त्रिभुवन विश्वविद्यालय
सेवा आयोग

प्राविधिक सेवा, स्वास्थ्य समूह, अधिकृत तृतीय श्रेणी, प्राविधिक अधिकृत (रेडियोलोजी) पदको खुला प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम
२०८१

लिखित परीक्षा योजना

लिखित परीक्षा : **कुल पूर्णाङ्क :** २००

पत्र/विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्न संख्या × अङ्क	समय
प्रथम	१००	४०	वस्तुगत - बहुवैकल्पिक प्रश्न (MCQs)	१०० प्रश्न × १ अङ्क	१ घण्टा ३० मिनेट
द्वितीय	१००	४०	विषयगत प्रश्न	८ प्रश्न × १० अङ्क	३ घण्टा
				४ प्रश्न × ५ अङ्क	

द्रष्टव्य :

1. लिखित परीक्षाका लागि १००/१०० पूर्णाङ्कका दुई पत्रहरु हुनेछन् ।
2. प्रथमपत्र र द्वितीय पत्रको लिखित परीक्षा पाठ्यक्रमको विषयवस्तु एउटै हुनेछ ।
3. प्रथमपत्र र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
4. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नको विकल्प छनौट गर्दा गलत विकल्प छानेमा ऋणात्मक मूल्याङ्कन (Negative Marking) गरिनेछ । अर्थात् यसरी मूल्याङ्कन गर्दा प्रत्येक गलत उत्तरको लागि २० प्रतिशत अङ्ककट्टा गरिनेछ । बहुबैकल्पिक प्रश्नको २० प्रतिशत अङ्क प्राप्ताङ्कबाट घटाइनेछ । (उदाहरणका लागि परीक्षार्थीले २० अङ्कको बहुबैकल्पिक प्रश्नमा १५ प्रश्नको सही उत्तर र ५ प्रश्नको गलत उत्तर दिएमा निजको प्राप्ताङ्क (०.२० × ५=१.००) अर्थात् १५–१= १४ अङ्क हुनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।
5. विषयगत प्रश्नको हकमा एउटै प्रश्नका दुई वा दुईभन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिनेछ ।
6. विषयगत प्रश्नमा प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । उम्मेदवारले प्रत्येक खण्डका प्रश्नको उत्तर सोही खण्डका उत्तरपुस्तिकामा लेख्नुपर्नेछ ।
7. प्रत्येक पत्रको उत्तीर्णाङ्क पूर्णाङ्कको ४० प्रतिशत हुनेछ ।
8. भाषा विषयबाहेक अन्य विषयका लागि उत्तरको माध्यम अङ्ग्रेजी वा नेपाली हुनेछ ।

प्रथम र द्वितीय पत्र :
Section (A) : 50 Marks

1. **Anatomy and Physiology**
   - 1.1 General anatomical terms; human cell structure and function; tissues; surface and regional anatomy; anatomical position of head, neck, thorax, abdomen and pelvic cavity
   - 1.2 Musculo-skeletal system : formation, growth and development of bones; function of bone according to the size and shape of bone; classification of bone; classification of joints and their function; different groups of muscle responsible for joint movement; healing of fractures
   - 1.3 Nervous system : neuron and nerve cells; central nervous system and brain; parts of ventricles of the brain and their extent; cerebrospinal fluid; brain stem; peripheral and autonomic nervous system; cranial nerves, spinal nerves
   - 1.4 Cardio-vascular system : blood and blood vessels- arteries, veins and capillaries; different parts of heart and its function; cardiac cycle; systemic circulation; pulmonary circulation; coronary circulation; aorta; inferior venacava and Superior venacava
   - 1.5 Lymphatic system : lymph, lymphatic vessels, lymph nodes, lymphatic drainage of the body, lymphatic tissue; spleen
   - 1.6 Respiratory system : lungs and pleura; organs of the respiratory system, respiratory passages (nose, pharynx, larynx, trachea, bronchioles, alveoli); physiology of respiration
   - 1.7 Digestive system : organs of the digestive system - mouth, salivary glands, pharynx, esophagus, stomach, small intestine, large intestine; function of alimentary tract; pancreas, liver, biliary tract and their function; metabolism of carbohydrates, protein and fat
   - 1.8 Urinary system : organs of urinary system - kidneys, ureters, bladder and urethra; kidneys - position, gross structure, cortex, medulla, pelvis; functional unit of kidney - nephron, function of kidneys; formation of urine, water-electrolyte balances in body; ureters - position structure and function; micturition-reflex control; structure and function of the urinary bladder and urethra; supra-renal glands, prostate gland
   - 1.9 Endocrine system : position, structure, functions and hormone secretion of – hypothalamus, pituitary gland, thyroid gland, parathyroid glands, adrenal gland, islets of langerhans, pineal gland, testis, ovaries, thymus
   - 1.10 Reproductive system : male reproductive system and female reproductive system
   - 1.11 Skin and special senses: structure and function of - skin; ear; eyes; nose; tongue

