SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF MEDICAL ELECTRONICS

QUESTION BANK

III Year- VI SEMESTER - MDE

1910602 – MEDICAL IMAGING TECHNIQUES

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UNIT I – RADIOGRAPHY AND FLUOROSCOPY

Nature of X-rays- X-Ray absorption – Tissue contrast. X- Ray Equipment – X-Ray Tube, the collimator, Bucky Grid, Digital Radiography- discrete digital detectors, storage phosphor and film scanning, – Fluoroscopy – X- ray Image Intensifier -Digital Fluoroscopy. Angiography, cine Angiography. Digital subtraction Angiography, Mammography.

PART A

Q.No	Questions	CO	BT Level	Domain
1	Define the phenomenon of projection in radiography.	CO1	BTL1	Remembering
2	Identify the most common imaging examination and mention its limitations	CO1	BTL1	Remembering
3	List the advantages of projection radiographic systems	CO1	BTL1	Remembering
4	State bremsstrahlung radiation with a neat diagram	CO1	BTL1	Remembering
5	What is characteristic radiation?	CO1	BTL1	Remembering
6	Mention the significance of Compton scattering	CO1	BTL1	Remembering
7	Tabulate the frequency range, wavelength, photon energies for soft, diagnostic x-rays and visible light	CO1	BTL1	Remembering
8	Define mathematically the EM radiation with energy equations	CO1	BTL1	Remembering
9	Enumerate the properties of x-rays	CO1	BTL1	Remembering
10	Point out the significance of units of X-rays	CO1	BTL2	Understanding
11	What is the importance of collimators?	CO1	BTL1	Remembering
12	Assess the importance of Bucky grids	CO1	BTL2	Understanding
13	Mention the various features of Compensation filters	CO1	BTL2	Understanding
14	Draw the schematic diagram of x-ray tube	CO1	BTL2	Understanding
15	Sketch the schematic diagram for different beam restrictors	CO1	BTL2	Understanding
16	Classify graphically the two different contrast agents	CO1	BTL2	Understanding
17	Outline the constructional details of intensifying screens	CO1	BTL2	Understanding
18	Point out the constructional details of x-ray image intensifiers (XRII)	CO1	BTL2	Understanding
19	Compare Radiography and Fluoroscopy	CO1	BTL2	Understanding

20	Write about the formation of latent image and the technique used to convert this image into digital form		**CO1**	**BTL2**	**Understanding**
21	What are the specific structural characteristics of intensifying screens?		**CO 1**	**BTL 2**	**Understanding**
22	State the projection phenomena in radiography.		**CO 1**	**BTL 2**	**Understanding**
23	What is Angiography?		**CO 1**	**BTL 2**	**Understanding**
24	What is Digital subtraction Angiography (DSA)?		**CO 1**	**BTL 2**	**Understanding**
	PART B				
1	(i) Explain the production of x-rays with detail description of construction of x-ray tubes (ii) Contrast the x-ray spectra leaving the tube filter and body with a neat graph.	**(9)** **(4)**	**CO 1**	**BTL3**	**Applying**
2	Explain the following with diagram (i) Digital Subtraction Angiography (ii) Mammography	**(7)** **(6)**	**CO 1**	**BTL4**	**Analyzing**
3	Describes the various aspects of compensation filters and its types with a neat diagram.	**(13)**	**CO1**	**BTL3**	**Applying**
4	Examine the significance of the contrasting agents and plot the attenuation coefficients for different contrasting agents	**(13)**	**CO1**	**BTL4**	**Analyzing**
5	Classify different types of Grids with a neat labelled diagrams for a typical x-ray system	**(13)**	**CO 1**	**BTL4**	**Analyzing**
6	Illustrate the following with a neat diagram (i) Intensifying screens (ii) Radiographic cassettes (iii) Radiographic films	 **(5)** **(4)** **(4)**	**CO 1**	**BTL3**	**Applying**
7	Draw and explain the working of x-ray image intensifiers with a schematic diagram	**(13)**	**CO 1**	**BTL3**	**Applying**
8	Generalize the working of mammography system by formulating the importance of spatial resolution numerically to determine the breast cancer	**(13)**	**CO 1**	**BTL3**	**Applying**
9	(i) Analyse the working of Digital fluoroscopy system by pointing out theimportance of image formation. (ii) Also tabulate the general procedure in fluoroscopy and its application.	**(6)** **(7)**	**CO 1**	**BTL4**	**Analyzing**
10	Explain in detail the interaction of radiation with matter and derive the relation between absorbance and concentration with a neat diagram	**(13)**	**CO1**	**BTL3**	**Applying**
11	Describe in detail the construction and working of stationary anode x-ray tube	**(13)**	**CO 1**	**BTL3**	**Applying**
12	Describe in detail the significance of Airgaps, and Scanning Slits	**(13)**	**CO 1**	**BTL3**	**Applying**

