Summer– 15 EXAMINATION

Subject Code: **17672** **Model Answer** Page No: 01/20

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.

Q. 1 (A) Attempt any THREE. (12)

a) Define following terms: (One mark for each definition) (04 marks)

1) Cardiac Arrhythmia

2) Tachycardia

3) Bradycardia

4) Heart block

Ans: 1) **Cardiac Arrhythmia** : Any change in normal sinus rhythm is called an Cardiac Arrhythmia

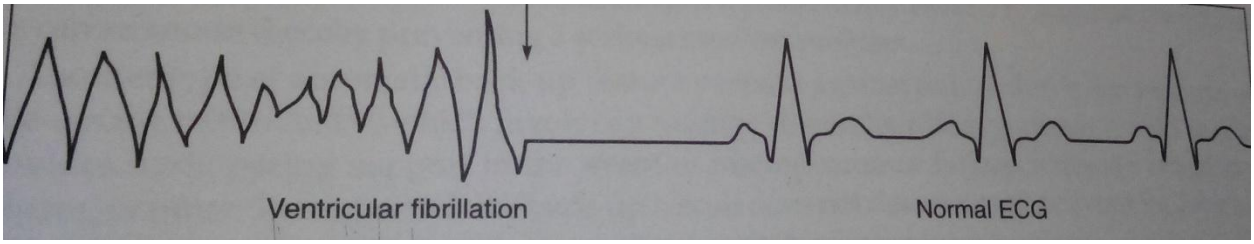
2) **) Tachycardia** : Tachycardia refers to an abnormally fast resting heart rate - usually at least 100 beats per minute**.**

3)**Bradycardia** :In case of arrhythmia the heart is paced at a much slower rate than normal ranging between 30 and 50 beats per minute this condition in which heart beat slower is called bradycardiya in which the heart cannot provide sufficient blood circulation to meet the body's physical demand.

4) **Heart block** :Whenever the conduction system fails to transmit the pacing impulses from the atria to the ventricles properly it is called heart block.

b) Describe the concept of fibrillation of heart. (defining fibrillation) (04 marks)

Ans:



Ans : As we know the heart is able to perform it's important pumping function only through precisely synchronized action of the heart muscle fibers. The rapid spread of action potentials over the surface of the atria causes these two chambers of the heart to contract together and pump blood through the two atrioventricular valves in to the ventricles After a critical time delay, the powerful Ventricular muscles are synchronously activated to pump blood through the pulmonary and systemic circulatory system.

A condition in which this necessary synchronism is lost is known as fibrillation. During fibrillation the normal rhythmic contractions of either the atria or the ventricles aer replaced by rapid irregular twitching of the muscular wall.

Fibrillation of atrial muscles is called atrial fibrillation . Fibrillation of the ventricles is known as ventricular fibrillation.

C) List the possible faults of ventilator and give their possible solution (One mark for each fault and it's solution Any 04)

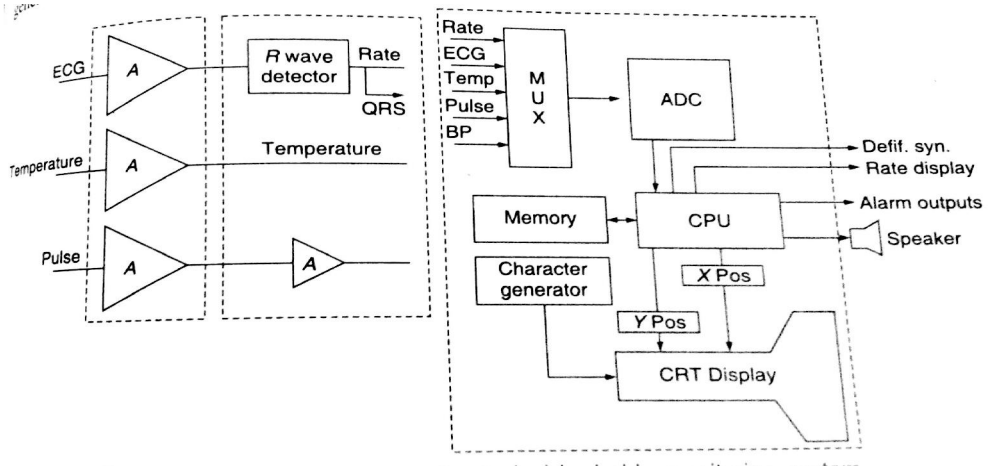
Ans: **(04 marks)**

Fault	Solution
Trigger problems	• Adjust trigger level to minimum (1-2 cm H2O; 1-2 L/min) • Check for and eliminate auto-PEEP

Flow problems	• If using flow-limited ventilation:
	  o Increase inspiratory flow to eliminate post-trigger patient effort
	  o Use ventilator that provides flow compensation
	  o Switch to pressure-limited ventilation
	• If using pressure-limited ventilation: adjust rise time to provide good pressure plateau without spiking
	• If using PSV, adjust off-cycling to assure effort-free and complete exhalation

Rate problems	• If using CMV, set rate to assure adequate expiratory time and proper I:E ratio • If using CMV, consider SIMV • If using SIMV, increase mandatory rate until spont rate is < 15-20/min • If using SIMV, increase pressure support until spont rate is < 15-20/min
Tidal volume/ Pressure limit	• Inspect pressure-volume curve for over distention; lower P or V if 'breaking' apparent
Inadequate minute volume	• Assure a minimum mandatory ventilation of at least 4-6 L/min for adults (if normal metabolism; higher as needed)
Mode	• Give preference to pressure-limited modes and/or those that provide flow compensation during inspiration

