



Summer– 15 EXAMINATION

Subject Code: 17671

Model Answer

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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

Marks 12

a. State any four therapeutic uses of IR

4m

1. Pain relief- heating irritates the sensory nerves ending & relieves pain by counter irritation.
2. Reduction in muscle spasm
3. Acceleration of healing or repair
4. Reduction of fungal infections – by regular IR therapy the through drive of skin surface is effective in reducing fungal infection.
5. Treatment for paralysis.
6. Reduction in odema.

b. Draw neat block diagram of traction unit and state the function of each block. (2m+2m)

4m

Block Diagram of lumber & Cervical traction

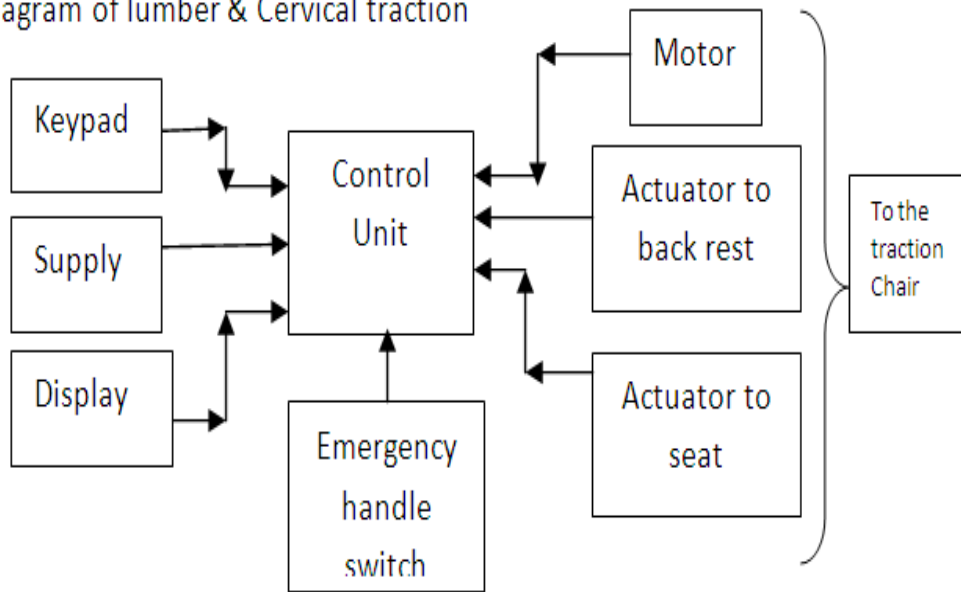


Fig 1 Block diagram traction unit

Traction Machine:

(Function of each blocks 2marks)

It is a routine therapy in which the pressure is applied on specific muscles and joints to properly realign the joints structure as well as to maintain proper gap between the bones. In this therapy muscle involvement of patient is required.

The block diagram of Traction machine is as shown in the fig. 1

Control Unit: It consists of a control unit through which all the control signals are given to motor and actuator for back and seat. There is a control panel on which the controls for various positions can be adjusted.

Display: There is a display provided on the control panel to see the actual parameters according to adjustments.

Emergency handle switch: One emergency switch is also provided to stop the unit in the case of emergency or discomfort to the patient.

Keypad: To operate various controls given on the machine for different settings.

- c. **Suggested Application techniques of ultrasound therapy for :** 4m
- i) Injured body part ii) For irregular surface
- i. **Injured body part: Water bath** (2 Marks)
- If there is a wound or injury the treatment may be carried out in water bath this is to avoid mechanical contact with the tissues which may be damaged. In this method it should be ensured that air bubbles are not present either on the probe or onto the skin. For this degassed water must be used. While giving treatment the body part must be rubbed with alcohol and kept in a water bath. The probe is moved over the area to be treated but held at a distance of about 1 -2 cm from patients body.
- ii. **For irregular surface: Water Bag** (2 Marks)
- On irregular body surface (joints) a rubber bag filled with degassed water can be used. A coupling medium has to be placed both between the rubber bag and the skin and between the rubber bag and treatment head to avoid any presence of air. The treatment head is moved over the water bag in the same way as if on a patient's skin.

- d. **State and explain the Principle of cold Therapy:** 4 m
- Application of cold to the tissues after injury is an old practice. When ice is applied to the skin heat is conducted from the skin to the ice in order to melt it. Consequently it is used to reduce pain, reduce spasticity, reduce muscle spasm and swelling, to promote repair. The initial response of the skin to cooling is an attempt to preserve heat.

Q 1 (B) Attempt any One Marks 06

- a. Draw neat Constructional diagram of ultrasound therapy transducer. Explain the function of matching layer and backing layer (3 Marks for any equivalent diagram showing all parts + 03m function of two layers) 6m

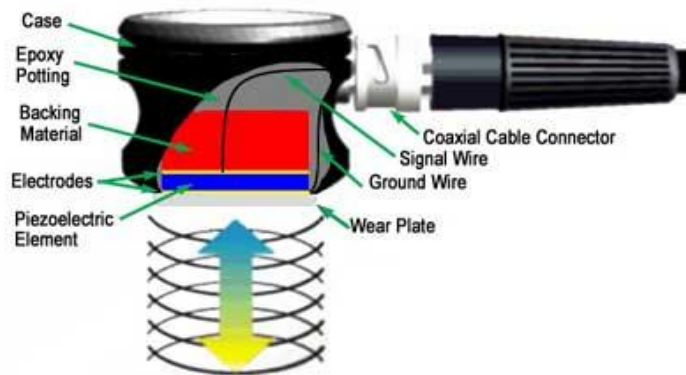


Fig. 2 Constructional diagram of ultrasound therapy transducer

It consists of piezoelectric crystal like Lead Zirconate Titanate (PZT). A high frequency (0.75 to 3MHz) AC current is applied to crystal whose acoustic vibrations causes the mechanical vibrations of transducer head, which is directly located in front of the crystal.

