WINTER – 2019 EXAMINATION

Subject Name: Therapeutic Equipment **Model Answer** **Subject Code: 22546**

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. No.	Sub Q. N.	Answer	Marking Scheme
1.		**Attempt any FIVE of the following:**	**10 M**
	a	**List effects of IR on human body.** **Ans:** **Effects of IR on human body:** 1. Irregular patches appear on the skin. 2. Sweating. 3. Sensation of thermal heating. 4. Increase in metabolism. 5. Discoloration of the skin.	**02 M**
	b	**State applications of ultrasound.** **Ans:** **Applications of ultrasound:** 1. Ultrasound is widely used in medicine to: 2. Take picture of developing fetus 3. Break up kidney stones 4. To look at internal organs 5. To check blood flow	**02M**
	c	**Give uses of cold therapy.** **Ans:** **Uses of cold therapy:** 1. Reduce spasticity 2. Reduce pain 3. Reduce muscle spasm 4. Reduce swelling 5. Promote repair 6. Provide excitatory stimulus when muscles inhibited.	**02M**
	d	**State any two effects of electric current on human tissues with respect to ESU.** **Ans:** **Effects of electric current on human tissues:** 1. Cut the tissue. 2. Coagulate the tissue.	**02 M**

		3. Desiccate the tissue. 4. Fulgurate the tissue.	
	e	**State technical specifications of nerve and muscle stimulator.** **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.	**02 M**
	f	**State function of ultrasound therapy transducer.** **Ans:** **Function of ultrasound therapy transducer:** Ultrasound therapy transducer which is used to convert one from of energy into another form of energy. 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 vibration causes the mechanical vibrations of transducer head. Which is directly located in front of the crystal.	**02 M**
	g	**Define microshock.** **Ans:** **Definition of microshock:** Microcurrent 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.	**02 M**
2.		**Attempt any <u>THREE</u> of the following:**	**12 M**
	a	**List any four uses of laser in biomedical field.** **Ans:** **Uses of laser in biomedical field:** 1. Tissues Healing 2. Pain control 3. Osteoarthritis 4. Retinal Coagulation 5. Measurement of eye activity	**04 M**
	b	**List technical specifications of SWD (any 4).** **Ans:** **Technical specifications of SWD:** 1. Input power- 230 V, 50 Hz 2. Max. Power output - 500W 3. Frequency operation-27.12 MHz 4. Wave length- 11 Meters 5. Fuse- 1Amp	**04 M**
	c	**Explain capacitive application technique of short wave diathermy.** **Ans:** **Capacitive application technique:** 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 take place due to the rotation of dipoles & the vibrations of the ions in the tissue fluids and molecular distortion in the tissues.	**04 M**
	d	**State maintenance steps of electrosurgical unit.** **Ans:** **Maintenance steps of electrosurgical unit:** 1. Clean dust from exterior and cover equipment after use. 2. Remove any foreign body from equipment. 3. Check regular electrosurgical unit & make sure power indicator is off when switch is off. 4. Check controls for correct positioning & operation. 5. Check cables and electrodes safely stored. 6. Check all fittings and accessories are mounted correctly. 7. Check for leakage current, check grounding connection. 8. Choose correct electrode tip for desired procedure. 9. Open the machine and test the continuity of circuit at different test points. 10. Repeat the above procedure and test the performance of the machine for different level controls. 11. Every six months biomedical technician check machine.	**04 M**
3.		**Attempt any <u>THREE</u> of the following:**	**12 M**
	a	**State physiological effects of electric shock on human body.** **Ans:** **Physiological effects of electric shock on human body:** 1. Pain. 2. Muscular contraction. 3. Fainting or unconsciousness. 4. Cardiac and/or respiratory arrest. 5. Severe Burn. 6. Ventricular fibrillation. 7. Neurological effects. 8. Permanent damage of body organs. 9. Death.	**04 M**
	b	**Sketch block diagram of traction unit and give its applications.** **Ans:** **Applications of Traction unit:** 1. Straightening broken bones or reliving pressure on the spine & skeletal system. 2. Regain normal length and alignment of involved bone. 3. To rescue an immobilized and fractured bone. 4. To lessen or eliminate muscle spasm. 5. To prevent or reduce skeletal deformities or muscle contraction.	**02 M**