13	Describe various steps involved to develop digital image from the latent form with a neat diagram of computed radiography cassette	**(13)**	**CO 1**	**BTL3**	**Applying**
14	Analyse the various filtration methods used in x-rays	**(13)**	**CO 1**	**BTL4**	**Analyzing**
15	Examine the several aspects of compensation filters and their classifications, accompanied with a clear illustration.	**(13)**	**CO 1**	**BTL4**	**Analyzing**
16	Draw the block diagram of X-Ray machine and explain the components.	**(13)**	**CO 1**	**BTL3**	**Applying**
17	Categorise several classifications of grids using clear and labelled graphics for a standard x-ray system.	**(13)**	**CO 1**	**BTL 4**	**Analyzing**
	PART C				
1	Evaluate the working of digital subtraction angiography system with a neat block diagram.	**(15)**	**CO 1**	**BTL 4**	**Analyzing**
2	Evaluate the automatic dose control system used in the x-ray image intensifiers with a neat block diagram	**(15)**	**CO 1**	**BTL 4**	**Analyzing**
3	Draw the schematic representation for developing a system for automatic exposure control	**(15)**	**CO 1**	**BTL3**	**Applying**
4	Assess various beam restrictors used in X-rays with neat diagrams	**(15)**	**CO 1**	**BTL 3**	**Applying**
5	Analyse the functionality of a digital subtraction angiography system using a clear and organised block diagram.	**(15)**	**CO 1**	**BTL 4**	**Analyzing**

UNIT II – COMPUTED TOMOGRAPHY

Principles of sectional imaging, Principles of computed Tomographic Imaging - Scan motions, X-ray sources.Influences of Images quality: Unsharpness- contrast - Image Noise-2-D image reconstruction techniques-Back projection and iterative.

PART A

Q.No	Questions	CO	BT Level	Domain
1	Define 2-D Transform.	**CO 2**	**BTL1**	**Remembering**
2	What is spiral CT?	**CO 2**	**BTL1**	**Remembering**
3	What is a tomogram?	**CO 2**	**BTL1**	**Remembering**
4	Draw the geometry of the second generation CT machine.	**CO 2**	**BTL2**	**Understanding**
5	Sketch the geometry of the third generation CT machine.	**CO 2**	**BTL2**	**Understanding**
6	Illustrate the geometry of the fourth generation CT machine	**CO 2**	**BTL2**	**Understanding**
7	Define the axial cross section of an image	**CO 2**	**BTL1**	**Remembering**
8	Mention the significance of CT number	**CO 2**	**BTL1**	**Remembering**
9	Enumerate the advantages of first generation CT.	**CO 2**	**BTL1**	**Remembering**
10	Point out the design importance of the 5 G CT machine	**CO 2**	**BTL1**	**Remembering**