Function of matching layer:

To get as much energy out of transducers as possible an impedance matching is to be made which is done by keeping proper matching layer in between the front plate and the electrodes. The matching layer must be half the thickness of the pzt crystal. For the contact type transducer matching layer is made up of such a material that it should protect the active element from scratching

Function of Backing layer:

In order to direct the energy out from the crystal the backing material is applied to the surface of the crystal opposite to the head of the transducer. Due to this the waves travels out only from one surface of the transducer. The backing material supporting the crystal with impedance similar to the active element will produce the most effective damping.

- b. Explain effect of electric current on human tissues and with a neat diagram, explain principle of working of electrosurgery (2m+2m+2m) 6m

Surgical diathermy depends on the heating effect of electric current. When a high frequency electric current is applied through the biological tissue it flows through the sharp edge of the wire loop or a point of a needle to the tissue, there is high concentration of current occur at that point. The tissues are heated to such an extent that the cells which are immediately under the electrode are torn apart by the boiling of the cell fluid. The frequency of current used in surgical diathermy machine is in the range of 1-3MHz.

Principle of working of electrosurgery :

It is an application of high frequency electric current through the biological tissue. It can be used to cut coagulate desiccated or fulgurate the tissue .Its benefit include ability to make precise cut with limited blood loss.The basic principle behind the ESU is as shown...

- Two electrodes are connected to the RF generator, one is active and other is passive
- Active electrode has very small cross sectional area. It is made in form of needle or probe.
- The passive electrode has much larger area than the active electrode it is the order of 100 cm^2
- The current flowing through the active electrode and passive is the same. But as the active electrode has very small cross sectional area the current density of an active electrode is much larger than the current intensity of the passive electrode

As there is difference between current density of two electrodes the tissues under passive electrode are heated slightly while the tissues under active electrode, are heated to cause cutting.

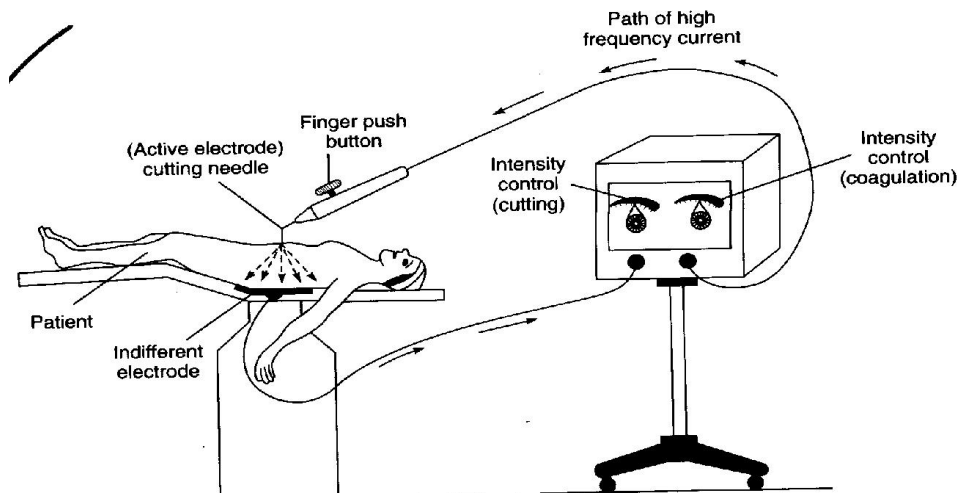


Fig. 3 Principle of working of electrosurgery

Q. 2 Attempt any FOUR

Marks 16

a. State the Need of traction treatment

4m

In orthopedic medicine traction refers to the set of mechanism for straightening broken bones or reliving pressure on the spine & skeletal system. The purpose and need of traction is to –

1. Regain normal length and alignment of involved bone.
2. To rescue an immobilized and fractured bone.
3. To lessen or eliminate muscle spasm.
4. To prevent or reduce skeletal deformities or muscle contraction.

b. State and explain the application techniques of nerve muscle stimulator (2 Marks for each technique)

4m

This technique is used for the treatment of paralysis with totally or partially denervated muscles, for treatment of pain, muscular spasm etc. This can be applied by following application techniques



- Monopolar technique (Labile technique)
- Bipolar technique (Stabile technique)

Monopolar technique (Labile technique)

1. The monopolar technique makes use of small active electrodes. In this technique the indifferent or dispersive or ground electrode is of large area and is placed near to the active electrode.
2. Each muscle is stimulated with the active electrode and a ground electrode is held over the lower end of the muscle to be stimulated.
3. In this method there is less irritation as only one active electrode is used.
4. Electrode can be of ball or plate electrode which is mounted on special handle which has finger tip switch for convenient control of output current.

