SUMMER– 18 EXAMINATION

Model Answer Subject Code: 17673

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 – 18 EXAMINATION

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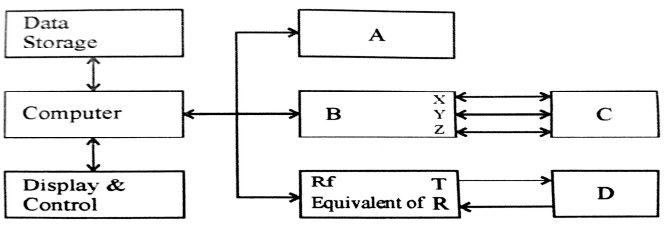
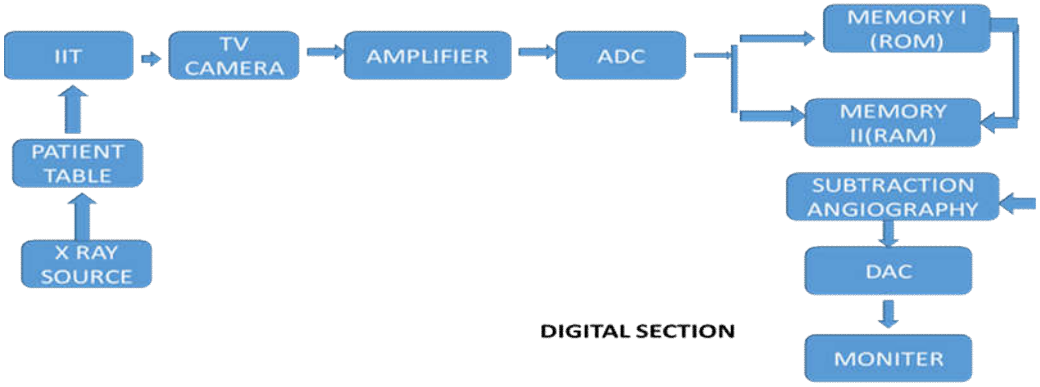
Q. No.	Sub Q.N	Answer	Marking Scheme
Q.1	**(A)**	**Attempt Any three of the Following.**	**12**
	a)	**State the working principle of Nuclear imaging.** **Ans :** It is a branch of medical imaging which deals with the application of radioisotopes for the assessment of functional status of biological organs and subsystem. In this type of imaging diagnosis is based on the evaluation of images of the organ obtained by a various devices such as rectilinear scanner, gamma camera and tomography systems like PET etc.. These images are referred to as medical images and are result of radio activity distribution in the organs or body site. This is done by administration of radioactive isotope inside the body and then detecting its distribution. **Stepwise procedure of nuclear imaging:** 1. Radionuclide is administered via mouth or vein. 2. They distribute in the body according to their strength for particular tissue called target tissue. 3. Radionuclide emit gamma radiation 4. Theses radiations are detected by a gamma camera, which forms the image showing the location of radionuclide in the body.	**4**
	b)	**List out the steps to be carried out for maintenance of ultrasound machine.** **Ans :** **1.** Wipe dust off exterior & cover equipment after check. 2. Remove any tape, paper or foreign body from equipment. 3. Wipe probe with alcohol free tissue or cloth. 4. Check all fittings & accessories are mounted correctly. 5. Check cables are not twisted & probe is safely stored. 6. Unplug, clean outside /wheels/rear with damp cloth, dry off. 7. Remove, clean & dry external filter if present. 8. Check mains plug screws are tight or not. 9. Check mains cable has no bare wire &is not damaged. 10. If machine has not been in use, run &test it periodically. Every six months Biomedical Technician check machine.	**4**
	c)	**Identify the missing blocks in given figure A and also state function of each block:**  **Fig. A**	**2**

		Ans : A- Primary Magnet. B- Gradient Magnet. C- Grad Coil. D- RF Coil. MRI detection system consists of primery magnet, gradient magnet, RF equipment, computer, data storage, display and control. The primery magnet consist of either a resisitive , superconductive or permanent magnet that provides a uniform magnetic field around the patient. Gradient magnet system consist of auxillary sets of x y an z gradient magnet coils. these coils are driven by high power audio amplifier that rapidly turn on and turn off to provide signal localization. RF equipment consists of transmitter capable of applying RF pulses in narrow frequency band. the system computer control all these devices as well as perform the FFT necessary foe assigning x y z co ordinates. The data is stored as numbers array that displayed under computer control as a video image on the display system.	**2**
	d)	**List medical application of following NMI techniques:** **(i) Endoscopy (any two)** **(ii) Thermography (any two)** **Ans:** **(i) Endoscopy** 1. Endoscopy is a nonsurgical procedure used to examine a person's digestive tract. 2. The endoscopy procedure uses an endoscope to examine the interior of a hollow organ or cavity of the body. 3. Confirmation of a diagnosis, most commonly by performing a biopsy to check for conditions such as anemia, bleeding, inflammation, and cancers of the digestive system. 4. Giving treatment, such as cauterization of a bleeding vessel, widening a narrow esophagus, clipping off a polyp or removing a foreign object. **(ii) Thermography** 1. Thermography is used to diagnose breast cancer. 2. To monitor inflammatory bones. 3. Deep vein thrombosis. 4. Thyroid examination	**02** **02**
	B) **a)**	**Attempt any ONE of the following.** **Draw neat labelled block diagram of angiography. State function of each block.** **Also give the significance of angiography.** **Ans : Significance of angiography :** It is a diagnostic & therapeutic procedure which is related to the disease of circulatory system This procedure is carried out by using or by inserting contrast material called as radioisotopes mostly iodine containing compound which is radioactive in nature is used. The contrast material provides radiographic image which is viewed on TV screen they are recorded as a film or video. It is invasive method that helps the physician to diagnose & treat the medical condition. **Block diagram of angiography:**	**06** **2**



2

X ray source:
It is used to pass narrow x ray beam to the patient.
Patient table: patient lies on the table.
IIT: The reflected x rays are collected by IIT unit in which brightness of image is increased & output is displayed on fluorescent screen.
Amplifier: It amplifies the output of image intensifier tube and gives it to the ADC where signal is converted into digital form.
Memory i& ii : digitally converted signal is stored into the ram & rom memory
Subtraction angiography: Digital subtraction angiography refers specifically to techniques which subtract two images that are obtained before and after contrast media is administered to the patient for the purposes of studying blood vessels (angiography).
DAC: it converts digital signal into analog signal.
Monitor: by using TV camera unit we can see the clear & live image of an patient body on monitor.

2

b) Identify position of grid & collimator in given given figure B. With neat diagram, give function of same in X-ray machine.

