostasis.</p> <p>The functions of the hypothalamus include:(1) controls the release</p>	01 mark	
		01 mark	



<p>of 8 major hormones by the hypophysis, and is involved in (2) temperature regulation, (3) control of food and water intake, (4) sexual behaviour and reproduction, (5) control of daily cycles in physiological state and behaviour, and (6) mediation of emotional responses.</p> <p>iii) Nephron: Its chief function is to regulate the concentration of water and soluble substances like sodium salts by filtering the blood, reabsorbing what is needed and excreting the rest as urine. It is smaller unit of kidney. They are available in millions number responsible for filtering.</p> <p>iv) Tricuspid valve: The function of the valve is to prevent back flow of blood from to right atrium to right ventricles.</p>	<p>01 mark</p> <p>01 mark</p>	
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