Bipolar technique (Stabile technique)

1. In this technique both the electrodes are active electrodes and are placed on the body. These are placed at each end of the muscle to be stimulated.
2. This method is useful for stimulation of deeply placed muscles which are difficult to isolate.
3. This method has advantage that it permits a large number of muscle contraction simultaneously.
4. It is difficult for operator to hold both electrodes and at the same time to regulate the current intensity. Hence to fasten electrodes may be fixed in position by a rubber strap. One is placed at the origin of the muscle and the other placed over the lower end of the muscle group to be stimulated.
5. In this method as the current is of high intensity the area of electrode should be sufficiently large so as to avoid uncomfortable heat sensation to the patient.

c. State the significance of leakage current motor.

4m

Small currents of the order of microamperes that flow between any adjacent insulated conductors that are at different potentials are called leakage currents. Leakage current flows through insulation, dust and moisture. The most important source of it is it flows from all conductors in electric device to lead wire to chassis and to the patient which create problem to patient's safety. Hence it should safely diverted to ground through low resistance path.

d. State the significance of Circulatory response and Neural Response (2m+2m)

4m

It is the initial response of the skin to cooling is an attempt to preserve heat. The initial vasoconstriction is often used to limit the blood flow into the tissues in injury like sports injury.

Neural response

The skin contains primary thermal receptors. There are several times colder than warm receptors. The cold receptors respond to cooling by a sustained discharge of impulses, the rate of which increases with further cooling. It has been shown that the rate of conduction of nerve fibres in a mixed peripheral nerve is reduced by cooling.

e. State different methods of cutting and coagulation and explain any two with neat diagram (1 mark to state different methods ,3 marks to explain any 2)

4m

- i. Cutting or electrotony: when electrode touches the tissue sufficiently high power density is applied to the cells. So there is boiling effect of the cell fluid it vaporizes and tissues get torn apart. Needle type electrode is used for this purpose.
- ii. Coagulation: Coagulation of tissues is caused by high frequency current flowing through the tissue and heating it locally so that it coagulates from inside. Ball type electrode is used for this purpose.
- iii. Fulguration: It is superficial tissue destruction without affecting deep seated tissues. Electrode in the form of needle or a ball electrode held near the tissue without touching it. An arc is formed whose heat dries out the tissues.
- iv. Desiccation: In this a needle point electrode is stuck into the tissues & then kept steady. This treatment may be used for treating the nodules under the skin where minimum damage to the skin surface is desired.

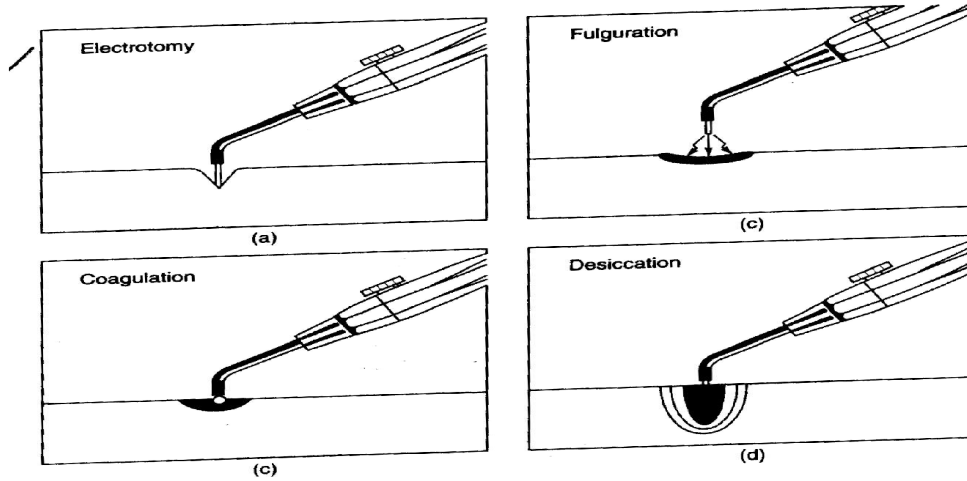


Fig. 4 Different methods of cutting and coagulation

f. Describe the procedure for testing of grounding system for leakage current.

4m

Ground resistance can be measured by passing up to 1 A through the ground wire and measuring the voltage between ground and neutral. Ground or neutral resistance should not exceed 0.2ohm. This gives an OK reading when the ground and neutral wires are transposed and when phase wires are connected to load and black wire is grounded.

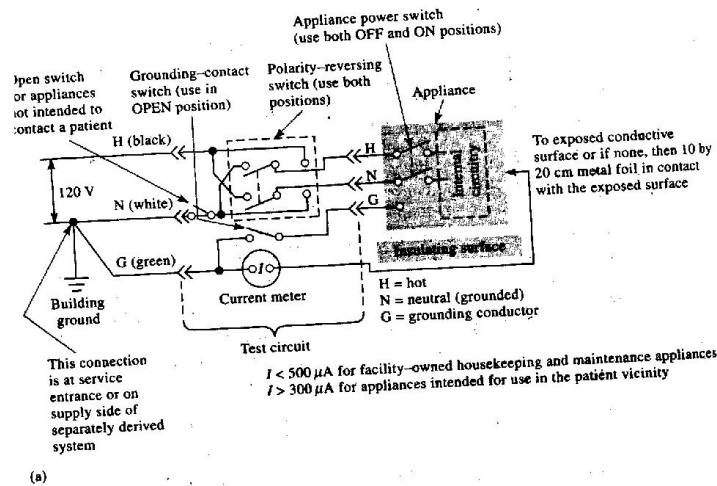


Fig 5 Testing of grounding system for leakage current



Q. 3 Attempt any FOUR

Marks 16

a. State any four properties of Laser

4m

- i. Monochromatic: It has same wavelength
- ii. Coherent: It has same phase and has same direction
- iii. Highly concentrated: Its concentration is very high.
- iv. Unidirectional: Its direction is same.

