

School of Bio Sciences and Technology

Winter Semester 2023-2024

Continuous Assessment Test – II

Programme Name & Branch : B. Tech Biotechnology

Course Name & code: Medical Diagnostics BBIT320L

Slot: A1 +TA1

Class Number: VL2023240502579

Faculty Name: I. Manjubala

Exam Duration: 90 Min.

Maximum Marks: 50

Answer ALL the Questions (5 x10 = 50 marks)

1. (a) Tissue samples collected for pathology analysis are stored in different color containers. What do these different colors represent?

(b) Why is infiltration of paraffin required before embedding?

(c) Improper orientation of the tissue during embedding can damage the tissue while sectioning. Justify this statement with one example.

(d) How is the decalcification end point determined for bone tissues? (2.5 marks each)
2. (a) What is antigen retrieval process? (2 marks)

(b) Explain the complete protocol of immunohistochemical staining of an abnormal tissue in pathological analysis? (8 marks)
3. (a) What is the role of echo ranging in ultrasound imaging technique? (2 marks)

(b) Elucidate the relationship between the frequency of the ultrasound and (i) transducer crystal and (ii) matching layer thickness? (4 marks)

(c) Calculate the minimum frequency of ultrasound that will allow you to see details as small as 0.22 mm in human tissue and what is the effective depth to which this sound is effective as a diagnostic probe? (Assume that the speed of sound through human tissues is 1540 m/s and the effective maximum scan depth is 500λ) (4 marks)

4. (a) Explain how are X-rays produced in X-ray tube? Which method is preferred in clinical diagnostics? (5 marks)

(b) Ultrasound produces vibrations and heat during propagation in the medium. How this property can be utilized for clinical applications? (3 marks)

(c) Which display modes of measurement in ultrasound instrument is applied for (i) ophthalmic applications and (ii) cardiac valve imaging? (2 marks)

5. An X-ray radiograph is taken for a patient who had an accident and fractured his hand, with two different X-ray machines of energy 80keV and 300keV. Assuming the structure of hand is two component system, *muscle-bone-muscle*,

(i) calculate the intensity of X-ray that emerges out of hand using both the machines?

(ii) Compare the results and Justify which instrument is harmless?

The parameters are defined as follows:

1. The thickness of bone is 5 mm and muscle on each side is 5 mm.

2. The density of muscle is 1.0 g cm^{-3} and the density of bone is 1.8 g cm^{-3} .

3. The attenuation coefficients are

E	$(\mu/\rho)_{\text{muscle}} (\text{cm}^2 \text{ g}^{-1})$	$(\mu/\rho)_{\text{bone}} (\text{cm}^2 \text{ g}^{-1})$
80 keV	0.183	0.209
300 keV	0.118	0.114