



Summer – 16 EXAMINATION

Subject Code:17672

Model Answer Page No: 1/25

Important Instructions to examiners:

- 1) The answers should be examined by key words 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.



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Model AnswerPage

No: 02/ 25

Q. 1 (A) Attempt any THREE of following.

12

a)List the 4 types of leads used in pacemaker and explain any 2 of them

4

Ans : list 2m + explain any 2 for 2m

Endocardial

Myocardial

Unipolar and

bipolar leads.

Endocardial :This is connected to inner side of heart chamber and used in external pacemaker.. The endocardial lead is inserted into the inside of the heart via a vein, usually in the chest area. Example : Porous tip electrode

Myocardial :This is connected to outer wall of heart muscle and used in internal pacemaker. This type of lead is most often used when other cardiac surgery is being performed and there is already access to the heart. Example: Steroid eluting electrode.

Unipolar and bipolar leads :

In unipolar system one electrode in inside or on the heart & is the stimulating electrode ,& the second electrode is usually a large metal plate attached to the pulse generator. The current in this case flows between the pacing electrode in the heart & the indifferent electrode via the body tissue.

Bipolar leads which have two electrodes positioned in the heart are designed with a coaxial connector requiring only a single receptacle resulting in improvement in the size of bipolar pacemaker connector. In the bipolar electrode system both electrodes are approximately of the same size and both are placed inside or on the heart so that current flows between the two electrodes.

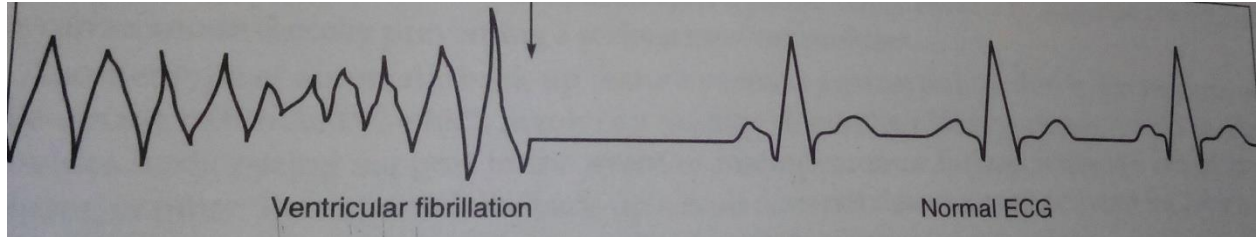
b) State the meaning of fibrillation of heart and State the need of defibrillator. (2+2)

Ans. **Fibrillation of the heart:**

Ventricular fibrillation is a serious cardiac emergency resulting from asynchronous contraction of the heart muscles. This uncoordinated movement of the ventricle walls of the heart may result from coronary occlusion, from electric shock or from abnormalities of body chemistry. Because of this irregular contraction of muscle fibres, the ventricles simply quiver rather than pumping the blood effectively. This results in a steep fall of cardiac output and can prove fatal if adequate steps are not taken promptly.



In fibrillation, the main problem is that the heart muscle fibres are continuously stimulated by adjacent cells so that there is no synchronized succession of events that follow the heart action. Consequently, control over the normal sequence of cell action cannot be captured by ordinary stimuli.



Need of defibrillator:

Ventricular fibrillation can be converted into a more efficient rhythm by applying a high energy shock to the heart. This sudden surge across the heart causes all muscle fibres to contract simultaneously. Possibly, the fibres may then respond to normal physiological pacemaking pulses. The instrument for administering the shock is called a defibrillator.

The shock can be delivered to the heart by means of electrodes placed on the chest patient (external defibrillator) or the electrodes may be held directly against the heart when the chest is open (internal defibrillator). Higher voltages are required for external defibrillation than for internal defibrillation.

c) Identify the figure . Name the blocks A and B and state the functions of block A and B 4

(Refer the diagram from question paper)

Ans: Name of figure: Functional blocks of positive pressure ventilator 2

Block A: Inspiratory flow delivery system: During inspiration this system creates a positive pressure in the tubes connected to the patient airway called patient circuit and the exhalation control system closes a valve at the outlet of the tubing to the atmosphere 1

Block B: Exhalation control system: When ventilator switches to exhalation the inspiratory flow delivery system stops the positive pressure and the exhalation system opens the valve to allow the patients exhaled breath to flow to the atmosphere 1



d) Draw and explain the block diagram of the central monitoring system

4

Ans: Draw 2M+ explain 2M

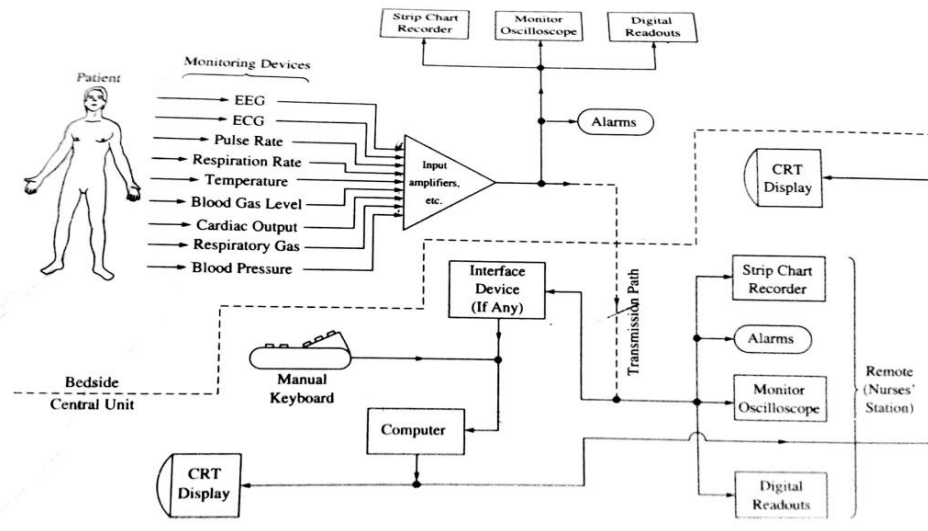


Fig : Block diagram of central monitor.

Central monitoring is the process of acquiring & recording the physiological parameter of different patients simultaneously on a single monitor at central station. In ICU the no. of critical patient is always high monitoring the physiological parameter for each patient is done by using bedside monitor but in some cases to reduce the manpower require delivering care.

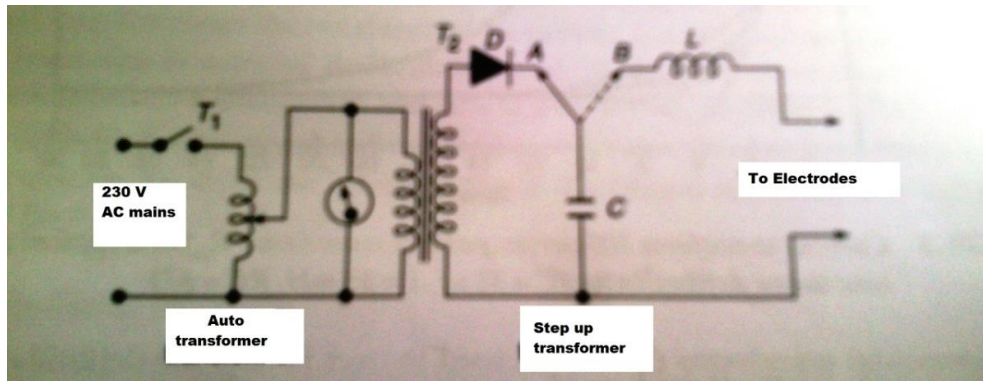
b) Attempt any ONE of following.