b. Enlist any four technical specifications of ultrasound therapy machine

4m

1. Input supply voltage: 230V AC, 50Hz.
2. Output power: 21 watt for pulse mode, 15 watt for continuous mode.
3. Frequency of operation: 0.75-3MHz
4. Maximum setting time: 15min.
5. Treatment head radiating area: 5 to 6 cm²

c. Draw block diagram of Solid state cautery machine and give its any four important technical specifications.

(2 m+2m .)

4m

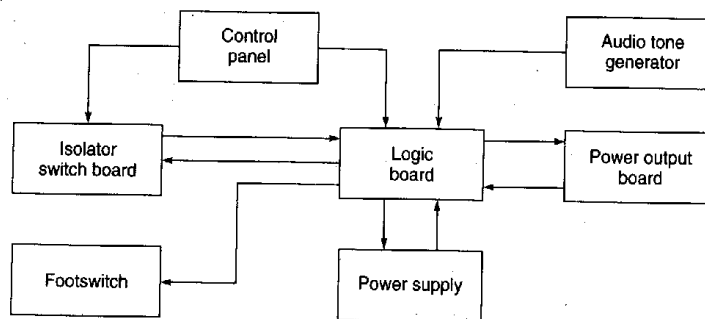


Fig 6 Block diagram of Solid state cautery machine

Technical specifications of Solid state cautery machine-

- i. Input power- 230 V, 50 Hz
- ii. Frequency of operation – 250KHz – 1MHz
- iii. Power delivering output – 400w for cutting and 150w for coagulation
- iv. Coagulation duration – 10-15 sec

d. State the steps to be carried out for maintenance of nerve muscle stimulator.

4m

1. Check the accessories such as power cord, pads and electrodes.
2. Connect the supply cord to 230V, 50 Hz AC mains.
3. Connect the electrodes



4. Switch 'ON' the machine.
5. Select the mode for operation as stabile or labile.
6. Press the switch according to the mode selected
7. Repeat the above procedure and test the performance of the machine for different level controls.
8. Open the machine and test the continuity of circuit at different test points.
9. Locate the fault as per the situations given below in observation table also suggest the possible cause and recommended action.

e. **Explain application techniques of cold therapy (any four)** 4m

1. Ice towels- Prepare the ice solutions by filling a bucket with crushed ice to one part water. In This solution towel is immersed and applied over the body part to be treated.
2. Ice packs – Crushed ice may be placed inside a specially made terry-towel bag or an ice towel folded into an appropriate shape. The part to be treated is exposed and put into comfortable position and ice pack is to be treated.
3. Immersion: In this technique the part which is to be treated is immersed in an ice solution.
4. Ice-cube massage: A large block of ice can be wrapped in a towel and can be applied over the part to be treated.
5. Excitatory cold: The sensory stimulus of ice on skin may be used to facilitate contraction of inhibited muscles.

Q4 (A) Attempt any THREE Marks 12

a. **Name application techniques of Short Wave Diathermy machine (SWD) which is used if elbow joint of patient is to be treated. Explain with neat diagram** (1m naming the technique + 1 mark diagram 2 marks explanation) 4m

1. Capacitive or condenser field or plate method
2. Inductive or cable or induction therapy method

For treating the elbow joint capacitive technique is to be used.

Capacitive method

In capacitor field method the output of SWD machine is connected to the metal electrodes which are positioned on the body over the region to be treated. Electrodes are placed on each side of the body part to be treated. In the terminology of the diathermy these electrodes are called as PADS. Electrodes don't directly come in contact with the skin usually layers of towels are interposed between the metal plate and the surface of the body. The pads are placed so that the portion of the body to be treated is sandwiched between them. This arrangement is called condenser method.. The metal electrodes act as two plates of the capacitor while the body tissue along with insulating material forms the dielectric of the capacitor. When RF output is applied to the electrodes rapidly alternating charges are set up on the electrodes and gives rise to an alternating electric field between them. Due to the dielectric losses of the capacitor heat is generated in the tissues. Dielectric losses takes place due to the rotation of dipoles and the vibrations of the ions in the tissue fluids and molecular distortion in the tissues

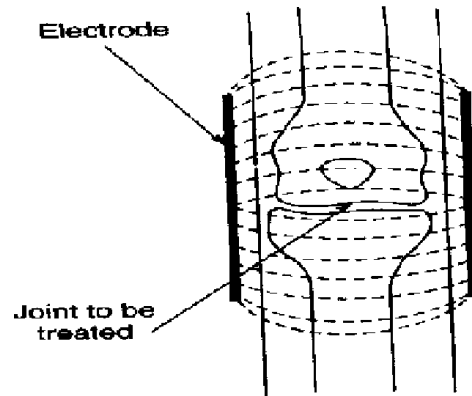


Fig. 7 Capacitive method

b. Draw block diagram of nerve muscle stimulator and explain any two blocks (2 m+2m)

