

पाठ्यक्रमको रूपरेखा :- यस पाठ्यक्रमको आधारमा निम्नानुसार चरणमा परीक्षा लिइने छ :

प्रथम चरण :-	लिखित परीक्षा	पूर्णाङ्क :- १००
द्वितीय चरण :-	अन्तर्वार्ता	पूर्णाङ्क :- २०

प्रथम चरण – लिखित परीक्षा योजना (Written Examination Scheme)

पत्र/विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्न संख्या X अङ्कभार	समय
सेवा सम्बन्धी	१००	४०	वस्तुगत बहुवैकल्पिक (Multiple Choice)	५० प्रश्न X २अङ्क = १००	४५ मिनेट

द्वितीय चरण

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तर्वार्ता	२०	मौखिक

द्रष्टव्य :

- यो पाठ्यक्रम योजनालाई प्रथम चरण (लिखित परीक्षा) तथा द्वितीय चरण (अन्तर्वार्ता) गरी दुई भागमा विभाजन गरिएको छ ।
- प्रश्नपत्र अंग्रेजी भाषामा हुनेछ ।
- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।
- वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरूको गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत अङ्क कट्टा गरिने छैन ।
- परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।
- परीक्षामा यथासम्भव सबै इकाईबाट प्रश्न सोधिने छ ।
- नगरपालिकाबाट संचालन हुने परीक्षामा परीक्षार्थीले मोबाइल वा यस्तै प्रकारका विद्युतीय उपकरण परीक्षा हलमा लैजान पाइने छैन ।
- यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जेसुकै लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम तथा नीतिहरू परीक्षाका मिति भन्दा ३ महिना अगाडि (संशोधन भएको वा संशोधन भई हटाईएको वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्भन्नु पर्दछ।
- लिखित परीक्षामा छनौट भएका उम्मेदवारहरूलाई मात्र अन्तर्वार्तामा सम्मिलित गराइनेछ ।
- लिखित परीक्षा र अन्तर्वार्ताको कुल अङ्क योगका आधारमा अन्तिम परीक्षाफल प्रकाशित गरिनेछ ।

**विषय :- रेडियोग्राफी**

## **1. Anatomy and Physiology**

### **1.1 General introduction**

- 1.1.1 The cell
- 1.1.2 Reproduction of the individual

### **1.2 The tissues**

- 1.2.1 Epithelial tissue
- 1.2.2 Connective tissue
- 1.2.3 Skeletal tissue
- 1.2.4 Muscular tissue

1.2.5 Nervous tissue

**1.3 General pathology**

1.3.1 Bacteria

1.3.2 Viruses

1.3.3 Tumours

**1.4 Surface and regional anatomy**

1.4.1 The anatomical position

1.4.2 The head

1.4.3 The neck

1.4.4 The thorax

1.4.5 The abdomen

1.4.6 The pelvic cavity

**1.5 The skeleton**

1.5.1 The structure of bone

1.5.2 Function of bone

1.5.3 The development and growth of bones

1.5.4 The healing of fractures

**1.6 The skull**

1.6.1 The skull viewed from above

1.6.2 The skull viewed from the front

1.6.3 The skull viewed from the side

1.6.4 The skull viewed from the below

1.6.5 The interior of the skull cap

1.6.6 The interior of the base of the skull

1.6.7 The nasal cavity

1.6.8 The accessory nasal sinuses

1.6.9 The individual bones of the skull

**1.7 The vertebral column, ribs and sternum**

1.7.1 The vertebral column

1.7.2 The ribs

1.7.3 The sternum

**1.8 The bones of the upper limb**

1.8.1 The clavicle

1.8.2 The scapula

1.8.3 The humerus

1.8.4 The radius

1.8.5 The ulna

1.8.6 The carpal bones

1.8.7 The metacarpal bones

1.8.8 The phalanges

1.8.9 Arteries and nerves related to the bones of the upper limb

1.8.10 Ossification of the bones of the upper limb

**1.9 The bones of the lower limb**

- 1.9.1 The hip bone
- 1.9.2 The pelvis
- 1.9.3 The femur
- 1.9.4 The patella
- 1.9.5 The tibia
- 1.9.6 The fibula
- 1.9.7 The tarsal bones
- 1.9.8 The metatarsal bones
- 1.9.9 The phalanges
- 1.9.10 The arches of the foot
- 1.9.11 Arteries and nerves related to the bone of the lower limb
- 1.9.12 Ossification of the bones of the lower limb