d) Draw a neat labeled block diagram of bed side monitor. **(4marks)**



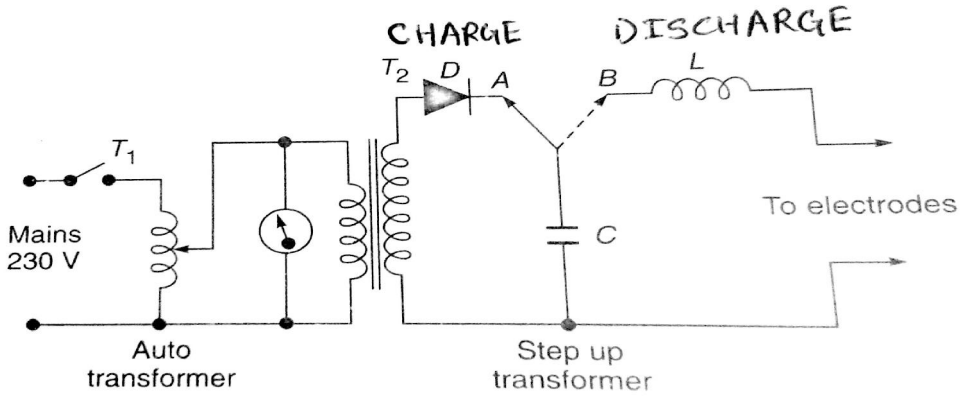
Bed Side Monitor

OR Any other diagram

B) Attempt any ONE **(06 marks)**

a) Draw and describe circuit diagram of charging and discharging sections of DC- defibrillator.

(Circuit diagram 03 marks, description 03 marks)



Schematic diagram of a defibrillator

The basic circuit diagram of a DC defibrillator is as shown.

CHARGING CIRCUIT:

A variable auto transformer T1 forms the primary of a high voltage transformer T2.

The output voltage of the transformer is rectified by a diode rectifier and is connected to a vacuum type high voltage change over switch.

In position A ,the switch is connected to one end of an oil filled 16 micro fared capacitor in this position the capacitor charges to voltage set by positioning of the auto transformer,

DISCHARGING CIRCUIT :

When the shock is to be delivered to the patient, a foot switch or a push button mounted on a handle of the electrode is operated

The high voltage switch changes over to position B and the capacitor is discharged across the heart through the electrodes.

In a defibrillator .an enormous voltage approximately 4000v is initially applied to the patient,.

b) Describe any two dialyzers with suitable diagram (each for 03 marks any 2) **(6marks)**

Ans: Types of dialyzers 1)Parallel Flow Dialyzers

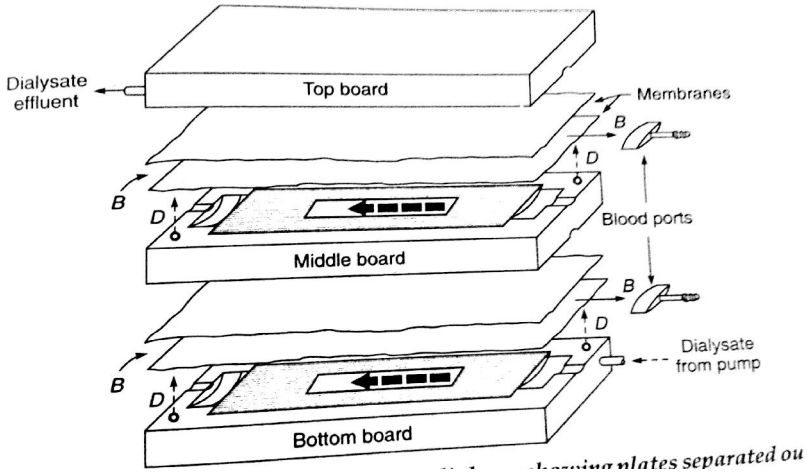
2) Coil Dialyzers

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.

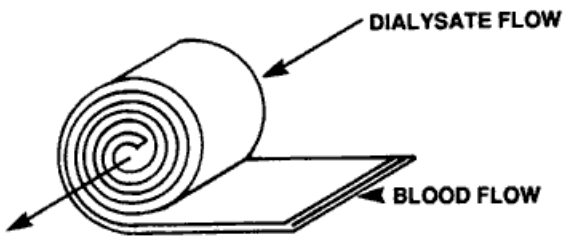


Parallel flow dialyzer

The KILL dialyzer is not disposable.

2) Coil Hemodialyzer:

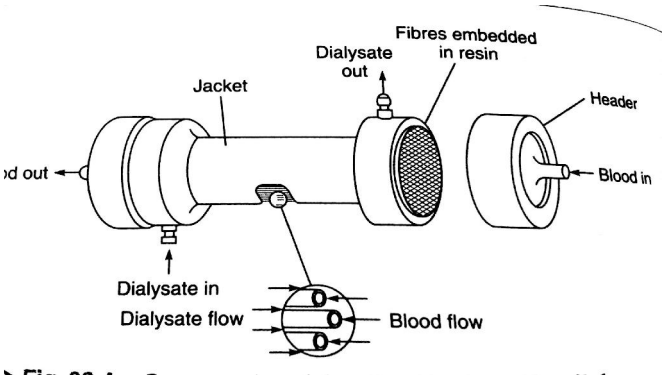
A coil hemodiaylizer comprises a tubular membrane placed between flexible support wrapped around a rigid cylindrical core .The coil is immersed in a dialyzing bath, The tubular membrane can be of cellphones. The average wall thickness is 20 to 30 micrometer. The coil membrane supports are woven screens or unwoven iattic, 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.



COIL DIALYZER

3) Hollow Fiber Hemodialyser:

The Hollow Fiber Hemodialyser is the most commonly used hemodiaiyzer. 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 hemodyliser 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.2**. Attempt any FOUR** **(16marks)**

a) Differentiate between Fixed and demand pacemaker. (01 marks for each point any 4 points) (04marks)

Fixed pacemaker	**Demand Type pacemaker**
1)This type of pacemaker uses competitive pacing mode	1) This type of pacemaker uses noncompetitive pacing mode
2)It is Ventricular asynchronous type of pacemaker.	2)It is R-Wave(ventricular) inhibited type of pacemaker.
3)it produces pulses at fixed rate which were independent of any natural cardiac activity.	3)It's output is suppressed as long as natural R wave is present .However output come in picture when the output goes below the pacer value.
4)It is generally installed in elderly patients whose SA nodes cannot provide proper stimuli	4)It is a ventricular programmed pacemaker.
5)It is having longest battery life.	5)Comparatively less battery life.
6)It is asynchronous mode	6)It is synchronous mode
7)It functions regardless of patients natural heart rhythm	7)It considers patients heart rhytm
8)Number of pulses per minute are fixed	8)Number of pulses per minute are not fixed

b) State the need of following machines(02+02) (4marks)

1 Heamodialysis Machine

2 Heart Lung Machine

Ans: 1) Heamodialysis Machine

It is also known as dialysis machine (dialyzer). It is used to partially or completely replace the functions of the kidney. When patient natural kidney fails to purify the blood by sucking out the toxic substances from it and eventually drained it, dialysis or artificial kidney is used.