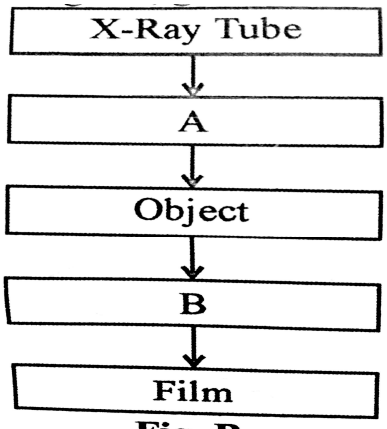


Fig. B

Ans:-

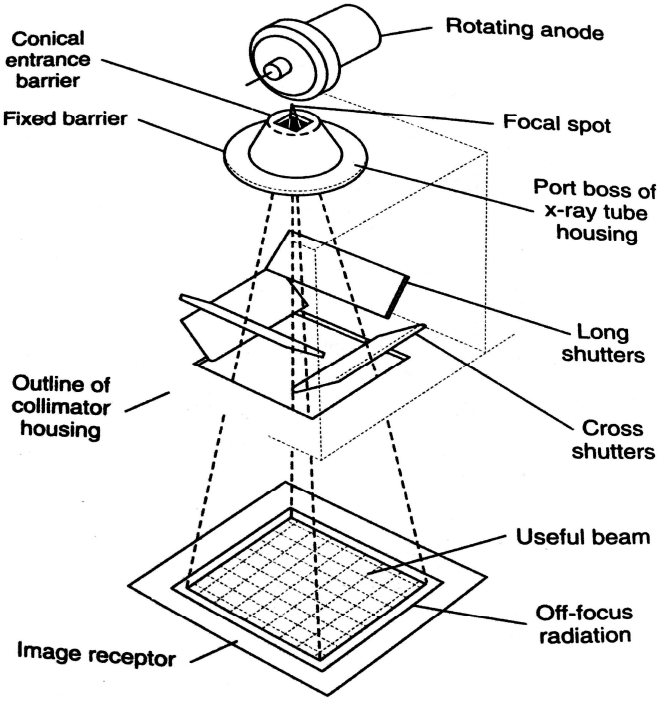
A –Collimator

02

B- Grid

Collimator: It is device attached in opening to x ray tube to regulate the shape & size of x ray beam.

01

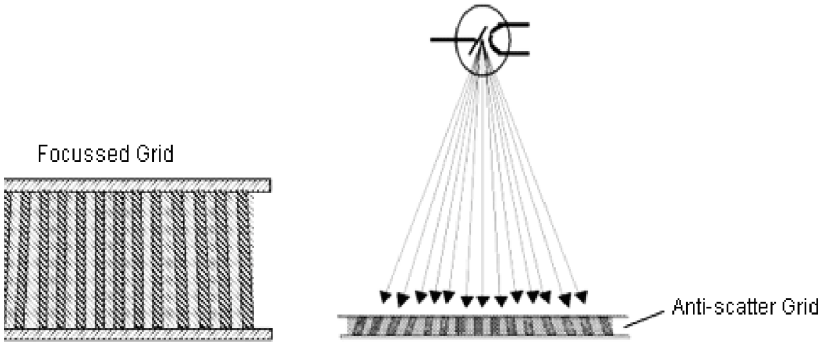


➤ **Fig. 19.14** ***Layout of a collimator***

01

Grid: It is the most effective way of removing scattered radiation.. They are used to absorb scattered radiation & improve image contrast.

01

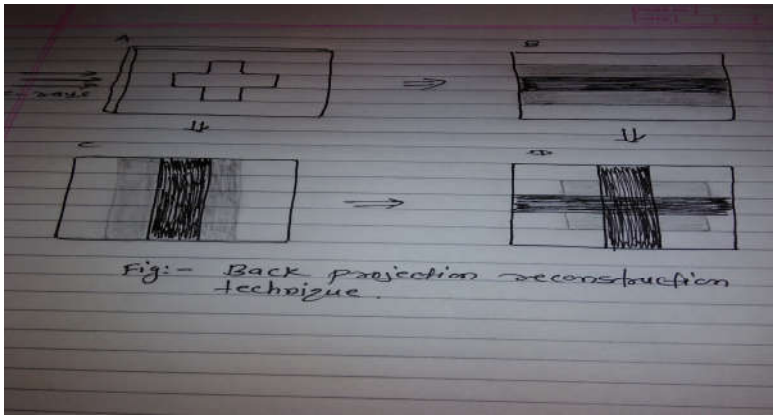


FOCUSED GRID, FIG.1

01

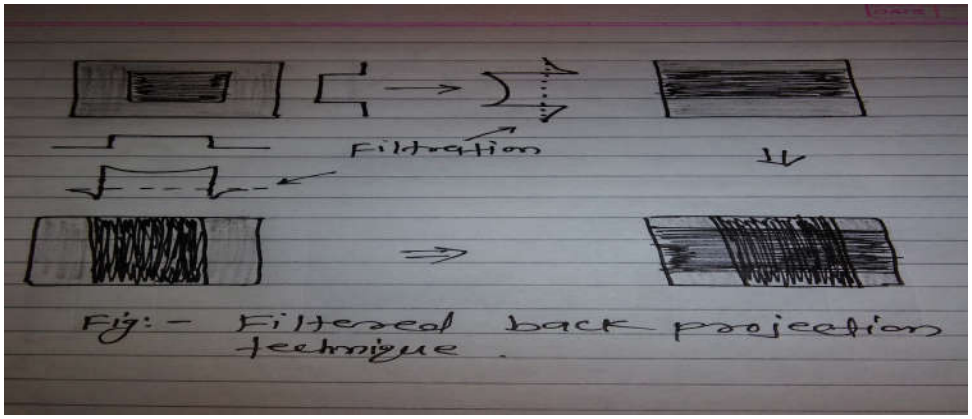
Q2	**a)**	**Attempt any Four of the following** **With neat diagram, explain any one image reconstruction techniques of CT.** **Ans :** (any one from the following) Various image reconstruction techniques used in CT are 1. Back projection reconstruction technique. 2. Filtered back projection technique. 3. Iterative reconstruction technique. 4. Fourier reconstruction technique	**16** **02 marks diagram and 02 marks explanation**

1. Back projection reconstruction technique:



Back projection some times called the 'summation method' which demonstrates a two dimensional reconstruction of a cross cut from the center of a solid block. The block is scanned from both the top &left sides by a moving X-ray beam to produce the image profile shown in fig. the image profile look like steps. The height of the steps is proportional to the amount of radiation passed through the block . The center transmitted the most radiation , so it is the highest step in the image profile. The steps are then assigned to a gray scale density. That is proportional to their height. These densities are arranged in rows , called 'Rays'. The width of the rays is the same as the width of the steps in the profile .The ray length is equal to the height of the original object. In back projection produces a crude reproduction of the original object.

