ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2018
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALISATION PAPER FOR RADIOLOGY & IMAGING SC. TECH.

Date : 7 October 2018
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 being provided 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 correct 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 are required to 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 atomic number of an atom is:
   a) The mass of the atom
   b) The number of protons added to the number of neutrons
   c) The number of protons
   d) Negatively charged

2. The S.I unit of absorbed dose is:
   a) RAD
   b) Gray
   c) Roentgen
   d) Rem

3. Concerning radiation protection of staff & patients:
   a) 2.5 mm of lead equivalent filter should be used for routine radiological procedures.
   b) Lead screen panels used in x-ray rooms to protect staff are usually 5 mm thick.
   c) Thyroid collars used in radiology have 0.5 mm lead equivalence.
   d) For chest radiography, the film to focus has 0.5 mm lead equivalence.

4. Which one of the following is not included in the cardinal principle of radiation protection?
   a) Distance
   b) Time
   c) Shielding
   d) Frequency

5. In stochastic type of radiation injury, which one of the following effect is seen?
   a) Hereditary effects
   b) Erythema
   c) Skin necrosis
   d) Cataract formation

6. All are key principles of Radiation Protection and safety EXCEPT:
   a) Justification-whether the benefit of use of radiation outweighs the risk
   b) Optimization- keeps exposure as low as reasonably achievable
   c) Dose limit- exposures should be within the prescribed dose limits
   d) Occupational exposure-all exposures of workers incurred during the course of their work

7. A wave that consists of two perpendicular transverse waves with one component of the wave being a vibrating electric field and the other being a corresponding magnetic field is called:
   a) Induction wave
   b) Electromagnetic wave
   c) Radiation wave
   d) Sound wave

8. Which of the following is an ionizing radiation?
   a) Microwaves
   b) Visible light
   c) X-rays
   d) Infrared rays

9. Which of the following has the shortest wavelength?
   a) Radio waves
   b) Light waves
   c) Microwaves
   d) Gamma rays

10. Target of an x-ray tube is often made from:
    a) Tungsten
    b) Cobalt
    c) Wood
    d) Aluminium

11. What is the typical range of kVp used in mammography?
    a) 10 – 18
    b) 20 – 35
    c) 45 – 55
    d) 62 – 72

12. If the radiographic image is over exposed, which of the following "exposure factor change " should be used to correct the problem?
    a) Decrease mAs
    b) Increase mAs.
    c) Decrease kVp
    d) Increase kVp

13. SID for cervical spine lateral projection is:
    a) 100 cm
    b) 180 cm
    c) 130 cm
    d) 110 cm

14. A device that converts alternating current to direct current:
    a) Resistor
    b) Transformer
    c) Rectifier
    d) Amplifier

15. In children with recurrent urinary tract infection, Micturating Cystography is done to detect:
    a) Bladder infection
    b) Vesico-ureteric reflux
    c) Posterior urethral valve
    d) Bladder tumors

16. Barium follow through study is performed to assess the:
    a) Stomach only
    b) Small intestine
    c) Stomach and small intestine.
    d) Colon only

17. In Digital Substraction Angiography (DSA);
    a) Image intensifiers are used to create the real-time images
    b) Image archrival on optic disk is possible
    c) Spatial resolution is about 5-10 lines per mm
    d) A digital-to-analog converter samples the video signal

18. Magnets that retain their magnetic property once they are magnetized:
    a) Electromagnets
    b) Temporary magnets
    c) Permanent magnets
    d) Super magnets

19. All of the following are true regarding use of proton in MR imaging EXCEPT:
    a) Hydrogen atom has only one proton
    b) Are present in abundance in body water
    c) Gives best and most intense signal among all nuclei
    d) Other atoms cannot be used at all

20. All of the following are true for T2 weighted image, EXCEPT:
    a) Long TE
    b) Water is bright
    c) Contrast is predominantly due to the difference in the T2 decay time of tissues
    d) Tissues with long T1 relaxation times are dark

21. T1 weighted images are commonly used for getting information about:
    a) Pathology
    b) Patho-physiology
    c) Anatomy/morphology
    d) Physiology

22. Regarding diffusion weighted imaging, all statements are true EXCEPT:
    a) Exploits the presence of random motion of water molecules
    b) Property of directional independence
    c) ADC shows opposite signal to DWI
    d) Hyper-acute infarcts are bright signal.