1) It is used to purify the blood when natural kidney fails to do so.
2) It is used to support the filtration.

2)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.

1) It is mainly used in case of the open heart surgery where the heart is exposed.
2) It is used in bypass surgery where we need to replace the function of the heart while it is being operated.

C)Write the significance of following mode of ventilator.(02 marks for each mode) (04 marks)

i)Assist mode

ii)Control mode.

Ans: i)Assist mode:

A ventilator which arguments the inspiration of the patient by operating in response to-the-patients 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. The assist mode is required for those patients who are able to breath but are unable to inhale a sufficient amount of air or for whom breathing requires a great deal of effort

ii)Control mode:

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.

d) List technical specification of bed-side monitor (any 04) One mark for each specification. (04 marks)

Ans: 1)Band pass filter -3 dB at 0.3 Hz and 150 Hz Bandwidth 0.3 - 128 Hz

2) Analogue to digital converter Delta sigma (1 per channel)

3) Sampling rate 256 samples/sec with 512 times oversampling Resolution 21 bits effective at 256 Hz

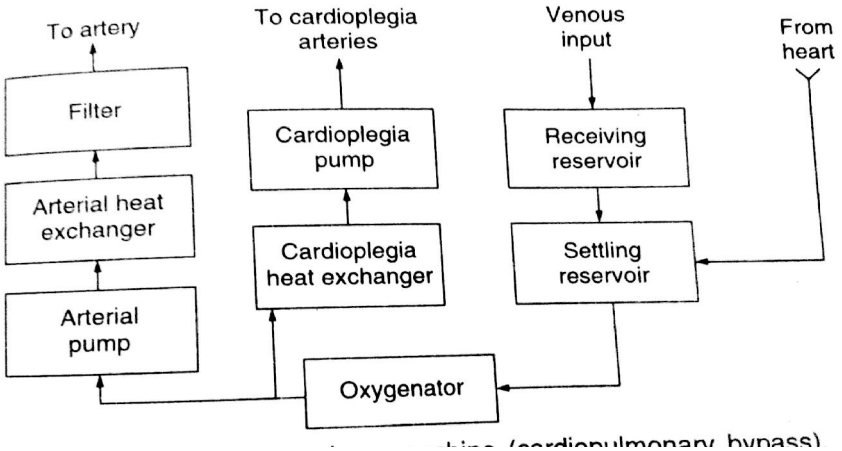
4) Input impedance 33 MΩ in parallel with 4.7 nF Allowed DC offset ±0.35 VDC at input Noise < 1 μVp-p

5) Common mode rejection >137 dB Operation (all components)

6) Temperature 0 to 40 °C (32 to 104 °F) Relative humidity 25 to 90% at 40 °C (non-condensing)

7) Power supply unit input voltage 100 - 240 VAC, 47-63 Hz, 1.1 – 0.45 A Power supply unit output voltage 24 VDC, 3.33 A maximum (80 W)

e) Draw the block diagram of heart lung machine and describe it's working. (4marks)



Heart lung machine

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

WORKING.

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 ts 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.

f) Explain the concept of unipolar and bipolar leads.(02 Mark each) (04 marks)

Ans: 1.Unipolar: In uniplar 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.

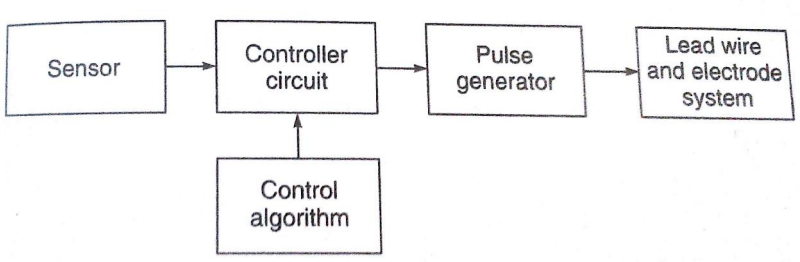
2. Bipolar leads: Bipolar leads which have two electrodes positioned in the heart are designed with a coaxial connector requiring only a single receptacle resulting in improvement in the size of bipolar pacemaker connector. In the bipolar electrode system both electrodes are approximately of the same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

Q.3 Attempt any four of the following: 16marks

a) Describe rate responsive pacemaker with suitable diagram. (04marks)

(Diagram -02 Marks, Description-02 Marks)

Ans:



Rate responsive pacemaker

In some patient, due to diseased condition of the sinus, the heart‘s natural pacemaker is not able to increase its rate in response to metabolic demands. Fig shows block diagram of rate responsive pacemaker. A sensor is used to convert a physiological variable in the patient to an electrical signal that serves as an input to the controller circuit, which can determine whether any artificial pacing is required or not. Today, the majority of pacemakers are rate responsive pacemaker, incorporating one or more sensor. The most common sensor which uses piezoelectric materials to detect vibration caused by the body movement. The sensor can be placed within the pacemaker itself or located at some other place in the body. It may be noted that each of physiological variables requires a different control algorithm for the control circuit.

b) A defibrillator delivers a square pulse of 4 K Volts with duration of 4 ms.The internal resistance of defibrillator is about 15 Ohm. The skin electrode resistance is 50 Ohm and thorax resistance is 30 Ohm.Compute the energy deliver to the patients thorax and total energy available from the defibrillator. (4marks)

Ans: Given R_D= 15Ω, R_E= 50Ω, R_T= 30Ω, T_D =4ms.

