

बि.पि. कोइराला मेमोरियल क्यान्सर अस्पताल  
प्राविधिक (स्वास्थ्य) सेवा, मेडिकल (एलाइड हेल्थ) समुह, रेडियोथेरापी टेक्नोलोजी उपसमुह, अधिकृत सातौं तह,  
टेक्नोलोजिष्ट पदको खुला र आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम  
एवं परीक्षा योजना

कुल पूर्णाङ्क : १२०

१. प्रथम चरण : – लिखित परीक्षा				पूर्णाङ्क :- १००		
पत्र / विषय	पूर्णाङ्क	उतीर्णाङ्क	परीक्षा प्रणाली	प्रश्नसंख्या X अङ्क	समय	
General Subject and Technical Subject	१००	४०	वस्तुगत	बहुवैकल्पिक प्रश्न (MCQs)	१०० प्रश्न x १ अङ्क	१ घण्टा ३० मिनेट

२. द्वितीय चरण : – अन्तर्वार्ता

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तर्वार्ता	२०	मौखिक

**द्रष्टव्य :**

१. यो परीक्षा योजनालाई प्रथम चरण (लिखित परीक्षा) र द्वितीय चरण (अन्तर्वार्ता) गरी दुई चरणमा विभाजन गरिएको छ ।
२. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।
३. लिखित परीक्षामा यथासम्भव पाठ्यक्रमका सबै एकाईबाट देहाय बमोजिम प्रश्नहरु सोधिनेछ ।

खण्ड	अङ्कभार	वस्तुगत प्रश्न संख्या
<b>A</b>	१०	१० प्रश्न X १ अङ्क = १०
<b>B</b>	१०	१० प्रश्न X १ अङ्क = १०

४. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरुको 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 ।
५. यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जेसुकै लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम तथा नीतिहरु परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्भनु पर्दछ ।
६. प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।
७. पाठ्यक्रम लागू मिति :- २०७४/११/२९

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पत्र/विषय : **General Subject and Technical Subject**

**General Subject**

**Section (A) – 10 Marks**

**1. B.P.Koirala Memorial Cancer Hospital, Related Legislations and General Health Issues**

- 1.1. B.P.Koirala Memorial Cancer Hospital : History, organizational structure, functions, roles, services, problems and challenges
- 1.2. National Health Policy
- 1.3. B.P.Koirala Memorial Cancer Hospital related act and regulations
- 1.4. Health Service Act, 2053 and Health Service Regulation, 2055
- 1.5. Professional council related acts and regulations
- 1.6. Professional ethics

**Technical Subject**

**Section (B) – 90 Marks**

**1. Anatomy and Physiology**

- 1.1 Cell and Tissues (Epithelial, Connective, Skeletal, Muscular and Nervous)
- 1.2 General pathology : Bacteria, Viruses, Tumours
- 1.3 Surface and regional anatomy
  - 1.3.1 The anatomical position
  - 1.3.2 Head, Neck, Thorax, Abdomen and Pelvic cavity
- 1.4 Skeleton System
  - 1.4.1 Structure and function of bones
  - 1.4.2 Development and growth of bones, and healing of fractures
  - 1.4.3 The skull
    - 1.4.3.1 The skull viewed from the above and the below
    - 1.4.3.2 The skull viewed from the side and the front
    - 1.4.3.3 The interior of the skullcap
    - 1.4.3.4 The interior of the base of the skull
    - 1.4.3.5 The nasal cavity
    - 1.4.3.6 The accessory nasal sinuses
    - 1.4.3.7 The individual bones of the skull
  - 1.4.4 The vertebral column, ribs and sternum
  - 1.4.5 The bones of the upper limb
    - 1.4.5.1 The clavicle
    - 1.4.5.2 The scapula
    - 1.4.5.3 The humerus
    - 1.4.5.4 The radius
    - 1.4.5.5 The ulna
    - 1.4.5.6 The carpal bones
    - 1.4.5.7 The metacarpal bones
    - 1.4.5.8 The phalanges
    - 1.4.5.9 Arteries and nerves related to the bones of the upper limb
    - 1.4.5.10 Ossification of the bones of the upper limb
  - 1.4.6 The bones of the lower limb
    - 1.4.6.1 The hipbone
    - 1.4.6.2 The pelvis