4m

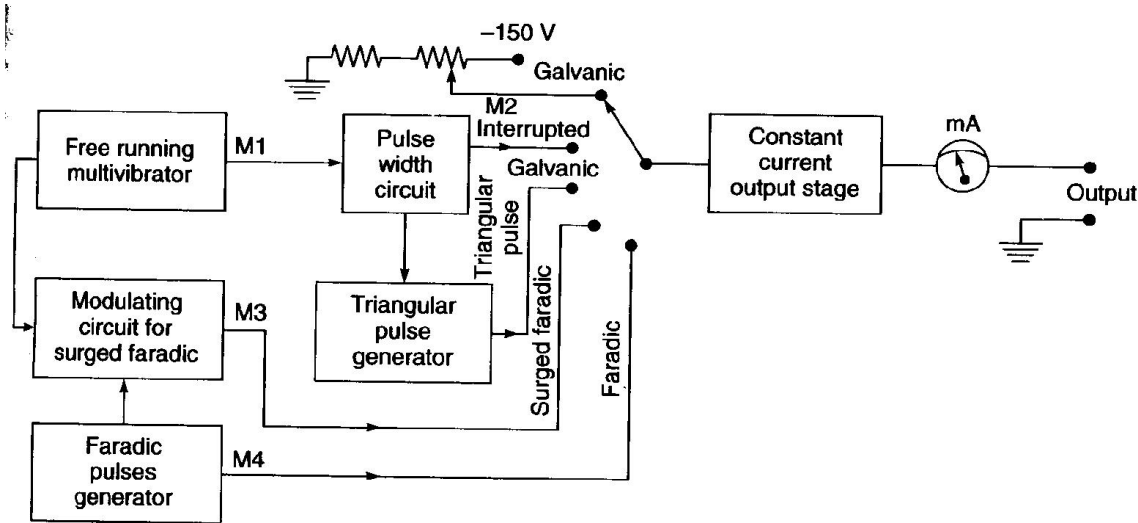


Fig 8 Block diagram of nerve muscle stimulator

Block diagram discription

Galvanic current of required intensity is achieved by simple DC supply tapping circuit. Electric current is directly applied to a patient.

Free running multivibrator M1: To set basic stimulation frequency variable rate multivibrator M1 is used.

Pulse width modulator: The o/p from this M1 triggers monostable multivibrator M2 which sets pulse width. The o/p from M2 provides an interrupted galvanic.

Surged faradic modulator: Another astable multivibrator M3 produces short duration pulses called faradic current. By modulating the faradic current with the required pulse duration we can get the surged faradic current. It is done in a mixer ckt.

Triangular pulse generator is used to get exponentially progressive current. This is done by integrating the o/p of M2 so that the interrupted galvanic pulses are modified to have exponential rise and fall.

c. Draw constructional diagram of UV lamp and state why quartz tube is used in it. (2 m+2m)

4m

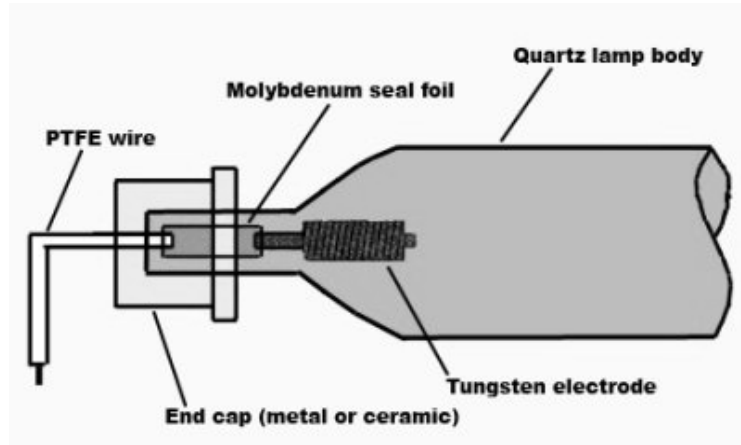


Fig.9 Constructional diagram of UV lamp

Significance of quartz tube:

(2 marks)

1. This material allows the passage of UV radiations.
2. It can withstand very high temperature.
3. It has very low coefficient of expansion.

d. Explain the significance of Interferential current therapy. Draw neat waveforms for the same (2 m+2 m)

4m

Principle of Interferential Current Therapy - Interferential Therapy is a form of electrical treatment in which two medium frequency currents are used to produce low frequency currents. The basic principle is when two medium frequency currents cross in patient's tissue it produces an interference effect in that tissue. In this method one current is kept at a constant frequency of 4000 Hz, and the second can be adjustable from 4000 to 4400 Hz. When fixed and adjustable frequency are combined they produce a desired beat frequency as shown in the waveform. The beat frequency is equal to the difference between the frequencies of two currents.

The conventional stimulator delivers most of the stimulations directly under electrodes but with an interferential stimulator the currents pass at greater depth and over a larger volume of tissue. As the medium frequency current is tolerated better by the skin, the therapy can be used for longer time.

