Summer– 16 EXAMINATION

Subject Code: **17671** **Model Answer** Page No: 1/ 24

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.

Summer– 16 EXAMINATION

Subject Code: **17671** **Model Answer** **Page No: 2/ 24**

Q.1 (A) Attempt any THREE: **Marks 12**

a) List any four effects of UV on human body. **4m**

(Each Effect 1m)

Ans:

Effects of UV on human body

1. Production of vitamin D
2. Pigmentation
3. Thickening of epidermis – due to over activity of basal layer of epidermis causes a mark thickening of outermost layer.
4. Peeling – The increased thickness of epidermis is resulting as peeling.
5. Aging – The normal aging process of the skin is accelerated if there is continued exposure to UV.
6. Erythma
7. Antibiotic effect

b) Draw and explain the block diagram of traction unit. **4m**

(Diagram 2m + Explanation 2m)

Ans:

Explanation of traction unit:

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.

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.

Block diagram of traction unit:

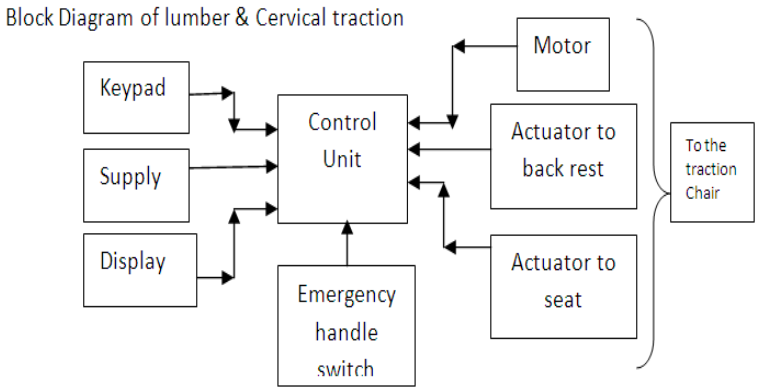


Fig: Block diagram of traction unit

c) State four effects of ultrasound on human body. 4m

(Each effect 1m)

Ans: Effects of ultrasound on human body

The result of absorption of ultrasound in the tissue is due to the oscillation of particles about their mean position. This oscillations or sonic energy is converted into heat energy which is proportional to the intensity of ultrasound. This heat energy can be used for treatment in the following ways:

1. Healing or thermal effect.
2. Micro-massage or mechanical effect.
3. Chemical effect (wound healing).
4. Biological effect (wound healing).

d) State the principle of cold therapy. 4m

(Principle 4m)

Ans:

Principle of cold therapy:

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.

(B) Attempt any ONE: **Marks 06**

a) Draw the block diagram of ultrasound therapy machine. Explain it. List any four applications of ultrasound machine. **6m**

(Diagram 2m + Explanation 2m + Applications 2m)

Ans:

Explanation of ultrasound therapy machine:

The ultrasonic generator or ultrasound therapy machine is constructed on the basis of piezoelectric effect. A high frequency oscillator of current of 0.75-3MHz is applied to a crystal whose acoustic vibrations cause the mechanical vibrations of the transducer head. The block diagram shows typical ultrasound therapy unit. The heart of the system is an oscillator which produces the oscillations of required frequency. 230AC, 50Hz is applied to a timer circuit through a fuse of 1A rating. The timer is set for the duration of ultrasonic therapy treatment which can be varied from 0 to 30 minutes. Unless the timer is switched ON, the input supply is not passed to the power control system. A neon lamp is used as the mains indicator. It is an AC power control circuit using DIAC and TRIAC. The output of oscillator can be controlled by controlling the output power of the circuit and it can be done directly by using a variable transformer or by controlling the firing angle of TRIAC. The machine can be operated in either continuous or pulsed mode by switching the output of power and voltage control circuit to half wave rectifier or full wave rectifier. The rectifier output is given to the oscillator which generates the output of 1MHz frequency. The power amplification is done with the power amplifier and finally it is given to the piezoelectric crystal.

Block diagram of ultrasound therapy machine:

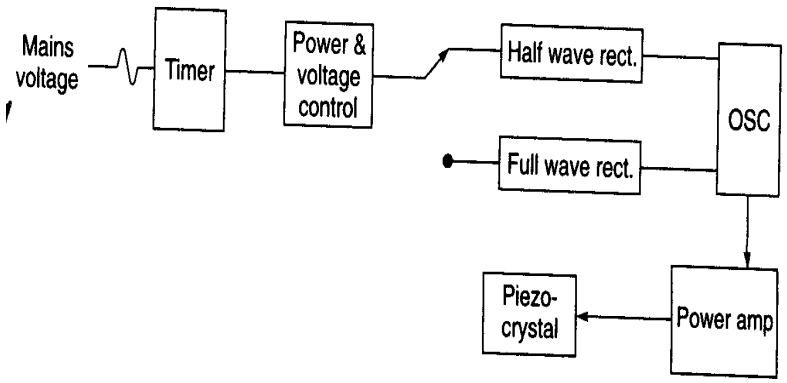


Fig: Block diagram of ultrasound therapy machine

Applications of ultrasound therapy machine:

Ultrasound machine is widely used in medical field to:

1. Take pictures of developing fetus
2. Break up kidney stones
3. To look at internal organs
4. To check blood flow.

The result of absorption of ultrasound in the tissue is due to the oscillation of particles about their mean position. This oscillations or sonic energy is converted into heat energy which is proportional to the intensity of ultrasound. This heat energy can be used for treatment in the following ways:

5. Healing or thermal effect
6. Micro-massage or mechanical effect
7. Chemical and biological effect (wound healing)

b) List and draw the different cutting and coagulation electrodes. 6m

(List 3m + Diagram 3m)

Ans:

1. Needle Electrode
2. Angulated Lancet Electrode
3. Wire loop electrode
4. Angulated band loop electrode
5. Straight electrode
6. Ball type electrode for coagulation

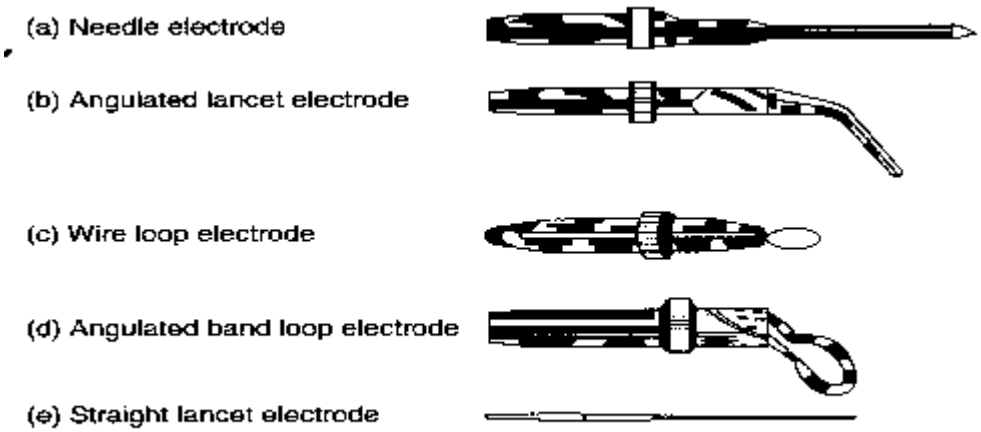


Fig. 27.8 *Cutting electrodes used with diathermy machine*

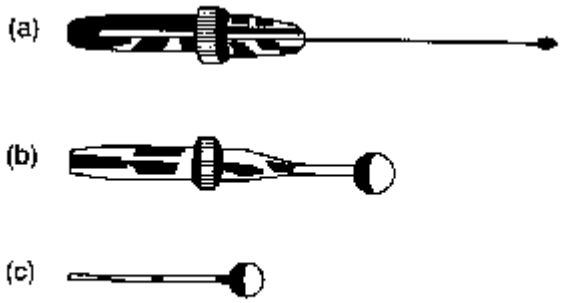


Fig. 27.9 *Coagulation electrodes of different shapes and sizes*

Q.2 Attempt any FOUR: **Marks 16**

a) State the necessity of traction unit. List the applications of cervical and lumbar traction unit. (any two) 4m

(Necessity 2m + Applications of cervical traction 1m + Applications of lumbar traction 1m)

Ans:

The necessity of traction unit:

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

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

The applications of cervical traction unit:

Cervical spinal traction is used for the short-term treatment of neck pain. It is designed to relieve muscle spasms and nerve root compression. Using a manual (hands only) or mechanical technique, a steady or intermittent force is applied to the neck to stretch the muscles and soft tissue and open up the spaces between the upper vertebrae. The physical therapist determines the amount of force and length of time a person remains in traction. Slowly, over time, the amount of pressure is increased.

The applications of lumber traction unit:

Similarly, lumbar traction is the continuous or intermittent application of force to the spine either manually or mechanically. The goal of lumbar traction is to reduce the pain associated with nerve root impingement and muscle spasms. It is also used to treat degenerative disc disease, herniated or protruding discs and osteoarthritis. As with cervical spinal traction, the process separates the space between vertebrae, which decompresses discs, alleviates pain and supports healing.

b) State and explain different current waveform used in nerve and muscle stimulator. 4m

(State 1m + Explain of current waveform 3m)

Ans:

State different current waveform:

1. Galvanic current
2. Faradic Current
3. Exponentially progressive current
4. Interrupted DC or rectangular pulses with adjustable slope.
5. Surged Faradic

Explanation of different current waveform:

1. **Galvanic current:**

It may be used for the preliminary treatment of autonic paralysis (muscles are completely deactivated or weak) deactivated and for the treatment of disturbance in blood flow for the treatment of disturbance in blood flow. It is also used for in tophoresis (introduction of drugs into the body through the skin by electrolytic means) in general the intensity of the current passing through any part of the body does not exceed 0.3-0.5mA/$cm^{2\ of}$ electrode surges.

2. **Faradic Current:**

This is used for the treatment of muscular weakness after lengthy immobilization when a patient is enable to produce muscle contraction or finds difficulty in doing so. This electrical stimulation may be used in accessing voluntary contraction.

