Ref. No. : Ex/PG/BME/T/129A/2025

MASTER OF BIO-MEDICAL ENGG. FIRST YEAR SECOND SEMESTER - 2025

MEDICAL IMAGING AND IMAGE PROCESSING

Time : 3h Full Marks : 100

Use Separate Answer scripts for each Part.

Part I
(Marks: 50)

Answer any two (2) questions

Q1. An ultrasound machine emits a sound wave with a frequency of 3 MHz (3 million Hz) in soft tissue where the speed of sound is approximately 1540 m/s. Calculate the wavelength of the sound wave in the tissue.

(25)

Q2. Describe computer axial tomography (CAT) in detail with block diagram.

(25)

Q3. Draw the structure of human eye. Mark clearly blind spot, fovea, lens, cornea, sclera, and choroid. Explain also the photopic vision and scotopic vision.

(15+10)

Q4. What is digital image processing? Draw and label X-ray tube and describe its working in a brief.

(10+10+5)

Q5. Consider a check-board images in which each square is 1X1 mm. Assuming that the image extends infinity in both coordinates direction, what is minimum sampling rate (in samples/mm) required to avoid aliasing.

(25)

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MASTER OF BIO-MEDICAL ENGINEERING

FIRST YEAR SECOND SEMESTER EXAM 2025

MEDICAL IMAGING AND IMAGE PROCESSING

PG/BME/T/129A (SUPPL)

Part - II (Image Processing)

Answer any 2 questions : 2 X 25 = 50

1. Differentiate between binary image and gray scale image. Explain components of general purpose image processing system. Define brightness, hue, saturation and chromacity. 5+10+10=25
2. Write short notes on : (any 2) $2X12\frac{1}{2}=25$
   i. Laplacian operator for edge detection
   ii. Image sampling
   iii. Image quantization
3. Write short notes on : (any 2) $2X12\frac{1}{2}=25$
   i. Histogram Equalization
   ii. Discrete Fourier transforms on image
   iii. Median filter
4. What is Frequency domain? State properties of Fourier Transformation. Differentiate between blurring and sharpening. 5+10+10=25
5. When do we need smoothing filter? Describe general procedure for filtering in Frequency domain. Describe RGB color model with proper diagram. 5+15+5=25

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