

ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2021
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALISATION PAPER FOR RADIO DIAGNOSIS

Date	: October 31, 2021
Total Marks	: 100
Writing Time	: 150 minutes (2.5 hours)
Reading Time	: 15 Minutes (prior to writing time)

GENERAL INSTRUCTIONS:

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is to check the number of pages of Question Paper, printing errors, clarify doubts and to read the instructions. You are NOT permitted to write during this time.
3. This paper consists of **TWO SECTIONS**, namely SECTION A & SECTION B:
 - **SECTION A** has two parts: Part I - 30 Multiple Choice Questions
Part II - 4 Short Answer Questions
All questions under SECTION A are COMPULSORY.
 - **SECTION B** consists of two Case Studies. Choose only **ONE** case study and answer the questions of your choice.
4. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.
5. All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating the Section, Part and Question Number will NOT be evaluated and no marks will be awarded.
6. Begin each Section and Part in a fresh page of the Answer Booklet.
7. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
8. Use of any other paper including paper for rough work is not permitted.
9. **You must hand over the Answer Booklet to the Invigilator before leaving the examination hall.**
10. This paper has **7 printed pages**, including this instruction page.

GOOD LUCK

SECTION A

PART I: Multiple Choice Questions [30 marks]

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 31 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. The X-ray attenuation is increased by
 - a) increase in the energy of the X-ray.
 - b) increase in the atomic number.
 - c) low density of the material.
 - d) the polychromatic beam.

2. In high KV radiography
 - a) skin dose is increased.
 - b) subject contrast is high.
 - c) tube heat loading is less.
 - d) amount of scattered radiation is relatively low.

3. The line focus principle
 - a) reduces the heel effect.
 - b) optimizes the anode heat loading.
 - c) does not apply to dual focus tube.
 - d) gives asymmetric effective focal spot.

4. The quality of an X-ray beam is
 - a) affected by the mAs setting.
 - b) dependent of the kVp setting.
 - c) controlled solely by the target material.
 - d) unaffected by the presence of characteristic X-rays.

5. The probability of a photoelectric reaction is
 - a) low for high energy photons using contrast media.
 - b) proportional to the cube of the photon energy.
 - c) proportional to the cube of the atomic mass.
 - d) proportional to the material density.

6. In the Compton effect
 - a) it produces photoelectrons.
 - b) it is dependent on the atomic number of the material.
 - c) there is interaction between a photon & a free electron.
 - d) the incident photon has the same energy as the scattered photon.

7. The patient dose is reduced by
 - a) usage of grids.
 - b) usage of low voltages.
 - c) a short focus to skin distance.
 - d) using a compression paddle in mammography.

8. The radiation dose for an employee within one year should not exceed
 - a) 10 mSV
 - b) 20 mSV
 - c) 30 mSV
 - d) 40 mSV

9. The electromagnetic radiation with the highest energy is
 - a) X-rays
 - b) Gamma rays
 - c) Radio waves
 - d) Micro waves

10. Isotopes
 - a) are radioactive.
 - b) have the same half life.
 - c) have near identical electrical properties.
 - d) have same mass and different atomic number.

11. An example of stochastic effect of ionizing radiation is
 - a) Cataract formation
 - b) Skin erythema
 - c) Sterilization
 - d) Leukemia

12. Acoustic impedance in tissue
 - a) is related to propagation of speed.
 - b) depends on ultrasound frequency.
 - c) is independent of tissue density.
 - d) is measured in Hz.

13. The frequency of the transducer effects
 - a) Contrast
 - b) Brightness
 - c) Penetration
 - d) Magnification

14. In diagnostic ultrasound
 - a) refraction is the change of beam direction when passing between different media.
 - b) dispersion is the loss of low frequencies in the sound beam.
 - c) the frequency of the beam is between 15,000 to 20,000 Hz.
 - d) partial reflection at interfaces reduces the image quality.