2. **Basic Radiation Physics**
   - 2.1 Electricity - current, voltage, Faradays' laws, Linz’s laws, mutual induction phenomena
   - 2.2 Transformer - different types of transformer (step down and step up transformer, central tapped transformer, auto transformer and variacter transformer)

2.3 Thermionic emission, semiconductor and rectifiers - phenomena of thermionic emission and Richardson, formation of P and N type semiconductor
2.4 Atomic structure and electromagnetic radiation - different electron shell, Bohr's theory of hydrogen atom, phenomenon of excitation and ionization and their corresponding potential
2.5 Measure of electromagnetic radiation and other particles - measurement of radiation and particles
2.6 X-rays - X-ray production (gas filled tube and Coolidge tube) and the properties and uses
2.7 Radioactivity - discovery of nucleus and its constituents (proton, neutron), mass number, atomic mass, atomic mass unit and isotopes.
2.8 Interaction of radiation with matter - radiation passes through the body, difference between homogeneous and heterogeneous beam.
2.9 Ultrasound - longitudinal wave and high frequency sound wave, generation and reception of ultrasound, intensity, power and field of ultrasound.

3. **Radiographic Equipment**
3.1 X-ray tubes and its development, basic design of stationary and rotating anode X-ray tube; radiographic couches, stands and tube supports - classify X-ray tube supports, various types of radiographic couches; Exposure timers - different type of timers (photoelectric timer and ionization chamber timer); Beam centering and beam limiting devices - functioning of coins and cylinders, aperture diaphragms, lighting beam diaphragms, positive beam limitation; Portable and mobile radiographic equipments
3.2 Control of scattered radiation - significance of scattered radiation, methods of controlling scattered radiation, and techniques of reducing the amount of scattered radiation produced
3.3 Fluoroscopic equipment - conventional fluoroscopy, fluoroscopy screen and fluoroscopic image, features of fluoroscopic X-ray table.
3.4 Radiation protection - radiation sensitivity, factors influencing radio- sensitivity
3.5 Tomography - principle of tomography, features of tomography equipment.
3.6 Equipment for dental radiography
3.7 Mammographic equipment - differentiate mammography X- ray tube and ordinary X-ray tube
3.8 Photofluorography - design photofluorography system (cut film and roll film type)

Section (B) : 50 Marks

4. **Radiographic Photography**
4.1 Radiographic photography principles - photographic effect, photosensitive materials, photographic emulsion, gelatin and function of the gelatin binder
4.2 X-ray films - background of X-ray film and its construction, duplitized X-ray film
4.3 Image characteristics - real and mental image, reflected, transmitted and emitted light image

4.4 X-ray film processing - development of hand processing to automatic processing, processing cycles, constituent of developing solutions and developer replenisher solution
4.5 Storage and archiving of film - storage areas, storage condition
4.6 Intensifying screens - luminescence, fluorescence and phosphorescence, quantum detection efficiency
4.7 Design and construction of darkroom - layout of a well-equipped ideal darkroom, darkroom location, size, radiation protection, floor
4.8 Presentation and viewing of radiographs - types of information: essential, technical and miscellaneous, methods of recording information: opaque letters and legends, actinic marking and perforating device
4.9 Estimation of exposure factors - kilo voltage (kv) and its effect in radiographic image, milliampere second (mas) and its effect in radiographic image

