SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF MEDICAL ELECTRONICS

QUESTION BANK

VI SEMESTER - MDE

MD 3661 – 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 properties of X- rays for medical diagnosis.	**CO1**	**BTL1**	**Remembering**
2	List the most common imaging examination and mention its limitations.	**CO1**	**BTL1**	**Remembering**
3	Outline the advantages of projection radiographic systems.	**CO1**	**BTL1**	**Remembering**
4	State bremsstrahlung radiation with a neat diagram	**CO1**	**BTL2**	**Understanding**
5	What is characteristic radiation?	**CO1**	**BTL1**	**Remembering**
6	Mention the significance of Compton scattering.	**CO1**	**BTL2**	**Understanding**
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**	**BTL2**	**Understanding**
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**	**BTL2**	**Understanding**
12	State the importance of Bucky grids.	**CO1**	**BTL1**	**Remembering**
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	Write the spatial resolution of a mammogram when the pixel size is 10μm in (line pairs per mm).	**CO1**	**BTL2**	**Understanding**
20	Outline 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 application of Digital Subtraction Angiography.	**CO 1**	**BTL1**	**Remembering**
23	Outline the principle of digital mammography.	**CO 1**	**BTL 2**	**Understanding**
24	Point out the benefits of cineangiography.	**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)** With necessary diagrams explain the X-ray spectra leaving the tube, the filter and the body.	**(8)** **(8)**	**CO 1**	**BTL3**	**Applying**
2	Examine different beam restrictors used in X-rays with neat diagrams.	**(16)**	**CO 1**	**BTL3**	**Applying**
3	Describe the various aspects of compensation filters and its types with a neat diagram.	**(16)**	**CO 1**	**BTL3**	**Applying**
4	Examine the significance of the contrasting agents and plot the attenuation coefficients for different contrasting agents.	**(16)**	**CO 1**	**BTL3**	**Applying**
5	Classify the different types of Grids with a neat labelled diagrams for a typical x-ray system.	**(16)**	**CO 1**	**BTL4**	**Analyzing**
6	Illustrate the following with a neat diagram (i) Intensifying screens (ii) Radiographic cassettes (iii) Radiographic films	 **(8)** **(4)** **(4)**	**CO 1**	**BTL3**	**Applying**
7	Draw and explain the working of X-ray image intensifiers with a schematic diagram.	**(16)**	**CO 1**	**BTL3**	**Applying**
8	Analyse the working of digital mammography X-ray system with necessary diagrams.	**(16)**	**CO 1**	**BTL4**	**Analyzing**
9	With necessary diagrams explain about Collimators and Grids.	**(16)**	**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.	**(8)** **(8)**	**CO 1**	**BTL4**	**Analyzing**
10	Draw the schematic representation for developing a system for automatic exposure control using photo cell method. Explain in detail.	**(16)**	**CO1**	**BTL3**	**Applying**
11	Describe in detail the construction and working of stationary anode x-ray tube with diagrams.	**(16)**	**CO 1**	**BTL3**	**Applying**
12	Elaborate in detail the significance of Airgaps, and Scanning Slits	**(16)**	**CO 1**	**BTL4**	**Analyzing**
13	Examine various steps involved to develop digital image from the latent form with a neat diagram of computed radiography systems.	**(16)**	**CO 1**	**BTL3**	**Applying**
14	Analyse the various filtration and contrast methods used in X-rays with necessary diagrams.	**(16)**	**CO 1**	**BTL4**	**Analyzing**
15	Examine the several aspects of compensation filters and their classifications with necessary illustrations.	**(16)**	**CO 1**	**BTL3**	**Applying**
16	Evaluate the working of digital subtraction angiography system with a neat block diagram.	**(16)**	**CO 1**	**BTL4**	**Analyzing**
17	Sketch the exposure timing systems using digital timing circuits and explain.	**(16)**	**CO 1**	**BTL3**	**Applying**

