

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2016
EXAMINATION CATEGORY: TECHNICAL**

PAPER III: SUBJECT SPECIALISATION PAPER FOR RADIOLOGY

Date:	2 October 2016
Total Marks:	100
Examination Time:	150 minutes (2.5 hours)
Reading Time:	15 minutes (<i>prior to examination time</i>)

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, printing error, clarify doubts and to read instructions in Question Paper. You are NOT permitted to write during this time.
3. This paper consists of **TWO Sections, namely Section A and 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 2 case studies. Choose only **ONE** case study and answer the questions under 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 correct Section, Part and Question Number will NOT be evaluated and no marks would 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. The Question paper has 8 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 (c). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. Most of the I.V contrast media contain iodine , which has atomic number:
 - a) 54
 - b) 53
 - c) 68
 - d) 74

2. The ideal time to perform HSG examination is
 - a) within 11 days of LMP
 - b) 11-20 days of LMP
 - c) above 20 days of LMP
 - d) All of above

3. Intensity of the X-ray can increased by increasing
 - a) Frequency
 - b) Current
 - c) Voltage
 - d) Resistance

4. The common bile duct is formed by
 - a) Cystic duct and pancreatic duct
 - b) Hepatic duct and pancreatic duct
 - c) Right hepatic duct and left hepatic duct
 - d) Common hepatic duct and cystic duct

5. A sound wave which has frequency higher than upper limit of human hearing is
 - a) Infrasonic
 - b) Supersonic
 - c) Ultrasonic
 - d) Megasonic

6. X-ray are filtered out before reaching the human body by using
 - a) Aluminum absorber
 - b) Copper absorber
 - c) Carbon absorber
 - d) Cadmium absorber

7. Sound wave cannot travel through
 - a) Air
 - b) Bone
 - c) Vacuum
 - d) lead

8. The number of cycle per second is called
 - a. Frequency
 - b. Wavelength
 - c. Wave period
 - d. Pulse repetition period

9. At 1.5 T the precessional frequency of hydrogen is
 - a) 21.28 MHz
 - b) 42.57 MHz
 - c) 63.86 MHz
 - d) 0.5 MHz

10. Typical pathology as seen on DWI and ADC image is
 - a) Bright on DWI and bright on ADC
 - b) Bright on DWI and dark on ADC
 - c) Dark on DWI and bright on ADC
 - d) Dark on DWI and dark on ADC

11. Compared with SE, GRE sequences use
 - a) Longer TR and longer TE
 - b) Shorter TR and longer TE
 - c) Longer TR and shorter TE
 - d) Shorter TR and shorter TE

12. The principal reason that contrast media will increase contrast resolution of a CT image is
 - a) Compton scattering
 - b) Photoelectric absorption
 - c) Coherent scatter
 - d) Bremsstrahlung

13. One advantage of spiral CT over conventional CT is
 - a) Contrast resolution is improved
 - b) Patients are more comfortable
 - c) The examination time is less
 - d) There is no intrascan delay

14. With the tungsten target, there is no characteristic x-rays in the beam when the kVp is set
- Above 90 kVp
 - Above 80 kVp
 - Above 70 kVp
 - Below 70 kVp
15. The circulatory system route that runs from the digestive tract to the liver is called
- Hepatic portal circulation
 - Systemic circulation
 - Pulmonary circulation
 - Coronary circulation
16. Which division of the nervous system initiates a response known as fight or flight
- The parasympathetic nervous system
 - The sympathetic nervous system
 - The somatic nervous system
 - None of the above
17. The size and shape of the electron stream are determined by
- Dimension of the filament tungsten wire coil
 - The construction of the focusing cup
 - The position of the filament in the focusing cup
 - The melting point of tungsten target
- I and II
 - I, II and III
 - I and III
 - I, II, III and IV
18. The precessional frequency is often called the Larmor frequency, because it is determined by
- Lower frequency
 - Liner frequency
 - Larmor equation
 - Higher frequency
19. In the presence of a uniform magnetic field, hydrogen protons
- Line up along the field and rotate around the axis
 - Line up along the field and precess around the axis
 - Remain oriented mostly randomly and precess around the field axis
 - Are not affected by the magnetic field
20. Inversion recovery (IR) sequences are helpful to
- Improve tissue contrast
 - Improve T2 weighting