6

a) Draw a circuit diagram of charging and discharging section of DC defibrillator and explain both the sections 6

Ans:- charging 3m+discharging 3m with diagrams

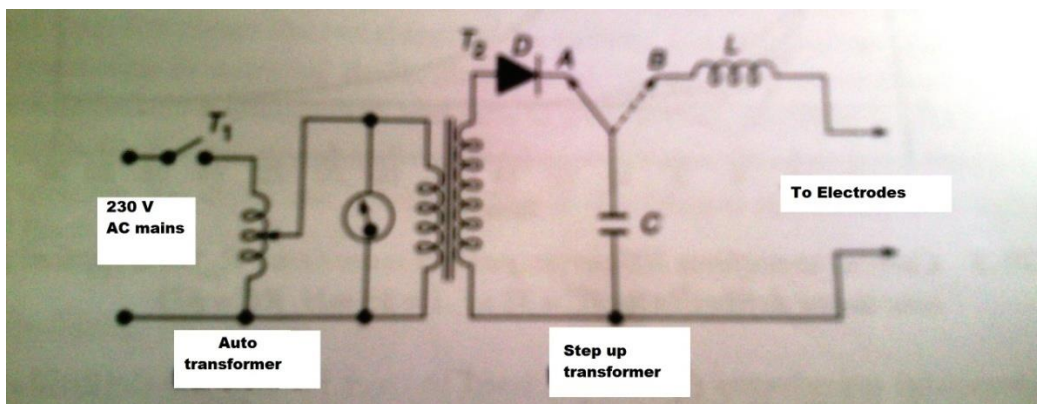
Charging circuit



Charging circuit

DC defibrillation is most successful method in correcting ventricular as well as atrial fibrillation and other type of arrhythmia. The basic circuit diagram of DC defibrillator is shown in figure. A variable auto transformer T_1 forms the primary of a high voltage transformer T_2 . The output of the transformer is rectified by a diode rectifier and is connected to vacuum type high voltage change over switch. In position A, a switch is connected to one end of an oil filled $16\mu\text{F}$ capacitor charges to a voltage set by the positioning of the autotransformer. When a shock is to be delivered to the patient a foot switch or a push button mounted on the handle of the electrode is operated. The high voltage switch changes over to position B, and a capacitor is discharge across the electrode.

Discharging circuit



Discharging circuit

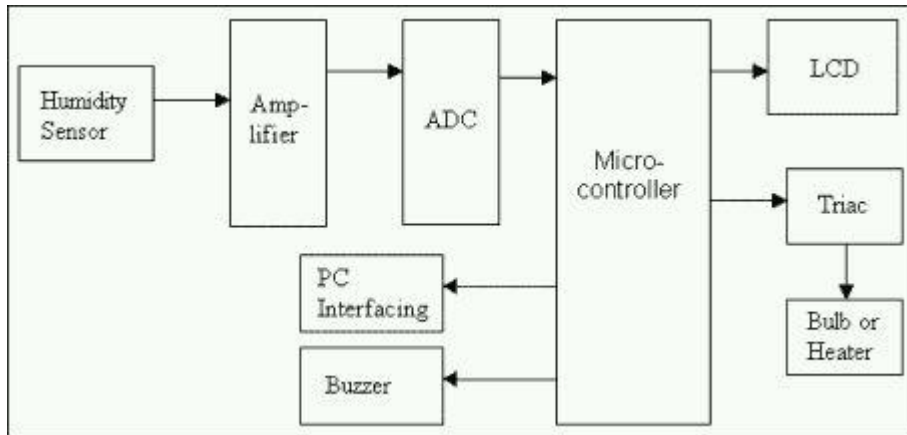
Discharging circuit-When a shock is to be delivered to the patient a foot switch or a push button mounted on the handle of the electrode is operated. The high voltage switch changes over to position B, and a capacitor is discharge across the electrode.



b) Name the apparatus used to maintain environmental conditions suitable for a newborn baby. Draw block diagram for the apparatus and explain the principle of operation for it 6

Ans: Name 2m+draw2M+explain2m

Name of apparatus: Baby incubator



OR Any other relevant diagram

Working principle:-

Basically in baby incubator the body temperature of the premature and new born babies is maintained at a particular level. This temperature is controlled for the predefined time. The machine is provided with the alarm facility. When the temperature increases above predefined level alarms and visual indications are triggered.

To control the temperature heater are used with along with the temperature sensing and controlling mechanism. The machine also provides gas supply to the babies which are unable to breath. For this purpose the centralized O2 supply or O2 gas cylinders are used.

Q. 2) Attempt any FOUR

16

a) Differentiate between on demand and fixed rate pacemaker any two points of each 4

Ans:- any two points of each for 4 m

Fixed Mode	Demand Mode
1) Pacing is competitive	1) Pacing is non competitive
2) It functions regardless of patients natural heart rhythm	2) It considers patients heart rhythm



3) It is asynchronous mode	3) It is synchronous mode
4) Number of pulses per minute are fixed	4) Number of pulses per minute are not fixed

b) Draw block diagram of Heart Lung machine and explain why heart lung machine is called a bypass machine 4

Ans : block dia 2 marks explanation 2 marks

Heart lung machine: Heart lung machine is used to partially or completely replace the functions of heart and the lungs. This machine is used to provide the oxygenated blood to the whole body and also to the heart. Heart lung machine works on the same principle of supplying the blood to the body and heart as in systemic and pulmonary circulation takes place.

It is mainly used in case of the open heart surgery where the heart is exposed.

It is used in bypass surgery where we need to replace the function of the heart while it is being operated.

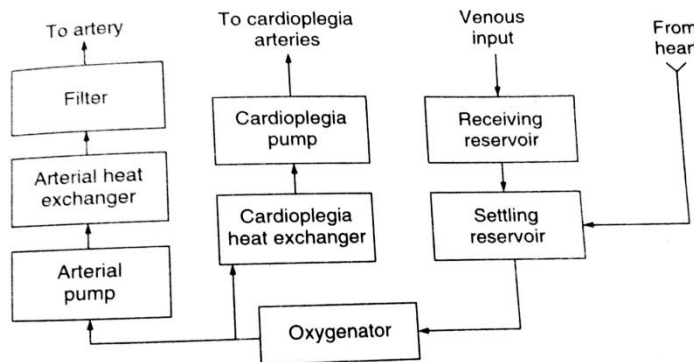


Figure 10.28 Heart lung machine (cardiopulmonary bypass).

OR any relevant diagram

During open heart surgery for installation of a valve prosthesis or correction of a congenital malformation the heart can not maintain the circulation. It is then necessary to provide extra- corporeal circulation with a special machine called heart lung machine..

