

Date: 11/05/2017

New

Exam No: \_\_\_\_\_

GANPAT UNIVERSITY

B. TECH SEM- VI(BM&I) REGULAR EXAMINATION- APRIL-JUNE 2017

2BM601: ULTRASONIC IMAGING AND RADIOLOGY

TIME: 3 HRS

TOTAL MARKS: 60

- Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.  
(2) Figures on right indicate marks. Conventional terms and notations are used.  
(3) Be precise and to the point in answering the descriptive questions.

SECTION: I

Q.1

- (a) Enlist and explain various factors affecting the size and relative position of the X-ray emission spectrum. (10) 4  
(b) What is heel effect? Explain in brief. How it can be used for radiographic imaging? 4  
(c) Define Ionization. State types of ionizing radiations. 2

OR

Q.1

- (a) Draw the neat diagram of X-ray tube. (10) 3  
(b) What is the function of anode in X-ray tube? Explain various types of anode. Why tungsten is used as target material on anode side? 5  
(c) How soft tissue radiography is obtained through mammographic machine? 2

Q.2

- (a) How beam restricting devices are used to reduce scattered radiation? Explain them briefly. (10) 4  
(b) Describe angiographic procedure performed using Digital subtraction technique. 4  
(c) Define: Extrafocal radiations 1  
(d) State inverse square law. 1

OR

Q.2

- (a) Explain in detail Photoelectric and Compton interaction of X-ray with matter. How these are dependent on X-ray energy and atomic properties? (10) 5  
(b) Write note on computed radiography. 3  
(c) Draw and mention various compensating filters. 2

Q.3

- (a) Distinguish between fluoroscopy and radiography. How image intensifier tube works? (10) 5  
(b) Describe the process of generation of k-characteristics and bremsstrahlung X-rays. 5

## SECTION: II

Q.4

- (a) A 1 MHz US wave with initial intensity  $100 \text{ mW/cm}^2$  (RMS) is travelling through fat. (We shall assume initially that we have a semi-infinite slab so that there is no reflected component.) Calculate: (a) the initial peak pressure, (b) the initial maximum velocity of oscillation of the particles, (c) the initial maximum displacement. Now suppose that, the beam hits a barrier with muscle 3cm from the starting point. Calculate: (d) the intensity of the reflected beam. The tissue properties are: fat:  $\delta = 940 \text{ kg/m}^3$ ,  $c = 1480 \text{ m/s}$ ,  $\alpha(\text{amplitude}) = 0.07 \text{ cm}^{-1}$ ; muscle:  $\delta = 1070 \text{ kg/m}^3$ ,  $c = 1566 \text{ m/s}$ ,  $\alpha(\text{amplitude}) = 0.15 \text{ cm}^{-1}$ .
- (b) Explain Doppler effect with some examples.

(10)

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OR

Q.4

- (a) Answer the following multiple choice questions
- i) The parameters spatial-peak, temporal-average, and pulse-average must be considered when expressing values for ultrasound:
- a. Intensity      b. Absorption      c. Velocity      d. Pulse Rate
- ii) Frequency range for ultrasound is
- a. 20,000 Hz above      b. less than 20,000 Hz  
c. 25,000 Hz      d. less than 20Hz
- iii) To determine Rayleigh scattering use the following.
- a. Frequency<sup>4</sup>      b. Square root of propagation speed  
c. PRF<sup>2</sup>      d. Half of the wavelength
- iv) 4D Ultrasound imaging means
- a. Two perpendicular 2D slices spanning a volume  
b. Volume imaging with time      c. Image display with time and frequency
- v) Spatial resolution refers to what?
- a. The ability to resolve structures in relation to time.  
b. The ability to resolve structures in relation to space  
c. The ability to resolve slow moving structures.  
d. The ability to resolve fast moving structures
- (b) Write short note on B mode scan.

(10)

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Q.5

- (a) An 8 MHZ beam of Ultrasound travels from soft tissue into fat. Calculate the wavelength in each medium and percentage wavelength change. For soft tissue speed of sound is  $1540 \text{ m/s}$  and for fat it is  $1450 \text{ m/s}$ .
- (b) Give the equations for transmission and reflection coefficients.
- (c) Calculate the percentage of U/S beam is transmitted from fat to muscle. Acoustic impedance for muscle =  $1.71 \times 10^6$ , acoustic impedance for fat =  $1.34 \times 10^6$ .

(10)

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OR

Q.5

- (a) Explain attenuation with its necessary equations.
- (b) Describe some wave equations for plane waves.

(10)

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Q.6

- (a) Enumerate and explain the various units of ionizing radiations.
- (b) What is latent image? How it can be converted into manifest image on X-ray film?
- (c) Describe the factors affecting X-ray quality. What is HVL?

(10)

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-----END OF PAPER-----