1	<u>Ulean</u>
Name:	\A/
Roll No.:	
Invigilator's Signature :	

CS/B.TECH (BME)/SEM-6/BME-603/2012

2012 BIOMEDICAL IMAGING-II

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A (Multiple Choice Type Questions)

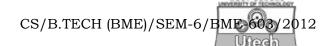
- 1. Choose the correct answers of the following: $10 \times 1 = 10$
 - i) The piezoelectric crystal used in commercially manufactured ultrasound units is
 - a) Caesium Iodide (CsI)
 - b) Natural quartz
 - c) Sodium Iodide (NaI)
 - d) Lead Zirconate Titanate.
 - ii) The value of Pulse Repetition Frequency (PRF) for diagnostic ultrasound is typically
 - a) 100 Hz
- b) 1 kHz
- c) 10 kHz
- d) 1 MHz.

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iii)	The	windowing system of	CT,	displayed the images		
	using					
	a)	6-bit gray scale	b)	8-bit gray scale		
	c)	10-bit gray scale	d)	12-bit gray scale.		
iv)		er chamber of supercistic consist of	ondu	active electromagnet in		
	a)	liquid nitrogen	b)	liquid helium		
	c)	liquid oxygen	d)	liquid carbon dioxide.		
v)	Roch	nelle Salt is a				
	a)	natural piezoelectric cr	ystal			
	b) synthetic piezoelectric crystal					
	c)) composite piezoelectric crystal				
	d)	none of these.				
vi)	In MRI the relaxation time T_2 of a tissue is always					
	a)	Greater than T_1	b)	Less than T_1		
	c)	Equal to T_1	d)	Half of T_1 .		
vii)	The	crystal used in Gamma	Cam	era head is :		
	a)	Caesium Iodide	b)	Barium Titanate		
	c)	Sodium Iodide	d)	Natural Quartz.		
viii)	Which of the Isotope Imaging scanners are not use anymore i.e. obsolete?					
	a)	PET scanner	b)	Gamera Camera		
	c)	Rectilinear scanner	d)	SPECT.		
ix)	Nuta	ation phenomena of MR	I is a			
	a)	first order motion	b)	second order motion		
	c)	third order motion	d)	none of these.		



- x) Time gain compensation is necessary in which of the following imaging modality?
 - a) CT

b) MRI

c) PET

d) Ultrasound.

GROUP - B

(Short Answer Type Questions)

Answer any three of the following.

 $3 \times 5 = 15$

- 2. Briefly explain A-Mode, B-Mode and M-Mode in ultrasound imaging.
- 3. What are the main systems of MRI instrumentation ? Mention the probable uses of MRI in medical field. $2\frac{1}{2} + 2\frac{1}{2}$
- 4. What is real-time imaging? Describe various scanning systems used in real time imaging. 2 + 3
- 5. Draw a neat sketch of an ultrasound transducer and explain function of the parts.
- 6. What is an Isotope ? Explain with a block diagram a Radioisotope Generator commonly used in the Nuclear Medicine Dept. of a hospital.
- 7. Write an equation for linear attenuation coefficient of an object having thickness 'x'.

Draw Houndsfield scale and indicate CT unmbers for air, water and bone. 2 + 3



GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

- 8. Explain the basic principle of X-ray Computed Tomography (CT). Write the names of the Detectors used in CT. Draw a block diagram of Data Acquisition System (DAS) in CT and explain. 5 + 3 + 7
- 9. What is ultrasound? Explain 'Doppler Effect' and write an equation.

Draw a block diagram of an ultrasound imaging system and explain the function of all the components. 2 + 3 + 5 + 5

- Describe T1 and T2 relaxation of magnetic resonance imaging. Explain the gradient system and its importance in tomographic imaging.
 8 + 7
- 11. Explain the principle of positron emission tomography.

 Describe the working principle of gamma camera. 6 + 9
- 12. Draw a diagram of cross sectional view of a superconducting magnet and explain the function of the components.Compare the advantages and disadvantages of Ultrasound, CT & MRI imaging.
- 13. Write short notes on any *two* of the following: $2 \times 7\frac{1}{2} = 15$
 - a) CT image reconstruction
 - b) PACS + DICOM
 - c) Piezoelectricity and equivalent circuit for piezoelectric crystal.
 - d) Artefacts and their causes in CT.