Usually two cannulas are inserted in to the right side of the heart to collect the returning venous blood as shown in fig.Using heart lung machine extracorporeal circulation can be possible and in which the lungs and heart are replaced by the **OXIGENERATOR** and **BLOOD PUMP** respectively.

The collected venous blood is directed in to a receiving reservoir of heart lung machine by gravity drainage.

The accumulated blood in the operating field is also collected and passed in to the receiving reservoir by suction devices. From here the blood is passed in to the setting reservoir or dabbling chamber and then it is passed in to oxygenator. In the oxygenator the blood is exposed to an atmosphere rich in oxygen.

From oxygenator a pump raises the pressure of the blood to the mean arterial pressure from which it flows in to an arterial heat exchanger. arterial heat exchanger. Is necessary during hypothermic or low temperature operation which is followed for two reasons the first is to reduce body metabolism and therefore to reduce



oxygen consumption during the operation. And secondly the brain damage due to oxygen starvation is reduced.

In the heat exchanger the blood is maintained at the human body temperature.

From the heat exchanger the blood passes through a filter to prevent the possibility of partials or bubbles returning to the body.

Systematic circulation is maintained by returning the this arterial oxygenated blood to a major artery.

c) Define **troubleshooting** and **State the troubleshooting steps carried out for ventilator.** 4

Ans : define 1m+any 3 points for 3marks

Definition: Troubleshooting is a form of problem solving, often applied to repair failed products or processes. It is a logical, systematic search for the source of a problem in order to solve it, and make the product or process operational again.

- 1) Check shutter & filter calibration.
- 2) Check battery & maintain cover.
- 3) Update software periodically.
- 4) Check TV camera connections.

d) State the purpose of bedside monitoring and central monitoring system

4

Ans: each for 2m

Bed side monitoring:

Bed side monitoring system used for measuring the values of patients important physiological parameters continuously or automatically. The objectives of this system is have quantitative assessment of the important physiological variables of the patients during critical periods of their biological functions.

Need:

- 1) When critically ill patients recovering from surgery or serious illness are often placed in intensive care units at that time there imp physiological parameters are monitored by bed side monitoring system.
- 2) During lengthy operative procedures to maintain intimate contact with the patients vital signs.
- 3) When patient is connected to life support apparatus.
- 4) During surgical operation the patient is deprived of several natural reaction mechanisms which normally restore abnormalities in his physical condition in this case indications or alarms that can not be given by the patient himself can be presented by bed side monitoring equipment.

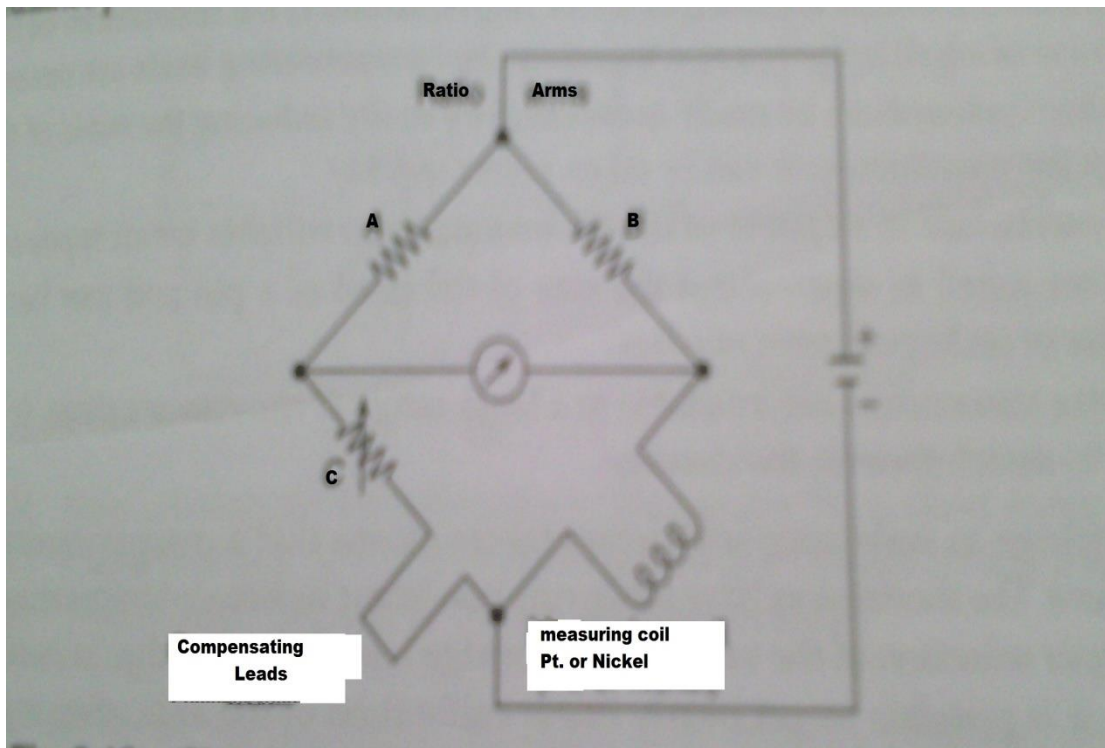


central monitor:

Central monitoring is the process of acquiring & recording the physiological parameter of different patients simultaneously on a single monitor at central station. In ICU the no. of critical patient is always high monitoring the physiological parameter for each patient is done by using bedside monitor but in some cases to reduce the manpower require delivering care.

e) Draw circuit diagram of temperature controlled system used in baby incubator. 4

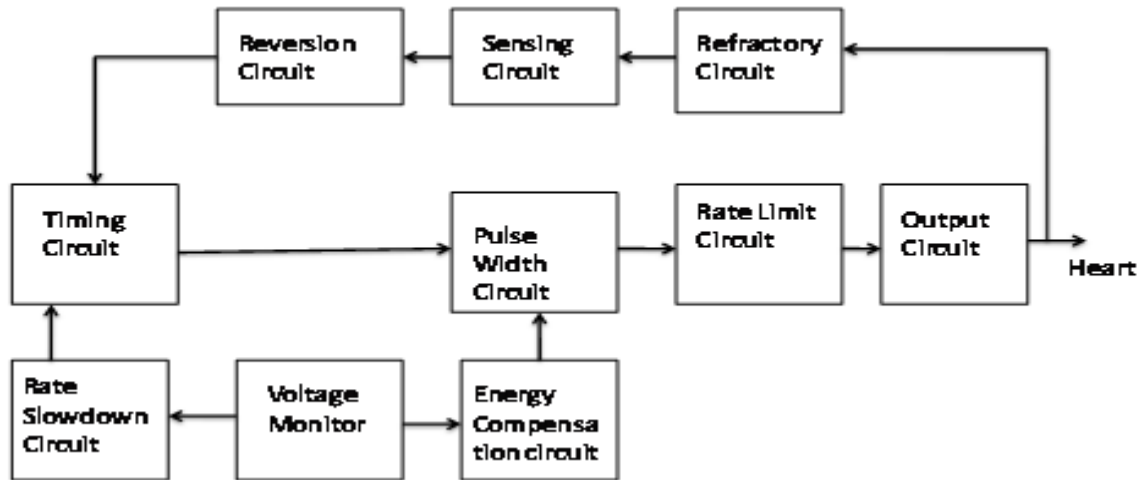
Ans:



Or Any other relevant diagram

f) Draw the block diagram of internal pacemaker and state the meaning of asynchronous and synchronous pacemaker 4

Ans BD2m+sync1m+async1m



: -Block diagram showing components of fixed implantable pacemaker.