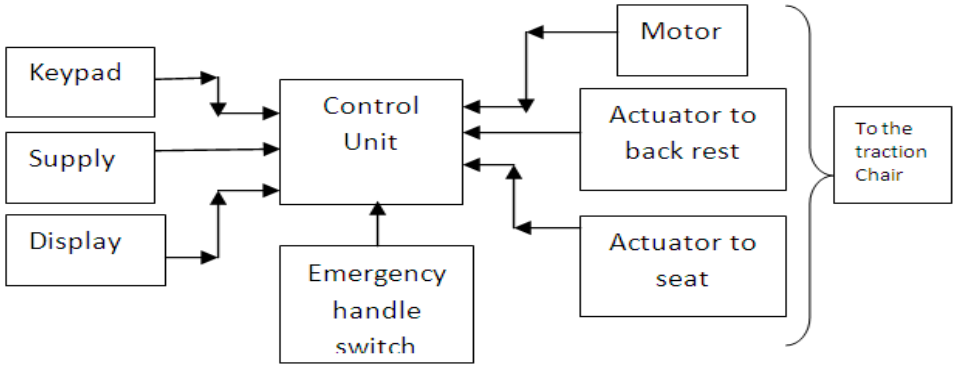


Fig: Block diagram of traction unit — **02 M**

c **Differentiate between UV and IR lamp.** — **04 M**

Ans:

UV Lamp	IR Lamp
1. UV lamps emit UV radiations.	1. IR lamps emit IR radiations.
2. It consists of U shaped quartz tube or burner which acts as a point source.	2. It consist of a coil wound on a cylinder which is made up of an insulating material Then electric current is passed through the wire and IR rays are emitted.
3. Time required by the UV lamps to emit the UV radiations of required wavelength is 5 minutes.	3. Time required by the IR lamps to emit the IR radiations of required wavelength is 5-15 minutes.
4. It emits the UV radiation in the range of 280-400nm.	4. It emits the IR radiations in the range of 750nm-15000nm.

Table: Differentiate between UV and IR lamp

d **Sketch types of cutting and coagulation electrodes. State the specific conditions when each type of electrode is used.** — **03 M**

(Sketch Cutting & Coagulation electrodes: 03 M)
(Specific conditions: 01 M)

Ans:

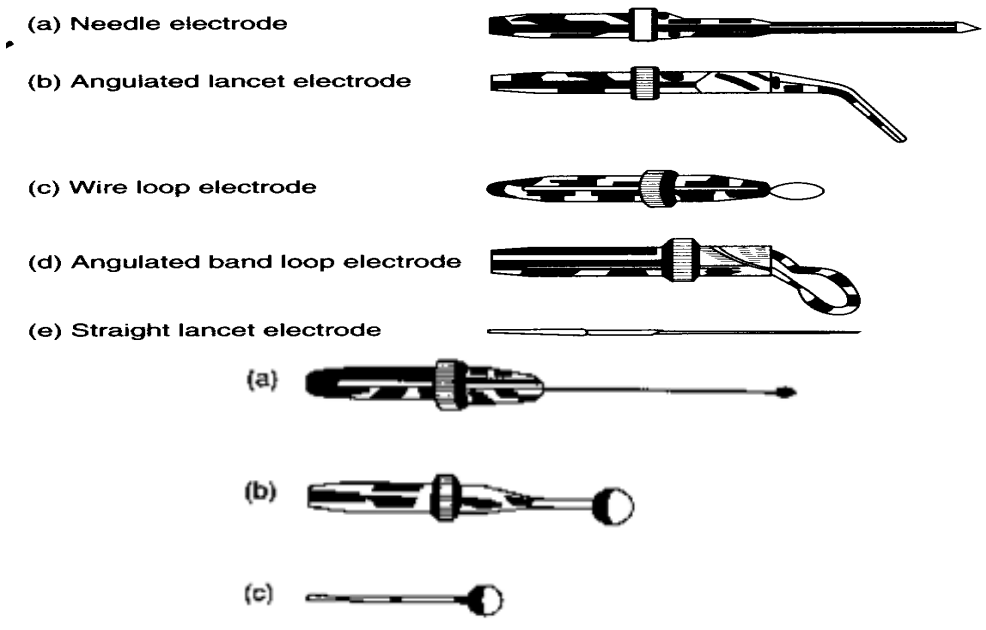
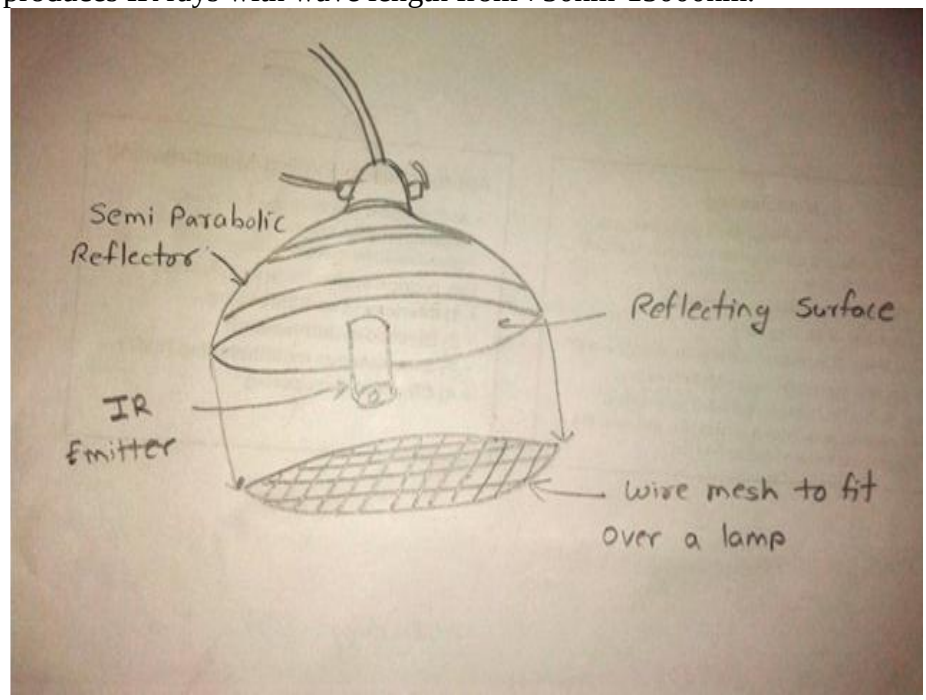


Fig: Cutting and Coagulation electrodes

		Conditions when each type of electrode is used: At the time of cut the tissue cutting electrodes are used. At the time of coagulate the tissue coagualation electrodes are used.	**01 M**
4.		**Attempt any <u>THREE</u> of the following:**	**12 M**
	a	**Explain working of IR lamp with neat sketch.** **Ans:** It consists of a coil of wire would on the cylinder of some insulating material such as fire clay or porcelain. An electric current is passed through the wire and produces heat. IR Ray's are emitted from the hot wire and from the fire clay former which is heated by conduction. It provides IR Ray's only. 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 hear up before the emission of rays reaches to maximum intensity. Hence lamp must be switched at proper time before they are required. Non luminous element produces IR rays with wave length from 750nm-15000nm.  **Fig: IR lamp**	**02 M** **02 M**
	b	**Compare unipolar and bipolar modes of electro surgical unit.** **Ans:** **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.	**04 M (any four)**