**1.10 The joints of the bones of the lower limb**

- 1.10.1 types of joints
- 1.10.2 The muscles and joints of the head
- 1.10.3 The joints and muscles of the neck and trunk
- 1.10.4 The joints and muscles of the upper limb
- 1.10.5 The joint and muscles of the lower limb

**1.11 The circulatory system**

- 1.11.1 The blood
- 1.11.2 The blood vessels
- 1.11.3 The heart
- 1.11.4 The pulmonary circulation
- 1.11.5 The systemic circulation
- 1.11.6 The veins

**1.12 The lymphatic system**

- 1.12.1 Lymph
- 1.12.2 The lymphatic vessels
- 1.12.3 The lymphnodes
- 1.12.4 The lymphatic drainage of the body
- 1.12.5 Lymphatic tissue
- 1.12.6 The spleen

**1.13 The respiratory system**

- 1.13.1 The nose
- 1.13.2 The pharynx
- 1.13.3 The larynx
- 1.13.4 The trachea
- 1.13.5 The bronchi
- 1.13.6 The lungs
- 1.13.7 The physiology of respiration

**1.14 The digestive system**

- 1.14.1 The mouth
- 1.14.2 The salivary glands

- 1.14.3 The pharynx
- 1.14.4 The oesphagus
- 1.14.5 The stomach
- 1.14.6 The small intestine
- 1.14.7 The large intestine
- 1.14.8 The pancreas
- 1.14.9 The liver
- 1.14.10 The biliary apparatus
- 1.14.11 The function of the alimentary system

**1.15 The urinary system**

- 1.15.1 The kidneys
- 1.15.2 The ureters
- 1.15.3 The urinary bladder
- 1.15.4 The urethra
- 1.15.5 The functions of kidneys
- 1.15.6 The control of micturition

**1.16 The nervous system**

- 1.16.1 Nervous tissue
- 1.16.2 The central nervous system
- 1.16.3 The brain
- 1.16.4 The spinal cord
- 1.16.5 The peripheral nervous system
- 1.16.6 The autonomic nervous system

**1.17 The endocrine system**

- 1.17.1 The pituitary gland
- 1.17.2 The thyroid gland
- 1.17.3 The parathyroid gland
- 1.17.4 The adrenal glands

**1.18 The reproductive system**

- 1.18.1 The male reproductive system
- 1.18.2 The female reproductive system

**1.19 The skin and the organs of special sense**

- 1.19.1 The skin
- 1.19.2 The eye
- 1.19.3 The ear
- 1.19.4 The nose
- 1.19.5 The tongue

**2 Radiographic Technique**

**2.1 General radiography**

- 2.1.1 Routine Radiography Technique for upper limb  
(Fingers, thumb, hand, wrist forearm, elbow, humerus, shoulder, scapula, clavicle)
- 2.1.2 Routine Radiography Technique for the lower limb,  
(Toes, foot, calcaneum, ankle, tibia, fibula, knee, femur, hip joint, neck of

