

**शहीद गंगालाल राष्ट्रिय हृदय केन्द्र, पदपूर्ति समिति**  
**पद: रेडियोग्राफर (सेवा -प्राविधिक, समूह - मेडिकल, उप-समूह - रेडियोलोजी) रा.प. अन.प्रथम (ख)**  
**को खुल्ला /आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम**  
**एवं परीक्षा योजना**

यस पाठ्यक्रम योजनालाई दुई चरणमा विभाजन गरिएको छ :

**प्रथम चरण :-** लिखित परीक्षा (Written Examination)

पूर्णाङ्क :- २००

**द्वितीय चरण :-** अन्तर्वार्ता (Interview)

पूर्णाङ्क :- ३०

**प्रथम चरण (First Phase) : लिखित परीक्षा योजना (Written Examination Scheme)**

Paper	Subject	Full Marks	Pass Marks	No. Questions & Weightage	Time Allowed
I	Technical Subject	100	40	(Objective Multiple Choice Questions) 50 × 2 = 100	1.00 hrs
II		100	40	(Subjective Descriptive Type) 8 × 5 = 40 (Short answer) 6 × 10 = 60 (Long answer)	3.00 hrs

**द्वितीय चरण (Second Phase)**

Subject	Full Marks	Examination
Interview	30	Oral

**द्रष्टव्य :**

- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।
- प्रथम र द्वितीय पत्रको विषयवस्तु एउटै हुनेछ । तर प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
- वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरूको गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।
- परीक्षार्थीले वस्तुगत बहुवैकल्पिक प्रश्नको उत्तर लेख्दा अंग्रेजी ठूलो अक्षर (Capital letter) A, B, C, D मा लेख्नुपर्नेछ । सानो अक्षर (Small letter) a, b, c, d लेखेको वा अन्य कुनै सङ्केत गरेको भए सबै उत्तरपुस्तिका रद्द हुनेछ ।
- बहुवैकल्पिकप्रश्नहरू हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।
- विषयगत प्रश्नहरूको हकमा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिने छ ।
- विषयगत प्रश्नमा प्रत्येक पत्र/विषयका प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । परीक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डका उत्तरपुस्तिकामा लेख्नुपर्नेछ ।
- परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।
- द्वितीय पत्रमा तोकिएको पाठ्यक्रमबाट सम्बन्धित पदको लागि आवश्यक Competency मा आधारित कम्तीमा दुई वटा Competency Based प्रश्नहरू लिखित परीक्षामा सोधिनेछ ।
- यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जेसुकै लेखिएको भएतापनि पाठ्यक्रममा परेका कानून, ऐन, नियम, विनियम तथा नीतिहरू परीक्षाको मितिभन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्झनु पर्दछ ।
- प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।
- पाठ्यक्रम लागु मिति : आ.व. २०७८/०७९ देखि

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**Paper I & II: - Technical Subject**

**Section (A): 50% Marks**

**For Paper I (25 MCQs ×2 marks) &**

**For Paper II (4×5 marks, 3×10 marks)**

**1. Human Anatomy and Physiology**

- 1.1 Surface and regional anatomy
  - 1.1.1 Anatomical position, head , neck, thorax, abdomen, pelvic cavity
- 1.2 Skeleton
  - 1.2.1 Structure and function of bone, development and growth of bones, healing of fractures
- 1.3 Skull
  - 1.3.1 Skull viewed from the above / below and the front / side
  - 1.3.2 Interior of the skullcap, interior of the base of the skull
  - 1.3.3 Nasal cavity, accessory nasal sinuses
  - 1.3.4 Individual bones of the skull
- 1.4 Vertebral column, ribs and sternum
- 1.5 Bones of the upper limb and lower limb
- 1.6 Circulatory system
  - 1.6.1 Blood vessels, Veins, Heart
  - 1.6.2 Pulmonary circulation and Systemic circulation
- 1.7 Respiratory system
  - 1.7.1 Nose, pharynx, larynx, trachea, bronchi, lungs
  - 1.7.2 Physiology of respiration
- 1.8 Digestive system
  - 1.8.1 Mouth, salivary glands, pharynx, oesophagus, stomach, small intestine, large intestine, pancreas, liver, biliary apparatus
  - 1.8.2 Function of the alimentary system
- 1.9 Urinary system
  - 1.9.1 Kidneys, ureters, urinary bladder, urethra
  - 1.9.2 Functions of kidneys and control of micturition
- 1.10 Nervous system
  - 1.10.1 Nervous tissue, central nervous system, brain, spinal cord, peripheral nervous system, autonomic nervous system
- 1.11 Endocrine system
  - 1.11.1 Pituitary gland, thyroid gland, parathyroid gland, adrenal glands
- 1.12 Reproductive system
  - 1.12.1 Male and female reproductive system
- 1.13 Skin and the organs of special senses

