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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 120002

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2024

Seventh Semester

Biomedical Engineering

U19BM717 – RADIOLOGICAL EQUIPMENTS

(Regulation 2019)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

| | | | |
|--------------------------|--------------------|----------------|-----------------|
| Knowledge Levels (KL) | K1 – Remembering | K3 – Applying | K5 - Evaluating |
| | K2 – Understanding | K4 – Analyzing | K6 - Creating |

PART – A

(10 x 2 = 20 Marks)

| Q.No. | Questions | Marks | KL | CO |
|-------|--|-------|----|-----|
| 1. | Define tissue contrast in the context of X-ray imaging. | 2 | K3 | CO1 |
| 2. | Identify the difference between mammography and dental X-ray units. | 2 | K3 | CO1 |
| 3. | Mention the advantages of computed radiography in terms of patient dose. | 2 | K3 | CO2 |
| 4. | State the function of X-ray detectors in Computed Tomography (CT). | 2 | K3 | CO2 |
| 5. | Mention the difference between T1 and T2 relaxation processes. | 2 | K3 | CO3 |
| 6. | What is the role of Radio Frequency (RF) coils in MRI? | 2 | K2 | CO3 |
| 7. | State the principle of nuclear imaging. | 2 | K3 | CO4 |
| 8. | Identify the significance of radionuclide imaging in bone imaging. | 2 | K3 | CO4 |
| 9. | What is Image-Guided Radiation Therapy (IGRT)? | 2 | K2 | CO5 |
| 10. | Define the CyberKnife system and its application in radiation therapy. | 2 | K2 | CO5 |

PART – B

(5 x 13 = 65 Marks)

| Q.No. | Questions | Marks | KL | CO |
|-------|--|-------|----|-----|
| 11. | a) Discuss in detail the components and working of an X-ray machine with a block diagram. | 13 | K3 | CO1 |
| | (OR) | | | |
| | b) Describe the process of angiography, cine angiography, and digital subtraction angiography (DSA). Compare these imaging techniques with respect to their clinical applications. | 13 | K3 | CO1 |
| 12. | a) Describe the different generations of CT scanners, highlighting the technological advancements in each generation. | 13 | K2 | CO2 |
| | (OR) | | | |
| | b) Discuss the following image reconstruction techniques adapted in CT. i. back projection ii. iterative methods. | 13 | K3 | CO2 |
| 13. | a) Explain the fundamentals of magnetic resonance, imaging and discuss the interaction of nuclei with a static magnetic field and radio frequency waves. | 13 | K3 | CO3 |
| | (OR) | | | |
| | b) Compare and contrast the following types of system magnets used in MRI. i. permanent magnets ii. electromagnets iii. superconductors. | 13 | K4 | CO3 |
| 14. | a) Compare the imaging and non-imaging techniques used in nuclear medicine for evaluating organ function. | 13 | K4 | CO4 |
| | (OR) | | | |
| | b) Explain the process of glomerular filtration rate (GFR) measurement using nuclear medicine techniques. Discuss its importance in diagnosing and monitoring kidney disease. | 13 | K3 | CO4 |
| 15. | a) Explain the working principle of a linear accelerator and a Telegamma machine used in radiation therapy. | 13 | K2 | CO5 |
| | (OR) | | | |
| | b) Explain the importance of radiation protection principles in medical settings. | 13 | K2 | CO5 |

PART – C

(1 x 15 = 15Marks)

| Q.No. | Questions | Marks | KL | CO |
|--------|--|-------|----|-----|
| 16. a) | A 7-year-old child presents with unexplained abdominal pain. The physician orders a CT scan to identify the cause but is concerned about minimizing the radiation dose due to the patient's age. Discuss the ethical considerations of using CT imaging in pediatric patients and how can be addressed through technological advancements like ultra-fast CT scanners. | 15 | K4 | CO2 |
| | (OR) | | | |
| b) | A 28-year-old male patient is brought to the emergency department after a car accident. He is suspected of having a spinal cord injury, and the physician orders an MRI scan to assess the extent of the damage. Discuss the considerations for using MRI over other imaging modalities like CT in the evaluation of spinal cord injuries. | 15 | K4 | CO3 |