11	How the CT number is calculated in CT imaging?		**CO 2**	**BTL2**	**Understanding**
12	Assess the iterative reconstruction technique		**CO 2**	**BTL1**	**Remembering**
13	Summarize the problems of image quality in CT		**CO 2**	**BTL2**	**Understanding**
14	Draw the gantry geometry in CT		**CO 2**	**BTL2**	**Understanding**
15	Tabulate the schematic of three detectors used in CT		**CO 2**	**BTL2**	**Understanding**
16	Classify the types of reconstruction techniques used in CT		**CO 2**	**BTL2**	**Understanding**
17	Mention the significance of slip rings		**CO 2**	**BTL1**	**Remembering**
18	Sketch the constructional details of X-Ray Image Intensifiers (XRII)?		**CO 2**	**BTL2**	**Understanding**
19	List different artefacts affecting the image quality in CT		**CO 2**	**BTL1**	**Remembering**
20	What is the importance of patient dose in CT machines?		**CO 2**	**BTL1**	**Remembering**
21	What are the characteristics needed for CT detectors?.		**CO 2**	**BTL1**	**Remembering**
22	Why slip rings are required?		**CO 2**	**BTL1**	**Remembering**
23	What does an image's axial cross section mean?		**CO 2**	**BTL1**	**Remembering**
24	List the several artefacts that impact the image quality in CT scans.		**CO 2**	**BTL2**	**Understanding**
	PART B				
1	(i) Explain the construction and working principle of X-Ray source in CT machines (ii) Explain the construction and working principle of collimators in CT machines	**(7)** **(6)**	**CO 2**	**BTL3**	**Applying**
2	Assess different features of Dual Energy Computed Tomography.	**(13)**	**CO 2**	**BTL4**	**Analyzing**
3	Describes the various aspects CT processing systems	**(13)**	**CO 2**	**BTL3**	**Applying**
4	Examine the significance of a viewing system for CT with a neat block diagram	**(13)**	**CO 2**	**BTL4**	**Analyzing**
5	Classify and tabulate various features of CT systems across different generations	**(13)**	**CO 2**	**BTL4**	**Analyzing**
6	Illustrate the following with a neat diagram (i) Gantry (ii) Slip rings (iii) Patient table	**(5)** **(4)** **(4)**	**CO 2**	**BTL3**	**Applying**
7	Draw and explain the working principle of CT machine with a schematic diagram	**(13)**	**CO 2**	**BTL3**	**Applying**
8	Generalize the various procedures involved iterative reconstruction techniques used in CT	**(13)**	**CO 2**	**BTL4**	**Analyzing**
9	Analyse the various steps involved back projection algorithm used in CT	**(13)**	**CO 2**	**BTL4**	**Analyzing**
10	Explain in detail the various types of noises in a CT Image	**(13)**	**CO 2**	**BTL4**	**Analyzing**
11	Explain in detail the various types of artefacts prone to occur in a CT machine	**(13)**	**CO 2**	**BTL4**	**Analyzing**
12	Describe in detail the significance of Contrast scale and window width	**(13)**	**CO 2**	**BTL3**	**Applying**

13	Describe various types of CT detectors used in a CT machine with a neat schematic representation	**(13)**	**CO 2**	**BTL3**	**Applying**
14	Analyse the various components of a ultrafast electron beam CT scanner withneat schematic diagram	**(13)**	**CO 2**	**BTL4**	**Analyzing**
15	Illustrate and Describes the operational mechanism of a CT machine using a schematic diagram.	**(13)**	**CO 2**	**BTL3**	**Applying**
16	Examine several characteristics of Dual Energy Computed Tomography.	**(13)**	**CO 2**	**BTL3**	**Applying**
17	Describes the different types of CT detectors utilized in a CT scanner using a clear schematic illustration.	**(13)**	**CO 2**	**BTL3**	**Applying**
	PART C				
1	Evaluate the CT instrumentation for the first, second, third and fourth generation CT machines	**(15)**	**CO 2**	**BTL4**	**Analyzing**
2	Formulate and prepare various reconstruction methods used in CT machines	**(15)**	**CO 2**	**BTL4**	**Analyzing**
3	Explain the techniques, advantages and disadvantages of different types of CT Scanner.	**(15)**	**CO 2**	**BTL4**	**Analyzing**
4	Describe the following components in a CT machine (i) Slip rings (ii) X-ray source (iii) CT detectors	**(5)** **(5)** **(5)**	**CO 2**	**BTL3**	**Applying**
5	Explain the various reconstruction techniques employed in CT equipment.		**CO 2**	**BTL3**	**Applying**

UNIT III – MAGNETIC RESONANCE IMAGING AND SPECTROSCOPY

Fundamentals of magnetic resonance- overview - Relaxation processes T1 and T2. Block Diagram approach of MRI system- system Magnet (Permanent, Electromagnet and Super conductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, contrast agents- tissue contrast in MRI- MR angiography, MR spectroscopy, Fmri