3**. Exponentially progressive current:**

It does not stimulate the surrounding healthy tissue. This current is useful for the treatment of functional paralysis.

4. **Interrupted DC or rectangular pulses with adjustable slope:**

It is used for the treatment of denervated muscle and to improve the condition of muscle having severe paralysis

5. **Surged Faradic:**

It is used for the treatment of functional paralysis. It is used also for the treatment of spasm, pain and for the odema and inflammation.

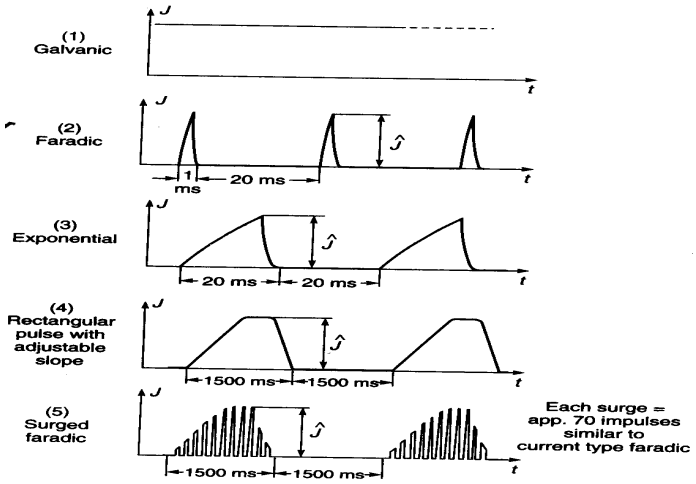


Fig : Current waveform

c) Give the significance of circulatory response and neural response. 4m

(Circulatory response 2m + Neural response 2m)

Ans:

The significance of circulatory response and neural response:

Circulatory response:

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.

d) Define leakage current. List and explain its types. 4m

(Definition 1m + List 1m + Explanation 2m)

Ans:

Definition of leakage current:

Leakage current is an inherent flow of current from the live electrical parts of an appliance or instrument to the accessible metal casing or parts. The value of this current is very low , about a few milliamperes (mA).This is called leakage current. This is not necessarily due to some fault in the equipment. 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.

List of leakage current:

1. Capacitive leakage current

2. Resistive leakage current

Explanation types of leakage current:

1. Capacitive leakage current:

The capacitive leakage current can originate in any instrument. The current , which results due to the distributive capacitance between any two wires or between a wire & the instruments metal case is called the capacitive leakage current.

2. Resistive leakage current:

Resistive leakage current arises due to faulty or poor insulation. This is mainly due to the insulation surrounding the power wires & transformer primary windings. However , resistive leakage current is negligible compared to capacitive leakage current.

e) Write the fault finding procedure of electrosurgical unit. (Any four steps) 4m

(Fault finding procedure 4m)

Ans:

1. Check power cable continuity.
2. Check fuse continuity.
3. Check the power ON/OFF switch.
4. Check the output of power supply circuit
5. Check output of at patient electrode.
6. Check the output of logic & control circuit.
7. Check the output of foot switch.

f) State the significance of grounding. **4m**

(Signification 4m)

Ans:

The significance of grounding:

Earthing or grounding means to connect any electrical appliance, machine or equipment at zero potential of general mass of earth with wire connected with the earth electrode buried in the earth at the moistened place. Earthing is as important as the fuses in the wiring circuits i.e.in the case of short circuits or over loads, the heavy current flows through the wires and fitting etc. which melts the fuse wire and stops the flow of current in the circuits, thus save the whole circuit from being damaged. When any live or phase wire touches the metal part of the fitting, appliance, machine or equipment, the current passes through the earth wire, if the appliance, equipment or machine etc. are connected with proper earth connection, blows the fuse at once and saves the operator from getting shock. Thus to avoid these dangers, all metal parts of the fitting, appliances, equipment, machines etc are earthed.

Q.3 Attempt any FOUR: **Marks 16**

a) List any four medical applications of LASER. **4m**

(Each application 1m)

Ans:

Medical applications of LASER

Lasers are presently used for variety of applications in medical field the medical use of laser is suitable where there is a favorable interaction between laser radiation and human tissues. The success of laser therapy depends upon:-

1. Radiation wavelength.
2. Ability of tissues to absorb this wavelength.
3. Power delivered by laser on treatment area.
4. Total energy incident on tissues & area treated.

1. **Tissues Healing**

Laser radiations are used to accelerate wound healing for this purpose red part of visible spectrum have been particularly employed and found to be effective.

2. **Pain control**

Laser therapy is used for relief of acute and long term pain, it can be used for treating of rheumatoid arthritis.

3. **Osteoarthritis**

Various back pains, nerve inflammation, muscular sprain etc lasers help in pain relieving effect and reduction of joint swelling pain is also treated by application of laser source to trigger acupuncture points neurogenic pain can be relieved in some patient by laser application.

4**. Retinal Coagulation**

The heat generated by laser results in retina being attached with the choroid.