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 Tomogram.	CO 2	BTL1	Remembering
2	State the reasons why conventional radiograph is not a tomogram.	CO 2	BTL2	Understanding
3	Mention the limitations of X-rays when compared to CT images.	CO 2	BTL2	Understanding
4	What is 2D Radon transform?	CO 2	BTL1	Remembering
5	Write the advantages and disadvantages of the 3 G CT machine.	CO 2	BTL2	Understanding
6	Sketch the geometry of the 4 G 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	List the advantages of 1 G CT machines	CO 2	BTL1	Remembering
10	Point out the design importance of the 5 G CT machine	CO 2	BTL2	Understanding
11	Illustrate the back projection image and back projection summation image.	CO 2	BTL2	Understanding
12	Outline about Field of View (FOV).	CO 2	BTL1	Remembering
13	Summarize the problems of image quality in CT.	CO 2	BTL1	Remembering
14	Identify the need of Gantry in CT machines.	CO 2	BTL2	Understanding
15	Write about three detectors used in CT.	CO 2	BTL1	Remembering
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	Outline about Fan- beam reconstruction.	CO 2	BTL2	Understanding
19	List different artifacts affecting the image quality in CT.	CO 2	BTL2	Understanding
20	What is the importance of patient dose in CT machines?	CO 2	BTL2	Understanding
21	Differentiate between CT and X-rays.	CO 2	BTL2	Understanding
22	Why slip rings are required?	CO 2	BTL2	Understanding
23	Write about Contrast scale.	CO 2	BTL1	Remembering
24	Write the value of specific gravity and attenuation coefficient for blood.	CO 2	BTL1	Remembering

PART B

1	Explain the construction and working principle of producing CT images using X- ray tube and detector with necessary diagrams.	(16)	CO 2	BTL3	Applying
2	With necessary diagrams explain the construction and working principle of collimators in CT machines.	(16)	CO 2	BTL3	Applying
2	Examine the different features of Dual Energy Computed Tomography with diagrams.	(16)	CO 2	BTL3	Applying
3	Mention and explain the various aspects CT Scanning and Processing systems with necessary diagrams.	(16)	CO 2	BTL4	Analyzing
4	Examine the significance of a viewing system for CT with a neat block diagram.	(16)	CO 2	BTL3	Applying
5	Classify and tabulate various features of CT systems across different generations. Mention its advantages and disadvantages.	(16)	CO 2	BTL4	Analyzing

6	Illustrate the following with a neat diagram: **(i)** Gantry **(ii)** Slip rings **(iii)** Patient table	**(8)** **(4)** **(4)**	**CO 2**	**BTL3**	**Applying**
7	Explain the working principle of CT machine with a schematic diagram.	**(16)**	**CO 2**	**BTL3**	**Applying**
8	Elaborate the various procedures involved iterative reconstruction techniques used in CT with diagrams.	**(16)**	**CO 2**	**BTL4**	**Analyzing**
9	Analyse the various steps involved back projection algorithm used in CT	**(16)**	**CO 2**	**BTL4**	**Analyzing**
10	Explain in detail the various types of noises with mathematical analysis in a CT Image.	**(16)**	**CO 2**	**BTL4**	**Analyzing**
11	Explain in detail the various types of artefacts prone to occur in a CT image resolution.	**(16)**	**CO 2**	**BTL3**	**Applying**
12	Describe in detail the significance of Contrast scale and CT number.	**(16)**	**CO 2**	**BTL3**	**Applying**
13	Describe various types of CT detectors used in a CT machine with a neat schematic representation	**(16)**	**CO 2**	**BTL3**	**Applying**
14	Evaluate the CT instrumentation for the first, second, third and fourth generation CT machines.	**(16)**	**CO 2**	**BTL4**	**Analyzing**
15	Explain the significance of the following **(i)** Storing documentation **(ii)** Gantry geometry **(iii)** Patient dosage	**(16)**	**CO 2**	**BTL3**	**Applying**
16	Examine several characteristics of Dual Energy Computed Tomography.	**(16)**	**CO 2**	**BTL3**	**Applying**
17	Examine the various reconstruction techniques employed in CT equipment with neat diagrams.	**(16)**	**CO 2**	**BTL4**	**Analyzing**