**2. Radiographic Technique (general radiography and contrast media)**

- 2.1 General radiography
  - 2.1.1 Routine Radiography Technique for upper limb and lower limb
  - 2.1.2 Routine Radiographic technique for thoracic cage and its contents (Chest, heart, ribs and sternum)
  - 2.1.3 Routine technique for the abdomen
  - 2.1.4 Routine technique of plain & erect abdomen x-ray
  - 2.1.5 Routine technique for the spine (Cervical, thoracic, lumbar, sacrum and coccyx, sacro-illac joint)

- 2.1.6 Routine technique for the skull
- 2.1.7 Tomography
  - 2.1.7.1 Basic principle of tomogram
  - 2.1.7.2 Practical application of Tomography for the chest, kidney, gall bladder and skeletal system
- 2.1.8 Registration process
  - 2.1.8.1 The steps of registration of patients
  - 2.1.8.2 The importance of a monthly and annual record, filling system and preparing the Performa invoices
  - 2.1.8.3 Filling of radiographs and reports (x-ray No, hospital number, patient's name, cross reference bill, with patient's name)
- 2.2 **Radiographic examination with contrast media**
  - Special examination with contrast media
  - 2.2.1 Contrast media
    - 2.2.1.1 Definition of the contrast media
    - 2.2.1.2 Types of contrast media
    - 2.2.1.3 Methods of introducing the contrast media
    - 2.2.1.4 Reactions of contrast media
    - 2.2.1.5 Name of the emergency equipments and drugs needed to cope with reactions
  - 2.2.2 Radiographic investigation of Gastro-intestinal tract using contrast media
    - 2.2.2.1 Barium swallow
    - 2.2.2.2 Barium meal
    - 2.2.2.3 Barium follow through
    - 2.2.2.4 Examination of GI tract
    - 2.2.2.5 Ba-enema
    - 2.2.2.6 Small bowel enema
    - 2.2.2.7 Loopogram
    - 2.2.2.8 State the role of a radiographer during fluoroscopy
  - 2.2.3 Investigation of urinary tract and hystero salpinogram
    - 2.2.3.1 Intravenous Urogram (IVU)
    - 2.2.3.2 Cystogram
    - 2.2.3.3 Micturating cystogram
    - 2.2.3.4 Urethrogram
    - 2.2.3.5 Retrograde pyelogram
    - 2.2.3.6 Hystero salpinogram (HSG)
  - 2.2.4 Radiographic procedure of the Biliary tract
    - 2.2.4.1 Intravenous cholangiography (IVC)
    - 2.2.4.2 Percutaneous transhepatic cholangiography and drainage (PTC and PTCD)
    - 2.2.4.3 Endoscopic retrograde cholangio pancreatography (ERCP)
    - 2.2.4.4 Operative cholangiography
    - 2.2.4.5 T. Tube cholangiography
  - 2.2.5 Use of portable/mobile x-ray in ward and operation theatre
    - 2.2.5.1 The uses of mobile machine
    - 2.2.5.2 The technique of using ward radiography
    - 2.2.5.3 The technique of using operating theatre radiography
    - 2.2.5.4 Technique to help in Hip pinning
    - 2.2.5.5 The technique of operative-cholangiography

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- 2.2.6 Vascular and Neurological examinations
  - 2.2.6.1 Carotid and vertebral angiogram
  - 2.2.6.2 Femoral angiogram
  - 2.2.6.3 Aortogram
  - 2.2.6.4 Myelogram
- 2.2.7 Special examinations
  - 2.2.7.1 Arthrogram
  - 2.2.7.2 Dacryocystogram
  - 2.2.7.3 Sinogram/Fistulogram
  - 2.2.7.4 Sialogram
  - 2.2.7.5 Mammogram
  - 2.2.7.6 Macro-radiography
- 3. **Radiographic photography**
  - 3.1 **Film**
    - 3.1.1 Construction and composition of x-ray film
    - 3.1.2 Types of x-ray film
    - 3.1.3 Characteristic curve, special sensitivity & role of dyeing
    - 3.1.4 Film speed, density, contrast, sensitometry
    - 3.1.5 Artifacts and its causes
  - 3.2 **Intensifying screen**
    - 3.2.1 Construction and composition of I.S.
    - 3.2.2 Screen speed, sharpness, coating weight
    - 3.2.3 Fluorescent material and phosphorescence
    - 3.2.4 Fluorescent material, new phosphors
  - 3.3 **Image**
    - 3.3.1 Production of radiographic image
    - 3.3.2 Component of radiographic image
      - 3.3.2.1 Contrast, sharpness, resolution
      - 3.3.2.2 Exposure factors
      - 3.3.2.3 Absorption coefficient
  - 3.4 **Film processing**
    - 3.4.1 Manual film processing
      - 3.4.1.1 Processing cycle
        - 4.4.1.1.1 Development-constituents of developer, factors affecting control of development, developer replenishes maintenance of activity & level of developer
        - 4.4.1.1.2 Rinsing
        - 4.4.1.1.3 Fixation-constituents of fixer, factors affecting fixation and regeneration of the Fixer
        - 4.4.1.1.4 Washing processing
        - 4.4.1.1.5 Drying process
        - 4.4.1.1.6 Tanks and containers for processing chemical, processing units
        - 4.4.1.1.7 Mixing chemicals
        - 4.4.1.1.8 storage of chemicals
        - 4.4.1.1.9 Film hangers
    - 3.4.2 Automatic processor
      - 3.4.2.1 Basic principle & its functioning

