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University Examinations 2024/2025

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF MEDICAL LABORATORY SCIENCES

HML 3418: RADIOLOGY AND DIAGNOSTIC MEDICAL IMAGING

DATE: JANUARY 2025 **TIME: 3 HOURS**

INSTRUCTIONS:
Answer ***All*** *questions*
Ensure that all your answers are properly numbered
Part I multiple Choice Questions (MCQ): Write the correct answer on the space provided in the answer booklet. Each MCQ is one mark
Part II: Short Answer Questions – Answer questions following each other on the answer booklet
Part III: Long Answer Questions – Answer each question on the answer booklet

SECTION A: MULTIPLE CHOICE QUESTIONS (20 marks)

1. Which of the imaging modality is the first test ordered by physicians:
   a) X-ray.
   b) CT.
   c) MRI.
   d) Angiography.

2. Which of the following modalities is the fastest:
   a) X-ray.
   b) CT.

c) MRI.

d) Angiography.

3. Which of the following will increase the maximum velocity a pulse wave Doppler machine is able to accurately detect?

   a) Decreased Doppler angle

   b) Decreased pulse repetition frequency

   c) Decreased pulse repetition period

   d) Increased transducer frequency

4. Which of the following will reduce side lobe intensity?

   a) Increase peripheral beam intensity

   b) Increase pulse damping

   c) Increase transducer element width

   d) Switching from pulse echo to continuous ultrasound

5. In order to visualize the flow of blood in the renal arteries, what process is done with CT?

   a) CT Angioplasty

   b) CT Angiography

   c) Simple CT

   d) CT Cardiography

6. The radiodensity or the radiopacity is measured in_____

   a) Ma

   b) mV

   c) g/m3

   d) HU

7. Which ultrasound mode is used to generate a 2 dimensional greyscale image?

   a) A mode

   b) B mode

   c) Doppler mode

   d) M mode

8. Spectral doppler mode CT is the golden standard for
   a) Cervical spine.
   b) Spinal cord disorders.
   c) Bone fractures.
   d) Soft tissue.
9. Which of the following is important for assessing cervical spine:
   a) X-ray.
   b) CT.
   c) MRI.
   d) Angiography
10. The current generation CT scanner use_____ for scanning
   a) Pencil beam and stationary detectors
   b) Pencil beam and rotating detectors
   c) Fan beam and detectors
   d) Electron beam and detectors
11. Increasing the magnetic field?
   a) Produces less susceptibility artifacts.
   b) Reduces the risk of tissue heating.
   c) Increase the signal to noise.
   d) Reduces the danger from metallic projectiles
12. A major advantage of MRI is:
   a) The ease with which equipment is updated or replaced.
   b) Its relatively low cost, compared to CT scans.
   c) Dose not require specialized room
   d) The ability to reposition the 'cross-section' through the body without repositioning the patient.
13. A growing application of MRI is "MRA", which stands for:
   a) Magnetic Resonance Amplication

b) Magnetic Resonance Angiographv
c) Minimal Radiology Applications
d) Medical Research Assistance

14. What does "MRI" stand for? c
    a) Magneto-Ray Iclometry
    b) Medical Radiometry Instrument
    c) Magnetic Resonance Imaging
    d) Maximal Radiology Imaging
15. True or False - Tl increases with magnetic field.
    a) False
    b) True
16. Concerning magnetic field strengths, which statement is true?
    a) The earth's magnetic field is about 0.5 G.
    b) A junkyard electromagnet that picks up cars is much stronger than the main field of most MR scanners.
    c) Research MR scanners for humans now exist with field strengths exceeding 20 T.
    d) Higher field strength scanners have wider bores than lower field strength scanners to accommodate the extra flux lines
17. The most common design configuration for clinical MR scanners is
    a) Open bore superconducting
    b) Closed bore superconducting
    c) Open bore permanent
    d) Dipolar electromagnet
18. Poor magnetic field homogeneity may affect image quality in the following ways
    a) Shading artifacts
    b) Spatial distortion
    c) Poor fat suppression
    d) Only a) and b)

e) All of the above

19. MRI facilities often display a sign on the door that says: "Warning! The magnet is always on." This sign would not strictly apply to a
    a) Resistive magnet scanner
    b) Permanent magnet scanner
    c) Superconducting magnet scanner
    d) The sign is applicable to all types of scanners, always
20. The primary purpose for radiofrequency shielding is
    a) To confine fringe fields to the scanner room itself.
    b) To constrain the NMR signal to remain within the bore of the magnet for better reception
    c) I o keep extraneous radiofrequency noise from entering the scanner room
    d) To reduce the effects of moving equipment (such as cars and elevators) from distorting the magnetic

SECTION B: SHORT ANSWER ALL QUESTIONS (40 MARKS)

Question One

Outline three functions of the cathode and three functions of the anode. (5 marks)

Question Two

Define Alara and highlight its important (5 marks)

Question Three

Briefly outline two differences between a radiograph and a CT image. (5 marks)

Question Four

Describe how ultrasound interacts with matter (5 marks)

Question Five

State the principle of nuclear medicine imaging and its applications (5 marks)

Question Six

Name five major components of an X- ray tube. (5 marks)

Question Seven

Outline ways in which photons interact with matter. (5 marks)

Question Eight

State the functions of the intensifying screen. (5 marks)

SECTION C: LONG ANSWER TWO QUESTIONS (40 MARKS)

Question One

a) Explain what radiation biology is (6 marks)

b) Discuss the classification of biologic effects of radiation. (6 marks)

c) Describe four types of personal monitors used in radiation protections and detection. (8 marks)

Question Two

a) Discuss four principal methods by which radiation exposures to individuals can be minimized (16 marks)

b) State the four effects of radiation as observed by Bergonie and Tribondeau. (4 marks)

Question Three

a) State the principle of the image intensifier (6 marks)

b) Discuss factors that affect image quality of an X ray. (6 marks)

c) Using an illustration, describe the complete radiographic imaging chain. (8 marks)