PART A

Q.No	Questions	CO	BT Level	Domain
1	Define the principle of MRI	**CO 3**	**BTL1**	**Remembering**
2	Define the principle of FMRI.	**CO 3**	**BTL1**	**Remembering**
3	What are the clinical relevance of MRI?	**CO 3**	**BTL1**	**Remembering**
4	Mention how stroke can be viewed using MRI system	**CO 3**	**BTL1**	**Remembering**
5	Illustrate the capability of MR image	**CO 3**	**BTL2**	**Understanding**
6	Illustrate the significance of Bloch equation.	**CO 3**	**BTL2**	**Understanding**
7	Define the phenomenon of nuclear magnetism	**CO 3**	**BTL1**	**Remembering**
8	Mention the significance of gyro magnetism.	**CO 3**	**BTL1**	**Remembering**
9	Define the concept of precession used in MRI	**CO 3**	**BTL1**	**Remembering**

10	Tabulate the various gyro metric ratios		**CO 3**	**BTL2**	**Understanding**
11	Illustrate the importance of Larmor frequency		**CO 3**	**BTL2**	**Understanding**
12	Assess the importance of magnetic susceptibility		**CO 3**	**BTL2**	**Understanding**
13	What is the principle of reciprocity?		**CO 3**	**BTL1**	**Remembering**
14	Formulate the transverse component of magnetization		**CO 3**	**BTL1**	**Remembering**
15	Formulate the longitudinal component of magnetization		**CO 3**	**BTL1**	**Remembering**
16	What are the factors that has direct implication on Bloch equations?		**CO 3**	**BTL1**	**Remembering**
17	Point out the significance of magnetic susceptibility		**CO 3**	**BTL1**	**Remembering**
18	What is the importance of chemical shift?		**CO 3**	**BTL1**	**Remembering**
19	Mention the importance of faraday law of induction		**CO 3**	**BTL2**	**Understanding**
20	Define the phenomenon of free induction decay.		**CO 3**	**BTL1**	**Remembering**
21	What is FMRI?		**CO 3**	**BTL1**	**Remembering**
22	List the significance of Larmor frequency		**CO 3**	**BTL2**	**Understanding**
23	Examine the importance of gyro magnetism.		**CO 3**	**BTL2**	**Understanding**
24	What role does chemical shift play?		**CO 3**	**BTL1**	**Remembering**
	PART B				
1	Explain the concept of microscopic magnetism in MRI	**(13)**	**CO 3**	**BTL4**	**Analyzing**
2	Explain the function of different gradient coils Gx, Gy and G z used in MRI	**(13)**	**CO 3**	**BTL4**	**Analyzing**
3	Describes the various aspects precession and Larmor frequency	**(13)**	**CO 3**	**BTL3**	**Applying**
4	Implement the significance of NMR signals	**(13)**	**CO 3**	**BTL3**	**Applying**
5	Contrast between transverse and longitudinal magnetization in MRI system.	**(13)**	**CO 3**	**BTL4**	**Analyzing**
6	Illustrate the concept of rotating frames in NMR	**(13)**	**CO 3**	**BTL3**	**Applying**
7	Draw and explain the importance of RF excitation	**(13)**	**CO 3**	**BTL3**	**Applying**
8	Generalize and draw the phenomenon of spin echoes	**(13)**	**CO 3**	**BTL4**	**Analyzing**
9	Analyse the various steps involved in p weighted contrast mechanism.	**(13)**	**CO 3**	**BTL4**	**Analyzing**
10	Explain in detail the Bloch equations used in NMR	**(13)**	**CO 3**	**BTL3**	**Applying**
11	Enumerate the various biological effects and advantages of NMR	**(13)**	**CO 3**	**BTL3**	**Applying**
12	Explain in detail about fMRI and its applications	**(13)**	**CO 3**	**BTL3**	**Applying**
13	Describe various steps in a t1 weighted contrast method	**(13)**	**CO 3**	**BTL 3**	**Applying**
14	Analyse the various sequence involved in t2 weighted contrast technique	**(13)**	**CO 3**	**BTL4**	**Analyzing**
15	Explain the T1and T2 relaxation processes in detail	**(13)**	**CO 3**	**BTL 3**	**Applying**