5. **Measurement of eye activity**

b) Write any four technical specifications of ultrasound therapy machine. 4m
(Each specification 1m)

Ans:

Technical specifications of ultrasound therapy machine:

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 cm^2

c) Compare unipolar and bipolar modes solid state cautery machine. (any two points of each) 4m

(Unipolar any two points 2m + Bipolar any two points 2m)

Ans:

Comparison between Unipolar & Bipolar mode:

Sr. No.	**Unipolar 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

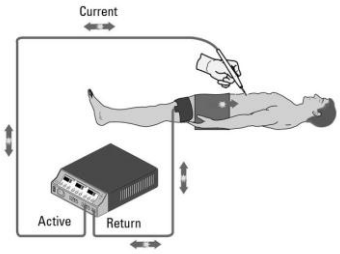
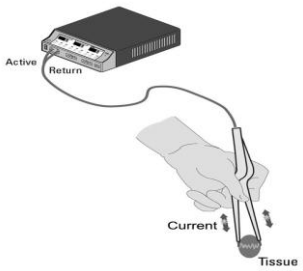
		cuts.
5.	Diagram 	Diagram 

Fig: Comparison between Unipolar & Bipolar mode

d) A nerve muscle stimulator is received with following problem. Explain the technique to eliminate it. 4m

i) Stimulation intensity too low

ii) Stimulation intensity too high

iii) Stimulation period is too short or long

iv) No stimulation is obtained

(Each technique 1m)

Ans:

The technique to eliminate it:

i) Stimulation intensity too low

Solution: Check the respective internal circuitry for intensity control.

i) Stimulation intensity too high

Solution: Check the respective internal circuitry for intensity control.

iii) Stimulation period is too short or long

Solution: Check timer block , if any fault then replace it.

iv) No stimulation is obtained

Solution: Check main power supply, switch, cable, Check the respective internal circuitry for intensity control.

(Any other relevant answer should be consider.)

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

(Each technique 1m)

Ans:

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.

Q.4 (A) Attempt any THREE: **Marks 12**

a) Which application technique of shortwave diathermy is used if the knee joint of patient is to be treated? 4m

Draw neat diagram of it.

(Name of application technique 2m + Diagram 2m)

Ans:

Name of application technique used if the knee joint of patient is to be treated:

1. Capacitive or condenser field or plate method.

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

Diagram of Capacitive or condenser field or plate method:

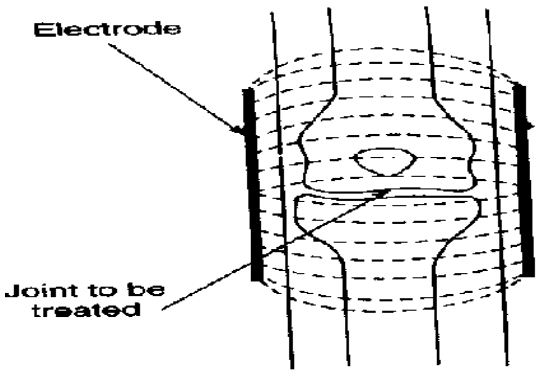


Fig: Capacitive or condenser field or plate method

b) What are the technical specifications of nerve and muscle stimulator? 4m

(Each specification 1m)

Ans:

Technical specifications of nerve and muscle stimulator:

1 .Power supply- 230V, 50Hz
2. Output voltage- 0 to 150v
3. Output current- up to 80mA
4. Variable pulse duration- 0.3,1,10,30,100,300 msec
5. Pulse repetitive duration - 0.3,1,3 up to 10 msec
6. Surged faradic frequency- 6 to 60 surges/min

c) Draw constructional diagram of UV lamp. Also describe principle of operation of UV lamp. 4m

(Diagram 2m + Operation 2m)

Ans:

Constructional diagram of UV lamp:

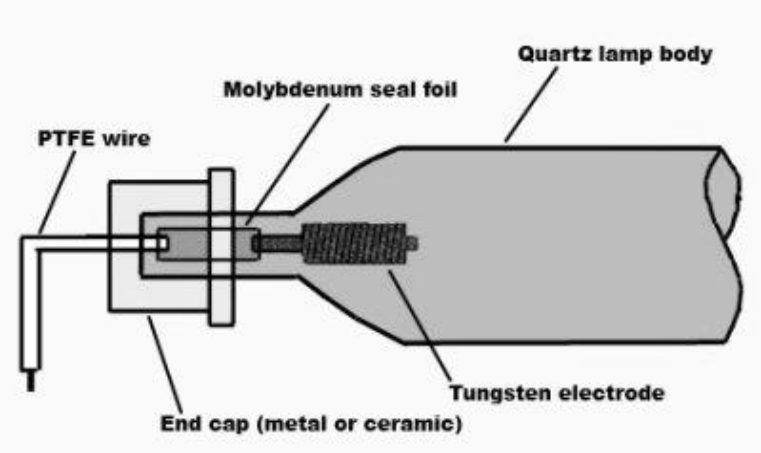


Fig: Constructional diagram of UV lamp

Principle of operation of UV lamp:

It consist of 'U' shape quartz tube. It allows the passage of UV radiation can withstand very high temperature & has low coefficient of expansion. The tube is filled with argon gas at low pressure a small quantity of mercury is also enclosed in the tube. An electrode is sealed on the either ends of the tube. Argon gas is extremely stable and inert high amount of energy is required to ionize the argon gas. It is obtained by applying high voltage (400 V) from an autotransformer across a tube for a fraction of seconds. Once the argon gas has been ionized normal AC mains voltage is been applied across the tube. When argon gas is ionized there are number of free electrons which can move randomly inside the tube.It will cause collision between free electrons & mercury atoms as well as free electrons &neutral argon atoms, Which causes further ionization current across the tube. This current flow can be seen as a glow discharge.

d) Describe the principle of interference therapy. **4m**

(Principle 4m)

Ans:

The principle of interference therapy:

Interferential Therapy is a form of electrical treatment in which to midium frequency currents are used to produce low frequesncy currents. The basic principal is when two midium frequency currents crosses in patients tissue it produceses interference effect in that tisuue. In this method one current is kept at contance frequency 4000 Hz. and second can be ajustable from 4000 to 4400 Hz. When fixed and adjustable frequency are combine they produces deisre beat frequency as shown in wave form. The beat frequency is equal to the difference in between frequency of two currents.

The convenstional stimulator delivers most of the stimulations directely under electrods but with interfentioal stumilator the currents passes at greater depth and over a larger valoume of tissue. As the midium frequency current is tollarated better by the skin the theorpy can be used for longer time.

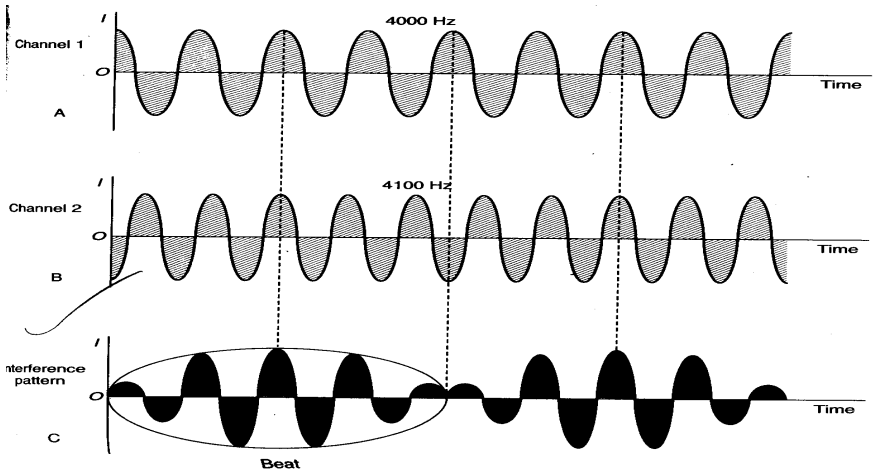


Fig: Waveforms for interference current therapy

(B) Attempt any ONE: **Marks 06**

a) Explain the methods of cutting and coagulation. **6m**

(Diagram 3m+ Explanation 3m)

Ans:

Methods of cutting and coagulation:

1**. Cutting or electrotomy:**
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

2. **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

.

3. **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.

4. **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.

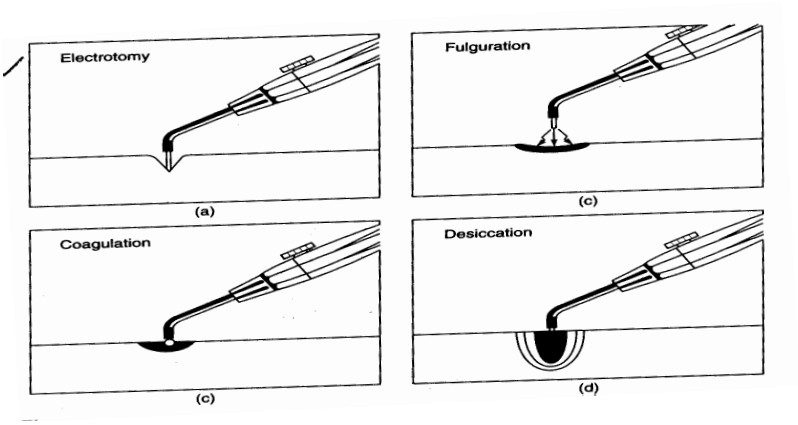


Fig : Different methods of cutting & coagulation

b) State and explain microwave diathermy with neat diagram. 6m

(Explanation 3m + Diagram 3m)

Ans:

Explanation of microwave diathermy:

When the electromagnetic energy of the microwave radiation is absorbed in the tissue, it provokes ionic movements, rotation of the dipoles & causes distortion of the molecules of the insulators. The amount of heat produce inside the tissue depends upon the fluid contents. The microwave penetrates deeper than infrared rays. The effective depth of penetration of MWD is 4.3 cm. The half value depth of MWD is 3 cm. As microwaves are more absorbed by the water so those tissues which have good blood supply like muscle are heated mostly while those tissues which have low fluid contents like fat produces less heat. The depth of penetration of MWD is frequency dependent. As the frequency decreases the depth of penetration increase i.e. MWD has two therapeutic frequencies 915 MHz and 2450 MHz , The depth of penetration of 915 MHz is greater than 2450 MHz .

