

GANPAT UNIVERSITY

B.TECH SEM. VI BIOMEDICAL & INSTRUMENTATION ENGINEERING

CBCS REGULAR EXAMINATION MAY/JUNE - 2014

2BM601 BIOMEDICAL IMAGING AND RADIOLOGY

TIME : 3 HOURS

TOTAL MARKS: 70

INSTRUCTION:

1. Write each section in separate answer books.
2. All questions are compulsory.
3. Draw figures and assume data wherever necessary.
4. Conventional terms / notations are used.
5. Figure to the right indicate marks.

Section – I

Que.1

- (a) Explain transverse and axial beam profiles for continuous and pulsed ultrasonic waves. What is near and far field. Show diagrammatically how beam width controls lateral resolution
- (b) Draw and explain each block of pulse-echo system in brief. What is swept gain control?

OR

Que.1

- (a) Write the formulas for ultrasonic intensity reflection and transmission coefficient at the tissue interface. An ultrasound beam (US) is reflected at the boundary between two types of body tissues with 4 % intensity reflection coefficient. a) Find the ratio of acoustic impedances of the two tissues. Assume US beam intensity at right angle to the boundary b) if the angle beam is decreased to 60° such that US beam intensity reduces to 0, calculate ratio of US beam velocity in two tissues if ratio of densities of two medium is $\sqrt{3}:1$.
- (b) What is the advantage of Manual scan over Real time B-mode scan? Drawing neat diagrams explain various mechanical and electronic scanners used to produce real time images.

Que.2

- (a) Sketch ultrasonic single crystal transducer showing its different parts. How their thickness depends on US wavelength? What is the importance of jelly?
- (b) Explain the working principle of color Doppler flow imaging with block diagram. Write its applications

OR

Que.2

- (a) Derive equation of Doppler shift. Explain pulsed mode Doppler system. Write its advantages and dis-advantages. Give formula to calculate Depth (min) and Depth (max).
- (b) Explain attenuation phenomenon of US waves. What is approximate attenuation dependence of frequency for Lungs? Calculate the US wave intensity at heart valve for 2 MHz frequency. US waves traverse through 1cm fat ($\mu = 0.06$ np/cm) and 2cm myocardium ($\mu = 0.35$ np/cm) before reaching heart valve.

Que.3 Write short note on (Any three)

[12]

- (a) Duplex Imaging
- (b) Echocardiography
- (c) Multi-element linear array scanner
- (d) Biological effects of Ultrasound

Section – II

Que.4

[12]

- (a) What is X-Ray? Enlist the way X-ray photons interact with matter and explain any two types of interaction in detail.
- (b) With diagram explain the external structure of X-ray tube.

OR

Que.4

[12]

- (a) What do you mean by X-ray quantity and quality? Explain all the factors affecting the X-ray quantity.
- (b) Explain the line focus principle and heel effect for X-ray. In connection with abdominal imaging and chest radiography explain how heel effect is useful.

Que.5

[11]

- (a) What is intensifying screen? With diagram explain the intensifying screen in detail.
- (b) Explain the conventional radiographic film in brief.

OR

Que.5

[11]

- (a) Scattered radiation affects the image contrast? Enlist the name of devices to reduce the scattered radiation and explain one of them.
- (b) Write short note on soft tissue radiography.

Que.6 Write short note on

[12]

- (a) Explain the generation of White radiation and Characteristic radiation.
- (b) Write short note on Digital Radiography.
- (c) What is the advantage of having dual focal spots on anode? How these focal spots are useful.

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