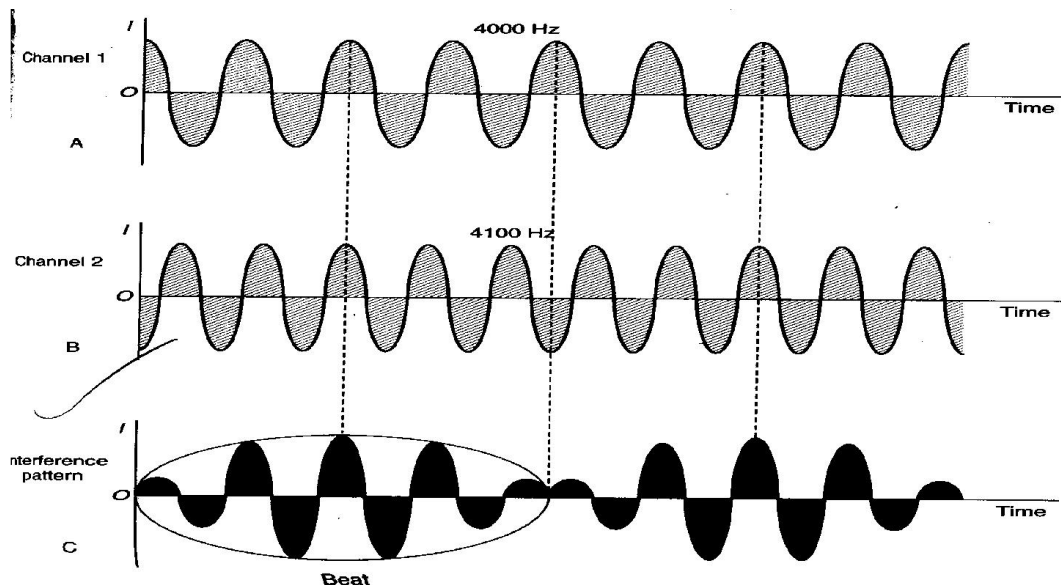


Fig. 10 Waveforms for Interferential current therapy



Q 4 (B)

Attempt any One

Marks 06

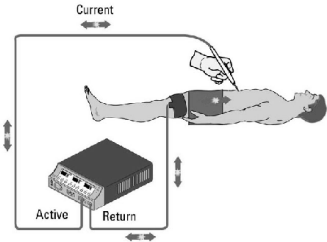
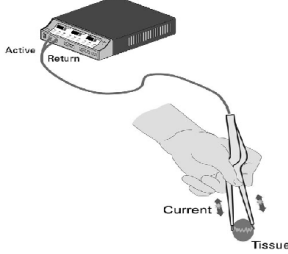
a. State two modes of electro surgery and differentiate between two on the basis of four points. 6m

{2 m modes +4m(any four points diff.)}

- i. Monopolar Mode
- ii. Bipolar Mode

Differentiation between Monopolar & Bipolar mode

(1 mark each for any 4 points)

Sr. No.	Monopolar Mode	Bipolar Mode
1.	In this mode there is only one active electrode.	In this mode there are two active electrodes.
2.	Current flowing through the patient's whole body	Current flowing through that part of the body only, which come in between the active electrodes
3.	It is less safe.	It is more safe
4.	It can be used for larger cuts	It can be used for very precise and fine cuts.
5.	Diagram 	Diagram 

b. Explain the principle of high frequency heating with neat diagram .Differentiate between short wave and microwave diathermy on the basis of i) wavelength ii) application

(Diagram 2 m+ description 2 m +2m difference)

6m

It is based on the fact that the dipole molecules of the body are normally placed randomly. Under the influence of an electric field they rotate according to the polarity of electric field. If the polarity of electric field is changing the dipole molecules try to orient themselves according to changing polarities of electric field. This result in the large inter molecular movement or friction which ultimately results in heating of that body.



The use of high frequency energy has the advantage of considerable penetration as compared to simple heat application. Thus it can be used for deeper laying tissues such as muscles, bones etc.

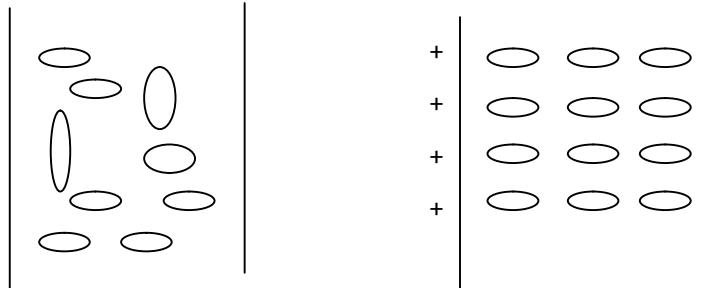


Fig 11 Randomly oriented dipole molecule Polarized dipole molecule

Differentiation between shortwave and microwave diathermy (2marks 1 mark for each pt.)

Sr. No.	Parameter	Shortwave Diathermy	Microwave Diathermy
1	Wavelength	3meters to 30 meters For therapeutic purpose 11mts	1 cm to 100 cm For therapeutic purpose 12.25cm, 69 cm
2	Application	It is used for the treatment of inflammation, bacterial infection pain relief and reducing healing time.	It is suitable for lesions in superficial tissues and with high fluid content, hence used for rheumatic conditions for small joints.