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	State the principle of FMRI.	**CO 3**	**BTL1**	**Remembering**
3	What are the clinical relevance of MRI ?	**CO 3**	**BTL2**	**Understanding**
4	Mention how stroke can be viewed using MRI system	**CO 3**	**BTL2**	**Understanding**
5	Outline about magnetic moment.	**CO 3**	**BTL2**	**Understanding**
6	Write the significance of Bloch equation.	**CO 3**	**BTL2**	**Understanding**
7	Define the phenomenon of G-Slice.	**CO 3**	**BTL1**	**Remembering**
8	Mention the significance of gyromagnetism.	**CO 3**	**BTL1**	**Remembering**
9	List the basic components of MRI.	**CO 3**	**BTL1**	**Remembering**
10	Mention the advantages of NMR Imaging System.	**CO 3**	**BTL1**	**Remembering**
11	Point out the importance of Larmor frequency	**CO 3**	**BTL2**	**Understanding**
12	Identify the importance of magnetic susceptibility in MRI.	**CO 3**	**BTL2**	**Understanding**

13	What is the principle of Free Induction Decay (FID) ?		**CO 3**	**BTL2**	**Understanding**
14	Formulate the transverse component of magnetization		**CO 3**	**BTL2**	**Understanding**
15	Formulate the longitudinal component of magnetization		**CO 3**	**BTL2**	**Understanding**
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**	**BTL2**	**Understanding**
18	What is the importance of relaxation mechanisms with excited nuclear spins?		**CO 3**	**BTL2**	**Understanding**
19	Mention the importance of faraday law of induction		**CO 3**	**BTL2**	**Understanding**
20	Define the phenomenon of free induction decay.		**CO 3**	**BTL2**	**Understanding**
21	What is FMRI?		**CO 3**	**BTL1**	**Remembering**
22	Sketch the significance of imaging sequences.		**CO 3**	**BTL1**	**Remembering**
23	Mention the commonly available receiver coils in MRI.		**CO 3**	**BTL1**	**Remembering**
24	Write the biological effect of NMR imaging.		**CO 3**	**BTL2**	**Understanding**
	PART B				
1	Draw the block diagram of an MRI system and explain its components in detail.	**(13)**	**CO 3**	**BTL3**	**Applying**
2	Explain the principles of MRI relaxation processes (T1 and T2), pulse sequencing, and MR image acquisition with relevant diagrams.	**(13)**	**CO 3**	**BTL3**	**Applying**
3	Explain the application of the Larmor equation in slice selection and how RF bandwidth and gradient strength determine slice thickness in MRI systems.	**(13)**	**CO 3**	**BTL3**	**Applying**
4	Analyze T1-weighted and T2-weighted imaging and their differences impact tissue visualization and diagnostic applications with necessary diagrams.	**(13)**	**CO 3**	**BTL4**	**Analyzing**
5	Explain the difference between transverse and longitudinal magnetization in MRI system with diagrams.	**(13)**	**CO 3**	**BTL4**	**Analyzing**
6	E l a b o r a t e the principle of NMR system with FID Fourier transformation.	**(13)**	**CO 3**	**BTL3**	**Applying**
7	Describe the construction and working of MRI subsystems with its components with diagrams.	**(13)**	**CO 3**	**BTL3**	**Applying**
8	Examine the various image reconstruction techniques used in NMR with neat diagrams.	**(13)**	**CO 3**	**BTL4**	**Analyzing**
9	Analyse the various steps involved in p weighted contrast mechanism in MRI imaging.	**(13)**	**CO 3**	**BTL4**	**Analyzing**
10	Explain with neat sketch about gradient magnetic coils, RF coils, and shim coils in MRI in enhancing image quality and spatial encoding.	**(13)**	**CO 3**	**BTL3**	**Applying**
11	**(i)** List the various biological effects of NMR. **(ii)** Explain about sequential line method of imaging of NMR.	**(6)** **(10)**	**CO 3**	**BTL3**	**Applying**
12	**(i)** Mention the advantages of NMR imaging system. **(ii)** Explain about sequential point method of imaging of NMR.	**(6)** **(10)**	**CO 3**	**BTL4**	**Analyzing**
13	Describe various steps in aT1 weighted contrast method with necessary diagrams.	**(13)**	**CO 3**	**BTL3**	**Applying**
14	Analyse the various sequence involved in T2 weighted contrast technique with neat diagrams.	**(13)**	**CO 3**	**BTL4**	**Analyzing**