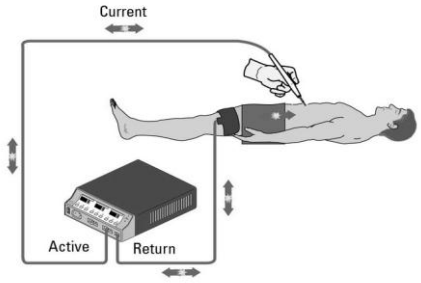
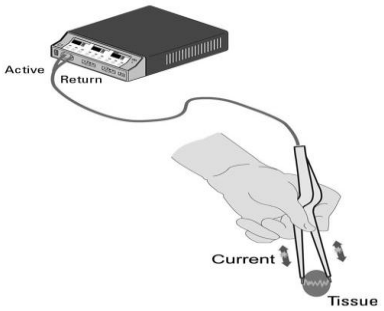
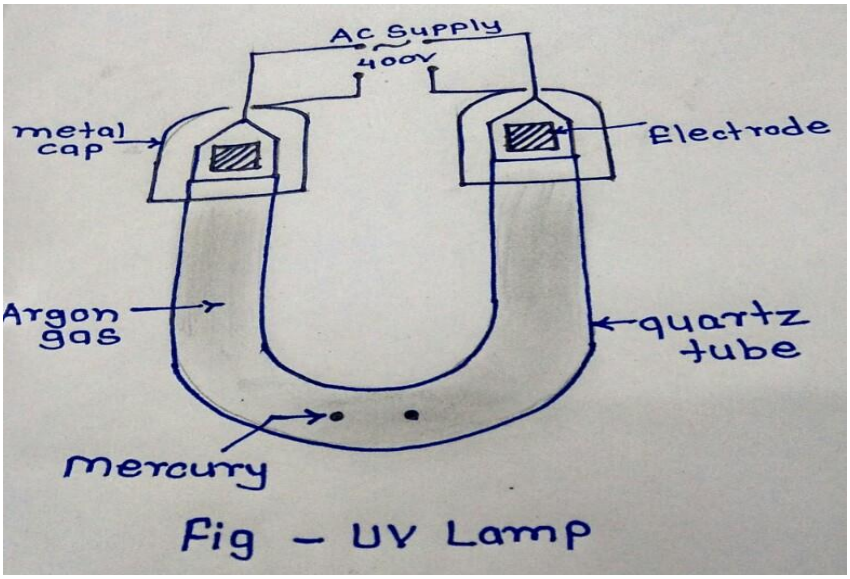
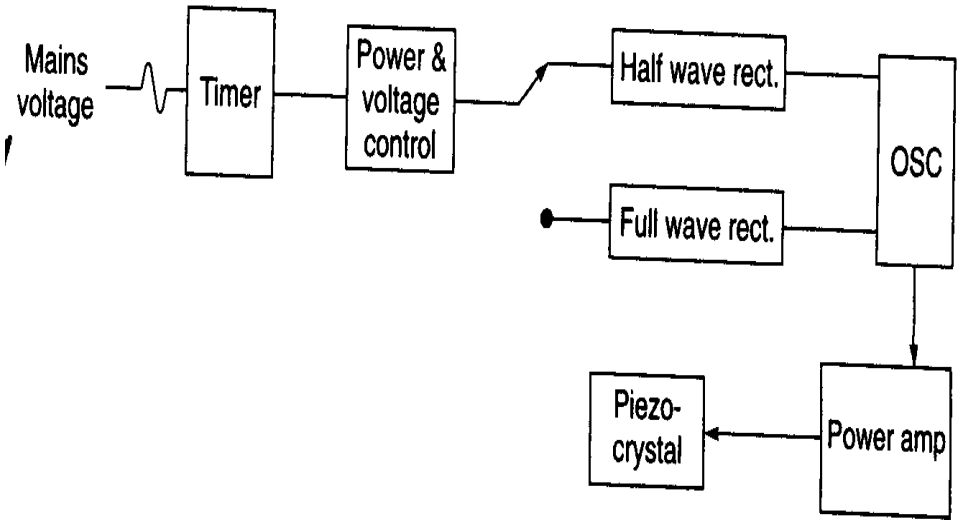
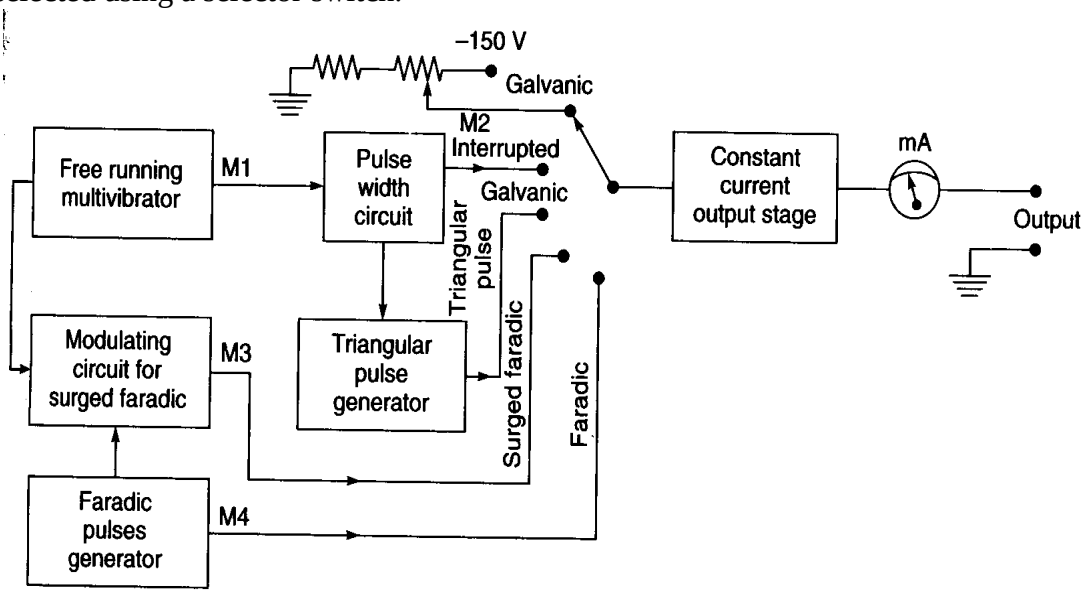
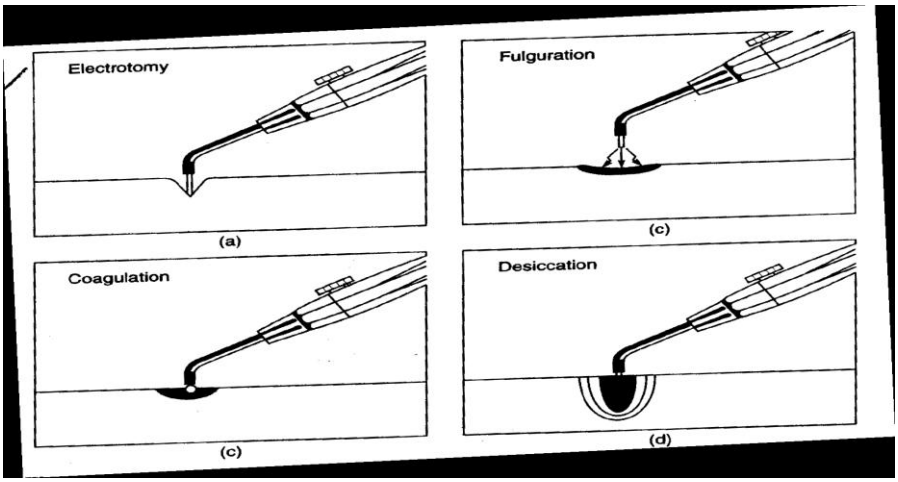
		5.	Diagram 	Diagram 	