Q. 5 Attempt any FOUR Marks 16

a. Compare CPM and Traction on the basis of any four points 4m

Sr. No.	Traction	CPM
1	In this therapy there is involvement patient's muscle	In this therapy there is no involvement patient's muscle
2	Force is applied	Force is not applied
3	It is used as routine therapy	It is specially used as post operative therapy
4	Types are Cervical traction & Lumber Traction	Types are Knee joint & Shoulder joint

b. State and explain any four effects of shortwave on human body. 4m

- i. Increased metabolic activity:
Heating treatment given through SWD can accelerate rate of metabolism, it is more in the superficial tissues.
- ii. Increased blood flow:

Increased blood supply ensures the optimum conditions for muscle contraction.

iii. Heating of nerves creating sedative effects:

Heat appears to produce sedative effects due to heating of nerves.

iv. Heating of muscles and tissues results in muscles relaxation:

Rise in temperature includes muscle relaxation and increases the efficiency of muscle action.

- c. Draw neat waveform for Surged faradic and biphasic current and explain its application for stimulation. (2m+2m)
4m

Ans: Surged faradic

If the peak current intensity applied to the patient increases and decreases rhythmically or periodically and the rate of increased and decreased of the peak amplitude is slow, it can provide relaxation and contraction of muscles. The ratio of ON time and OFF time of surging is also adjustable so that graded exercise may be given.

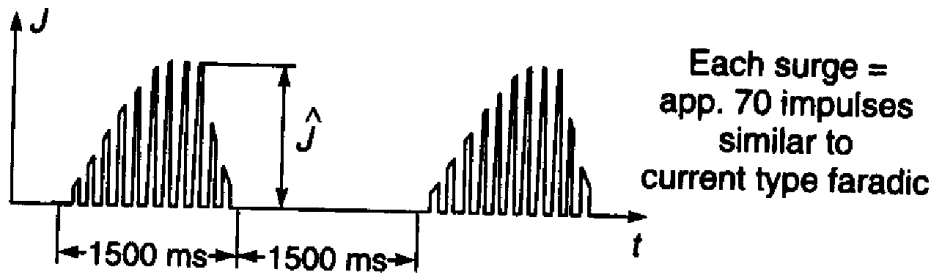


Fig 12 Surged faradic current

Biphasic Current:

The cell recovery from the effect of stimulus current can be achieved by the passage of lower intensity current of opposite polarity over a longer period. Such type of combination of positive and negative pulse is called as biphasic stimulation. In this the stimulating pulse are followed by a pulse of opposite polarity of $1/10^{\text{th}}$ of the amplitude and 10 times the width.

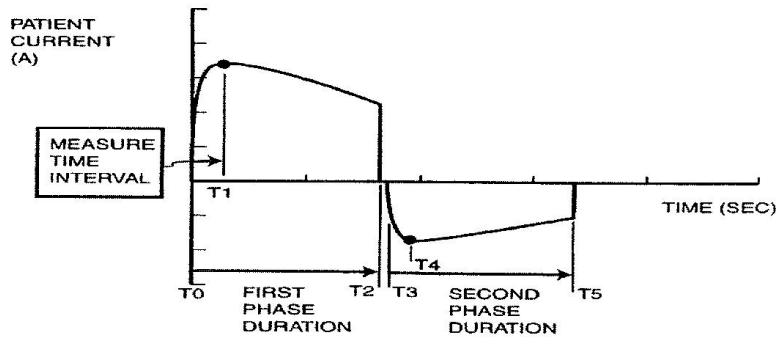


Fig 13 Biphasic current

- d. State contraindications of cold therapy 4 m
1. It should not be used to particularly the elder patients as it may create discomfort to them.



2. To be avoided in cardiac conditions: The initial shock of the ice application may cause a marked drop in blood pressure thus causing an increase in heart rate. It can cause problem to heart patient.
 3. To be avoided in peripheral nerve injuries: These types of injuries lose their normal response to cooling. If such an area were cooled with ice it may become very cold and take many hours to regain normal temp.
 4. Peripheral vascular disease: As cold application may reduce an already inadequate blood supply, ice is avoided.
- e. Draw a neat diagram for test of grounding system in patient care area and explain (3 marks diagram 1 mark explanation)
4m

Ans: The voltage between a reference grounding point and exposed conductive surfaces should not exceed 20mv for new construction. For existing construction the limit is 500mv for general care areas and 40 mv for critical care areas. The impedance between the reference grounding point and receptacle grounding contacts must be less than 0.1 ohm for new construction & less than 0.2 for existing construction.