Total resistance=R= R_D+ 2R_E+ R_T (1)

I_D = V_D = 4000 =27.586 amperes.

Total resistance 15+2*50+30 (1)

Energy delivered to the patient's thorax = $I_D 2\ R_T\ T_D$

$= (27.586)^2 * 30 * 4 * 10^{-3}$

= 91.32J. (1)

Total Energy $= I_D^2 R\ T_D$

$= (27.586)^2 * 145 * 4 * 10^{-3}$

= 441.37J (1)

c) List any four technical specifications of suction apparatus. (01 Mark each) (04marks)

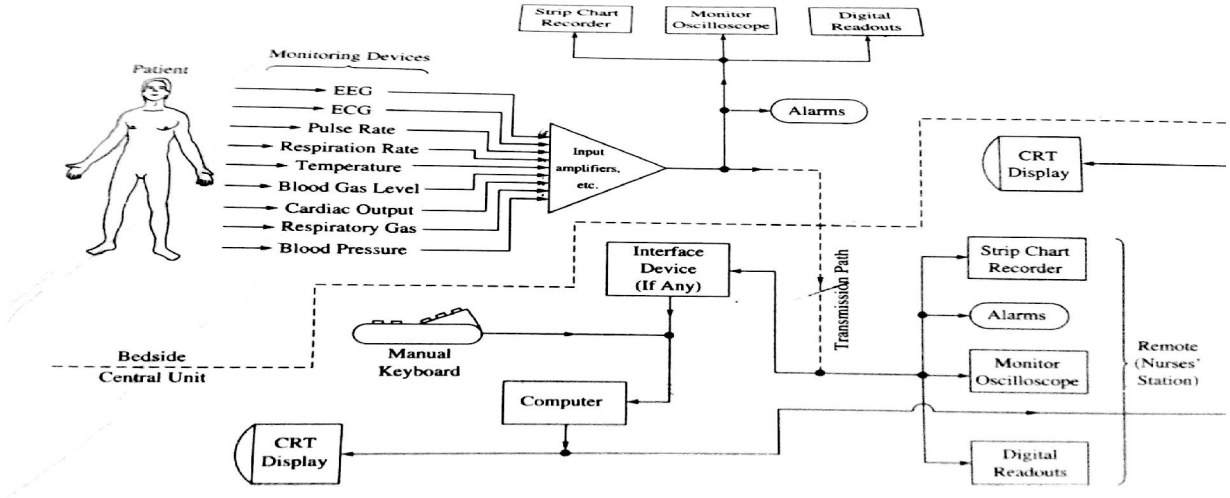
Ans: 1.Power Supply-230V 50Hz.

2. Rating of Motor- continuous
3. Suction Bottle Capacity- 2 x 2000 ml minimum (with safety valve)
4. Gauge- 0 to760 mm Hg
5. Pump- Oil lubricates rotary pump
6. Suction Tubing- ID 7 mm, 5m long and non-collapsible.
7. Vacuum capacity: 18 litres/mim
8. Maximum depression: -75kPa (-563mmHg)
9. Working temperature range: +5°C to +40°C.

d) Draw block diagram of central monitor. State the need of it. (04marks)

(Diagram -02 Mark, Need - 02 Mark)

Ans:

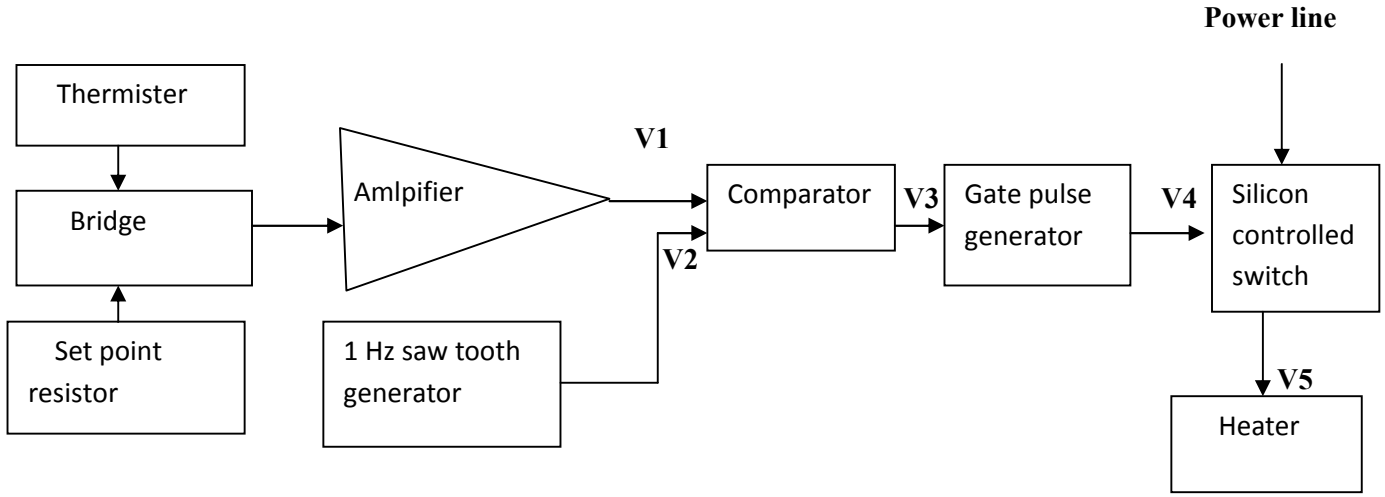


Need of Central monitor: Central monitoring is the process of acquiring & recording the physiological parameter of different patients simultaneously on a single monitor at central station. In ICU the no. of critical patient is always high monitoring the physiological parameter for each patient is done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

e) Draw a circuit diagram of temperature control and indicator used in baby incubator and describe its working.

