



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech(BME)/SEM-6/BME-603/2011**

**2011**

**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 alternatives for the following :  $10 \times 1 = 10$

i) The sampling frequency of a 1 MHz US signal is

- a) 1 MHz
- b) 2 MHz
- c) 5 MHz
- d) 10 MHz.

ii) The image resolution is measured in

- a)  $\text{LP mm}^{-1}$
- b)  $\text{LP m}^{-1}$
- c)  $\text{LP in}^{-1}$
- d)  $\text{LP ft}^{-1}$ .

iii) Accoustical impedance of a material is proportional to

- a) density
- b) density and velocity
- c) velocity
- d) reflection coefficient.



- iv) Computed tomography measures the
- a) transmitted intensity of X-ray
  - b) attenuation coefficient of X-ray
  - c) incident intensity of X-ray
  - d) detectors efficiency.
- v) Ring artifacts in CT image occurs due to
- a) beam hardening
  - b) detectors non-uniformity
  - c) higher slice thickness
  - d) noise.
- vi)  $T_2$  relaxation in an MRI system is also referred to as
- a) spin-lattice relaxation
  - b) spin-spin relaxation
  - c) spin-echo relaxation
  - d) none of these.
- vii) Time domain signal is converted to a frequency domain signal using
- a) back projection algorithm
  - b) Fourier transform
  - c) Laplace transform
  - d) Z-transform.



viii) The radioisotopes used in nuclear medicine is

- |                      |                       |
|----------------------|-----------------------|
| a) $^{124}\text{Xe}$ | b) $^{130}\text{Te}$  |
| c) $^{99m}\text{Tc}$ | d) $^{235}\text{U}$ . |

ix) Pixel is

- |             |                   |
|-------------|-------------------|
| a) 1D image | b) 2D image       |
| c) 3D image | d) none of these. |

x) Lead zirconate titanate is a

- |                                    |
|------------------------------------|
| a) natural piezoelectric crystal   |
| b) synthetic piezoelectric crystal |
| c) composite piezoelectric crystal |
| d) none of these.                  |

**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.  $3 \times 5 = 15$

2. What is computed tomography ? Describe the different informations obtained from the gantry in the form of data. 2 + 3
3. What is the importance of time-gain circuit of medical ultrasound ? Describe the construction of ultrasound probe with a neat sketch. 2 + 3
4. Describe the data acquisition system of CT scanner with block diagram. Describe one detector system with a neat sketch.  $2\frac{1}{2} + 2\frac{1}{2}$
5. In CT, what data are we measuring ? Draw and explain Hounsfield scale. 1 + 4
6. Explain the principle of echo-encephalography. 5
7. Describe the basic principles of ultrasound imaging. What is therapeutic and diagnostic ultrasound ? 3 + 2



**GROUP – C**

**( Long Answer Type Questions )**

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

8. Describe the basic principles of CT scan. Briefly explain the image quality and probable causes of CT image artifacts. 8 + 7
9. What is windowing system of CT image display ? Explain the CT image reconstruction technique in detail. 7 + 8
10. Explain different scanner systems of ultrasound imaging. Describe different modes of operation and their applications. 7 + 8
11. What is a cyclotron ? Briefly explain its operation. Draw a diagram of Positron Emission Tomography ( PET ) used in isotope imaging and explain the principle of imaging. 2 + 4 + 4 + 5
12. What is acoustic impedance in ultrasound ? Write an equation for the acoustic impedance for ultrasound. Draw a neat sketch of ultrasound transducer ( probe ) and explain the function of all the components. 2 + 3 + 5 + 5
13. Write short notes on any *two* of the following :  $2 \times 7\frac{1}{2}$
- a) Generation of CT
  - b) Superconductive electromagnet of MRI
  - c) T1 and T2 relaxation of MRI.
  - d) PACS + DICOM
  - e) SPECT.
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