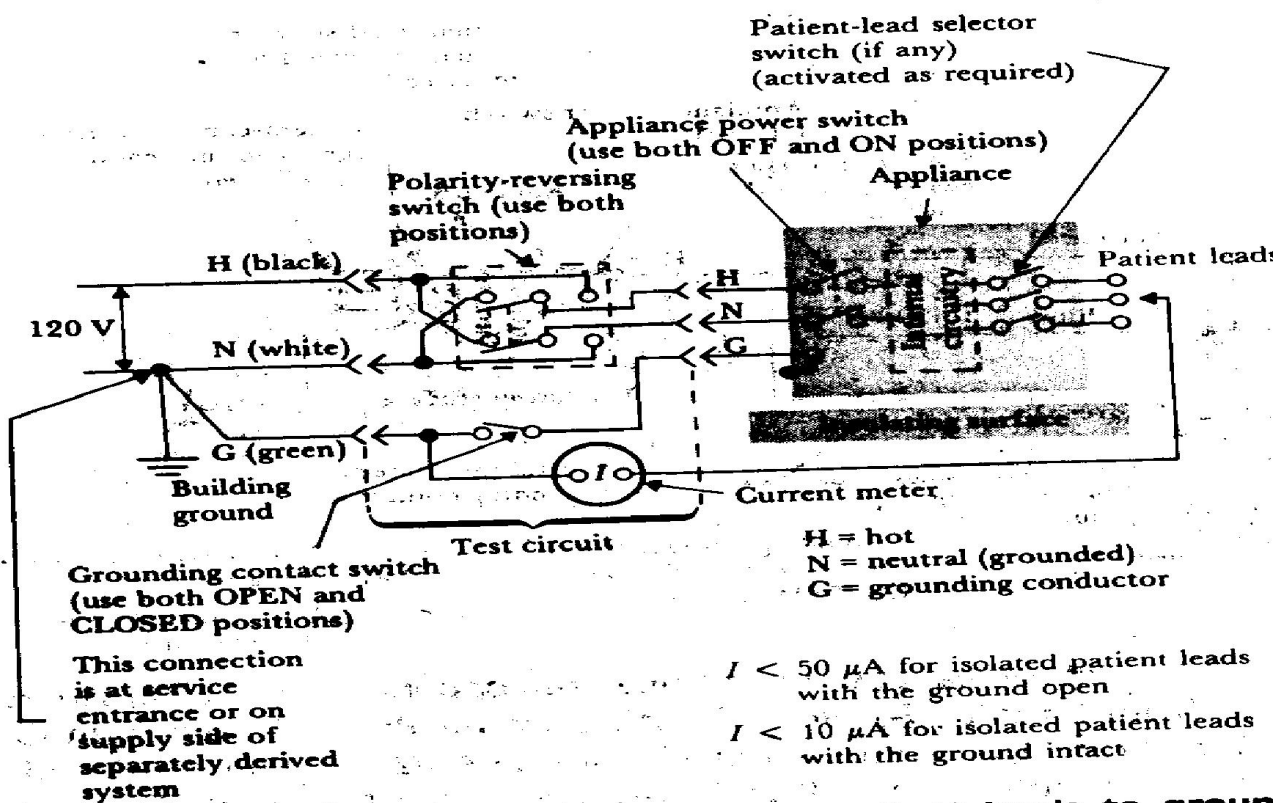


Fig. 14 Testing of grounding system in patient care area



f. State the concept of Electrostatic discharge.

4m

Ans: Electrostatic discharge (ESD) is the release of static electricity .ESD first requires a buildup of an electrostatic charge. This occurs when two different materials rub together. One of the material becomes positively charged; and the other becomes negatively charged. The positively charged material now has an electrostatic charge .When that charge comes into contact with right material .it is transferred an we have an ESD event. Heat from the event is extremely hot although we do not feel it when we are shocked.

However when the charge is released on electronic device such as expansion card ,the intense heat from the charge can melt or vaporize the tiny parts in the cards causing the device to fail. For example, hard drive components are sensitive to only 10v .For this reason, manufacturers of electronic devices incorporate measures to prevent (ESD).Sensitive devices can be packed with materials that shield the product from a charge.

Examples of ESD like the shock we receive when we walk across carpet and touch a metal doorknob and the static electricity we feel after drying clothes in clothes dryer.While most ESD events are harmless, it can be an expensive problem in many industrial environments.

Q. 6 Attempt any FOUR

16 Marks

a. State the faults that can occur on ultrasound machine and shortwave diathermy unit (two of each machine)

4m

Ultrasound machine:

(2 marks for any 2 pts)

- i. Power cord may be faulty
- ii. Fuse may be blown out
- iii. On/Off switch may not working
- iv. Control circuit may not working

Short wave diathermy

(2 marks for any 2 pts)

- i. Power cord may be faulty
- ii. Fuse may be blown out
- iii. On/Off switch may not working
- iv. Control circuit may not working

b. Describe any two methods for accident prevention.

4m

- i. Grounding
- ii. Double insulation
- iii. Protection by low voltage
- iv. Ground- fault circuit interrupter
- v. Isolation of patient connected parts
- vi. Isolated power distribution system

c. Differentiation between luminous and non luminous generator(4 pts)

4 m

Sr. No	Luminous Generator	Non-Luminous Generator
1	It consists of a tungsten filament	It consists of coil wound on ceramic cylinder
2	Wavelength of light generated is 350-4000nm	Wavelength of light generated is 750-1500nm
3	It produces IR, visible and UV radiation	It produce only IR radiation



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4	It requires 600- 1500 w power	It requires 750- 1000w power
5	It requires 5min pre heating time	It requires 5min- 15 min pre heating time

d. **Suggest the possible solution and state the cause for the following faults on ESU(Electro surgical Unit)** 4m

Sr. No.	Faults	Cause	Solution
1	Deactivation of alarm tone	Loose or damaged connection between speaker board and main circuit board	Check connection Replace the faulty speaker
2	Mode buttons do not operate	Loose or disconnected cable between main circuit board and display board	Check connection/ cable Replace the chord
3	Non- responding foot switch	Loose or damaged connection between machine and foot switch	Check connection/ cable Replace the chord
4	Electric shock	Leakage current, open power chord may be touching to metal body, faulty grounding	Check connection/ cable grounding system

e. **Identify the figure A and mention the name of electrodes used at position A and position B** 4m

Ans: Figure is representation of monopolar mode of Electrosurgical unit- (2 marks)

Electrode at position A- An active electrode it can be needle or loop electrode (1 mark)

Electrode at position B- Passive electrode or differential electrode or patient's plate it provides return path. (1 mark)