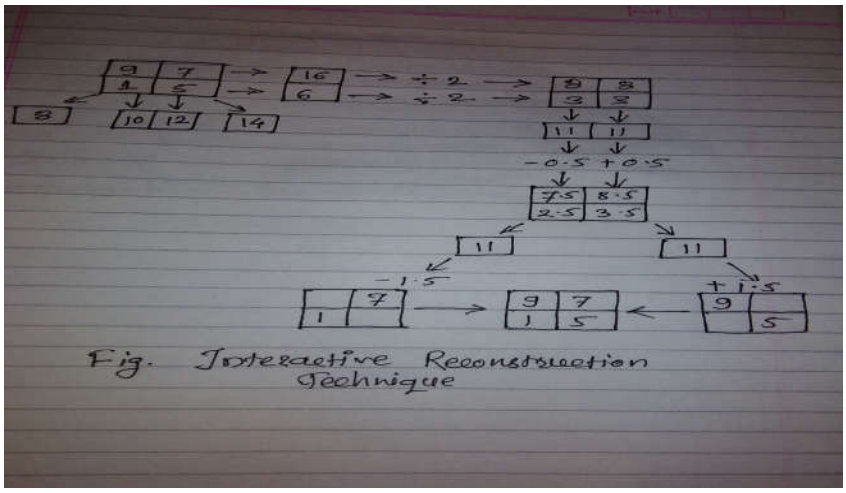
2. Filtered back projection technique:



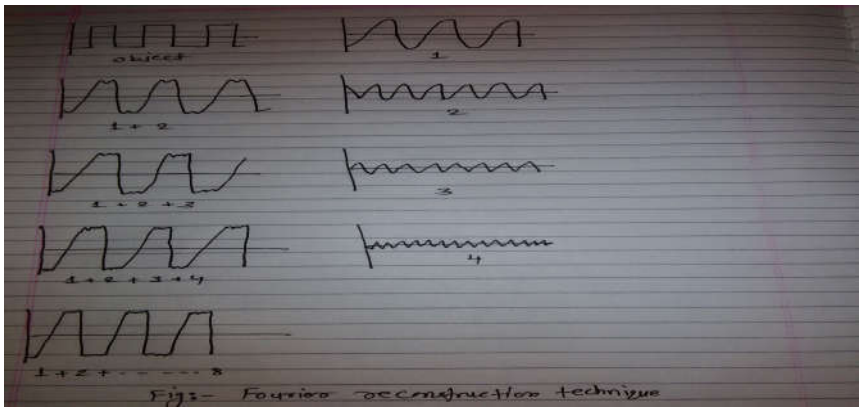
Filtered back projection is similar to back projection expect the image is filtered or modified to exactly counterbalance the effect of sudden density changes , which causes blurring (the star pattern) in simple back projection. In this technique the projected information is filtered much like light is filtered by a polarizing lens. The fig shows a two dimensional filtered back projection of a square object. The density of the projected rays is adjusted to compensate for the star effect.

3. Iterative reconstruction technique: In the iterative reconstruction for a four element square .Horizontal ,vertical , & diagonal ray sums are shown in the adjacent blocks . In the first step , the two horizontal ray sums (16 &6 in the hatched blocks) are divided equally among the two element in the ray. If the ray sums had represented 10 elements , the sum would have been divided equally among all 10 elements. Next the new numbers in the vertical row are added to produce the new ray sum (11 &11 in the shaded blocks) and compared with the original measured ray sums ((also in shaded blocks). The

difference between the original & new ray sums (10-11= -1 and 12-11= +1) is divided by the number of elements in the ray (-1/2 = -0.5 and +1/ 2 = +0.5).These differences are algebraically added to each element (8-0.5 =7.5 , 3-0.5 =2.5 , 8+ 0.5 = 8.5 , and 3+ 0.5 = 3.5) The process is repeated for diagonal ray sums to complete the first iteration.



4. Fourier reconstruction technique



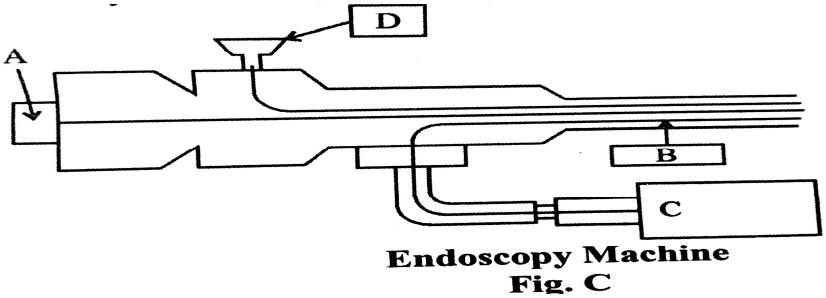
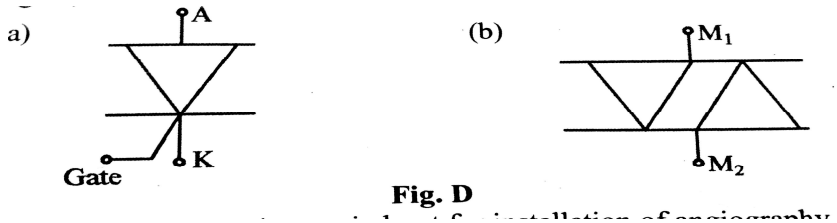
The basis of Fourier analysis is that any function of time or space can be represented by the sum of various frequencies and amplitudes of sine and cosine waves. The ray projections are shown with squared edges , which is the most difficult wave form to reproduce . The actual projected images would be more rounded than those shown , which would simplify a Fourier reconstruction. The last reconstruction represents the sum of eight cosine waves, but only the first four steps are shown in fig. This type of mathematical manipulation is easily and quickly processed in a computer.

b) List any four properties of ultrasound. — **4**

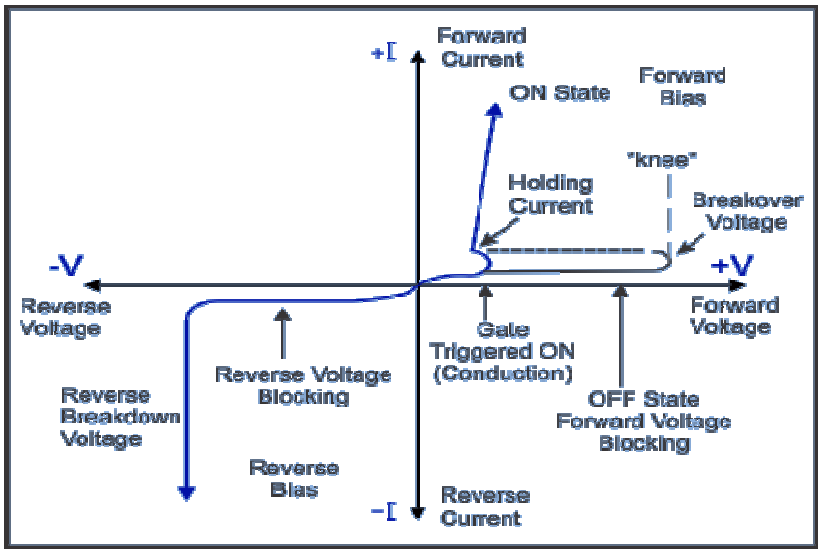
Ans:

1) Frequency of Ultrasound is above 20 kHz.
2) Ultrasound travels at a velocity of about 1500m/s in soft tissue of the body.
3) The velocity of ultrasound waves in various biological media is approx. the same and nearly equal to that in water.
4) Velocity in bone about 3 times higher and in air it is 3 times less.

