Name : .....

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.

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) Dewer chamber of superconductive electromagnet in MRI is consist of

a) liquid nitrogen b) liquid helium

c) liquid oxygen d) liquid carbon dioxide.

v) Rochelle Salt is a

a) natural piezoelectric crystal

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 Camera head is :

a) Caesium Iodide b) Barium Titanate

c) Sodium Iodide d) Natural Quartz.

viii) Which of the Isotope Imaging scanners are not used anymore i.e. obsolete ?

a) PET scanner b) Gamera Camera

c) Rectilinear scanner d) SPECT.

ix) Nutation phenomena of MRI 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. 1 + 4

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

10. 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. 9 + 6

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.