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Question Paper Code:U6B02

B.E./B.Tech. DEGREE EXAMINATION, APRIL /MAY 2025

Sixth Semester

Biomedical Engineering

21UBM602- MEDICAL IMAGING EQUIPMENT

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Enumerate the properties of x-rays. CO1- U
2. Compare radiography and fluoroscopy. CO1- U
3. Mention the significance of CT number. CO1- U
4. Identify why conventional radiograph is not a tomogram. CO1- U
5. Illustrate the importance of Larmor frequency in MRI. CO1- U
6. Define the concept of precession used in MRI. CO1- U
7. List the characteristics of Alpha radiation. CO1- U
8. The half-life of a radiopharmaceutical is 6 hours. If a patient is injected with 10 mCi of the radiopharmaceutical, how much activity will remain after 24 hours? CO2- App
9. Emphasize the importance of film badges in radiation monitoring. CO1- U
10. List out the role of a Linear Accelerator in radiation therapy. CO1- U

PART – B (5 x 16= 80 Marks)

11. (a) (i) Explain the principle and working of digital fluoroscopy with a neat diagram. CO1-U (12)
- (ii) Compare radiography and fluoroscopy with the clinical needs. CO1-U (4)
- Or
- (b) (i) Draw the block diagram of X-ray machine and explain the need of each block. CO1-U (12)
- (ii) Inspect the causes of X-ray tube failures. CO1-U (4)

12. (a) In a clinical scenario a patient needs a CT scan to assess soft tissue injuries in the abdomen. Explain how you would use the CT scanner's settings to enhance soft tissue contrast. Discuss how you would minimize radiation exposure while achieving optimal image quality. CO2-App (16)

Or

- (b) During a CT scan of the abdomen, the patient moves slightly causing motion artifacts. How would you minimize these artifacts? Discuss adjustments to scan time, X-ray tube settings or use of image reconstruction techniques to ensure the final images are diagnostically useful. CO2-App (16)

13. (a) Explain the principle of Nuclear Magnetic Resonance Imaging. Discuss how the Larmor frequency is related to the strength of the static magnetic field in MRI. Why is this relationship critical for the resonance process? CO1-U (16)

Or

- (b) Compare and contrast the characteristics of T1 and T2 weighted images in MRI. How do these differences impact the visualization of different tissues? CO1-U (16)

14. (a) Identify the potential impact of positron-emitting isotopes on the field of medical imaging and diagnosis, including their ability to provide high-resolution images and accurate measurements of metabolic activity. How might this impact in medical research and treatment, and what ethical considerations should be taken into account when using these technologies? CO4-Ana (16)

Or

- (b) Analyze how optical coherence tomography (OCT) is used in the diagnosis and treatment of eye illnesses such as glaucoma and macular degeneration. In what ways does OCT make it feasible to detect and monitor these disorders at an earlier stage? CO4-Ana (16)

15. (a) A patient is diagnosed with a deep-seated tumor. How would you decide whether a Linear Accelerator or a Telegamma Machine is the most suitable treatment option? Justify your choice with clinical and technical considerations. CO3-App (16)

Or

- (b) A 35 years old women was admitted in hospital for cancer treatment. Which type of radiation therapy (3D CRT, IMRT, IGRT or Cyber Knife) would be most appropriate for treating a tumor located close to critical organs, and why? Evaluate the advantages and disadvantages of each type of therapy in this situation. CO3-App (16)