OR any other relevant diagram

ASynchronous pacemaker: It is one that is free running Its electric stimulus appears at a uniform rate regardless of what is going on in the heart or rest of the body It gives a fixed heart rate

Synchronous pacemaker: There are two general forms of synchronous pacemaker: the demand pacemaker and the atrial synchronous pacemaker

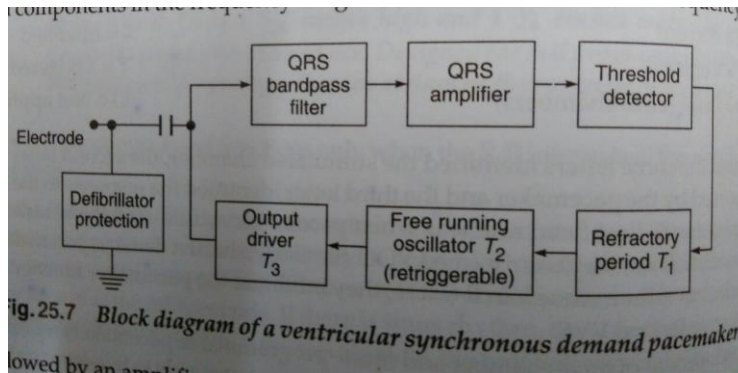
Q.3) Attempt any FOUR of the following.

(16)

a) Draw and explain ventricular synchronous demand pacemaker

4

Ans: draw 2m+explain 2m



The pulse generator has two functions pacing and sensing. Sensing is accomplished by picking up the ECG signal. In the case of dual chamber pacing the p wave is also sensed. Once the ECG signal enters the sensing circuit it is passed through a QRS bandpass filter. This filter is designed to pass signal component in the frequency range of 5-100Hz with a centre frequency of 30 Hz. This is followed by an amplifier and threshold detector which is designed to operate with a detection sensitivity of 1-2mv.

b) Calculate the energy stored in a $16 \mu\text{F}$ capacitor that is charged to a potential of 5000V dc. 4

Ans:

$$E = \frac{1}{2} C V^2$$

$$C = 16 \mu\text{F} \quad V = 5000\text{V}$$

$$E = 200\text{J}$$

c) State the concept of respiration and apnea 4

Ans: **respiration 2 marks apnoea 2 marks**

Respiration – Respirator is device which helps in the respiration. To initiate the procedure of respiration certain amount of force is required by the body to move the chest upward and in front during inspiration while backward and downward during expiration. This creates the partial pressure difference between the atmosphere and the body which helps the air to go in and out, thus carried respiration. In some cases when patient fails to initiate this process, or unable to perform its own respiration, respirator is used which triggers and/or helps in complete respiratory cycle of the patient.

Apnea – Apnea is the cessation of breathing which may precede the arrest of the heart and circulation in several clinical situations such as head injury, drug over dose, anesthetic complication and obstructive respiratory diseases.



d) classify the below given equipments into either ICU or OT equipment: 4

Ans each for 1 m

- a) Anesthesia equipment OT
- b) Heart lung Machine ICU
- c) Pacemaker ICU
- d) Defibrillator machine ICU/OT

e) Draw and explain any two types of dialyzers 4

Ans any 2 for 2m each

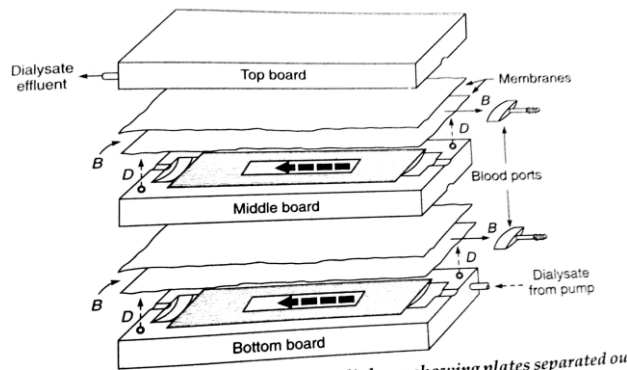
Types of dialyzers 1) Parallel Flow Dialyzers

2) Coil Dialyzers

3) Hollow Fiber Hemodialyzer.

1) Parallel Flow Dialyzers : The parallel flow dialyzer has a low internal resistance which allows adequate blood flow through the dialyzer with the patient's arterial blood pressure, eliminating the need for a blood pump. The dialyzing surface area of a parallel flow dialyzer is about 1 sq. m. At a blood flow rate of 200 ml/min and a dialysate flow of 500 ml/min.

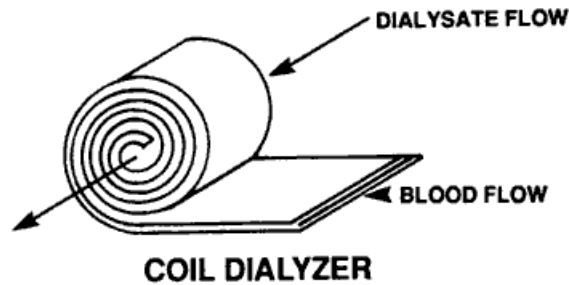
The KILL dialyzer has earlier been the most commonly used form of parallel flow dialyzer. As shown in fig. It consist of three polypropylene boards with dialyzing membrane lead between them. The boards are held firmly with a frame on the top and bottom and are fastened by a series of bolts on the side. The rubber gasket runs along the periphery of the boards inner surface to prevent blood and dialysate leakage. The dialysate enters through a stainless still port and is distributed to grooves running across the end of board both above and below the membrane of each layer.



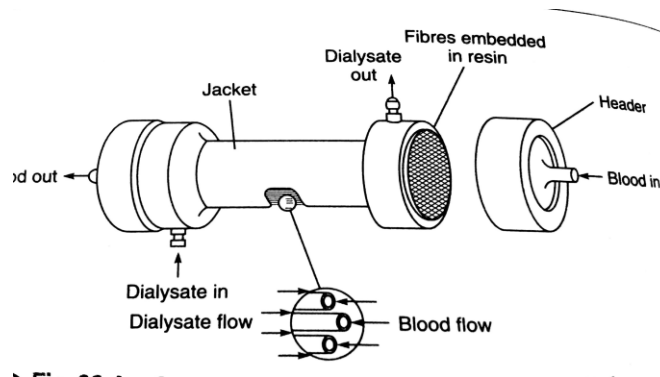
The KILL dialyzer is not disposable.



2) Coil Hemodialyzer: A coil hemodialyzer comprises a tubular membrane placed between flexible support wrapped around a rigid cylindrical core. The coil is immersed in a dialyzing bath. The tubular membrane can be of cellulose. The average wall thickness is 20 to 30 micrometer. The coil membrane supports are woven screens or unwoven iatic, Usually the twin coil is made with three layers of woven polyvinyl chloride coated fiber glass screen separated by four narrow strips of the same material which are sewn in to place with cotton threads.