23. The CT number:
    a) Is negative for water
    b) Is dependent on kV used.
    c) Is zero for fat
    d) Is highest for bone

24. Following are common CT artefacts, EXCEPT:
    a) Reverberation artefact
    b) Motion artefact
    c) Beam hardening artefact
    d) Volume averaging artefact

25. Regarding MDCT, all the following are true, EXCEPT:
    a) Faster acquisition & scanning time
    b) Larger anatomic coverage
    c) Use of multiple row of detectors
    d) The gantry is fixed

26. The frequency of the ultrasound used in the medical imaging is in the range of:
    a) 1-20Hz
    b) 1-20 MHz
    c) 10-20 KHz
    d) 10-20 MHz

27. During USG the structure that does not produce any internal echoes is called:
    a) Echogenic
    b) Hypoechoic
    c) Anechoic
    d) Mixed echoic

28. All the following statement regarding why we do intervention radiology is true, EXCEPT:
    a) Longer hospital stays after intervention
    b) Typically access structures through a tiny nick in the skin
    c) Better quality of life for patients
    d) High intensity localized treatments

29. Which arteries is not the part of circle of Willis?
    a) Anterior cerebral arteries
    b) Middle cerebral arteries
    c) Posterior cerebral arteries
    d) Internal carotid arteries

30. Superior vena cava drains blood into:
    a) Inferior Vena Cava
    b) Left atrium
    c) Right atrium
    d) Right ventricle

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 the part position & centering, FFD for chest x-ray PA view with an air-gap technique. What is Towne's view/projection? (4+1 marks)

2. How would you perform CT-Urogram? What are the different phases? When are the delayed phases necessary? (2+2+1 marks)

3. What are the sources of medical radiation? Write briefly how you would practice radiation protection to patients. (3+2 marks)

4. What are the advantages & disadvantages of ultrasonography? Write down the common artefacts in ultrasonography. (3+2 marks)

SECTION B

Case Study

Choose either Case I OR Case II from this section. Each case study carries 50 marks.

Case I

A 55 years old man, known case of HTN, DM & peptic ulcer disease presented to the emergency department with shortness of breath, generalized abdominal pain associated with distension & generalized weakness. His vitals show high pulse rate & hypotension. The emergency physician had advised urgent bedside ultrasonography, urgent X-ray abdomen, CT abdomen & MRI brain. In this case scenario, answer the following:

1. What are the radiological imaging required for this patient? What are the probable findings? (3+2 marks)

2. What do you understand by FAST? What are the probable ultrasound findings of the abdomen in this case? What are the components of the Transducer? (2+4+4 marks)

3. Explain briefly how you would perform the urgent abdominal X-ray in this case. What are the disadvantages of the portable x-ray? (5+5 marks)

4. Explain the scanning protocol for CT abdomen from preparation till the patient is out of the CT room. Mention the contraindications for contrast CT. (8+2 marks)

5. Mention the routine sequences for MRI brain. What are the basic differences between these sequences? What are the common artefacts of MRI? (5+5+5 marks)

Case II

A 70 years old male, known case of DM & HTN presented with history acute altered sensorioum, slurring of speech & weakness of left half of the body for 1 day. You are the radio-technologist to perform the MRI & MRA brain of this patient. In this context, answer the following questions:

1. What is your provisional diagnosis? What imaging modalities would you perform in this case? (2+3 marks)

2. Mention the basic sequences for the MRI brain. Explain the salient features you see in each of the sequences you mentioned. (5+10 marks)

3. Write briefly on MR angiography. Write the normal CSF flow pathway of the brain? (5+5 marks)

4. Compare & contrast CT & MRI of brain in this case. (10 marks)

5. Write briefly how you would perform the MRI stoke protocol. (10 marks)

TASHI DELEK