Diagram of microwave diathermy:

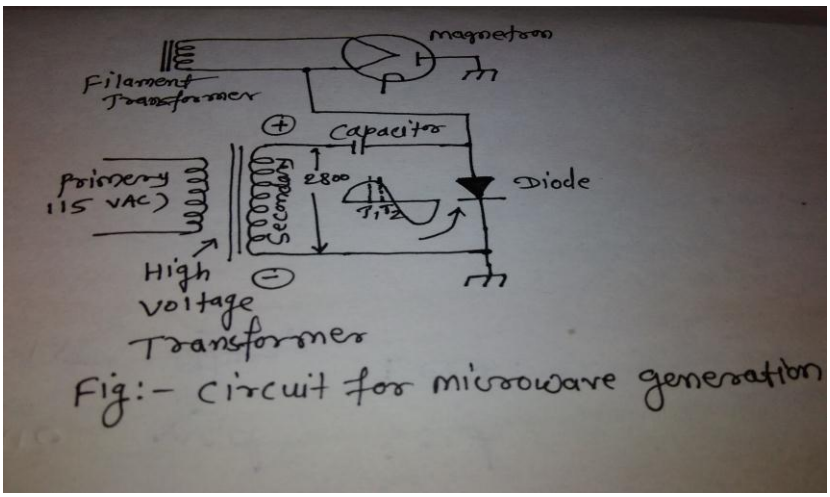


Fig: Microwave diathermy

Q.5 Attempt any FOUR: **Marks16**

a) Compare CPM & traction unit. (Any two points of each) **4m**

(CPM two points 2m + traction two points 2m)

Ans:

Compare CPM & traction unit:

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

Fig: Compare CPM & traction unit

b) List any four technical specifications of shortwave diathermy. **4m**

(Each Technical specification 1m)

Ans:

Technical specifications of shortwave diathermy:

1. Input power- 230 V, 50 Hz
2. Max. Power o/p- 500W
3. Frequency operation-27.12 MHz
4. Wave length- 11 Meters
5. Fuse- 1Amp

c) Name the currents used for treatment of atonic paralysis, muscle weakness, functional paralysis, denervated muscle. **4m**

(Each current 1m)

Ans:

1. Atonic paralysis – Galvanic Current
2. Muscles weakness – Faradic Current
3. Functional Paralysis – Surged Faradic Current
4. Denervated Muscles – Rectangular pulse with adjustable slope or Interrupted DC

d) State and explain contra- indication method. **4m**

(State 2m + Explanation 2m)

Ans:

State contra- indication method:

Contra indication: A condition which makes a particular treatment or procedure potentially inadvisable.

A contraindication may be absolute or relative.

Explain contra- indication method:

1. An absolute contraindication is a situation which makes a particular treatment or procedure absolutely inadvisable. In children, for example, aspirin is almost always contraindicated because of the danger that aspirin will cause Reye syndrome.

2. A relative contraindication is a condition which makes a particular treatment or procedure possibly inadvisable. For example, X-rays in pregnancy are relatively contraindicated (because of concern for the developing fetus) unless the X-rays are absolutely necessary. Contraindications often highlight the balance of risk versus benefit of a particular treatment or procedure.

e) Describe electrical microshock and macroshock. **4m**

(Electrical microshock 2m + Electrical macroshock 2m)

Ans:

Electrical microshock:

In this case current passes directly through the heart wall (internal part of body). In this case small amount of current cause very dangerous to the person. Micro current applied internally to the body. In this case directly current pass through the heart. Therefore less current to produce ventricular fibrillation . Such situations are commonly generated in hospital.

Electrical macroshock:

In macroshock or gross shock current flows through the external body parts of person ex. Hand , Foot. Macroshock will be generated by the person accidental contact with electrified object at any point on the surface of body. The majority accidents involves or develop passage of current from one upper limb to the feet. The value of electric current flowing through the body varies from person to person. The value of current depend upon the contact impedance, age, weight, condition of skin, sex, frequency of current, duration of current etc.

f) State the concept of electrostatic discharge. **4m**

(Concept 4m)

Ans:

The concept of electrostatic discharge:

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 dryier.While most ESD events are harmless, it can be an expensive problem in many industrial environments.

Q.6 Attempt any FOUR : **Marks16**

a) List any four faults and causes of faults found in ultrasound therapy machine. **4m**

Also explain the action for overcoming these faults.

1. Equipment is not running

2. Fuse keeps blowing

3. Electrical shock

4. Probe head damaged or noisy

(Each fault 1m)

Ans:

1. Equipment is not running

Cause: 1.No power from mains socket

2. Electrical cable fault

Action taken: 1.Check power switch is ON.