3) Hollow Fiber Hemodialyzer: The Hollow Fiber Hemodialyzer is the most commonly used hemodialyzer. It consists of about 10000 hollow de- acetylated cellulose diacetate capillaries. The capillaries are jacketed in a plastic cylinder 18 cm in length and 7 cm in diameter. The capillaries are sealed on each end in to a tube sheet with an elastomer. The capillaries range from 200-300 mm internal diameter and a wall thickness of 25-30 micro meter. The dialyzing area is approximately 9000 cm square unit. The primary volume with blood manifolds exclusive of tubing is approximately 130 ml. The blood is introduced and removed from hemodialyzer through manifold headers. The dialysate is drawn through the jacket under a negative pressure around the outside of the capillaries counter-current to the blood flow, the dialyzer is disposable.



Q.4 A Attempt any Three of the following:

12

(a) Differentiate between internal and external pacemaker (any 2 points of each).

4



Answer: any 2 points of each

Internal pacemaker	External pacemaker
1. Internal pacemakers are used in long-term pacing cases.	External pacemakers used in short time pacing cases.
2. These types of pacemakers are used when there is permanent damage to the heart.	These types of pacemakers are used when the heart block presents as an emergency.
3. Internal pacemakers are implanted beneath the skin along with its electros.	External pacemaker is applied externally on the surface of body by using metal electrodes.
4. Internal pacemakers are small in size.	External pacemakers are large in size.

b) State the different modes of ventilator 4

Ans:

Modes of ventilator.(any 2 modes 2 marks each)

i) Controller:

A ventilator which operates independent of the patient's inspiratory effort. The inspiration is initiated by a mechanism which is controlled with respect to time, pressure or another similar factor. Controlled ventilation is required for patients who are unable to breathe on their own.

ii) Assistor:

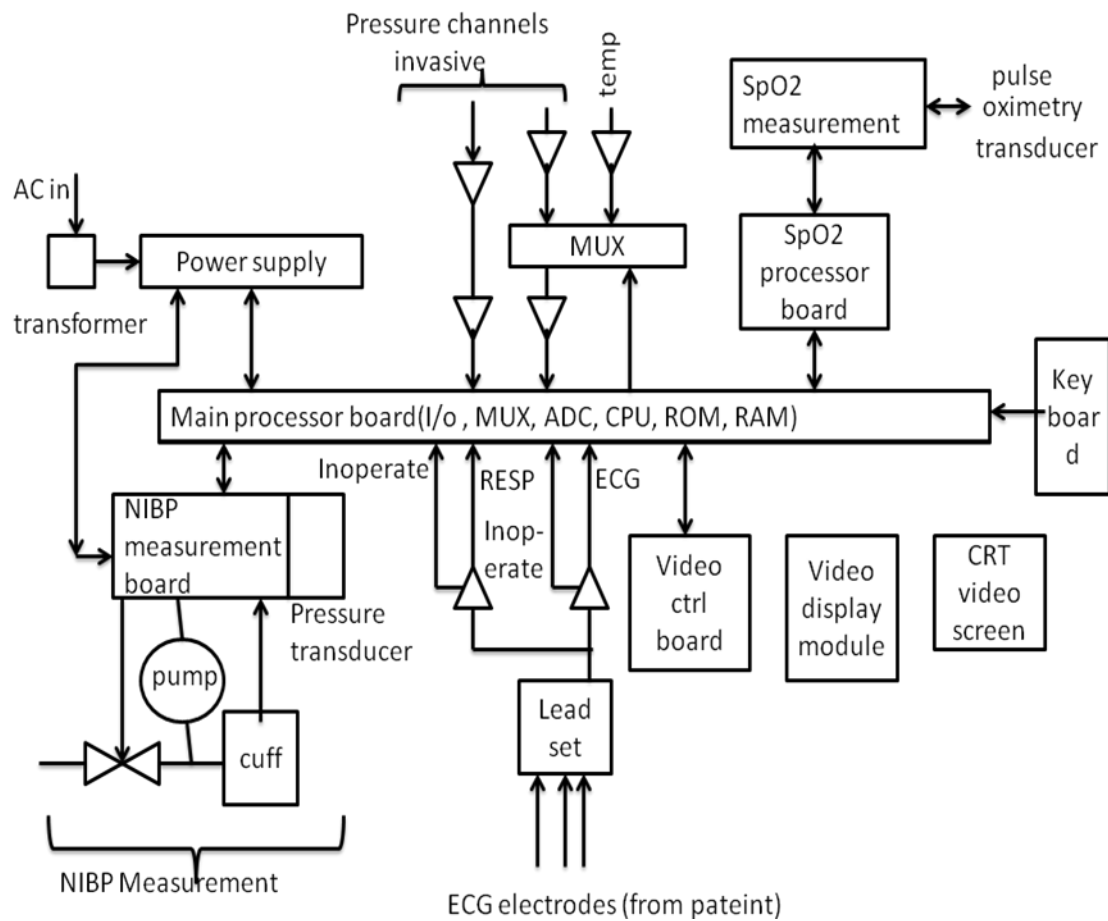
A ventilator which augments the inspiration of the patient's inspiratory effort. A pressure sensor detects the slight negative pressure that occurs each time the patient attempts to inhale and triggers the process of inflating the lungs. Thus the ventilator helps the patient to inspire when needed. A sensitivity adjustment provided on the equipment helps to select the amount of effort required on the patient's part to trigger the inspiration process. The assist mode is required for those patients who are able to breathe but are unable to inhale a sufficient amount of air or for whom breathing requires a great deal of effort.

iii) Assistor\Controller:

A ventilator which combines both the controller and assistor functions. In these devices, if the patient fails to breathe within a pre-determined time, a timer automatically triggers inspiration process to inflate the lungs. Therefore, the breathing is controlled by the patient as long as it is possible, but in case the patient should fail to do so, the machine is able to take over the function. Such devices are most frequently used in critical care units.

c) Draw a block diagram of bedside monitor and explain it. 4

Ans bd 2m+explain2m



2 marks

Fig : Block diagram of bedside monitor

Bed side monitoring system used for measuring the values of patients important physiological parameters continuously or automatically. The objectives of this system is have quantitative assessment of the important physiological variables of the patients during critical periods of their biological functions.

Need:

- 1) When critically ill patients recovering from surgery or serious illness are often placed in intensive care units at that time there imp physiological parameters are monitored by bed side monitoring system.
- 2) During lengthy operative procedures to maintain intimate contact with the patients vital signs.
- 3) When patient is connected to life support apparatus.
- 4) During surgical operation the patient is deprived of several natural reaction mechanisms which normally restore abnormalities in his physical condition in this case indications or alarms that can not be given by the patient himself can be presented by bed side monitoring equipment.

-Easy to review the necessary information :



Various parameter modules and units, from basic parameters to multi-gas and Flow/Paw. Also you can review the data from external units on the same screen. Dual displays provide different sets of information for the surgeon and anesthesiologist.

- High performance for intensive monitoring and easy operation for medical care staff :

Enhanced ECG monitoring and variety of review displays for intensive care. Flexible components and easy operation by touch screen, mouse, keyboard and remote controller.