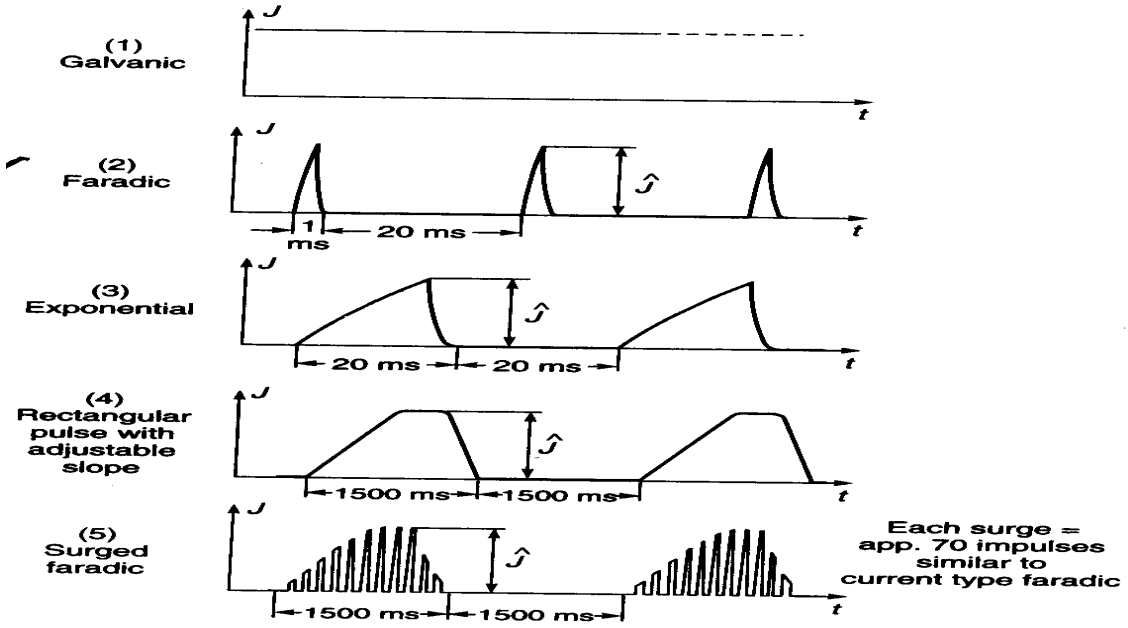
Table: Compare unipolar and bipolar modes of electro surgical unit