15. The Doppler transducer
- depends on change of wavelength.
 - operates only in continuous mode.
 - preferentially uses low frequency.
 - depends on change of frequency.
16. The CT number is
- dependent on the kV used.
 - highest for blood.
 - measured in mAs.
 - negative for fat.
17. CT image noise is decreased by
- decreasing scan time.
 - imaging obese patients.
 - decreasing patient dose.
 - choosing smaller slice thickness.
18. Spiral CT depends on
- pulsed low-frequency power supply.
 - a 360 degree detector ring.
 - wide beam collimation.
 - slip ring technology.
19. Patient CT dose
- spiral studies always give more dose than sequential studies.
 - is the sum of the individual slice doses.
 - fast scan time increases the dose.
 - is proportional to mAs.
20. Spatial resolution in CT is improved by
- use of a filter.
 - decreasing pixel size.
 - decreasing the matrix size.
 - increasing the slice thickness.
21. The T1 relaxation value
- depends on exchange of energy between spins and the material lattice.
 - depends on the exchange of energy between adjacent spins.
 - is short for simple compound like water.
 - is long for more complex like fat.
22. The MRI
- can demonstrate function.
 - reconstruction is not possible.
 - is a real time imaging modality.
 - can suffer from partial volume effect.

23. With regard to MRI artifacts
- the artifacts from ferromagnetic objects are reduced by reducing the bandwidth.
 - the chemical shift artifacts can be reduced using smallest possible field of view.
 - the aliasing artefacts can be generated from anatomy outside the field of view.
 - the chemical shift artefacts are observed in the phase encoding direction.
24. Patient dose for mammography is best measured as
- Mean glandular dose
 - Entrance dose rate
 - Half-value layer
 - Exit dose rate
25. All of the following statements regarding TLD is correct, EXCEPT
- Hold their exposure information for a long time.
 - Can be used as high sensitivity room monitors.
 - Require ultraviolet radiation for read out.
 - Can be used as personal monitors.
26. The correct statement regarding effective doses for the following radiology imaging procedures is
- IVU-1 mSv
 - CXR-0.02mSv
 - CT abdomen-2 mSv
 - Barium enema- 5 mSv
27. Which one of the following is the dimeric contrast media?
- Iothalamate
 - Gadolinium
 - Iopamidol
 - Ioxaglate
28. In digital subtraction angiography
- image archival on optical disc is impossible.
 - spatial resolution is about 5 to 10 lines per mm.
 - image intensifiers are used to create the images.
 - a digital-to-analog converter samples the video signal.
29. Which of the following statements is INCORRECT regarding radionuclide imaging?
- The radionuclide most commonly used is Technetium-99m (^{99m}Tc).
 - A gamma camera consists of large sodium iodide crystal.
 - Gamma rays are produced by radioactive decay.
 - Technetium 99m has half-life of 6 minutes.
30. The suture that separates the parietal bones is called as
- Coronal suture
 - Sagittal suture
 - Metopic suture
 - Lambdoid suture

PART II – Short Answer Questions [20 marks]

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks

1. Write short notes on CORADS and post COVID lung.
2. Classify arthritis. Give the radiological features of rheumatoid arthritis.
3. What are the differential diagnosis of solitary pulmonary nodule? How will you evaluate solitary pulmonary nodule?
4. What are the causes of IUGR? How will you evaluate IUGR?

SECTION B: Case Study [50 marks]

Choose either Case I OR Case II from this section. Each case study carries 50 marks. Mark for each sub-question is indicated in the brackets.

CASE I

A 45-year-old male came to ER and then to your department with trauma following motor vehicle accident. Preliminary examination showed injury to head, right shoulder, chest and abdomen. You will need to evaluate the case radiologically. Answer the following questions:

1. Describe the CT head/brain of the patient. (5 marks)
2. Describe the MRI features of different ages of bleed in the brain. (10 marks)
3. Give the MR protocol and write in brief the findings of rotator cuff tear of the shoulder. (5+5 marks)
4. Give account of CT urogram. (7 marks)
5. Discuss the MDCT imaging of the focal liver lesions. (8 marks)
6. Enumerate the causes of osteonecrosis. Describe the MRI findings of avascular necrosis (AVN) of the hip. (5+5 marks)

CASE II

An adult lady presented with sudden onset of confusion, disorientation and slurred speech. How will you proceed to diagnose the case radiologically? Answer the following questions based on the above case:

1. Describe the possible CT brain findings. (5 marks)
2. Discuss the MRI stroke protocol. (10 marks)
3. Write a short note on calcium scoring in coronary angiogram. Write briefly about Digital Subtraction Angiography (DSA). (7+5 marks)
4. Give an account of MR protocol & MR evaluation of epilepsy. (5+5 marks)
5. Describe the Seldinger technique of vascular access in Interventional Radiology (IR). (8 marks)
6. What do you understand by functional MRI? (5 marks)

TASHI DELEK