(Any other relevant points should be considered)

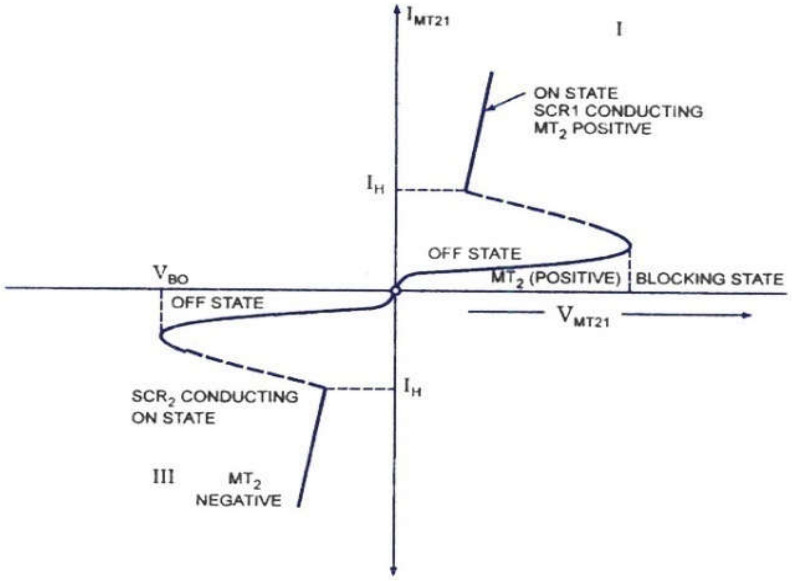
	c)	**Identify the missing blocks ii given figure C and also state their functions.**  **Endoscopy Machine** **Fig. C** **Ans :** A- Eye Piece Function: A reflected light from the distal tip that is image is transferred through another optical fiber to eyepiece for viewing. B- Optical Fiber: Function: An optical fiber inside the tube carries light from the light source to illuminate the area in front of its distal tip end. C- Light Source Function: Light source is usually a halogen lamp which provides good quality light for investigation of the organ D- Channel of air, water, suction etc. Function: An channel allows the passage of fine flexible accessories (e.g. biopsy forceps, cytology brushes, sclerotherapy needles, diathermy snares) from a port on the endoscope control head through the shaft and into the field of view.	**4**
	d)	**Identify the following components and draw their V-I characteristics. (refer fig. D)**  **Fig. D** **Ans:** (a) SCR (b) TRIAC	**02**

V-I characteristics of SCR:



01

V-I characteristics of TRIAC:



V-I Characteristic of a Triac

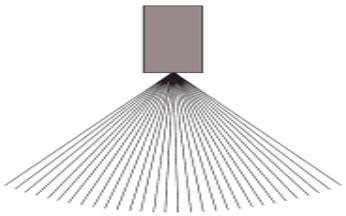
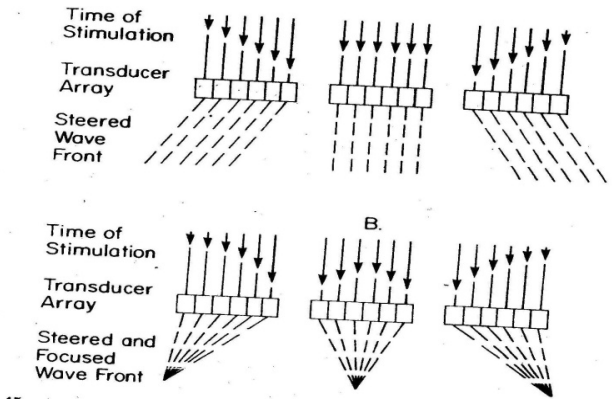
01

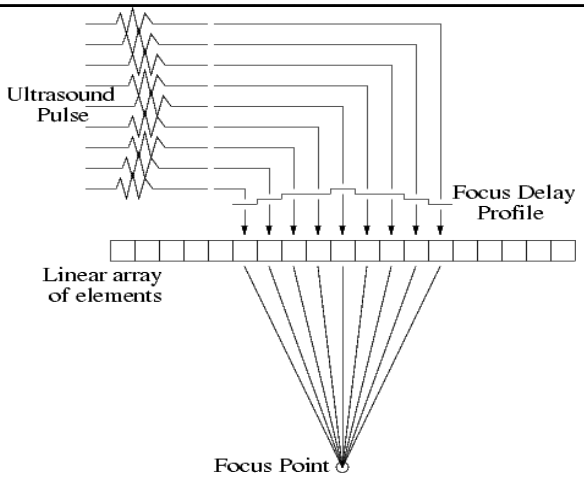
e) List out the steps carried out in installation of angiography machine.

Ans:

Prepare lab area layout.
2. Unpack the box.
3. Read the user manual carefully.
4. Check environmental condition of room.
5. Check electrical supply of the room.

		6. Assemble all the accessories of equipment 7. Mount TV camera, heat exchanger , power supply, x ray tube and attached assembly cover ,c arm unit, driver unit ,image intensifier tube. 8. Install control cabinet & mount display unit. 9. Please check alignment of x ray beam mount collimator & check its alignment. 10. Install other optional components like monitor support, remote console, console car. 11. Check the settings, inspect all the connection. 12. Perform demo test.	**4**
	f)	**Explain risk involved in handling CT and MRI.** **Ans:** **CT scan protocols while handling.** Dose given: Dose of radiation should not be more than what is needed to provide a quality Radiograph for radiologist to read. Shielding: When radiation is used, the patient should be shielded to block radiation from reaching body parts that do not need to be imaged. Shielding is usually lead that lines the inside of a piece of fabric Motion**:** Children's most difficult patients to image.as sometimes they are reluctant to hold still. Result can be motion artifacts or blurred images. Rendering image not suitable for diagnosis. Limit Exams: When it comes to children or pregnant women's CT should not scan more than area of interest. Goal should be only one scan. The exposure to ionizing radiation may cause a small increase in a person's lifetime risk of developing cancer. A special dye called a contrast material through a vein in arm of patient before CT scan which can cause medical problems or allergic reactions. **MRI scan protocols while handling.** Medical Alert cards should be checked of patients. Cards state whether or not implant of patient is MRI compatible. Cards should be checked by radiologists. There is possible damage to MRI scanner due to ferromagnetic objects as they magnetize themselves, hence should not be possessed by technologists or patient entering the MRI room. It takes 4 days to remove the object and to repower the scanner. Noise : Loud noise due to magnets is generated while undergoing an MRI scan hence special ear protections must be provided to the patients Metallic chips, materials, surgical clips, or foreign material (artificial joints, metallic bone plates, or prosthetic devices, etc.) can significantly distort the images obtained by the MRI scanner. Patients who have heart pacemakers, metal implants, or metal chips or clips in or around the eyeballs cannot be scanned with an MRI because of the risk that the magnet may move the metal in these areas.	**02** **02**