16	Interpret the several biological impacts of NMR.	**(13)**	**CO 3**	**BTL3**	**Applying**
17	Explain the idea of rotating frames in nuclear magnetic resonance (NMR)	**(13)**	**CO 3**	**BTL4**	**Analyzing**
	PART C				
1	Describes about the various components used in NMR to build a MRI system	**(15)**	**CO 3**	**BTL3**	**Applying**
2	Explain the principle of NMR system with an FID Fourier transformation	**(15)**	**CO 3**	**BTL3**	**Applying**
3	Summarize the following and give its significance in image formation (i) Spin Lattice relaxation (ii) Spin- Spin relaxation	**(8)** **(7)**	**CO 3**	**BTL3**	**Applying**
4	Formulate and describe about the various image reconstruction techniques used in NMR	**(15)**	**CO 3**	**BTL4**	**Analyzing**
5	Elaborate on the diverse components utilized in NMR to construct an MRI system.	**(15)**	**CO 3**	**BTL4**	**Analyzing**

UNIT IV – RADIO ISOTOPIC IMAGING AND INFRARED IMAGING

Radio nuclides for imaging -Rectilinear scanners – linear scanners – Gamma camera – Emission computed tomography- SPECT, PET- Physics of thermography – imaging systems – pyroelectric vidicon camera clinical,thermography – liquid crystal thermography.

PART A

Q.No	Questions	CO	BT Level	Domain
1	Mention the significance of radio tracers	**CO 4**	**BTL1**	**Remembering**
2	What is radiation therapy?	**CO 4**	**BTL2**	**Understanding**
3	Define isobars, isotones	**CO 4**	**BTL1**	**Remembering**
4	Mention the importance of mass defect with example.	**CO 4**	**BTL2**	**Understanding**
5	Illustrate graphically average binding energy as a function of nuclide	**CO 4**	**BTL2**	**Understanding**
6	Illustrate the significance of nuclide and radio nuclide	**CO 4**	**BTL2**	**Understanding**
7	Define the phenomenon of binding energy	**CO 4**	**BTL1**	**Remembering**
8	Mention the significance of line of stability	**CO 4**	**BTL1**	**Remembering**
9	Define the concept of radioactivity with example.	**CO 4**	**BTL1**	**Remembering**
10	State the various modes of decay	**CO 4**	**BTL2**	**Understanding**
11	Illustrate the importance of positron decay.	**CO 4**	**BTL2**	**Understanding**
12	Give a short note on gamma emission	**CO 4**	**BTL1**	**Remembering**
13	Define isometric transition	**CO 4**	**BTL1**	**Remembering**
14	Give a note on beta emission	**CO 4**	**BTL2**	**Understanding**
15	List the characteristics of Alpha radiation	**CO 4**	**BTL2**	**Understanding**
16	Sketch the importance of main particulate radiation.	**CO 4**	**BTL2**	**Understanding**
17	What are the classes of ionization radiation?	**CO 4**	**BTL2**	**Understanding**
18	Examine the reason for terming nuclear medicine imaging as emission imaging	**CO 4**	**BTL2**	**Understanding**
19	Point out the importance of Infrared radiation	**CO 4**	**BTL2**	**Understanding**
20	What are the physical factors of IR radiation?	**CO 4**	**BTL2**	**Understanding**