(Diagram-02 Mark, Working-02 Mark) Note: Any relevet diagram can be consider)

Ans:



Temperature controlled air is passed through the chamber in which the baby is located to maintain it at set temperature. The temperature is controlled in modern units by means of proportional control system which is as shown in fig. Temperature in the air supply lines varies a thermister resistance that is compared with a fixed resistance that corresponds to the set temperature. If the temperature of air entering the infant's chamber is lower than the set temperature power is applied to the heater to correct for difference. In this system, the amount of power applied to the heater is proportional to the difference between the actual air temperature and set point. In this system the thermister in a bridge circuit with the set point resistance as another arm of bridge. The bridge output is amplified, giving the voltage V1 at the output, which is proportional to difference in temp between the thermister and the set point**.**

Q.4 (A) Attempt any Three of the following: 12marks

a) Differentiate between endocardial and myocardial pacemaker leads. (04marks)

Ans: (Any four 01 Mark each)

Endocardial pacemaker leads	Myocardial pacemaker leads.
1. This is connected to inner side of heart chamber.	1. This is connected to outer wall of heart muscle.
2. This is used in external pacemaker.	2. This is used in internal pacemaker.
3. The endocardial lead is inserted into the inside of the heart via a vein, usually in the chest area.	3. This type of lead is most often used when other cardiac surgery is being performed and there is already access to the heart.
4.Example : Porous tip electrode	4. Example: Steroid eluting electrode.

b) State the maintenance steps carried out for ventilator.(any 4 points (4 marks)

Ans: - 1 Check the ON/OFF switch
2.Check the fuse continuity
3. Check the power cable continuity

4. Check the Gas Supply.

5. Check the Pneumatic lines (including air filters).

6. Check the Gas cylinders (and gauges and regulators, if so equipped)

7. Check the Patient Circuit

8. Check the Breathing circuit (including filters)

9. Check the Humidifiers

10. Pressure-relief mechanism

c) State the causes for following faults of bedside monitor.(4marks)

i) Temperature varies frequently.

ii) SpO2 or pulse is not displayed

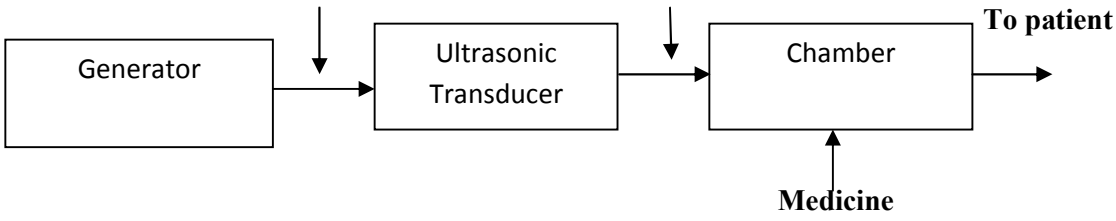
iii) ECG wave displayed is improper.

Ans:

Fault	**Causes**
Temperature varies frequently	1.Temperature probe and Sensor not working. 2. Patient movement
SpO2 or pulse is not displayed	1. Probe is not mounted correctly. 2.Probe not able to read through Dirt, nail polish, etc. 3. Patient movement. 4.Internal malfunction
ECG wave displayed is improper.	1.Improper electrode connection with patient or problem with the ECG cable. 2. Patient movement

d) Draw a labeled block diagram of Nebulizer.(4m)

Ans:



Block diagram of neubilizer

(OR any other relevant diagram)

(B) Attempt any ONE **06marks**

a) List any four possible faults and its solution in defibrillator. Also give maintenance procedure for defibrillator. (any 4 Faults its solution 04 Mark, Maintenance procedure 02 Mark)

Ans:

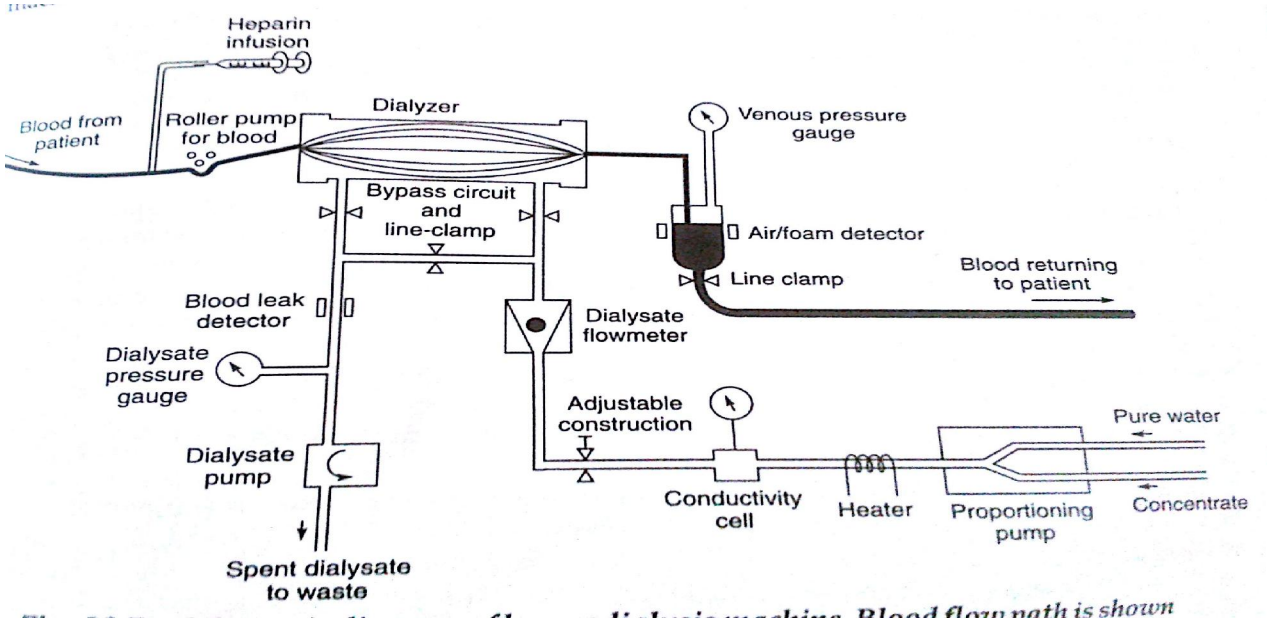
Sr. No.	Fault	Solution
1.	Machine not getting ON	Check and replace the plug. Check and replace the fuse. Check and replace the power cable.
2.	Not getting proper charge at the output	Check and replace the capacitor. Check and replace the step up transformer.
3.	Shock is not properly delivered as per ECG	Check and replace the detector. Check and correct the program.
4.	Hand switch not working properly	Check and replace the switch. Use foot switch
5.	Doctor is also getting shock	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, synchonisation

b) Draw a neat block diagram hemodialysis machine. List any four technical specifications of it. (Diagram – 04 Marks, Technical specification - 02 marks (any four)) Note: Any relevant technical specification should be consider)