Q.3		Attempt any Four of the following.	16
	a)	**Elaborate with neat diagram construction and working of ultrasound transducer.**	
		Ans :	
		Transducers used in ultrasound imaging linear array transducer Phased array transducer **Phased array transducer** Phased array transducer produces a sector scan format in which scan line spread in fan like formation from a point in the center of the transducer face. As shown in fig	02
		 Sector scan format of phased /steered array scanner Electronic focusing, is based on the use of electronic delays applied during emission and reception along each of the channels of the probe. These delays have an effect similar to that of a focusing lens and enables focusing to different depths. Electronic focusing allows only one phased array probe to be used where several single-element probes with different focal distances would be necessary. Beam can be steered or directed to a desired angle by a similar mechanism of time delays. By choosing the appropriate time delay between the simulations of the individual elements of the transducer, it is possible to steer the beam or to steer and focus the beam simultaneously.	
		 The **linear array transducer** can have up to 512 elements spaced over 75-120 mm. The beam produced by such a narrow element will diverge very rapidly after the wave travels only a few millimeters (the smaller the face of the transducer, the more divergent). This would result in poor lateral resolution due to beam divergence and low sensitivity due to the small element size	02



b) Draw a neat labelled diagram of Thermography machine. — **04**

Ans :

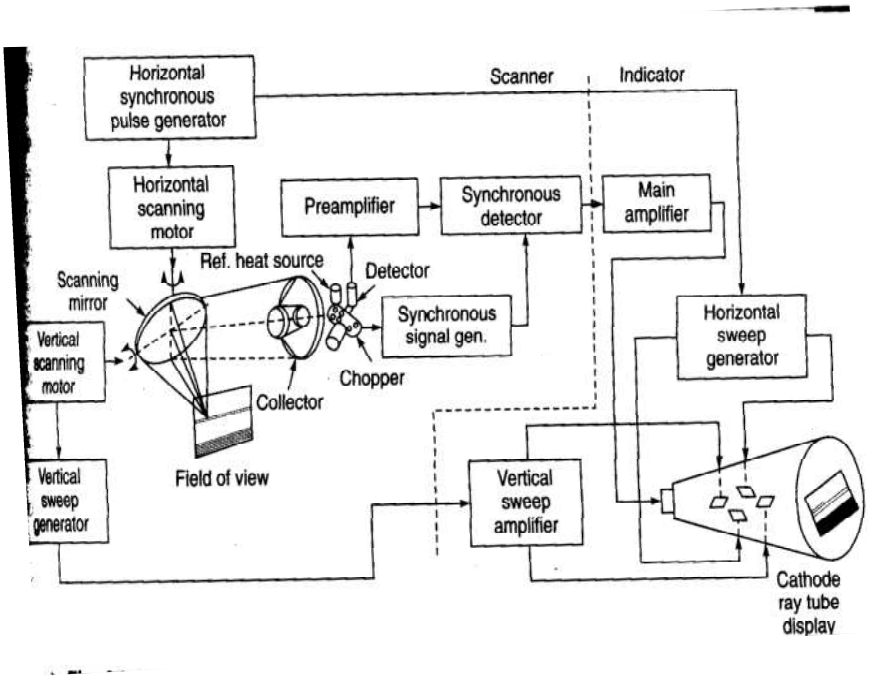
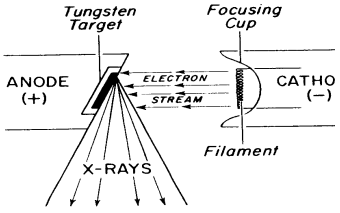
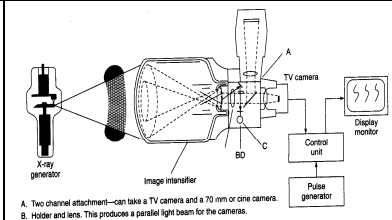


Fig: Diagram of Thermography machine

c) Differentiate between Fluoroscopy and Radiography.(any four points) — **4**

Ans:

	Radiography	Fluoroscopy
Diagram	 Figure 2–4 Lateral view of the cathode and anode of a stationary anode x-ray tube	 A. Two channel attachment—can take a TV camera and a 70 mm or cine camera. B. Holder and lens. This produces a parallel light beam for the cameras. C. Photo pick-up. D. Electrical signal from photo pick-up. It provides the control for 70 mm and cinefluorography. Fig. 19.21 *X-ray image intensifier system*

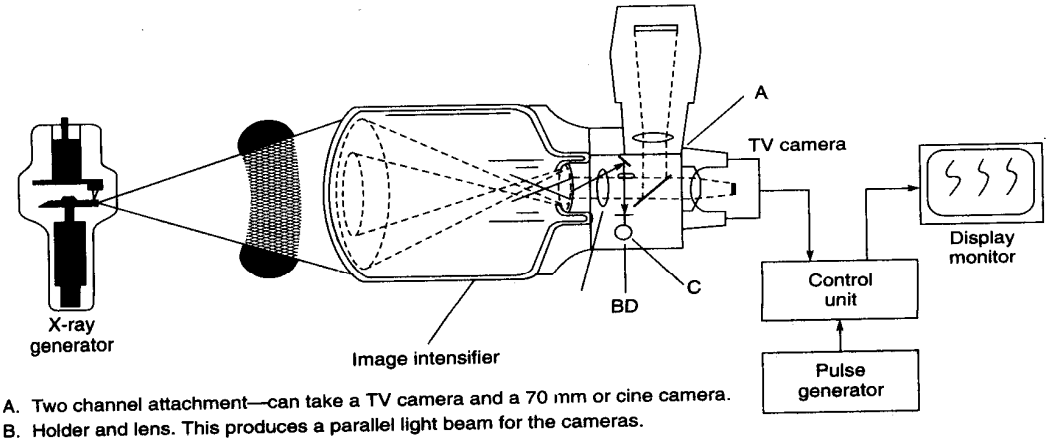
		Principle	Radiography is an imaging technique that uses electromagnetic radiation other than visible light, especially X-rays, to view the internal structure of a non-uniformly composed and opaque object (i.e. a non-transparent object of varying density and composition) such as the human body	Fluoroscopy is a technique for obtaining "live" X-ray images of a living patient - it is like an X-ray TV camera. The Radiologist uses a switch to control an X-Ray beam that is transmitted through the patient. The X-rays then strike a fluorescent plate that is coupled to an "image intensifier" that is (in turn) coupled to a television camera. The Radiologist can then watch the images "live" on a TV monitor		
		Viewing media used	Radiographic film	TV camera		
		Application (any one)	1. X ray: x rays are used for to detect cracks, fractures in bones. 2. It is also used for killing cancerous cells 3. CT scan: CT scanning is used for diagnosing some urgent and emergent conditions, such as cerebral hemorrhage, pulmonary (clots in the arteries of the lungs), aortic dissection (tearing of the aortic wall), appendicitis, diverticulitis, and obstructing kidney stones. Ultrasound: it is used for obtain images of almost entire range of internal organs in abdomen .development of fetus during development. Thermography: it gives video of temperature distribution over the surface of the skin.	1. To obtain real-time moving images of the internal structures of a patient 2. Investigations of the gastrointestinal tract, including barium enemas, defecating proctograms, barium meals and barium swallows, and enteroclysis. 3. Orthopedic surgery to guide fracture reduction and the placement of metalwork. 4. Angiography of the leg, heart and cerebral vessels. 5. Placement of a PICC (peripherally inserted central catheter) 6. Urological surgery 7. Cardiology for		