	c	**List technical specifications of solid state cautery machine. List steps for its maintenance.** **Ans:** **Technical specifications of Solid state cautery machine:** 1. Input power- 230 V, 50 Hz 2. Frequency of operation – 250KHz – 1MHz 3. Power delivering output – 400w for cutting and 150w for coagulation 4. Coagulation duration – 10-15 sec. **Maintenance steps of solid state cautery machine:** 1. Clean dust from exterior and cover equipment after use. 2. Remove any foreign body from equipment. 3. Check regular solid state cautery machine & make sure power indicator is off when switch is off. 4. Check controls for correct positioning & operation. 5. Check cables and electrodes safely stored. 6. Check all fittings and accessories are mounted correctly. 7. Check for leakage current, check grounding connection. 8. Choose correct electrode tip for desired procedure. 9. Open the machine and test the continuity of circuit at different test points. 10. Repeat the above procedure and test the performance of the machine for different level controls. 11. Every six months biomedical technician check machine.	**02 M** **02 M**
	d	**Explain electric hazard in hospital environment.** **Ans:** **Electric hazard in hospital environment:** 1. Hazard caused by electrical wiring failures that allow personal contact with the live wire or surface at the full power line voltage such things as frayed power cords, broken plugs, faulty lamp sockets and wrongly wired outlets all have the potential of allowing contact with electrical live parts and lethal voltages. 2. The second electrical hazard is leakage current, electrical current can be accidently transmitted to the body by operational error, equipment defects, potential from external sources on signal leads. 3. The patient or the operator may not realize that a potential hazard exists. This is because potential differences are small and high frequency and ionizing radiations are not directly indicated. 4. The environmental conditions in hospitals, particularly in the operating theatres, cause an explosion or fire hazards due to the presence of anesthetic agents, humidity and cleaning agents.	**04 M**