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- 1.4.6.3 The femur
- 1.4.6.4 The patella
- 1.4.6.5 The tibia
- 1.4.6.6 The fibula
- 1.4.6.7 The tarsal bones
- 1.4.6.8 The metatarsal bones
- 1.4.6.9 The phalanges
- 1.4.6.10 The arches of the foot
- 1.4.6.11 Arteries and nerves related to the bone of the lower limb
- 1.4.6.12 Ossification of the bones of the lower limb
- 1.4.7 The joints of the bones of the lower limb
  - 1.4.7.1 Types of joints
  - 1.4.7.2 The muscles and joints of the head
  - 1.4.7.3 The joints and muscles of the neck and trunk
  - 1.4.7.4 The joints and muscles of the upper limb
  - 1.4.7.5 The joint and muscles of the lower limb
- 1.5 Circulatory System
  - 1.5.1 The blood
  - 1.5.2 The blood vessels
  - 1.5.3 The heart
  - 1.5.4 The pulmonary circulation
  - 1.5.5 The systemic circulation
  - 1.5.6 The veins
- 1.6 Lymphatic System
  - 1.6.1 Lymph
  - 1.6.2 The lymphatic vessels
  - 1.6.3 The lymph nodes
  - 1.6.4 The lymphatic drainage of the body
  - 1.6.5 Lymphatic tissue
  - 1.6.6 The spleen
- 1.7 Respiratory System
  - 1.7.1 The nose
  - 1.7.2 The pharynx
  - 1.7.3 The larynx
  - 1.7.4 The trachea
  - 1.7.5 The bronchi
  - 1.7.6 The lungs
  - 1.7.7 The physiology of respiration
- 1.8 Digestive System
  - 1.8.1 The mouth
  - 1.8.2 The salivary glands
  - 1.8.3 The pharynx
  - 1.8.4 The oesophagus
  - 1.8.5 The stomach
  - 1.8.6 The small intestine
  - 1.8.7 The large intestine
  - 1.8.8 The pancreas
  - 1.8.9 The liver

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- 1.8.10 The biliary apparatus
- 1.8.11 The function of the alimentary system
- 1.9 Urinary System
  - 1.9.1 The kidneys
  - 1.9.2 The ureters
  - 1.9.3 The urinary bladder
  - 1.9.4 The urethra
  - 1.9.5 The functions of kidneys
  - 1.9.6 The control of micturition
- 1.10 Nervous System
  - 1.10.1 Nervous tissue
  - 1.10.2 Central nervous system, brain and spinal cord
  - 1.10.3 Peripheral nervous system
  - 1.10.4 Autonomic nervous system
- 1.11 Reproductive System
  - 1.11.1 Female Reproductive System & Breast
    - 1.11.1.1 External genitalia, Uterus, Ovaries: Position, structure functions
    - 1.11.1.2 Menstrual cycle, Reproduction & menopause
    - 1.11.1.3 Breast-Position, structure and its functions
    - 1.11.1.4 Puberty
  - 1.11.2 Male Reproductive System:
    - 1.11.2.1 Position structure and functions of scrotum, testes, epididymis, deferent ducts, seminal vesicles, ejaculatory ducts and penis
    - 1.11.2.2 Puberty
- 1.12 Special Senses
  - 1.12.1 Skin- structure and function
  - 1.12.2 The ear (external, middle & internal ear)-structure and function
  - 1.12.3 The Eyes- structure & functions.
  - 1.12.4 Nose- structure and functions
  - 1.12.5 Tongue-structure, functions,
  - 1.12.6 Taste buds and Sense of taste
- 1.13 Endocrine System
  - 1.12.7 Endocrine glands - pituitary gland, thyroid gland, parathyroid glands, adrenal gland, islets of langerhans, pineal gland, testis, ovaries, thymus etc.
  - 1.12.8 Endocrine glands - Position, structure, functions and hormone secretion