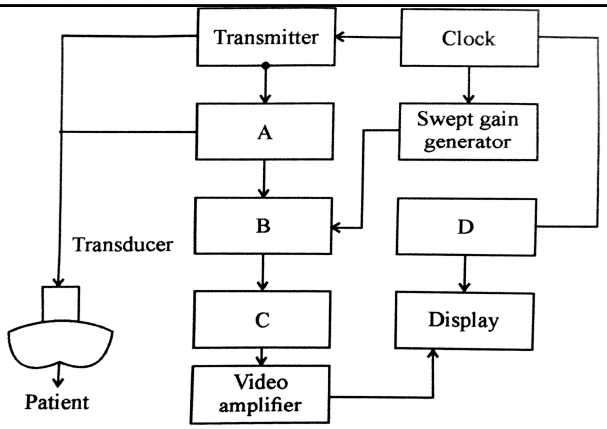
			NMI: used to detect biochemical process are occurring normally and where they are occurring too slowly or quickly. MRI: To obtain anatomical information about human body	diagnostic angiography, 8. Implementation of pacemakers, implant able cardioverter defibrillators and car diac resynchronization devices) 9. Discography, an invasive diagnostic procedure for evaluation for intervertebral disc pathology.		
	d)	**List stepwise procedure to be carried out for installation of X-ray machine.** **Ans:** 1. The basic radiological system designed by world health organization. • For x ray laboratory minimum two room are required i.e. x ray tube and dark room • The BRS is also specify the difficult requirements for the x ray system i.e. it deals with different components of x ray. • The floor plan for 3 or 2 rooms is suggested by BRS 2. Dark room requirement • For manual processing the dark room should have floor area of 5m2 • For automatic processing the dark room should have floor area small dimensions. • The dark room must have entirely light proof arrangement even with the bright sunlight. • The different light sources require in dark room & the paint used in dark room is also has to be consider while designing the x ray dark room 3. Electrical supply • Check the characteristics of available power supply while connecting the x ray generator to AC mains. • The main power cord has proper connectors instrument is properly grounded. 4. Different components of x ray machine. 5. Safety precaution s for radiation hazards. • Operating control panel has in its front a protective lead screen with lead glass window minimum size 30*30				**4**
	e)	**Describe different types of Magnets used in MRI.** **Ans :** **Types of magnets used in MRI**: 1. Resistive magnet: Resistive systems consist basically of a suitable coil or collection of coils through which a strong electric current is passed. If these coils are set up in a proper geometry, a homogeneous magnetic field can be created, as shown in Figure 03-01 and Figure 03-05. Such systems have a high power consumption (e.g., a 0.1 T unit requires about 20 kW), create a lot of heat, and therefore					

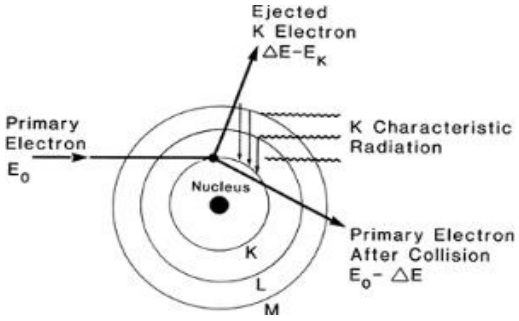
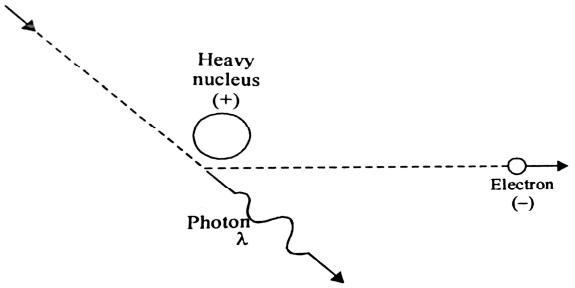
		need large-capacity cooling systems. 2. Permanent magnet: Certain alloys possess ferromagnetic properties. A magnet built of such materials has the advantage of needing no power to maintain the field strength. Likewise, it needs no cooling because there is no power dissipation. Such systems have small fringe (stray) fields when compared to the other magnet systems. Capital and operational costs of permanent magnets are low. The disadvantages are the weight of the currently produced systems for wholebody imaging, although new alloys developed during recent years have cut down the weight of permanent systems from 100 tons to less than 20 tons. nother drawback of permanent magnet systems are the field-strength limitations, which presently seem to be about 0.3 T for magnetic resonance imaging. Most of them operate at about 0.2 T. Many permanent magnets have a vertical magnetic field which distinguishes them from some resistive and most superconducting systems with horizontal fields (Figure 03-04). The field direction has an impact on the use of certain transmitter and receiver coils. 3. Super conductive magnet: A superconducting magnet is an electromagnet made from coils of superconducting wire. They must be cooled to cryogenic temperatures during operation. In its superconducting state the wire can conduct much larger electric currents than ordinary wire, creating intense magnetic fields. Superconducting magnets can produce greater magnetic fields than all but the strongest electromagnets and can be cheaper to operate because no energy is dissipated as heat in the windings. They are used in MRI machines in hospitals, and in scientific equipment such as NMR spectrometers, mass spectrometers and particle accelerators.	**4**
Q4	**(A) a)**	**Attempt any three of the following:** **Define the following terms.** **(i) RF Shielding** **(ii) RF Shimming** **Ans:** **(i) RF Shieldin:** Radio frequency (RF) shielding is a solution used for blocking radio frequency interference. It involves the construction of an enclosure to reduce the electric and magnetic transmissions from one space to another. Radio frequency shielding helps to protect electronic and computer devices from radio frequency interference issues that can affect their performance and functionality. Radio frequency shielding is also known as radiation shielding. **(i) RF Shimming:** The individual drive characteristics (e.g. waveform, power, amplitude, phase) for each of the RF sources can be obtained by mapping the B1 field inside the subject produced by each of the independent RF sources. The actual B1 field inside the subject can be treated as a linear combination of the B1 fields generated by each source. Driving all sources in parallel using characteristics determined per patient results in a significantly more uniform B1 field inside the subject. The process of obtaining the coefficients with which to drive each of the RF sources, and applying these coefficients during parallel	**12** **02** **02**