2. Replace fuse with correct voltage & current if blown.

3. Try cable on another piece of equipment.

4. Contact electrician.

2. Fuse keeps blowing

Cause: Power supply or cable fault

Action taken: Refer to electrician

3. Electrical shock

Cause: Wiring fault

Action taken: Refer to electrician

4. Probe head damaged or noisy

Cause: Possible internal fault

Action taken: 1. Exchange probe

2. Send for testing & repair

b) List methods of accident prevention and explain any one with diagram. 4m

(List 1m + Explain 1m + Diagram 2m)

1. Grounding
2. Double insulation
3. Protection by low voltage
4. Ground- fault circuit interrupter
5. Isolation of patient connected parts

1. Explanation of grounding method:

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.

Diagram of grounding method:

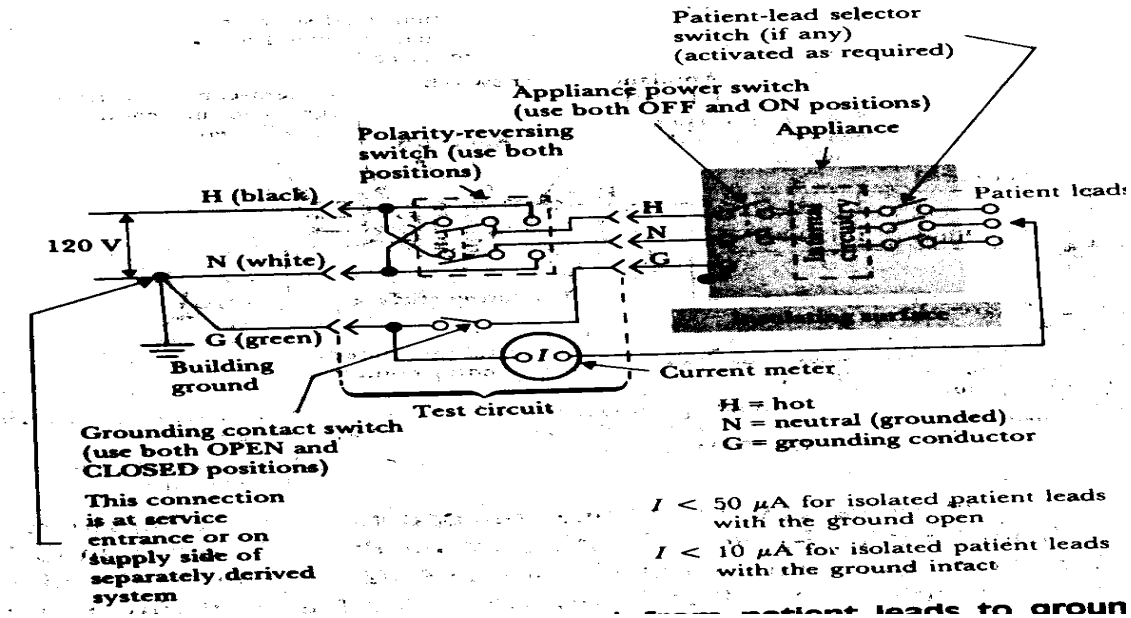


Fig: Grounding method

2. Double Insulation:

Insulated equipment the case is made of nonconductive material, usually a suitable plastic. If accessible metal parts are used, they are attached to the conductive main body of the equipment through a separate(protective)layer of insulation in addition to the (functional) insulation that separates this body from the electrical parts. The intention of this method is to assure that the fault resistance Rf is always very large. Double – insulated equipment need not be grounded, and therefore it is usually equipped with a plug that does not have a ground pin. Equipment of this type must be labelled "Double Insulated." Double insulation is now widely used as a method of protection in hand-held power tools and electric-powered garden equipment such as lawn mowers. Unless the equipment is also designed to be waterproof, the double insulation can easily be rendered ineffective if a conductive fluid such as saline or urine is spilled over the equipment or if the equipment is submerged in such a fluid**.**

3. Protection by low voltage:

In the generalized accident model of figure 16.1(b) it was assumed that the voltage source was the line voltage (115 or 230 v ac.) If, instead, another voltage source were used, and if the voltage of this source could be made small enough, the body resistance RB would be sufficient to limit the body current to a safe value, even if the fault and contact resistances become very small. One way of creating this situation is to operate the equipment from batteries. Aside from its lower voltage there is the additional advantage that battery-operated equipment does not have to be grounded. A low operating voltage can also be obtained by means of a step-down transformer. In addition to lowering the voltage the transformer provides isolation of the supply voltage from ground. Where power requirements are small, the transformer can be made an integral part of the line plug, a design now frequently employed in small electronic equipment as well as in such medical devices as ophthalmoscopes and endoscopes**.**

4. Ground-Fault Circuit Interrupter:

Normally all current that enters a device through the hot wire returns through the neutral wire. However, in the case of such an accident, part of the current actually returns through the body of the victim and through ground. In the ground fault circuit interrupter, the difference between the currents in the hot wire and neutral wires of the power line is monitored by a differential transformer and an electronic amplifier. If this difference exceeds a certain value, usually 5 mA, the power is interrupted by a circuit breaker. This interruption occurs so rapidly than ,even in the case of a large current flow through the body of victim, no harmful effects are encountered**.**

5. Isolation of Patient-connected parts:

Modern technology makes it possible to design circuits that isolated the patient leads from ground. For patient leads that connect to an amplifier, this isolation is most commonly achieved by the use of an isolated input amplifier, as shown figure 16.5. This type of amplifier is completely isolated from the rest of the equipment, with the power provided through a low- capacitance transformer. A second transformer is used to couple the amplified signal to the rest of the equipment. Because signal transformers are difficult to design for the frequency range of biological signals, a modulation scheme is normally employed. The amplifier shown in the figure users amplitude modulation of the carrie signal used to provide power for the isolated amplifier. Other designs use frequency modulation.

