निजामती कर्मचारी अस्पताल

प्राविधिक सेवा, मेडिसिन समूह, रेडिएसन अंकोलोजी उपसमूह, रेडियोथेरापिस्ट पद, छैठौं तहको खुला तथा आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

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) : **परीक्षा योजना (Examination Scheme)**

पत्र	विषय	पूर्णाङ्क	उतीर्णाङ्क	परीक्षा प्रणाली		प्रश्नसंख्या X अङ्क	समय
प्रथम	Technical Subject	१००	४०	वस्तुगत	बहुवैकल्पिक प्रश्न	५० प्रश्न x २ अङ्क	४५ मिनेट
द्वितीय		१००	४०	विषयगत		१० प्रश्न X १० अङ्क	३ घण्टा

द्वितीय चरण (Second Phase)

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तर्वार्ता	३०	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. प्रथम र द्वितीय पत्रको पत्रको विषयवस्तु एउटै हुनेछ ।

४. प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।

५. परीक्षामा सोधिने प्रश्नसंख्या, अङ्क र अङ्कभार यथासम्भव सम्बन्धित पत्र/विषयमा तोकिए अनुसार हुनेछ ।

६. 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 ।

७. वस्तुगत बहुवैकल्पिक हुने परीक्षामा परीक्षार्थीले 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 ।

८. बहुवैकल्पिक प्रश्नहरु हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।

९. विषयगत प्रश्नका लागि तोकिएका १० अङ्कका प्रश्नहरुको हकमा १० अङ्कको एउटा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरु (Short notes) सोध्न सकिने छ ।

१०. विषयगत प्रश्नमा प्रत्येक पत्र/विषयका प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरु हुनेछन् । परिक्षार्थीले प्रत्येक खण्डका प्रश्नहरुको उत्तर सोही खण्डका उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

११. 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 पाठ्क्रममा परेको सम्झनु पर्दछ ।

११. प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।

१२. पाठ्यक्रम लागू मिति :– आ.व. २०७९/०८०

यो पाठ्यक्रम मिति २०७९।०९।१८ बाट लागू गरिएको छ ।

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Paper I and II: Technical subject

Section (A): 50 % 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 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 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 Vertebral column, ribs and sternum
     - 1.4.5 Bones of the upper limbs
       - 1.4.5.1 clavicle, scapula, humerus, radius, ulna, carpal bones, metacarpal bones, phalanges
       - 1.4.5.2 Arteries and nerves related to the bones of the upper limb
       - 1.4.5.3 Ossification of the bones of the upper limb
     - 1.4.6 Bones of the lower limbs
       - 1.4.6.1 Hipbone, pelvis, femur, patella, tibia, fibula, tarsal bones, metarsal bones, phalanges
       - 1.4.6.2 The arches of the foot
       - 1.4.6.3 Arteries and nerves related to the bone of the lower limb
       - 1.4.6.4 Ossification of the bones of the lower limb
     - 1.4.7 Types of joints
     - 1.4.8 Muscles and joints of the head, neck and trunk, upper limbs and lower limbs
   - 1.5 Circulatory System
     - 1.5.1 Blood and blood vessels
     - 1.5.2 Heart
     - 1.5.3 Pulmonary circulation
     - 1.5.4 Systemic circulation
     - 1.5.5 Veins
   - 1.6 Lymphatic System
     - 1.6.1 Lymph and lymphatic vessels
     - 1.6.2 Lymph nodes
     - 1.6.3 Lymphatic drainage of the body
     - 1.6.4 Lymphatic tissue
     - 1.6.5 Spleen
   - 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, oesphagus, 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
- 1.9.3 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 Ear (external, middle & internal ear)-structure and function
- 1.12.3 Eye- structure and 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
- 1.13.1 Endocrine glands - pituitary gland, thyroid gland, parathyroid glands, adrenal gland, islets of langerhans, pineal gland, testis, ovaries, thymus etc.
- 1.13.2 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
- 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 and its properties

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

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

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Section (B): 50% Marks

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

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 5.5.1 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)

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

8. **General knowledge about Civil Service Hospital and its Bylaws**