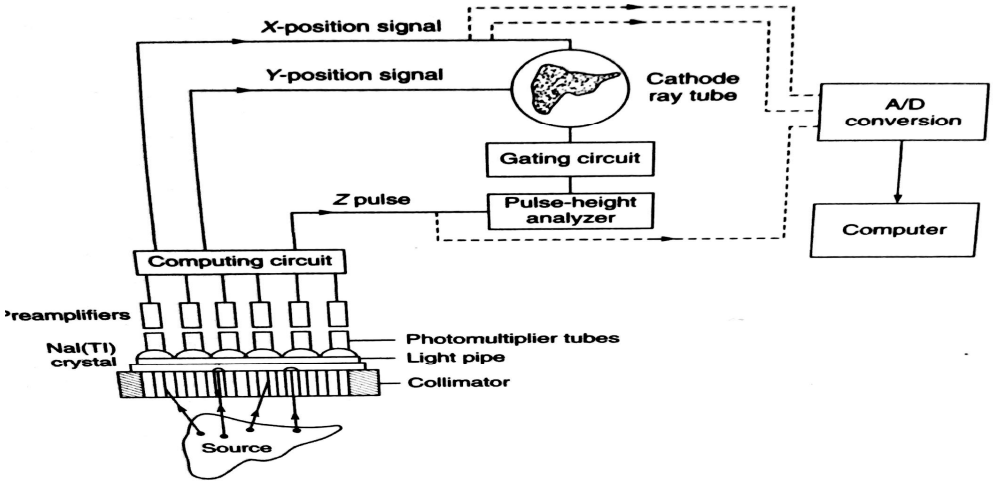
		excitation, is known as RF shimming. Due to the reciprocity principle, RF shimming can also be used during MR signal reception.	
	b)	**List the transducers used in NMI and explain any one.** **Ans :** i) Geiger Muller tube detector. ii) Scintillation detector. iii) Semiconductor detector. iv) Xenon gas detector. **Geiger Muller tube detector.:** The detector most common to the public is the Geiger-Mueller counter, commonly called the Geiger counter. It uses a gas-filled tube with a central wire at high voltage to collect the ionization produced by incident radiation. It can detect alpha, beta, and gamma radiation although it cannot distinguish between them. Because of this and other limitations, it is best used for demonstrations or for radiation environments where only a rough estimate of the amount of radioactivity is needed. **Scintillation detector:** Scintillators are usually solids (although liquids or gases can be used) that give off light when radiation interacts with them. The light is converted to electrical pulses that are processed by electronics and computers. Examples are sodium iodide (NaI) and bismuth germanate (BGO). These materials are used for radiation monitoring, in research, and in medical imaging equipment. **Semiconductor detector:** A **semiconductor detector** in ionising radiation detection physics is a device that uses a semiconductor (usually silicon or germanium) to measure the effect of incident charged particles or photons. Semiconductor detectors find broad application for radiation protection, gamma and X-ray spectrometry and as particle detectors. **Xenon gas detector:** Liquid xenon has several attractive features, which make it suitable for applications to nuclear medicine, such as high scintillation yield and fast scintillation decay time, better than currently used crystals. Since the '90s, several attempts have been made to build Positron Emission Tomography scanners based on liquid xenon, which can be divided into two different approaches: on one hand, the detection of the ionization charge in TPCs, and, on the other one, the detection of scintillation light with photomultipliers.	**02** **02**
	c)	**List any four medical applications of X-ray.** **Ans:** **i)** Radiation therapy: It is the treatment using penetrating x-rays, on the affected region of the body to destroy the cancer cells. **ii)** Radiography: It is the use of ionizing electromagnetic radiation such as X-rays to view objects. **iii)** Mammography is an X-ray examination of breasts and other soft tissues. This has been used mostly on women to screen for breast cancer **iv)** Angiography is the use of fluoroscopy to view the cardiovascular system.	**4**
	d)	**List out maintenance steps to be carried out for angiography machine.** **Ans :**(any other relevant answer should be consider as a valid answer) 1. Maintenance must be performed in the normal mode.	

		2. Check Program: Check Program must be performed in the normal mode. 3. Perform calibration and maintenance with a personal computer, it is necessary to prepare the following. 4.Check calibration for motor of arm 5 .Check calibration of position table for its up down movement. 6.Check collimator alignment and its position 7.Check x ray tube alignment & its position 8. Check shutter & filter calibration. 9. Check battery & maintain cover. 10. Update software periodically. 11. Check TV camera connections ,IIT,XRAY TUBE	**4**
Q.4	**(B) a)**	**Attempt any ONE of the following :** **List out steps to be carried out for maintenance of x-ray machine and also state the risks involved in handling of X-ray equipment.** **Ans:** **Maintenance steps for x-ray machine** 1.Look for physical damage that could affect radiation shielding (i.e., hole in the wall, broken window, broken collimator glass or shutter, any type of damage which would allow radiation leakage from the room or the machine). 2. Ensure that the x-rays are inhibited when in the Positive Beam Limitation (PBL) model and not at 40" or 72" SID. 3. Ensure that x-rays are inhibited when EXPHOLD lamp is illuminated RED. 4. When collimator filter is off, and kV is greater than 49kV, exposures must be inhibited. The READY light will turn off 5. Wipe down the x-ray control unit and a soft cloth every day before leaving. 6. Maintenance of control panel should be 7. Never open the x-ray control unit. 8. Never place food or drink on the X-ray Control Unit. 9.Performance tests should be carried out 10. Measuring or testing the performance of exposure. The safe annual exposure to the radiation to the persons handling is inversely proportional to the number of years working in that area. **Risk factors involved in handling of x ray equipment are:** i) X rays are highly absorbed in soft tissue, and severe burns can result from exposure of the hands, arms, skin or eyes to the direct or diffracted beams. ii) High dose can cause reddening of the skin or erythema. iii) Loss of hair or epilation iv) If a large area of skin is irradiated, erythema and pigmentation will occur with the pigmentation eventually fading. v) If enough radiation of the proper energy is absorbed in the skin this will result in permanent destruction of either hair or sweat glands, or whole skin, with a resulting scar. vi) It can cause chronic radiation dermatitis, Radiation cancer. It can affect fetus if it is used for pregnant women.	**6** **03** **03**