(Any other relevant answer should be consider.)

c) State and explain the construction and working of IR lamp. 4m

(Construction 2m + Working 2m)

Ans:

Construction of IR lamp:

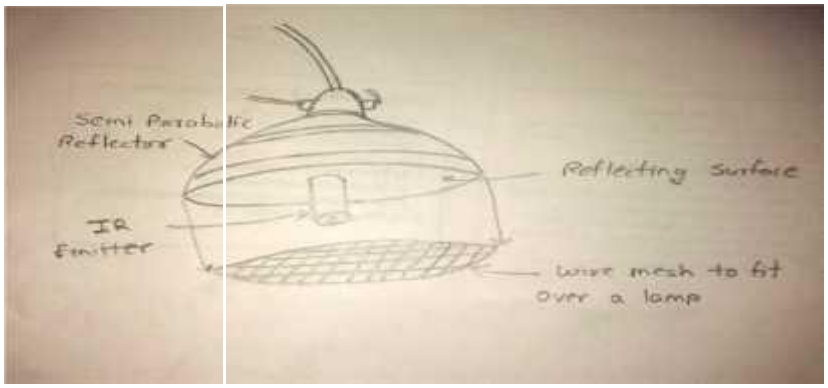


Fig: Construction of IR lamp

Working of IR lamp:

There are two types of IR generators

1. Non Luminous generator- generates only IR.
2. Luminous generator-generates IR, visible & some UV rays.

1. Non Luminous generator Construction & working

It provides IR rays only. It consists of an element for producing IR rays. A coil of wire is wound on the cylinder of some insulating material such as fire clay or porcelain. An electric current is passed thro the wire and produces heat. IR rays are emitted from the hot wire and from the fire clay former which is heated by conduction. Usually the coil of wire is embedded in the fire clay or placed behind a plate of fire clay. The emission of rays is then entirely from the fire clay. The elements are placed at the focal point of a parabolic or gently curved spherical reflector. The reflector is mounted on a stand and its position can be adjusted as required. All non luminous elements require some time to heat up before the emission of rays reaches to maximum intensity. Hence lamp must be switched at proper time before the they are required. Non luminous elements produce IR rays with wave length from 750 nm – 15000 nm.

d) Suggest possible solution for following faults of electrosurgical unit. 4m

1) Equipment is not turning ON

2) NO cut & but coagulation is OK

3) Electrical shock to user

4) NO control over the intensity

(Each fault Solution 1m)

Ans:

Possible solution for following faults of electrosurgical unit:

1) Equipment is not turning ON

Solution: 1.Check power switch is ON

2. Check mains power is present at socket using equipment known to be working.

3. Try cable on another piece of equipment.

2) NO cut & but coagulation is OK

Solution: 1. Check the timer IC if it is faulty replace it.

2. Check the connection of relay if any fault replace it.

3. Check the foot switch if it is not operating replace it.

4. Check the waveform of Multiviabrator if waveform is not available than RF generator faulty. Then replace it

3) Electrical shock to user

Solution: Check connection/ cable grounding system.

4) NO control over the intensity

Solution: 1.Check intensity control switch if it is faulty replace it.

2. Check the intensity control section.

3. Check the connection of electrode if any fault replace it.

e) Name the following Fig. A and complete this block diagram. What is the role of the missing components in this diagram. **4m**

(Name 1m + Complete Diagram 1m + role of the missing components)

Ans:

Name the following Fig. A:

Block diagram of Solid state cautery machine.

Complete block diagram:

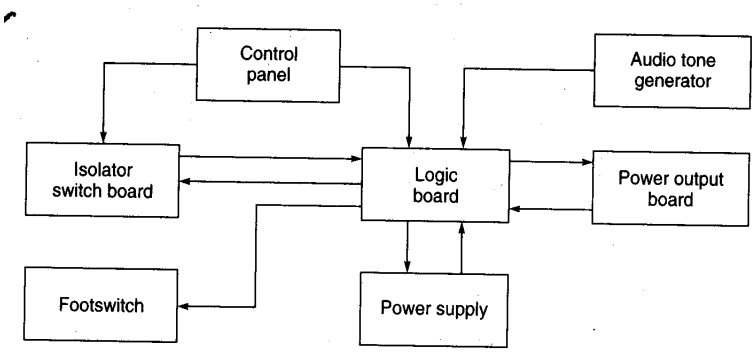


Fig:(A) Block diagram of Solid state cautery machine

Role of the missing components:

1. **Logic board:** The heart of the system is logic & control unit which produces the basic signals and various timing signals for cutting & coagulation modes of operation.

2. **Audio tone generator:** In order to facilitate the identification of each mode of operation the machine incorporate an audio tone generator.