15	With neat block diagram explain in detail about NMR detection system.	**(13)**	**CO 3**	**BTL3**	**Applying**
16	Illustrate the application of T1 and T2 relaxation times in selecting pulse sequences for brain MRI imaging with diagrams.	**(13)**	**CO 3**	**BTL4**	**Analyzing**
17	Explain the idea of rotating frames in nuclear magnetic resonance (NMR)	**(13)**	**CO 3**	**BTL3**	**Applying**

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 for medical diagnosis.	**CO 4**	**BTL1**	**Remembering**
2	Name any two commonly used radioisotopes in imaging.	**CO 4**	**BTL1**	**Remembering**
3	What type of radiation is detected in radio-isotopic imaging?	**CO 4**	**BTL1**	**Remembering**
4	Illustrate the significance of nuclide and radio nuclide	**CO 4**	**BTL2**	**Understanding**
5	State the tracer principle.	**CO 4**	**BTL1**	**Remembering**
6	Outline about gamma camera?	**CO 4**	**BTL1**	**Remembering**
7	Define the concept of radioactivity with example.	**CO 4**	**BTL2**	**Understanding**
8	Name the main components of a gamma camera.	**CO 4**	**BTL1**	**Remembering**
9	Mention the function of a collimator?	**CO 4**	**BTL1**	**Remembering**
10	List the applications of radio-isotopic imaging.	**CO 4**	**BTL2**	**Understanding**
11	State the advantage and limitation of radio-isotopic imaging.	**CO 4**	**BTL2**	**Understanding**
12	Write the principle of SPECT?	**CO 4**	**BTL1**	**Remembering**
13	Mention the application of SPECT.	**CO 4**	**BTL1**	**Remembering**
14	List the advantages and limitations of SPECT.	**CO 4**	**BTL2**	**Understanding**
15	Define the principle of PET?	**CO 4**	**BTL1**	**Remembering**
16	Point out the importance of Infrared radiation	**CO 4**	**BTL1**	**Remembering**
17	Distinguish between SPECT and PET.	**CO 4**	**BTL2**	**Understanding**
18	Write the significance of annihilation radiation?	**CO 4**	**BTL2**	**Understanding**
19	What is a thermographic imaging system?	**CO 4**	**BTL2**	**Understanding**
20	Name two detectors used in thermographic imaging systems.	**CO 4**	**BTL1**	**Remembering**
21	What is the working principle of liquid crystal thermography?	**CO 4**	**BTL2**	**Understanding**
22	Why is thermography useful in cancer detection?	**CO 4**	**BTL2**	**Understanding**
23	Mention the advantage of a pyroelectric vidicon camera?	**CO 4**	**BTL1**	**Remembering**
24	Outline about clinical thermography?	**CO 4**	**BTL2**	**Understanding**

PART B

1	With necessary diagram explain the difference between X-ray and gamma emissions. State the importance of radio isotopes in medical diagnosis.	**(16)**	**CO 4**	**BTL 3**	**Applying**
2	Explain the method of radio detection using ionising chamber.	**(16)**	**CO 4**	**BTL3**	**Applying**
3	With necessary diagram, explain SPECT system for medical application in detail.	**(16)**	**CO 4**	**BTL 3**	**Applying**