## 2. Radiation Physics

### 2.1 Atomic structure

- 2.1.1 General introduction
- 2.1.2 Electron shells & energy levels
- 2.1.3 Mass number, atomic number, atomic mass unit, binding energy
- 2.1.4 Properties of electromagnetic waves
- 2.1.5 Concept of photon and quanta
- 2.1.6 Nuclear fission and fusion

### 2.2 Radioactivity

- 2.2.1 Radioactive elements
- 2.2.2 Radioactive series, different types of radioactive disintegration
- 2.2.3 Properties of radioactive particles

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- 2.2.4 Radioactive decay law
- 2.2.5 Alpha, beta and gamma disintegration
- 2.3 **X-rays and Gamma rays**
  - 2.3.1 Historical background of x-rays
  - 2.3.2 Mechanism and production of x-rays
  - 2.3.3 Properties of x-rays
  - 2.3.4 Continuous and characteristic spectra
  - 2.3.5 Gamma rays
  - 2.3.6 Properties of gamma rays
- 2.4 **Basic interactions between x-rays and matter**
  - 2.4.1 Coherent scattering
  - 2.4.2 Photoelectric effect
  - 2.4.3 Compton scattering
  - 2.4.4 Pair production
  - 2.4.5 Photodisintegration
- 2.5 **Radiation detection and measurement**
  - 2.5.1 Principle of measurement
  - 2.5.2 Construction and working of the free air ionization chamber
  - 2.5.3 Thimble ionization chamber
  - 2.5.4 Condenser ionization chamber
  - 2.5.5 Scintillation counter
  - 2.5.6 Gieger-muller counter
- 2.6 **Clinical Dosimetry**
  - 2.6.1 Radiation absorbed dose
  - 2.6.2 Relationship between Kerma, Exposure and absorbed dose
  - 2.6.3 Cavity theory
  - 2.6.4 Measurement of absorbed dose
  - 2.6.5 Phantom
  - 2.6.6 Dose calibration parameters
  - 2.6.7 Depth dose distribution
    - 2.6.7.1 Percentage depth dose
    - 2.6.7.2 Tissue-air ratio
    - 2.6.7.3 Tissue maximum ratio
- 2.7 **Review of Electricity**
  - 2.7.1 Electromagnetic induction and its laws
  - 2.7.2 Self and mutual induction,
  - 2.7.3 A.C generator, Peak and effective values of AC
  - 2.7.4 Concept of Reactance, Impedance & phase angle
- 2.8 **Transformer**
  - 2.8.1 Theory, construction, Losses & Efficiency, Transformer ratings
  - 2.8.2 Filament transformer
  - 2.8.3 High-tension transformer
  - 2.8.4 Autotransformer or variac transformer
- 2.9 **Thermionic emission and rectifiers**
  - 2.9.1 Diode - construction, principle & characteristics
  - 2.9.2 Rectifiers: Self-rectification, Half-wave, Full-wave (two valves and four valves) and constant voltage rectifiers
  - 2.9.3 The cold cathode gas filled diode and its use

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### 3. Clinical Oncology

- 3.1 Tumors
  - 3.1.1 Tumor definition
  - 3.1.2 Benign tumors and malignant tumors
  - 3.1.3 Spread of tumors
- 3.2 Clinical Presentation
  - 3.2.1 Symptoms and signs
  - 3.2.2 Diagnostic procedure
    - 3.2.2.1 Hemogram
    - 3.2.2.2 Biochemical
    - 3.2.2.3 Tumor marker
    - 3.2.2.4 Radiological- X-ray, U.S.G., C.T, M.R.I
    - 3.2.2.5 Pathological – FNAC, FNAB, Incision biopsy, excision biopsy
    - 3.2.2.6 Surgery
- 3.3 Staging
  - 3.3.1 TNM Classification
- 3.4 Malignancies and Treatment
  - 3.4.1 CNS tumours
  - 3.4.2 Ca-Larynx
  - 3.4.3 Ca-Tongue, Head and Neck cancers
  - 3.4.4 Ca-Breast
  - 3.4.5 Ca-Lung
  - 3.4.6 Ca-Cervix and Gynecological malignancies
  - 3.4.7 Ca-Oesophagus
  - 3.4.8 Bone and soft tissue cancers, thyroid