	b)	**With neat diagram, explain the working of fluoroscopy machine, List advantages of fluoroscopy over Radiography.(any four)** **Ans:**  A. Two channel attachment—can take a TV camera and a 70 mm or cine camera. B. Holder and lens. This produces a parallel light beam for the cameras. C. Photo pick-up. D. Electrical signal from photo pick-up. It provides the control for 70 mm and cinefluorography. ➤ **Fig. 19.21** *X-ray image intensifier system* Fluoroscopy is a technique for obtaining "live" X-ray images of a living patient. The Radiologist uses a switch to control an X-Ray beam that is transmitted through the patient. The X-rays then strike a fluorescent plate that is coupled to an "image intensifier" that is (in turn) coupled to a television camera. The Radiologist can then watch the images "live" on a TV monitor. **Advantages of fluoroscopy:** 1. Allows a physician to see a live image of the body's internal organs in order to observe their size, shape and movement. 2. Provide dynamic and functional information. 3. Allow real time interaction. 4. Inexpensive.	**02** **02** **02**
Q5	**a)**	**Attempt any four of the following:** **Identify the possible cause for the following faults in endoscopy:** **(i) Picture is cloudy or dark.** **(ii) Leakage in flexible cable.** **Ans:** **i) Picture is cloudy or dark.** Cause: 1. Humidity may have introduced into camera heads connecting plug. 2. Build up of matter on the distal lens. 3. Broken fibers in cable. **ii) There is leakage in flexible endoscope**. Cause: Tears or cut in flexible shafts.	**16** **02** **02**
	b)	**Identify the diagram and also identify missing blocks in it.**	

		 **Fig. E**	**01**
		Ans : **Fig.E:** Ultrasound scanner A- Limiter. B- R.F Amplifier. C- Demodulator. E- Time Base Generator.	**03**
	c)	**List any four advantages of of MRI.** **Ans** 1. They are particularly useful for showing soft tissue structures, such as ligaments and cartilage, and organs such as the brain, heart, and eyes. 2. They can provide information about how the blood moves through certain organs and blood vessels, allowing problems with blood circulation, such as blockages, to be identified. 3. It show both three-dimensional and cross-section images of the body 4. It shows swelling and inflammation. 5. It can differentiate better between fat, water, muscle, and other soft tissue than CT.	**4**
	d)	**What will be the cause and action taken for following faults in X-ray machine?** **(i) Machine does not work** **(ii) Radiograph does not show desired object.** **Ans :** **(i) Machine does not work.** **Cause:** Mains supply is not proper. **Action taken:** 1. Move position of mains compensator control. 2. Check mains fuses, faulty connection in switch replace if defective **(ii) Radiograph does not show desired object.** **Cause:** Improper calibration **Action taken:** Adjust focal spot and check collimator setting.	**02** **02**
	e)	**With neat diagram, explain Characteristics Radation and Bremsstrahlung Radiation.** **Ans :** **Characteristics Radation:** When a fast-moving electron collides with a K-shell electron, the electron in the K-shell is ejected (provided the energy of the incident electron is greater than the binding energy of K-shell electron) leaving behind a 'hole'. An outer shell electron fills this hole (from	**01**

		the L-shell, M-shell, etc.) with an emission of a single X-ray photon, called characteristic radiation, with an energy level equivalent to the energy level difference between the outer and inner shell electron involved in the transition.  **Bremsstrahlung Radiation:** The word Bremsstrahlung IS German for breaking radiation. An example of Bremsstrahlung is shown in fig. An electron with kinetic energy E_1 approaches and is deflected by the heavy nucleus of a nearby atom. After the deflection, the electron has a new level of energy, E_2. By consideration of energy conservation: $$E_1 - E_2 = Hf$$ X-rays are generated by Bremsstrahlung and they are merely photons (electromagnetic waves) with a wavelength of approximately one angstrom (10^{-10} meters) .  **4. Diagram of a Bremsstrahlung collision by which X-rays are produced**	**01** **01** **01**
	f)	**List out any four clinical application of CT.** **Ans:** 1. Organs such as stomach, gall bladder, liver, spleen, pancreas, kidneys, lower gastrointestinal (GI) tract, the colon and rectum can be visualized with great clarity using CT imaging of the abdomen. 2. They are used for the diagnosis of appendicitis, stage of cancer, tumors and gangrene. 3. CT scan is used for the diagnosis of Alzheimer's disease, brain tumors, bleeds, injuries to the brain and other major brain diseases. Computed Tomography Angiography helps in the visualization of blood flow in the arteries throughout the body. It is used in the diagnosis of aneurysms (bulging), stenosis (narrowing) of the arteries, dissection of the aorta etc. 4.CT scan are used to take images of multiple tissues such as lungs, heart, bones, muscles, blood vessels, soft tissues etc. These images are used to detect acute and chronic changes in lung parenchyma, diagnose tumors, emphysema, inflammations etc.	**4**
Q6)	**a)**	**Attempt any four of the following:**	**16**

		List advantages and disadvantages of X-ray. **Ans :** **Advantages of x-rays:** 1. X-rays are used to treat malign tumors before its spreads throughout the human body. 2. They help radiologists identify cracks, infections, injury, and abnormal bones. 3. They also help in identifying bone cancer. 4. X-rays help in locating alien objects inside the bones or around them. **Disadvantages of x-ray** 1. X-rays makes our blood cells to have higher level of hydrogen peroxide which could cause cell damage. 2. The X-rays are able to change the base of the DNA causing a mutation.	**2** **2**
	b)	**What is CT number? List the types of detectors used in CT.** **Ans : -** **CT number**: Linear attenuation coefficient of tissue is known as CT number. It is represented as integers that usually range in values from -1000 to + 1000. It is denoted by Hounsfield unit (H). i) Geiger Muller tube detector. ii) Scintillation detector. iii) Semiconductor detector. iv) Xenon gas detector.	**02** **02**
	c)	**List any four technical specifications of ultrasound.** **Ans :** 1) Power supply – 230 V AC 50 Hz 2) Frequency range – 1 to 15 MHz 3) Scan time – 1 to 3 s 4) Eco signal intensity – up to 80 dB 5) Storage capacity - 512 Mb 6) Transducer technique (phased array)	**4**
		Draw a neat labeled diagram of gamma camera. **Ans :**  	**4**
	e)	**For the following faults in ultrasound suggest solution and possible causes of it:** • **Fuse keeps blowing.** • **Image quality is poor.**	

		Ans **i) Fuse keeps blowing.** **Cause:** The fuses being used are the wrong type. **Solution:** Select the correct fuse types for your circuits. **Cause:** Short circuits **Solution:** Find the short circuit and correct it. **ii) Image quality is poor.** **Cause:** Insufficient gel Controls set incorrectly Main voltage is too low Probe/display problem **Solution:** Apply gel properly Set Controls properly Check probe and display setting.	**2** **02**