4	Examine in detail about discrete detector and camera based approaches for SPECT	**(16)**	**CO 4**	**BTL4**	**Analyzing**
5	**(i)** Explain the working of Gamma camera with a neat block diagram **(ii)** Mention the applications of Gamma camera	**(10)** **(6)**	**CO 4**	**BTL4**	**Analyzing**
6	Describe the principle of two types of scanners based on Emission Computed Tomography (ECT) with a neat diagram.	**(16)**	**CO 4**	**BTL 3**	**Applying**
7	Illustrate the following with a neat diagram: **(i)** Ionisation Chamber **(ii)** Scintillation Detector	 **(8)** **(8)**	**CO 4**	**BTL3**	**Applying**
8	Explain in detail the principle of PET scanner for vivo cross-sectional images.	**(16)**	**CO 4**	**BTL 3**	**Applying**
9	Explain in detail the sensitivity in a nuclear medicine imaging system	**(16)**	**CO 4**	**BTL 3**	**Applying**
10	Describe Pyro electric Vidicon camera with a neat block diagram.	**(16)**	**CO 4**	**BTL 3**	**Applying**
11	Assess the importance of a gating mechanism employed in nuclear medicine imaging systems .	**(16)**	**CO 4**	**BTL4**	**Analyzing**
12	Elaborate Gantry and detector modules used in PET scanner with a neat diagram.	**(16)**	**CO 4**	**BTL4**	**Analyzing**
13	Elaborate on the image resolution and clarity in SPECT using scintillation camera.	**(16)**	**CO 4**	**BTL 3**	**Applying**
14	Examine the principle of IR thermography system with a neat block diagram	**(16)**	**CO 4**	**BTL 3**	**Applying**
15	**(i)** Explain the schematic diagram for Digitization of Thermogram. **(ii)** Write short notes on Sensitivity of Thermograpic Imaging systems	**(10)** **(6)**	**CO 4**	**BTL4**	**Analyzing**
16	Integrate various components used to build a SPECT system. Explain in detail.	**(16)**	**CO 4**	**BTL4**	**Analyzing**
17	With a neat diagram. Explain the multicrystal gamma camera for whole body positioning system.	**(16)**	**CO 4**	**BTL 3**	**Applying**

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	Define ultrasound and mention its frequency range used in medical imaging.	**CO 5**	**BTL 1**	**Remembering**
2	What is meant by acoustic impedance of a biological tissue?	**CO 5**	**BTL 1**	**Remembering**
3	State the average velocity of ultrasound in soft tissues.	**CO 5**	**BTL1**	**Remembering**
4	Outline about attenuation and list its components in ultrasound propagation.	**CO 5**	**BTL2**	**Understanding**
5	Write the pulse-echo principle used in ultrasound imaging?	**CO 5**	**BTL2**	**Understanding**