21	Mention the importance of radioisotopes used as tracers in scientific research and medical imaging.		**CO 4**	**BTL1**	**Remembering**
22	Point out the significance of Infrared radiation.		**CO 4**	**BTL2**	**Understanding**
23	What does the term "binding energy" mean?		**CO 4**	**BTL2**	**Understanding**
24	What are the uses of Infrared radiation?		**CO 4**	**BTL2**	**Understanding**
	PART B				
1	Explain the construction and working principle of Anger Scintillation camera	**(13)**	**CO 4**	**BTL4**	**Analyzing**
2	Interpret the various different features of Collimators used in nuclear medicineimaging systems	**(13)**	**CO 4**	**BTL3**	**Applying**
3	Describes the various aspects of attenuation and scatter in PET and SPECT	**(13)**	**CO 4**	**BTL3**	**Applying**
4	Examine the significance of a gating system used in nuclear medicine imaging system	**(13)**	**CO 4**	**BTL4**	**Analyzing**
5	Analyse the image capture mechanism used in nuclear medicine imaging system	**(13)**	**CO 4**	**BTL4**	**Analyzing**
6	Illustrate the following with a neat diagram (i) Photo multiplier tube (ii) Scintillation crystal (iii) Positioning logic	**(5)** **(4)** **(4)**	**CO 4**	**BTL3**	**Applying**
7	Sketch and explain the working principle of solid state and other new cameras	**(13)**	**CO 4**	**BTL3**	**Applying**
8	Implement the estimation principle of the following image reconstructiontechniques (i) Algebraic Reconstruction Technique (ART) (ii) Maximum Likelihood by Expectation Maximization	**(7)** **(6)**	**CO 4**	**BTL3**	**Applying**
9	Analyse the working principle of combined PET/CT system	**(13)**	**CO 4**	**BTL4**	**Analyzing**
10	Explain in detail the image quality in PET and SPECT	**(13)**	**CO 4**	**BTL 3**	**Applying**
11	Explain in detail the sensitivity in a nuclear medicine imaging system	**(13)**	**CO 4**	**BTL4**	**Analyzing**
12	Describe in detail the significance of quantitative medial thermography.	**(13)**	**CO 4**	**BTL3**	**Applying**
13	Describe various blocks available in a Pyro electric Vidicon camera with a neat block diagram.	**(13)**	**CO 4**	**BTL4**	**Analyzing**
14	Analyse the working principle of combined PET/MRI system	**(13)**	**CO 4**	**BTL4**	**Analyzing**
15	Interpret the importance of a gating mechanism employed in nuclear medicine imaging systems	**(13)**	**CO 4**	**BTL3**	**Applying**
16	Explain the Gamma Camera	**(13)**	**CO 4**	**BTL4**	**Analyzing**

17	Elaborate on the image resolution and clarity in PET and SPECT	**(13)**	**CO 4**	**BTL4**	**Analyzing**
	PART C				
1	Examine the various components used to build a SPECT system	**(15)**	**CO 4**	**BTL4**	**Analyzing**
2	Demonstrate the principle of IR thermography system with a neat block diagram	**(15)**	**CO 4**	**BTL 3**	**Apply**
3	Summarize the image formation techniques in the following (i) SPECT (ii) PET	**(8)** **(7)**	**CO 4**	**BTL4**	**Analyzing**
4	Explain about the various components used to build a PET system	**(15)**	**CO 4**	**BTL 3**	**Apply**
5	Demonstrate the fundamental concept of an infrared thermography system using a clear and organised block diagram.	**(15)**	**CO 4**	**BTL 3**	**Apply**

UNIT V – ULTRASOUND, NEUROMAGNETIC IMAGING

Ultrasound: Wave propagation and interaction in Biological tissues -Transducers and imaging systems- Imaging modes- Time required to obtain Images- System components, signal processing -dynamic Range- Ultrasound Image Artifacts- Quality control, Origin of Doppler shift- Limitations of Doppler systems.
Neuromagnetic Imaging: Background

PART A

Q.No	Questions	CO	BT Level	Domain
1	List the significance of echocardiogram	**CO 5**	**BTL 1**	**Remembering**
2	Mention the significance of fetal ultrasound	**CO 5**	**BTL 1**	**Remembering**
3	Point out the important property of ultrasound	**CO 5**	**BTL1**	**Remembering**
4	Write the principle of production of ultrasound	**CO 5**	**BTL2**	**Understanding**
5	Classify the various biological tissues based on its ultrasound properties	**CO 5**	**BTL2**	**Understanding**
6	Illustrate the significance of 3D acoustic waves	**CO 5**	**BTL2**	**Understanding**
7	Define the phenomenon of spherical waves	**CO 5**	**BTL 1**	**Remembering**
8	Mention the significance of acoustic energy	**CO 5**	**BTL1**	**Remembering**
9	Define the concept of acoustic intensity.	**CO 5**	**BTL 1**	**Remembering**
10	What are wave transmissions at plane interfaces?	**CO 5**	**BTL2**	**Understanding**
11	Illustrate the importance of beam width in ultrasound.	**CO 5**	**BTL2**	**Understanding**
12	Give the frequency dependence of various biological tissues	**CO 5**	**BTL2**	**Understanding**
13	Summarize the importance of axial and lateral resolution with diagram	**CO 5**	**BTL2**	**Understanding**
14	State the phenomenon of Doppler effects for various cases.	**CO 5**	**BTL2**	**Understanding**
15	Write the phenomenon of Doppler effect	**CO 5**	**BTL 1**	**Remembering**
16	List the importance of characteristic impedance	**CO 5**	**BTL2**	**Understanding**