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- 3.5 **Dark room planning**
  - 3.5.1 Location, layout, radiation protection, safelight filter & sensitivity range
- 3.6 **Identification** : Methods and Importance
- 3.7 **Silver recovery** : General introduction

**Section (B): 50% Marks**

**For Paper I (25 MCQs ×2 marks) &  
For Paper II (4×5 marks, 3×10 marks)**

- 4. **Radiographic equipment**
  - 4.1 **Historical background of x-ray and its production**
    - 4.1.1 X-ray tube construction
    - 4.1.2 Stationary and rotating x-ray tube
    - 4.1.3 Recent advancement of an x-ray tube
    - 4.1.4 Tube rating cooling and care of x-ray tube and its faults
  - 4.2 **Control panel, x-ray table and tube column**
    - 4.2.1 Type of x-ray table
    - 4.2.2 Different metering equipment
    - 4.2.3 X-ray tube support
  - 4.3 **Fluoroscopic equipment** : Conventional fluoroscopy and image intensifier tube
  - 4.4 **Control of scatter radiation & beam restricting devices**
    - 4.4.1 Secondary radiation grids
    - 4.4.2 Air gap technique
  - 4.5 **Portable and mobile x-ray units** : Capacitor discharge and c-arm
  - 4.6 **Conventional tomography**
  - 4.7 **Introduction to modern modalities (CT, MRI, mammography)**
    - 4.7.1 Types of MRI, Strength of MRI scanner, Advantages and disadvantages of MRI over CT, uses of MRI, contrast used in MRI, Artefacts in MRI
- 5. **Radiation Physics**
  - 5.1 **Atomic structure**
    - 5.1.1 The Nucleus
    - 5.1.2 Electron orbits and energy levels
  - 5.2 **Production of x-ray, properties of x-rays**
    - 5.2.1 General radiation (Bremsstrahlung),
    - 5.2.2 Characteristic Radiation
    - 5.2.3 Intensity of x-rays beams
    - 5.2.4 Target material
    - 5.2.5 voltage (kVp) applied
  - 5.3 **Basic interactions between x-rays and matter**
    - 5.3.1 Compton scattering
    - 5.3.2 Pair production
    - 5.3.3 Photodisintegration
  - 5.4 **Radiation measurement and units**
    - 5.4.1 Construction & working of the free air ionization chamber
    - 5.4.2 Thimble ionization chamber & condenser ionization chamber
  - 5.5 **Radiation protection**
    - 5.5.1 Historical introduction or why the protection is necessary against the radiation
    - 5.5.2 Maximum permissible dose

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- 5.5.3 Tabulation of the recommended maximum permissible doses for the different parts of the body
  - 5.5.4 Following the code of practice
  - 5.5.5 Identifying the protective materials
  - 5.6 **Personnel monitoring**
    - 5.6.1 The necessity of personnel monitoring & monitoring instruments (film badge, ionization chamber & thermoluminescent dosimeter)
  - 5.7 **Safety requirements for operating a x-ray unit**
6. **Patient Care and Management**
- 6.1 **Hospital, the patient and the radiographer**
    - 6.1.1 Clinical responsibility and Legal responsibility
    - 6.1.2 The radiographer and the hospital
  - 6.2 **Features of general patient care**
    - 6.2.1 General preliminaries to the examination
    - 6.2.2 Moving chair and stretcher patients
    - 6.2.3 The anaesthetized patient
    - 6.2.4 Hygiene in the x-ray department
    - 6.2.5 General comfort and reassurance for the patient
  - 6.3 **Drugs in the x-ray department**
    - 6.3.1 Poisons and dangerous drugs
    - 6.3.2 Units of measurement
    - 6.3.3 Drugs used in preparation of the patient
    - 6.3.4 Contrast agents used in x-ray examinations
    - 6.3.5 Drugs used in resuscitation
    - 6.3.6 Labeling and issuing
  - 6.4 **Preparation of the patient**
    - 6.4.1 General abdominal preparation
    - 6.4.2 Clothing of the patient
  - 6.5 **First aid in the x-ray department**
    - 6.5.1 Radiological emergencies
    - 6.5.2 Shock
    - 6.5.3 Hemorrhage
    - 6.5.4 Burns, scalds
    - 6.5.5 Loss of consciousness
    - 6.5.6 Asphyxia
    - 6.5.7 Fractures
    - 6.5.8 Electric shock
  - 6.6 **Medico-legal aspects of the radiographer's work**
    - 6.6.1 Breach of professional confidence
    - 6.6.2 Negligence
    - 6.6.3 Procedure in the event of an accident
    - 6.6.4 The importance of records
7. **General information related to Shahid Gangalal National Heart Centre**