- User Friendly Interface : You can operate the monitor by touch screen, keyboard, mouse or remote controller.

d) State the concept of suction apparatus and anesthesia machine 4

Ans 2 marks each

(i) Suction apparatus : The main function of this device to remove liquids and gases (such as vomiting, saliva) from mouth and respiratory tract, and also during surgeries to remove fluid from operated area.

(ii) Anaesthesia machine : A surgical method of treatment consists mainly of operations which are normally carried out under some form of anesthesia.

So anesthesia ensures that the patient does not feel pain and minimizes patient discomfort. It provides the surgeon with favorable conditions for the work.

(B) Attempt any ONE 06

a) The defibrillator machine has following problems displayed on its monitor screen Identify the cause and solution for it 6

Ans: 2 marks each

1) **No paddles:** To get good defibrillation paddles should be clean. So that if it is dirty cleans them with spirit.

If Hand switch not working properly it is Faulty hand switch. Check and replace the switch.

Use foot switch

2) **Leads off:** Shock is not properly delivered as per ECG. ECG detector will faulty.

Check and replace the detector.

3) **Low Battery:** The wearing element that would yield low energy output is the battery pack. The battery voltage should be tested under loaded conditions. In accordance with manufacturer



specification it should be periodically fully discharged. After recharging the battery will be capable of delivering its rated energy.

Also refer:

Sr. No.	Fault	Causes	Solution
1.	Not getting proper charge at the output	Capacitor not charging. Output of step up transformer not proper.	Check and replace the capacitor. Check and replace the step up transformer.
2.	Shock is not properly delivered as per ECG	ECG detector will faulty. Synch. Program is not proper.	Check and replace the detector. Check and correct the program.
3.	Hand switch not working properly	Faulty hand switch.	Check and replace the switch. Use foot switch
4.	Doctor is also getting shock	Improper isolation of electrodes.	Use properly isolated electrodes.

Maintenance procedure for defibrillator:

1. To get good defibrillation paddles should be clean. So that if it is dirty cleans them with sprit.
2. Check the insulation of coil chord, mains cable.
3. Check the battery.
4. Check the fuses and consumable.
5. Check the switches such as joules, charge, discharge, synchronisation

b) State the need of artificial kidney and draw the block diagram of hemodialysis machine 6

Ans: need 2m+BD4m

Need of artificial kidney:

Haemodialysis machine is used to purify the blood in case if kidney is partially or completely not working. Proportionating pump prepare the dialysate solution by using dry chemicals and water with the ratio of 1:35 respectively. The Haemodilysis procedure is done at the room temperature. The heater is used to maintain the temperature of the dialysate. The rate of filtration depends upon the concentration in the dialysate. To measure the concentration in the dialysate a conductivity cell is placed at the path of the dialysate before it reaches to the dialyzer. Dialyzer is an artificial kidney. It is actual site where the filtration takes place. Depending upon the construction of the dialyzer the blood and dialyzer are made to come in contact to each

other through a semipermeable membrane. The impurities in the blood are sucked out through this semipermeable membrane into the dialysate. During the process of dialysis two more detectors are used.

- 1) Blood leak detector: it is used to detect if there are any leakage in the blood tubing or blood path. If detected any leakage then the blood is bypassed to the body.
- 2) Air Bubble Detector: during the whole procedure if some air bubble found in the blood tubing it must be removed before it reaches to heart. Because air bubble in the blood circulation can cause serious problems. This detector uses photoelectric method. If some air found in the path the blood is bypassed to the body.

Heparin is added to the blood to avoid the blood clotting.

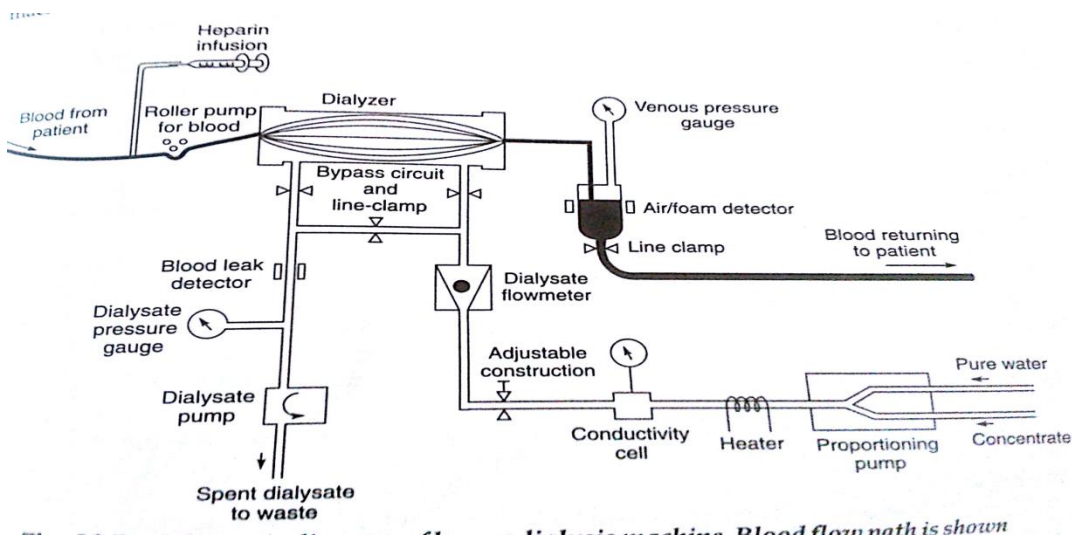


Fig : Block diagram of haemodialyzer machine.

Q5. Attempt any FOUR:

16

a) Name the figure B Identify the missing block A and B. Give the importance of block A and B 4

Ans: fig name 2m+block A 1m+block B 1m

Refer diagram

Name: Functional block diagram of programming interface

A= External programmer: The external unit which generates programmed stimuli which is transferred to an internal unit by one of the several communication technique

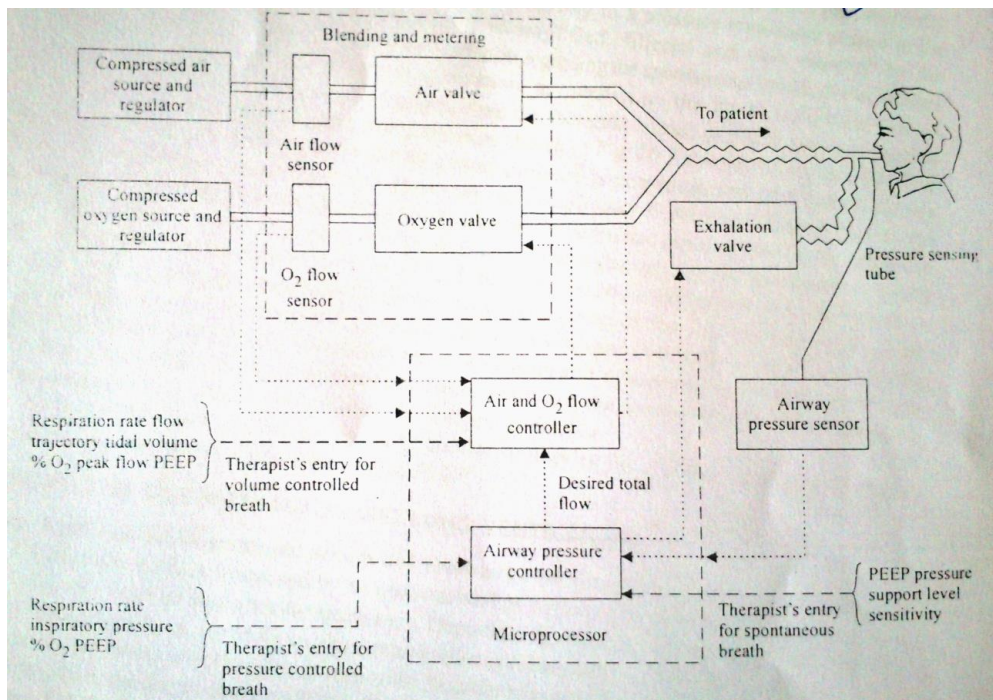
B= Rate and width adjustable pulse generator