- c) Improve signal to noise
 - d) Shorten imaging time
21. All of the following are true for T2 weighted image except
- a) Long TE
 - b) Water are bright
 - c) Contrast is predominately due to the difference in the T2 decay time of tissues
 - d) Tissues with long T1 relaxation times are dark
22. The best way to correct a partial volume artifact during spiral CT is to
- a) Change the reconstruction plane
 - b) Increased pitch
 - c) Use a thicker slice
 - d) Use a thinner slice
23. Motion artifact on a CT image normally appear as
- a) A herringbone pattern
 - b) Cupping
 - c) Peaking
 - d) Streaks
24. During CT examination with the technologist in the control booth, the occupational radiation monitor should be positioned
- a) At chest level
 - b) At waist level
 - c) At collar level
 - d) Anywhere on the trunk of the body
25. Heating a transducer above _____ will cause depolarization.
- a) The curie temperature
 - b) The boiling point
 - c) Room temperature
 - d) The body temperature
26. X-radiation is part of the _____ spectrum.
- a) Radiation
 - b) Energy
 - c) Atomic
 - d) Electromagnetic
27. Which X-ray tube component serves as a source of electrons for x-ray production?
- a) Filament
 - b) Focusing cup

- c) Stator
 - d) Target
28. What percentage of the kinetic energy is converted to heat when moving electron strike the anode target?
- a) 1%
 - b) 99%
 - c) 25%
 - d) 59%
29. Grid ration is defined as the ratio of the
- a) Height of the lead stripe to the distance between them
 - b) Width of the lead stripe to their height
 - c) Number of lead stripe to their height
 - d) Width of the lead stripe to the width of the interspaces material
30. Cystogram is used to visualize
- a. Kidney
 - b. Ureter
 - c. Urethra
 - d. Urinary bladder

PART II – Short Answer Questions (20 marks).

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

1. What is mean by the term ‘justification’ under the radiation protection? Outline the ways in which a radiographer can reduce the dose to staff and other patients on the ward during a mobile chest procedure. (3+2)
2. List the factors that affect the density on a radiograph. Explain what is mean by attenuation. (3+2)
3. Write down the part position and centering for skull lateral supine with horizontal beam. Add note on exposure factor. (3+2)
4. What are the advantages of using ultrasound? What is the purpose of the gel during the ultrasound scan? (3+2)

SECTION B

Case Study

Choose either Case 1 or 2 from this section. Each case study carries 50 marks. Marks for each sub-section are indicated in the brackets.

Case 1

You are the Radio-technologist and in this capacity you have been given the task of teaching on radiation hazard and protection to the X-ray student in Faculty of Nursing and Public Health. In this context answer the following question.

- a) How would you ensure that the students during attachment in the X-ray field are protected from X-ray radiation? (8)
- b) Write briefly about the hazard of radiation. (8)
- c) What are the interactions that take place between X-ray and matter? Describe the 2 interaction that take place frequently in diagnostic radiation. (2+5)
- d) What are the advantages and disadvantages of X-ray tube filter? Explain the type of X-ray filtration. (2+4)
- e) Describe the ideal x-ray room construction. (8)
- f) What are the main purposes of using X-ray beam restrictor? What are the functions of the X-ray tube shield? (2+2)
- g) How X-ray is produced in an x-ray tube? Which of the prime exposure factors influences both quality and quantity of the X-ray photons? (3+2)
- h) What is the function of replenishment? If the processing temperature is not maintained at a constant level, what will happen? (2+2)

OR

Case 2

A 56 years old male, came to emergency department with severe headache associated with weakness of right lower limb. The physician on duty suspects CVA and advised MRI Brain. In this context answer the following question.

- a) What does PROPELLER stand for? Describe the patient positioning and basic protocol (sequences) for MRI brain stroke. (2+6)
- b) Explain the planning for Axial, Sagittal and Coronal of brain. (6)

- c) What are the contraindications for MRI scan? (4)
- d) Describe how a MRI scanner works? (5)
- e) Describe how fat and water look different on a T1 weighted and T2 weighted image. (5)
- f) List the main factors that make gradient echo sequences different from spin echo? (5)
- g) What parameter are used in FLAIR sequences and why? (5)
- h) What is magnetic susceptibility and how do you reduce it? (6)
- i) What conditions are necessary for resonance? What is the purpose of shielding? (3+ 3)

TASHI DELEK