5. **Radiographic Techniques**

5.1 Upper limb - process of all routine radiographic examination of upper limb including fingers thumb, hand, wrist joint, radio-ulnar joint, lower two third of radius and ulna, elbow joints
5.2 Shoulder girdle and thorax - view of head of humerus, shoulder joints; shoulder outlet view, acromio-calvicular joint, view of scapula
5.3 Lower limb - radiographic examination of the lower limb including foot, toes, great toe, tarsus calcaneum, talo- calaneual joint, ankle joint, knee joints
5.4 Vertebral column - radiographic examination of the spines cranio- vertebral joint (region), atlanto-occipital joint
5.5 Pelvic girdle and hip regions - radiographic examination for whole pelvis, ileum, ischium, and pubic bones, hip Joints
5.6 Skull - process of routine examination of the face, cranium, mandible, zygomatic arches, nasal bone, paranasal sinuses
5.7 Thoracic cage and abdomen - radiographic examination of the thoracic cage including lungs, trachea, bronchi, mediastinal structure, heart and sternum, ribs
5.8 Pelvimetry - radiation hazard
5.9 Ward and domiciliary radiography
5.10 Mammography - principle and routine of radiography views of mammography.
5.11 Macro-radiography - principles and its application.
5.12 Tomography - practical application of tomography of the chest, kidney, gall bladder, skeletal system
5.13 Dental radiography

6. **Radiological Procedures**

6.1 First aid and emergency care
6.2 Contrast medias -types, methods of introduction, reactions, emergency equipments and drugs to cope the reaction
6.3 Radiographic investigations of gastro-intestinal tract using contrast medias- indications, contraindications and preparation

6.4 Investigations of urinary tract and hysteron-salphingography- indications, contraindications and preparation of contrast media and radiographic techniques

6.5 Special Examinations - Arthrogram, Dacrocystogram, sinogram, Fistulogram, Siologram, Bronchogram, Mammogram, Lymphangiogram, Thermogram, Micro radiography, Soft tissue radiography

7. **Modern Medical Imaging Technology**

7.1 Computed Tomography (CT) : basic principles of CT; generations of CT/ MDCT/Newer advances in CT; system components; image characteristics and image quality in CT; artifacts in CT

7.2 Magnetic Resonance Imaging (MRI) : fundamental concepts: magnetic moments, precession, resonance, nuclear magnetic resonance (NMR); basic principles of MR imaging and related parameters; artifacts in MRI

7.3 CT and MRI technique : head, chest, abdomen and other body parts

7.4 PET and hybrid imaging (PET - CT, PET MRI)

8. **त्रि.वि ऐन र नियम सम्बन्धी सामान्य जानकारी**

8.1 त्रि.वि ऐन, २०४९

8.2 त्रि.वि शिक्षक कर्मचारी सेवा सम्बन्धी नियम, २०५०

प्राविधिक सेवा, स्वास्थ्य समूह, अधिकृत तृतीय श्रेणी, प्राविधिक अधिकृत (रेडियोलोजी) पदको खुला प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

(Specification Chart)

२०८१

प्रथम पत्र : वस्तुगत - बहुवैकल्पिक प्रश्न

पूर्णाङ्क : १०० **समय: १ घण्टा ३० मिनेट**

खण्ड	एकाइ	विषय शीर्षक	अङ्क	प्रश्न सङ्ख्या	प्रश्न सङ्ख्या × अङ्कभार
A	1.	Anatomy and Physiology	50	100	100 प्रश्न × 1 अङ्क
	2.	Basic Radiation Physics			
	3.	Radiographic Equipment			
B	4.	Radiographic Photography	50		
	5.	Radiographic Techniques			
	6.	Radiological Procedures			
	7.	Modern Medical Imaging Technology			
	8.	त्रि.वि ऐन र नियम सम्बन्धी सामान्य जानकारी			
कुल जम्मा			100	100	

द्वितीय पत्र : विषयगत

पूर्णाङ्क: १०० **समय: ३ घण्टा**

खण्ड	एकाइ	विषय शीर्षक	अङ्क	प्रश्न सङ्ख्या	प्रश्न सङ्ख्या × अङ्क भार
A	1.	Anatomy and Physiology	50	8 + 4	8 प्रश्न × 10 अङ्क 4 प्रश्न × 5 अङ्क
	2.	Basic Radiation Physics			
	3.	Radiographic Equipment			
B	4.	Radiographic Photography	50		
	5.	Radiographic Techniques			
	6.	Radiological Procedures			
	7.	Modern Medical Imaging Technology			
	8.	त्रि.वि ऐन र नियम सम्बन्धी सामान्य जानकारी			
कुल जम्मा			100	12	