An electromagnet placed on the surface of the body establishes a magnetic field which operates pacemakers reed switch. The signal is received by a suitable receiver in the pacemaker which carries out the desired function.

b) Draw and explain block diagram of microprocessor based ventilator

4

ans: draw2m+explain2m



The pneumatic flow system enables the flow of gas through the ventilator. Oxygen and medical grade air enter in ventilator. These gases enter air oxygen mixer where they combine the required percentage

As gases leave ventilator they pass by an oxygen analyser. The electronic controlsystem use one or more microprocessor and software to perform monitoring and control functions in a ventilator.

c) State the importance of Infusion pump

4

Ans : 4m

Infusion pump:



In many medical applications intra-venous (IV) fluids & drugs need to be infused over a period of time which could be several minutes, hours, & days. The most common method of doing this is by manual injection of bolus doses using syringes by manually setting the drip rate of gravity feed intra-venous infusion sets. The volumetric infusion pump is generally used to deliver larger volumes of fluid from a bag or bottle. This pump technology evolved from the desire to improve on the flow rate control provided by the simple mechanical roller clamp. The first improvement was the electronic drop counter that could quickly determine the drip rate of IV delivery. Soon there after came a device which could control the drop rate automatically. Control of secondary medications, variable delivery patterns, dose rate calculations & even in-line mixing of medications are other refinements resulting from the changing requirements of new drug therapies.

d) List the technical specifications of DC defibrillator (any 4).
(1 mark for each point)

Answer:

1. Battery: 9VDC, 4.2 Ah
2. Energy o/p: For adults 150J * 50 Ω load & For children 50J * 50 Ω load
3. Shock to Shock cycle time: typically < 20 sec
4. Capacity: min 200 Shocks or 4 hours of operating time

e) List the possible faults of hemodialysis machine and give their possible solution 4

Ans: any 2 faults and solutions for 2 marks each

The main faults in dialysis machines can be classified into two main parts: Mechanical faults.

Electrical faults.

Mechanical faults can be divided into three common types: Conductivity faults.

Pressure faults. Pumps faults.

The electrical faults on the other hand can be divided into two common types:

Power faults.

Transducers and sensors faults

Some causes of conductivity faults are: Machine pumps malfunction which is due to long period of operation i.e. the preparation of the dialysis solution takes about four hours per session. Bad solution and this can be caused by the improper acid concentration.

Pressure Faults

Common causes are: Filters and valves; sometimes the filters are stuck by wastes and valves failure can be due to high electric current. • Leakage; this is due to overheat which causes pressure fault. Pumps when the pressure of pumps is not calibrated pressure fault



can occur. Pressure transducers if are not calibrated or the calibration is not proper, pressure fault occurs.

Pumps Faults

Pumps faults causes can be classified into: Brush defect due to longer brush operation. Gear erosion; this can happen because of longer brush operation. Pumps stuck as a result of bad solution or no proper disinfection of machine after dialysis sessions.

Power Faults

Causes of power faults can be: High current which is common fault in power and it is due to instability of the electric current from the main electricity supply. High temperature; that is when the word temperature is above 29°C a power fault may occur. Fluid spills in the machine which could make a short circuit and a power fault occur.

Transducers and Sensor Faults

Causes could be: Software defects caused by: Mobile telephone electromagnetic waves. The installed software is not matched with the machine. Hardness due to the improper filtration of dialysis water. Calibration; when transducer is not calibrated or the calibration is not proper fault occurs.

Generally the faults can be overcome by considering the following:

The dialysis room's temperature must not exceed 27°C.

The inside and outside of the machine must be cleaned and sterilized perfectly and periodically.

Disposable parts of machine have to be changed after each 5000 hours of work.

Dialysis machines have to be exposed to calibration processes to check their efficiency.

Only original patient sets recommended to each machine have to be used i.e. universal patient sets must not be used.

The operators must be aware of how to deal with the machine and the outcomes of using the machine in careless way.



f) Write any 4 technical specifications of ventilator 4

Ans: Any 4 for 4 m (Or consider any other relevant specifications)

Power Source: - 220/230 V Ac 50 Hz supply.

Ventilation parameters: - 1. Tidal volume - 200 – 2000 ML (Adult patient). a. 50 to 300 ML (Paediatric PC mode).

2. Respiratory rate - 5 – 100 BPH.

3. Pressure - 0 – 100 cm H₂O.

4. Inspiratory Peak Flow - 4 – 100 l/min.

5. Minute volume - 1 – 30 l/min.

6. Oxygen Concentration - 21 – 100 %

7. Inspiratory pause - 0.1 – 5.5 sec.

8. PEEP/CPAP - 30 cm H₂O.

Ventilation modes 1. Paediatric mode.