- femur, pelvis)
- 2.1.3 Routine Radiographic technique for thoracic cage and its contents (Chest, heart, ribs and sternum)
- 2.1.4 Routine technique for the abdomen  
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
- 2.1.6.1 The radiograph anatomical landmarks of the skull
- 2.1.6.2 The process of routine examination of the bones of skull (cranium, facial bone and mandible)
- 2.1.7 To locate the following by x-rays (scaphoid, foreign body in the hand, head of humerus & axial Shoulder, acromio-calvicular joints, sterno- calvicular joints, foreign body in the foot, lateral foot, weight bearing, skyline view of patella, tibial tuberosity)
- 2.1.8 a) The supplementary views of the chest and abdomen (Apical views, lordotic view & decubitus, oblique views for heart size & lateral with barium swallow, thoracic inlet, diaphragm exursion, inhaled or swallowed foreign body, imperforated anus)  
b) The purposes of these views
- 2.1.9 The supplementary views for the spine and pelvis (soft tissue) (Neck, odontoid peg (open-mouth), vertebral foramina of cervical spine, upper thoracic spine oblique lumbar spine, lumbosacral junction, oblique sacro-illac joints, illum, acetabulum, pelvimetry, skeleton survey)
- 2.1.10 The supplementary views for the skull (towne's view, submento vertical, sella turcica, temporo-mandibular joint, nasal bones, paranasal sinuses, mastoids, orbits, optic foramina, foreign body in the eye, dental radiography)
- 2.1.11 Tomography
- a) Basic principle of tomogram
- b) Practical application of Tomography for the chest, kidney, gall bladder and skeletal system
- 2.1.12 Registration process
- a) The steps of registration of patients
- b) The importance of a monthly and annual record, filling system and preparing the Performa invoices
- c) 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 hysterosalpinogram
    - 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 Oral cholecystography(OCG)
    - 2.2.4.2 Intravenous cholangiography(IVC)
    - 2.2.4.3 Percutaneous transhepatic cholangiography and drainage (PTC and PTCD)
    - 2.2.4.4 Endoscopic retrograde cholangio pancreatography(ERCP)
    - 2.2.4.5 Operatic cholangiography
    - 2.2.4.6 T. Tube cholangiography
  - 2.2.5 Use of portable/mobile x-ray in ward and operation theatre
    - 2.2.5.1 The uses of portable 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
  - 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 Phlebogram
    - 2.2.6.5 Encephalogram
    - 2.2.6.6 Ventriculogram
    - 2.2.6.7 Myelogram
  - 2.2.7 Special examinations
    - 2.2.7.1 Arthrogram
    - 2.2.7.2 Dacryo cystogram
    - 2.2.7.3 Sinogram/Fistulogram
    - 2.2.7.4 Sailogram

- 2.2.7.5 Mammogram
- 2.2.7.6 Macro-radiography
- 2.2.7.7 Soft tissue radiography

### **3. Patient Care and Management**

#### **3.1 The hospital, the patient and the radiographer**

- 3.1.1 Clinical responsibility
- 3.1.2 Legal responsibility
- 3.1.3 The radiographer and the hospital

#### **3.2 Features of general patientcare**

- 3.2.1 General preliminaries to the examination
- 3.2.2 Moving chair and stretcher patients
- 3.2.3 The anaesthetized patient
- 3.2.4 Hygiene in the x-ray department
- 3.2.5 General comfort and reassurance for the patient

#### **3.3 Drugs in the x-ray department**

- 3.3.1 Poisons and dangerous drugs
- 3.3.2 Units of measurement
- 3.3.3 Drugs used in preparation of the patient
- 3.3.4 Contrast agents used in x-ray examinations
- 3.3.5 Drugs used in resuscitation
- 3.3.6 Labeling and issuing

#### **3.4 Sterilization and sterile techniques**

- 3.4.1 Methods of sterilization
- 3.4.2 Central sterile supply
- 3.4.3 Preparation of the hands for aseptic procedures

#### **3.5 Preparation of the patient**

- 3.5.1 General abdominal preparation
- 3.5.2 Clothing of the patient

#### **3.6 First aid in the x-ray department**

- 3.6.1 Radiological emergencies
- 3.6.2 Shock
- 3.6.3 Hemorrhage
- 3.6.4 Burns and scalds
- 3.6.5 Loss of consciousness
- 3.6.6 Asphyxia
- 3.6.7 Fractures
- 3.6.8 Electric shock

#### **3.7 Medico-legal aspects of the radiographer's work**

- 3.7.1 Breach of professional confidence
- 3.7.2 Negligence
- 3.7.3 Procedure in the event of an accident
- 3.7.4 The importance of records

