

Student Exam No: _____

GANPAT UNIVERSITY
B.TECH SEM. VIII BIOMEDICAL & INSTRUMENTATION ENGINEERING
REGULAR EXAMINATION MAY/JUNE-2012
BME-801:- ADVANCED BIOMEDICAL IMAGING TECHNIQUES

TIME: 03 HOURS

TOTAL MARKS-70

- INSTRUCTIONS: - 1 All the questions are compulsory.
2 Figure to the right indicates full marks.
3 Answer to each section must be written in separate answer sheet.
4 Assume suitable data if necessary.

SECTION-I

Que.-1

- (a) Give the fundamental difference between CT and Conventional radiography. With diagram explain the principle of operation of CT. 12
(b) Prove that 1D FT of $P_0(K)$ is equal to 2D FT of image function $f(x,y)$. Based on that explain the Direct Fourier Image reconstruction technique.

OR

Que.-1

- (a) Explain the scintillation detector of CT with diagram, construction, working, advantages and disadvantages. 12
(b) What is the function of collimator in CT? Give the fundamental use of pre and post patients collimator in CT.
(c) Give reason why in back projection image reconstruction technique output image is blurred?

Que.-2

- (a) Give the Spiral CT scanner design components and explain any two components in detail. 11
(b) With diagram explain the SPECT in detail.

OR

Que.-2

- (a) How radioisotopes are produced? Explain in detail. Also give complete process of production of radioisotopes ^{99m}Tc with diagram. 11
(b) How PHA is useful? Explain the scintillation detector for radionuclide imaging.

Que.-3

- (a) Write short note on Infrared Photography. 12
(b) With diagram explain the Rectilinear type scanner for radionuclide imaging.

Section-II

Que.-4

- (a) Enlist the factors affecting the image quality of MRI. Explain T1 weighted image and FLAIR images with their applications
- (b) Draw the block diagram of MRI and describe each block in brief.
- (c) During an MRI sequence on an MRI scanner with main magnetic field B_0 1.0 T the slice-selective gradient G_z is 30 mT/m. Estimate the frequency of the transmitted RF pulse (f_{RF}) so that a slice is selected 40 cm and 70 cm away from the centre of the scanner.

12

OR

Que.-4

- (a) Describe phase and frequency encoding process. Draw necessary diagrams
- (b) Distinguish between 2D and 3D MRI imaging. Calculate the total scan time of spin echo sequence if following data's are given:
TE 45 ms and TR 1500 ms; NSA 3; Slice width 5 mm; Field of View 200 mm \times 270 mm & Image matrix ($N_x \times N_y$) 256 \times 128
- (c) Draw and explain T1 and T2 relaxation time. Give its typical values for tissues and water

12

Que.-5

- (a) Draw figure of endoscopic instrument showing all its components. Explain distal end in detail
- (b) What is optical fiber dispersion? Draw and explain its types? Explain about any one approach which can be used to overcome intermodal dispersion

11

OR

Que.-5

- (a) Draw and explain optical fiber connectors and couplers
- (b) Draw and explain the spin echo sequence. Sketch the k-space trajectory of this sequence

11

Que.-6

Answer the following questions(Any Three)

- (a) Capsule endoscopy
- (b) Superconducting magnet
- (c) Biological effects and safety aspects of MRI
- (d) Properties of k-space

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END OF PAPER