Ans:



Hemodialysis machine

Technical specifications

1. Power input to be 220-240VAC, 50Hz.
2. Dialysate temperatures selectable between 35 degrees C to 39 deg. C.
3. Variable conductivity setting between 12 to 15.
4. Dialysate flow 200-800 ml/mt.
5. Heparin pump with syringe sizes 20 to 30 ml with pump flow rate from 1-10 ml/hr.
6. Ultra filtration 0.1 to 2.5 liters/hr.
7. Blood pump rate from 20-500 ml/min.
8. Variable conductivity setting between 12 to 15.

Q5. Attempt any FOUR: 16marks

(a) Differentiate between internal and external pacemaker (any 4 points). (4marks)
(1 mark for each point)

Answer:

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) Describe the need of anesthesia machine. (4 marks)

Ans:

A surgical method of treatment consists mainly of operations which are normally carried out under some form of anesthesia.

Anesthesia serves the following two functions.

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

When anesthesia is given the patient loses consciousness, it is called general anesthesia.

In general anesthesia, the anesthetic agent is administered to the body so that it reaches the brain via the blood stream.

Usually "inhalation anesthesia" method is used in which gaseous anesthetic agents are introduced via the lungs.

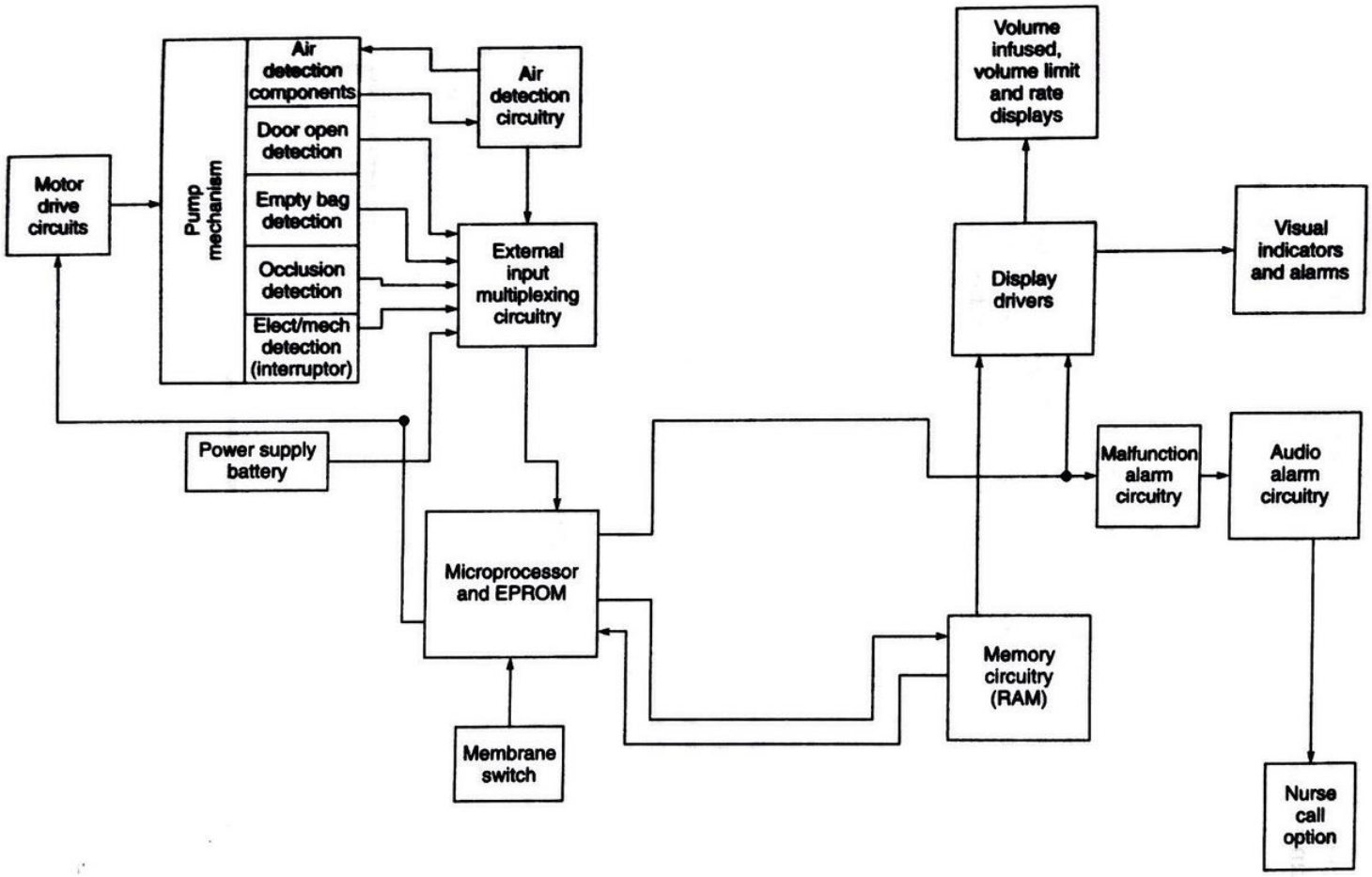
During anesthesia, the anesthetic agents as well as oxygen is given in required amount. Any excess carbon dioxide is also eliminated.

In the superficial stages of anesthesia, the patient can breathe for himself-spontaneous ventilation.