17	What is the wavelength and frequency of ultrasound?		**CO 5**	**BTL2**	**Understanding**
18	Examine the property of velocity of propagation		**CO 5**	**BTL2**	**Understanding**
19	Tabulate the speed of ultrasound in various biological tissues.		**CO 5**	**BTL2**	**Understanding**
20	Write a note on the detection of ultrasound.		**CO 5**	**BTL2**	**Understanding**
21	Identify the importance of echocardiography.		**CO 5**	**BTL2**	**Understanding**
22	Outline the ultrasonic production principle.		**CO 5**	**BTL2**	**Understanding**
23	Identify the importance of acoustic energy.		**CO 5**	**BTL2**	**Understanding**
24	Mention the ultrasonic frequency and wavelength.		**CO 5**	**BTL2**	**Understanding**
	PART B				
1	Explain the significance of damping and matching in ultrasound systems	**(13)**	**CO 5**	**BTL3**	**Applying**
2	Distinguish the various types of transducers used in ultrasound systems	**(13)**	**CO 5**	**BTL4**	**Analyzing**
3	Interpret the piezoelectric behaviour of ultrasound crystal with a neat diagram	**(13)**	**CO 5**	**BTL3**	**Applying**
4	Explain the significance of A-scan mode used in ultrasound imaging system.	**(13)**	**CO 5**	**BTL3**	**Applying**
5	Analyse the various ultrasound probes used in ultrasound imaging system	**(13)**	**CO 5**	**BTL4**	**Analyzing**
6	Illustrate the following with a neat diagram (i)M-scan (ii)B-scan mode	**(3)** **(10)**	**CO 5**	**BTL3**	**Applying**
7	Draw and explain the working principle of 3 D ultrasound imaging technique	**(13)**	**CO 5**	**BTL3**	**Applying**
8	Generalize the occurrence of noise and speckle in the following (i)Electronics noise (ii)Compound Scanning for Speckle Reduction	**(7)** **(6)**	**CO 5**	**BTL3**	**Applying**
9	Analyse the working principle of combined PET/CT system.	**(13)**	**CO 5**	**BTL4**	**Analyzing**
10	Explain in detail the image quality in ultrasound imaging	**(13)**	**CO 5**	**BTL3**	**Applying**
11	Explain in detail the following in an ultrasound imaging system (i)Frequency (ii)AED (iii)Focussing	**(5)** **(4)** **(4)**	**CO 5**	**BTL3**	**Applying**
12	Describe in detail the significance of medical ultrasound	**(13)**	**CO 5**	**BTL3**	**Applying**
13	Describes on the working principle of echo-ophthalmoscope	**(13)**	**CO 5**	**BTL3**	**Applying**
14	Analyse the working principle of echo cardiograph circuit with block diagram	**(13)**	**CO 5**	**BTL 4**	**Analyzing**
15	Implement the importance of the A-scan mode utilised in ultrasonic imaging systems.	**(13)**	**CO 5**	**BTL3**	**Applying**
16	Examine the piezoelectric properties of an ultrasonic crystal, accompanied by a clear illustration.	**(13)**	**CO 5**	**BTL3**	**Applying**

17	Explain the different types of transducers employed in the ultrasound systems? Write briefly about the types.	**(13)**	**CO 5**	**BTL3**	**Applying**
	PART C				
1	Demonstrate on the various components used in a real time ultrasonic imaging system	**(15)**	**CO 5**	**BTL3**	**Applying**
2	Explain the principle of linear scanners with phased array systems.	**(15)**	**CO 5**	**BTL3**	**Applying**
3	Assess the principle of Duplex scanners with area array systems	**(15)**	**CO 5**	**BTL 4**	**Analyzing**
4	Describe the different components used to build a digital scan converter system and explain the biological effects of ultrasound	**(15)**	**CO 5**	**BTL3**	**Applying**
5	Elaborate on the concept of linear scanners in conjunction with phased array systems.	**(15)**	**CO 5**	**BTL3**	**Applying**