### **4. Radiographic Photography**

- 4.1 Film**
  - 4.1.1 Construction and composition of x-ray film
  - 4.1.2 Types of x-ray film
  - 4.1.3 Characteristic curve, special sensitivity & role of dyeing
  - 4.1.4 Film speed, density, contrast, sensitometry
  - 4.1.5 Artifacts and its causes
- 4.2 Intensifying screen**
  - 4.2.1 Construction and composition of I.S.
  - 4.2.2 Screen speed, sharpness, coating weight
  - 4.2.3 Fluorescent material and phosphorescence
  - 4.2.4 Fluorescent material, new phosphors
- 4.3 Image**
  - 4.3.1 Production of radiographic image
  - 4.3.2 Component of radiographic image
    - 4.3.2.1 Contrast, sharpness, resolution
    - 4.3.2.2 Exposure factors
    - 4.3.2.3 Absorption coefficient
- 4.4 Film processing**
  - 4.4.1 Manual film processing
    - 4.4.1.1 The processing cycle
      - 441.1.1 Development-constituents of developer, factors affecting control of development, developer replenishes maintenance of activity & level of developer
      - 441.1.2 Rinsing
      - 441.1.3 Fixation-constituents of fixer, factors affecting fixation and regeneration of the Fixer
      - 441.1.4 Washing processing
      - 441.1.5 Drying process
      - 441.1.6 Tanks and containers for processing chemical, processing units
      - 441.1.7 Mixing chemicals
      - 441.1.8 storage of chemicals
      - 441.1.9 Film hangers
  - 4.4.2 Automatic processor
    - 4.4.2.1 Basic principle & its functioning
- 4.5 Dark room planning**
  - 4.5.1 Location, layout, radiation protection, safelight filter & sensitivity range
- 4.6 Identification**
  - 4.6.1 Methods
  - 4.6.2 Importance
- 4.7 Silver recovery**
  - 4.7.1 General introduction
- 5. Radiographic equipment**
  - 5.1 Historical background of x-ray and its production**
    - 5.5.1 X-ray tube construction



- 5.5.2 Stationary and rotating x-ray tube
- 5.5.3 Recent advancement of an x-ray tube
- 5.5.4 Tube rating cooling and care of x-ray tube and its faults
- 5.2 Control panel, x-ray table and tube column**
  - 5.2.1 Type of x-ray table
  - 5.2.2 Different metering equipment
  - 5.2.3 X-ray tube support
- 5.3 Fluoroscopic equipment**
  - 5.3.1 Conventional fluoroscopy and image intensifier tube
- 5.4 Control of scatter radiation & beam restricting devices**
  - 5.4.1 Secondary radiation grids
  - 5.4.2 Air gap technique
- 5.5 Portable and mobile x-ray units**
  - 5.5.1 Capacitor discharge and c-arm
- 5.6 Conventional tomography**
- 5.7 Introduction to modern modalities (CT, MRI, mammography)**
- 6. Radiation Physics**
  - 6.1 Atomic structure**
    - 6.1.1 The Nucleus
    - 6.1.2 Electron orbits and energy levels
  - 6.2 Production of x-ray, properties of x-rays**
    - 6.2.1 General radiation (Bremsstrahlung),
    - 6.2.2 Characteristic Radiation
    - 6.2.3 Intensity of x-rays beams
    - 6.2.4 Target material
    - 6.2.5 voltage (kVp) applied
  - 6.3 Basic interactions between x-rays and matter**
    - 6.3.1 Coherent scattering
    - 6.3.2 Photoelectric effect
    - 6.3.3 Compton scattering
    - 6.3.4 Pair production
    - 6.3.5 Photodisintegration
  - 6.4 Radiation measurement and units**
    - 6.4.1 Construction & working of the free air ionization chamber
    - 6.4.2 Thimble ionization chamber & condenser ionization chamber
  - 6.5 Radiation protection**
    - 6.5.1 Historical introduction or why the protection is necessary against the radiation
    - 6.5.2 Maximum permissible dose
    - 6.5.3 Tabulation of the recommended maximum permissible doses for the different parts of the body
    - 6.5.4 Following the code of practice
    - 6.5.5 Identifying the protective materials
  - 6.6 Personnel monitoring**
    - 6.6.1 The necessity of personnel monitoring & monitoring instruments (film

badge, ionization chamber & thermoluminescent dosimeter)

**6.7 Safety requirements for operating a x-ray unit**

सूर्यबिनायक नगरपालिका