At a greater depth of anesthesia, it may be necessary to support the patient with artificial ventilation known as controlled ventilation.

(c) Draw a block diagram of programmable microprocessor based infusion pump. (4 marks)

Ans:



Programmable microprocessor based infusion pump
(Or Any other relevant diagram)

(d) Give any 4 technical specifications of DC defibrillator. (4marks)
(1 mark for each point any 4)
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) Write different types of oxygenators and give its importance in heart-lung machine. (4marks)

(Types of oxygenators: 2 marks, its importance: 2 marks)

Answer:

There are two types of oxygenators which are used in heart-lung machine:

1. Bubble oxygenators

2. Membrane oxygenators

Importance of oxygenators in heart-lung machine:

Oxygenator is a device that is capable of exchange in oxygen and carbon dioxide in the blood of human body during surgical procedure.

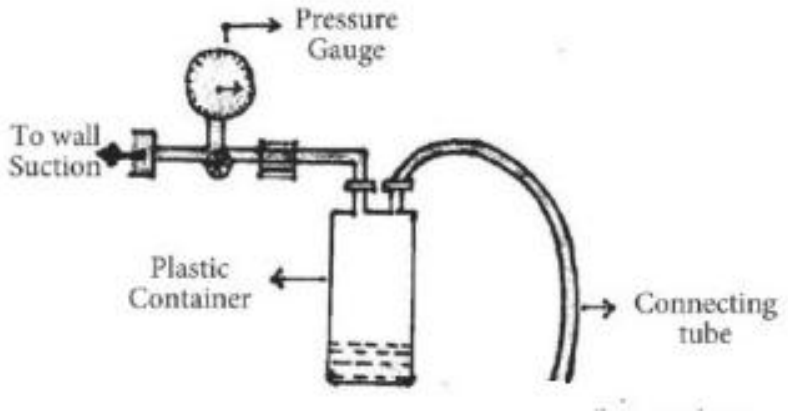
The oxygenators repeatedly draw of the blood from the veins, reoxygenates and pumps it into the arterial system.

The oxygenator serves as the lung during the open heart surgery as the lung.

(f) Describe the operation of suction apparatus with suitable diagram. (4marks)

(Diagram: 2 marks, Description: 2 marks)

Answer:



Suction Apparatus

Suction pump typically consists of an inlet where the fluid enters the pump and an outlet where the fluid comes out.

Also there is a plastic container which will contain a fluid from the patient's body.

The inlet location is said to be at the suction side of the pump. The outlet location is said to be at the discharge side of the pump.

At inlet side there is a connecting tube which is made up of plastic and called as catheter.

At outlet side there is a pressure gauge which shows that how much pressure is applied.

Operation of the pump creates suction (a lower pressure) at the inlet/suction side so that fluid can enter the pump through the inlet.

Pump operation causes higher pressure at the outlet/discharge side by forcing the fluid out at the outlet.

The whole apparatus is connected to the wall suction.

Q6. Attempt any FOUR: 16marks

(a) Describe fail safe system of anesthesia machine. (4marks)

Ans:

From the supply, the gas flows into the inlet of the anesthesia machine and is directed through the pressure safety system (fail-safe system) towards the flow delivery unit.

The pressure safety system will not allow nitrous oxide to flow unless an oxygen supply pressure exists in the machine.

The fail-safe system consists of a master pressure regulator valve located in the oxygen supply line.

From master regulator, a reference pressure is provided to the salve regulator valve controlling the pressure and flow of the nitrous oxide line.

When sufficient oxygen pressure of 275 kPa is present in the master regulator, the reference pressure enables the slave regulator valve to open and for nitrous oxide to flow.

Regulations require oxygen –nitrous oxide ratio safeguards, which need a minimum continuous low flow of oxygen varying from 200 to 300 mL/min, as indicated by the low-flow rotameter.

In newly designed machines, ingenious mechanical devices prevent the delivery of gas mixtures with an oxygen concentration below a low limit.

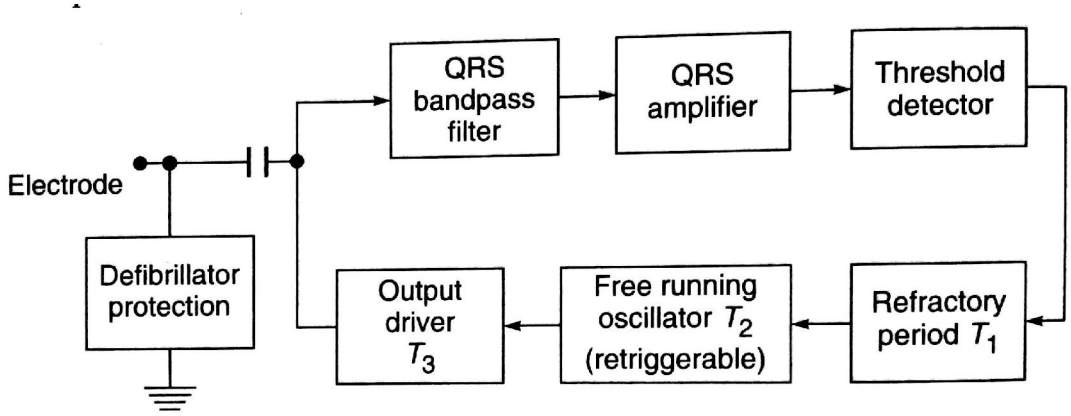
Oxygen-nitrous oxide ratios vary from 25:75 to 30:70, depending on the manufacturer.

(b) A patient requires a pacemaker for a short time while operating him. Suggest the type of pacemaker required for patient. Draw a block diagram of it. (4marks)

(Suggestion of type of pacemaker: 2 marks, Diagram: 2 marks)

Answer:

For a short time, it is suitable to use External pacemaker.