	e	**Explain methods of accident prevention in hospital environment.** **Ans:** **Methods of accident prevention in hospital environment:** 1. **Grounding:** Is one of the most frequently method used for accident prevention. The principle of this method is to make grounding resistance small enough that for all fault resistance values, majority of fault current by passes body of the victim & body current remains at safe level even if contact & body resistances are small. 2. **Double Isolation:** In this method, fault resistance is very large. Double isolated equipment need not be grounded. It is widely used as method of protection in hand held power tool & electric powered garden equipment e.g. lawn mowers. 3. **Protection by low voltage:** A low operating voltage can be obtained by means of step down transformer, in addition to bowering the voltage; the transformer provides isolation of supply voltage from ground. 4. **Ground fault circuit interrupter:** All current that enters a device through hot wire returns through neutral wire. Current actually return through body of victim & through ground, in this method difference between the currents in the hot and neutral wires of power line is an electric amplifier. If this difference exceeds a certain value, usually 5 mA, power is interrupted by a circuit breaker. In case of large current flow through body of victim, no harmful effects are encountered.	**04 M**
5.		**Attempt any <u>TWO</u> of the following:**	**12 M**
	a	**Explain working of UV lamp with sketch. State the conditions where UV radiations are used.** **Ans:**  **Fig: UV lamp** **(Any relevant diagram should be consider)** It consists of 'U' shape quartz tube. It allows the passage of UV radiation can withstand very high temperature and 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 (400V) from an autotransformer across a tube for a fraction of seconds. Once the argon has been ionized normal AC mains voltage is applied across the tube. When argon gas is ionized there are number of free electrons which can move randomly	**02 M** **02 M**

		inside the tube. It will cause collision between free electrons and mercury atoms as well as free electrons and neutral argon atoms, which causes further ionization current across the tube. This current flow can be seen as a glow discharge. **Conditions where UV radiations are used:** At the time of 1. Increase blood circulation 2. Improve skin condition 3. Production of vitamin D 4. Sterilization effect on skin (Any relevant diagram should be consider)	**02 M**
	b	**Explain block diagram of ultrasound therapy machine with sketch.** **Ans:**  **Fig: ultrasound therapy machine** 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.	**03 M** **03 M**
	c	**Explain block diagram of nerve and muscle stimulator with sketch.** **Ans:** 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 output from this M1 triggers monostable multivibrator M2 which sets pulse width. The output 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	**03 M**

		can get the surged faradic current. It is done in a mixer circuit. Triangular pulse generator is used to get exponentially progressive current. This is done by integrating the output of M2 so that the interrupted galvanic pulses are modified to have exponential rise and fall. It is capable of generating different types of pulses at its output and any one selected using a selector switch.  **Fig: Block diagram of nerve and muscle stimulator**	**03 M**
6.		**Attempt any <u>TWO</u> of the following:**	**12 M**
	a	**Explain methods of cutting and coagulation with sketch.** **Ans:**  **Fig: Methods of cutting and coagulation** **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 Tissue gets 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	**03 M** **03 M**

		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.	
	b	**Explain installation and maintenance steps of short wave diathermy machine.** **Ans:** **Installation steps of short wave diathermy machine:** 1. Unpack the instrument 2. Check all the accessories of instrument 3. Check the instrument for any damage 4. Place the instrument on vibration free and dust free plane surface 5. Connect all the accessories to instrument 6. Switch on the instrument 7. Calibrate the instrument. 8. Take a performance test. **Maintenance steps of short wave diathermy machine:** 1. Clean dust from exterior and cover equipment after use. 2. Remove any foreign body from equipment. 3. Check regular short wave diathermy machine and power indicator is off when switch is off. 4. Check controls for correct positioning & operation. 5. Check cables and electrodes safely stored. 6. Check all fittings and accessories are mounted correctly. 7. Check for leakage current, check grounding connection. 8. Choose correct electrode for desired procedure. 9. Open the machine and test the continuity of circuit at different test points. 10. Repeat the above procedure and test the performance of the machine for different level controls. 11. Every six months biomedical technician check machine.	**03 M** **03 M**
	c	**Illustrate the use of different current waveforms used in nerve muscle stimulator with proper sketch.** **Ans:**  **Fig: Current waveforms used in nerve muscle stimulator**	**03 M**

		1. **Galvanic current:** It may be used for the preliminary treatment of autonic paralysis (muscles are completely deactivated or weak) and for the treatment of disturbance in blood flow. 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 pain and for the odema and inflammation. 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.	**03 M**