2. Controlled mode.

3. Asst. Controlled mode.

4. Pressure Controlled Ventilation.

5. SIMV/V and SIMV/P.

6. Bipressure Ventilation.

7. CPAP and PEEP.

8. Facility for Non-Invasive ventilation

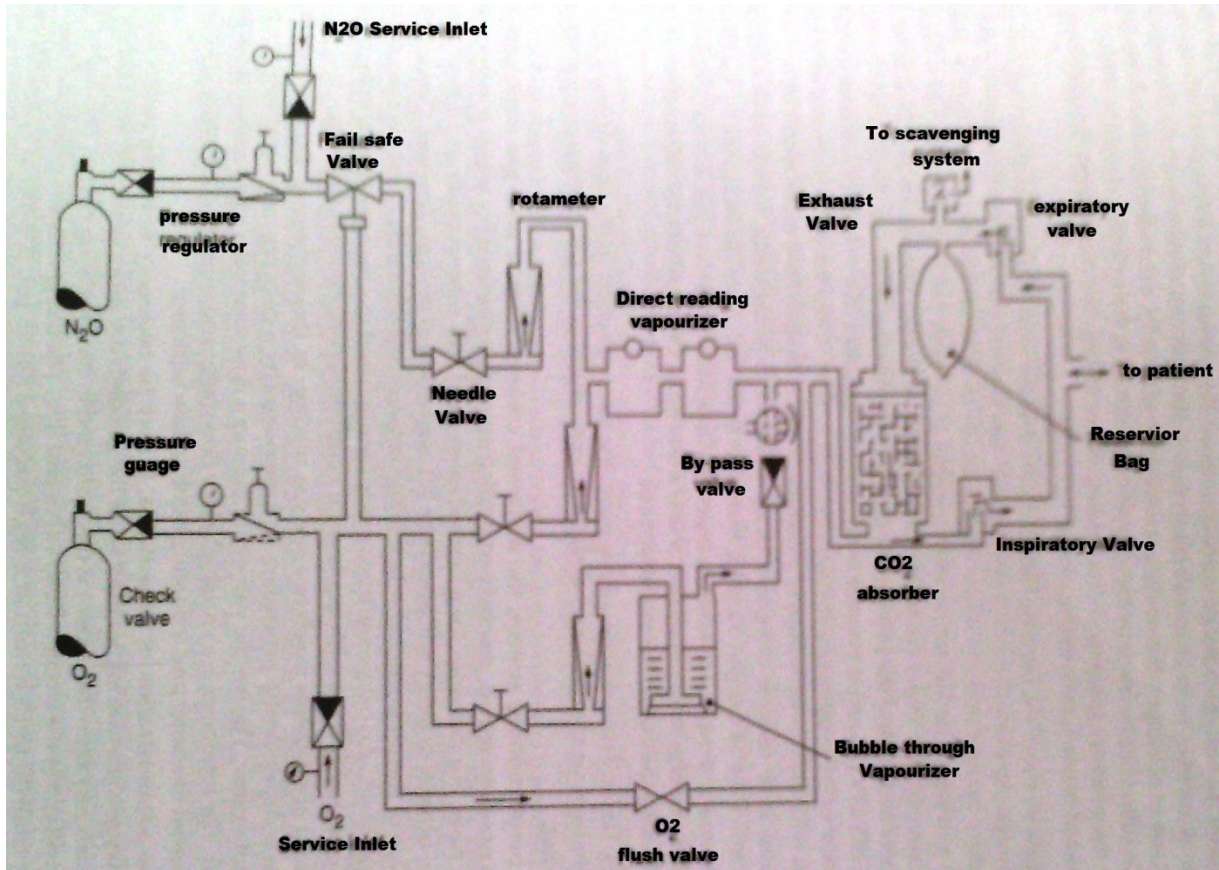
Q6. Attempt any FOUR:

16

a) State the significance of Boils apparatus in OT and draw the block diagram of it

4

Ans: draw 2m+significance2m



Working of anesthesia machine:

Gas supply system: gases are provided to the anesthesia machine either by a pressurized hospital central supply or by using the gas cylinders attached to the machines through pressure regulators.

Fail safe system: from the supply the gas flows in to the inlet of anesthesia machine and is directed to fail safe system. This system will not allow to flow nitrous oxide unless oxygen is not present.

Gas delivery units: from the fail safe unit the gas is directed to flow delivery unit.

Vapor delivery: various gases that possess anesthetic properties are too strong to be used as pure vapors. They are thus diluted in the carrier gas such as air or oxygen.

Anesthesia delivery system consists of a patient breathing ckt, a ventilator and airway equipment. It comprises of a gas supply, delivery unit and anesthetic vaporizer.

Breathing ckt consists of a closed loop of breathing tubing containing two unidirectional breathing valves and an adjustable pressure limiting valve, a ventilator is used for positive pressure ventilation.

Airway management equipment includes masks and endotracheal tubes for the suitable delivery of the anesthetic gases to the patient.

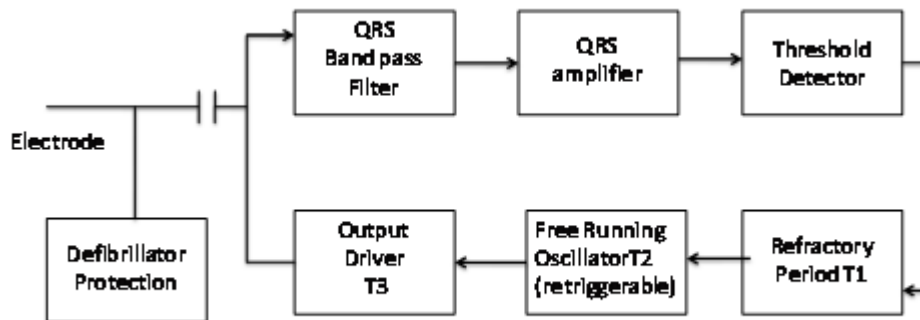


Function of patient breathing system is to deliver anesthetic & respiratory gases to the patient

b) A patient requires pacemaker for specific time while operating him. Suggest the type of pacemaker required for patient and draw block diagram of pacemaker 4

Ans Suggest 2m+ bd 2m

Demand type pacemakers (Also refer any other relevant type and diagram for same application)



Block diagram of external pacemaker (on demand)

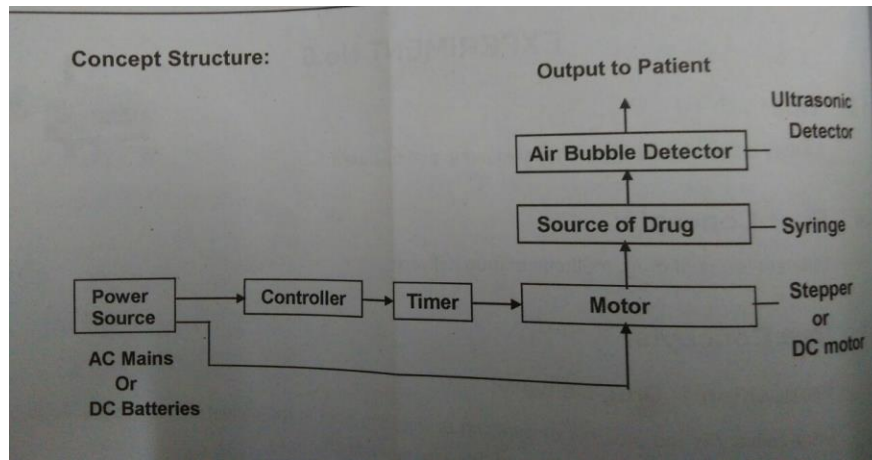
(c) List down any four technical specifications of the baby incubator machine. 4

Ans : any 4 for 4 marks (or any other relevant specifications)

- 1) Recommended environment for operation $24^{\circ}\text{C} - 30^{\circ}\text{C}$
- 2) Baby bed size 550×390 mm
- 3) Heater wattage 250 watts
- 4) Electrical 230v AC 50 Hz
- 5) Weight 45 kgs Approx

(d) Draw the block diagram of drug delivery system and explain it 4

Ans draw 2m+explain2m



Drug delivery is the process of applying or injecting drug into patients body in solid liquid or gas form

It is the combination of mechanical and electronic system

The system provides control over rate drug delivery

Indications – audible,lights

e) List any four technical specifications of Pacemaker. 4

Ans : any 4 points for 4 marks

- 1) Output voltage 0-15v
- 2) Output current 1-12 mA
- 3) Maximum sensitivity 1.5 mv
- 4) Battery material lithium
- 5) Pulse width 2-3ms