6	State piezoelectric effect with reference to ultrasound transducers.		**CO 5**	**BTL2**	**Understanding**
7	Mention any two materials used for ultrasound transducer crystals.		**CO 5**	**BTL 1**	**Remembering**
8	Identify the function of backing material in an ultrasound transducer?		**CO 5**	**BTL1**	**Remembering**
9	Write about A-mode ultrasound imaging?		**CO 5**	**BTL 1**	**Remembering**
10	Define B-mode imaging and state one clinical application.		**CO 5**	**BTL 1**	**Remembering**
11	Mention the applications of M-mode imaging.		**CO 5**	**BTL 1**	**Remembering**
12	Outline about dynamic range in ultrasound imaging systems.		**CO 5**	**BTL 1**	**Remembering**
13	What is meant by scan conversion in ultrasound systems?		**CO 5**	**BTL 1**	**Remembering**
14	Write about Doppler shift in medical ultrasound.		**CO 5**	**BTL2**	**Understanding**
15	Formulate the Doppler frequency shift equation.		**CO 5**	**BTL 1**	**Remembering**
16	What is aliasing in pulsed Doppler systems?		**CO 5**	**BTL 1**	**Remembering**
17	List any two limitations of Doppler ultrasound systems.		**CO 5**	**BTL2**	**Understanding**
18	What is aliasing in pulsed Doppler systems?		**CO 5**	**BTL2**	**Understanding**
19	List the application of neuromagnetic imaging.		**CO 5**	**BTL2**	**Understanding**
20	What is an ultrasound image artifact?		**CO 5**	**BTL2**	**Understanding**
21	Define acoustic shadowing artifact.		**CO 5**	**BTL 1**	**Remembering**
22	Distinguish between A-mode and B-mode scan displays.		**CO 5**	**BTL2**	**Understanding**
23	What is neuromagnetic imaging?		**CO 5**	**BTL 1**	**Remembering**
24	Name the sensor used for detecting neuromagnetic signals.		**CO 5**	**BTL2**	**Understanding**
	PART B				
1	Explain in detail the propagation of ultrasound waves in biological tissues and their interaction mechanisms.	**(16)**	**CO 5**	**BTL3**	**Applying**
2	Describe reflection, refraction, scattering, absorption, and attenuation of ultrasound in biological tissues with suitable illustrations.	**(16)**	**CO 5**	**BTL4**	**Analyzing**
3	Illustrate the construction and working principle of an ultrasound transducer with a neat diagram.	**(16)**	**CO 5**	**BTL3**	**Applying**
4	With a neat block diagram, explain the A-mode ultrasound imaging with suitable examples	**(16)**	**CO 5**	**BTL3**	**Applying**
5	**(i)** Examine the working of B-mode ultrasound imaging with suitable examples. **(ii)** Write the difference between A-scan and B-scan displays.	**(10)** **(6)**	**CO 5**	**BTL4**	**Analyzing**
6	Explain the principle of M-mode echocardiograph system with suitable diagram.	**(16)**	**CO 5**	**BTL3**	**Applying**
7	With a neat block diagram, explain the functional blocks of modern ultrasound imaging systems.	**(16)**	**CO 5**	**BTL4**	**Analyzing**
8	Describe Doppler ultrasound imaging and explain the origin of Doppler frequency shift.	**(16)**	**CO 5**	**BTL3**	**Applying**
9	Derive the Doppler shift equation used in medical ultrasound and explain the significance of each parameter.	**(16)**	**CO 5**	**BTL3**	**Applying**
10	Explain the working principle of continuous-wave and pulsed-wave Doppler systems.	**(16)**	**CO 5**	**BTL4**	**Analyzing**
11	**(i)** If the Doppler frequency is measured to be +500 Hz, what is the velocity of the blood? Is it moving toward or away from the transducer? **(ii)** Mention the limitations of Doppler ultrasound systems in clinical practice.	**(10)** **(6)**	**CO 5**	**BTL4**	**Analyzing**

12	Explain the blood flow measurement through Doppler imaging with a neat block diagram.	**(16)**	**CO 5**	**BTL4**	**Analyzing**
13	Describe ultrasound signal processing steps used for image formation with necessary diagrams.	**(16)**	**CO 5**	**BTL3**	**Applying**
14	Examine various ultrasound image artifacts, their causes, and methods to reduce them.	**(16)**	**CO 5**	**BTL 4**	**Analyzing**
15	Explain quality control procedures in diagnostic ultrasound systems.	**(16)**	**CO 5**	**BTL3**	**Applying**
16	Elaborate the basic principles of neuromagnetic imaging with necessary diagrams.	**(16)**	**CO 5**	**BTL4**	**Analyzing**
17	Explain the instrumentation, applications, and limitations of neuromagnetic imaging systems.	**(16)**	**CO 5**	**BTL3**	**Applying**