### 4. Radiotherapy Technique

- 4.1 Principle of Radiotherapy
  - 4.1.1 Tumor histology
  - 4.1.2 Grade, sensitivity,
  - 4.1.3 Anatomical site, critical organs
  - 4.1.4 General condition of the patient, extent of tumor, previous treatments
  - 4.1.5 Radical/Palliative and prophylaxis
- 4.2 Types and Methods of Radiotherapy
  - 4.2.1 Tele-therapy Technique
  - 4.2.2 Brachytherapy Technique
- 4.3 Radiotherapy Resources
  - 4.3.1 Low energy beams
  - 4.3.2 High energy beams
  - 4.3.3 Electron beams
- 4.4 Treatment Planning
  - 4.4.1 Tumor localization and verification
  - 4.4.2 Isodose Curves
  - 4.4.3 Single field, parallel opposed field, multiple field
  - 4.4.4 Rotation therapy
  - 4.4.5 Beam Modification
  - 4.4.6

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## 5. Radiotherapy Equipment and Quality Assurance

- 5.1 Teletherapy Equipments
  - 5.1.1 Superficial and orthovoltage equipment
  - 5.1.2 Cobalt-60 tele therapy equipment
  - 5.1.3 Linear accelerator
  - 5.1.4 Simulator
  - 5.1.5 Brachytherapy equipment
    - 5.1.5.1 Low dose rate (LDR)
    - 5.1.5.2 Medium dose rate (MDR)
    - 5.1.5.3 High dose rate (HDR)
  - 5.1.6 Tomotherapy
- 5.2 Quality Control
  - 5.2.1 Cobalt-60
  - 5.2.2 Linear Accelerator
  - 5.2.3 Brachytherapy
  - 5.2.4 Simulator
- 5.3 Radiation Protection
  - 5.3.1 Concept of radiation protection
  - 5.3.2 Justification, Optimization and Limitation
  - 5.3.3 Units, Maximum Permissible Dose
  - 5.3.4 Personnel monitoring
  - 5.3.5 Protective materials

## 6. Radiographic equipment

- 6.1 Historical background of x-ray and its production
  - 6.1.1 X-ray tube construction
  - 6.1.2 Stationary and rotating x-ray tube
  - 6.1.3 Recent advancement of an x-ray tube
  - 6.1.4 Tube rating cooling and care of x-ray tube and its faults
  - 6.1.5 USG
  - 6.1.6 CT
  - 6.1.7 MRI
- 6.2 Control panel, x-ray table and tube column
  - 6.2.1 Type of x-ray table
  - 6.2.2 Different metering equipment
  - 6.2.3 X-ray tube support
- 6.3 Fluoroscopic equipment
  - 6.3.1 Conventional fluoroscopy, image intensifier tube and Digital fluoroscopy
- 6.4 Control of scatter radiation & beam restricting devices
  - 6.4.1 Secondary radiation grids
  - 6.4.2 Air gap technique
- 6.5 Portable and mobile x-ray units
  - 6.5.1 Capacitor discharge and c-arm
- 6.6 Computed and Direct Digital Radiography
- 6.7 Introduction to modern modalities (CT, MRI, mammography)

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**7. Radiation Biology**

- 7.1 Cell cycle
- 7.2 Effect of radiation on the normal cell, tissue and organs
- 7.3 Radiation sensitivity
- 7.4 Physical and biological factors affecting radiation sensitivity
  - 7.4.1 LET
  - 7.4.2 RBE
  - 7.4.3 OER
- 7.5 Cell survival curves
- 7.6 4Rs of radiobiology
- 7.7 Radiation hazard and radiation protection

The questions distribution for this paper/subject shall be as follows:

Section	Marks	Multiple Choice Questions
		No. of Questions × Mark
A	10	10 Questions × 1Mark =10 Marks
B	90	90 Questions × 1Mark =90 Marks