(Or Any other relevant diagram)

(c) Draw a block diagram of conventional method and closed loop control drug delivery system.(4marks)

(Conventional method Diagram: 2 marks, closed loop control Diagram: 2 marks)

Answer:

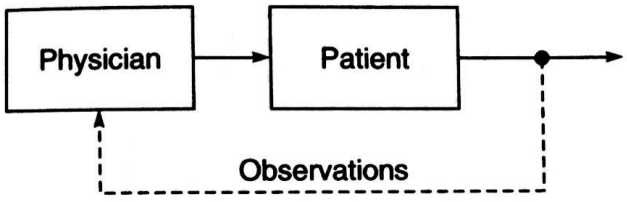


Fig a. Conventional method drug delivery system

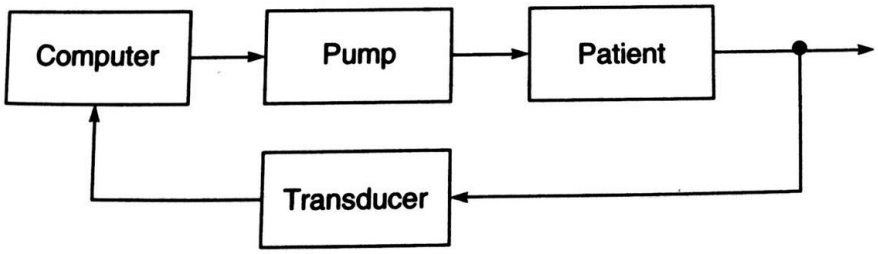
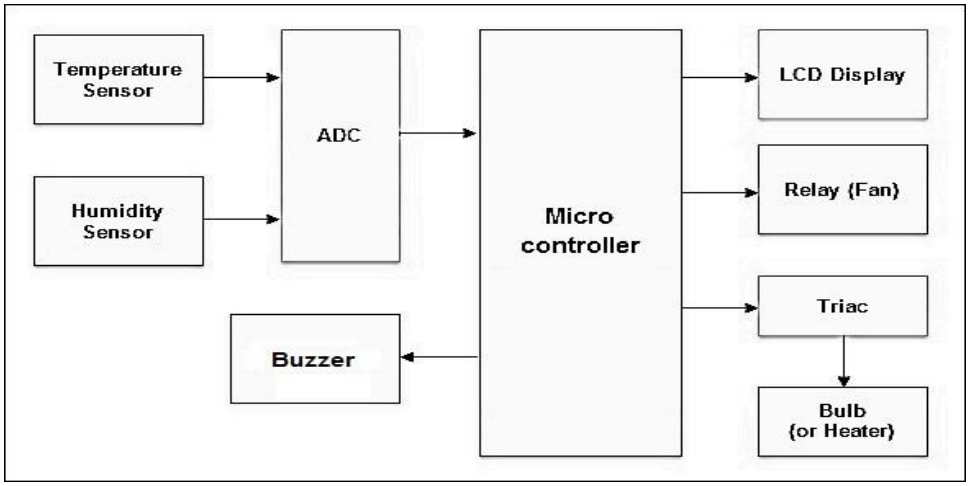


Fig b. Closed loop control drug delivery system

(d) Draw block diagram of baby incubator and describe it. (4marks)

(Diagram: 2 marks, Description: 2 marks)

Answer:



Block diagram of baby incubator

Above figure shows the block diagram of baby incubator.

It consists of a temperature sensor and a humidity sensor to sense temperature and humidity.

The signals are then given to the ADC which will convert analog signals to digital form.

Then these are given to the microcontroller.

LCD display is used for display purpose which will display the temperature and humidity

Whenever Temperature rises above a threshold level at that time a Relay is turned on.

There is a 12 volt DC fan at the output of Relay.

Whenever Humidity rises above a threshold level, at that time microcontroller gives firing angle pulses to a Triac.

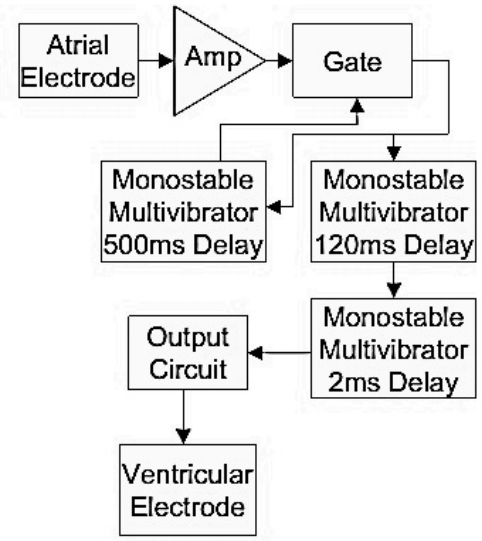
Then this is connected to a heater or bulb. The intensity of bulb varies with the increase in Humidity value.

The buzzer is connected which can be used in an emergency case.

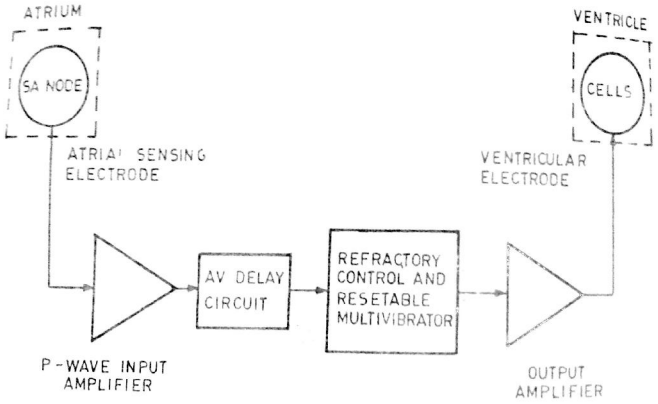
(e) Draw block diagram of atrial synchronous pacemaker and describe it. (4marks)

(Diagram: 2 marks, Description: 2 marks)

Answer:



OR



(Or Any other relevant diagram)

As SA node fires, it triggers the pacemaker. Gate is used to trigger the circuit and amplifier for amplification purpose.

Delays are used to simulate natural delay from SA to AV node (120ms) and to create a refractory period (500ms).

Output circuit controls ventricular contraction. 2ms delay is given to the output circuit.

Combining the demand pacemaker with this design allows the device to let natural SA node firing to control the cardiac activity.