प्रदेश लोक सेवा आयोग

गण्डकी प्रदेश

प्रदेश/स्थानीय स्वास्थ्य सेवा, रेडियोग्राफी समूह, रेडियोग्राफी/रेडियोथेरापी उपसमूह, सातौं तहको अन्तरतह र खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

पाठ्यक्रमको रुपरेखा :– यस पाठ्यक्रमको आधारमा निम्नानुसार दुई चरणमा परीक्षा लिइने छ :

प्रथम चरण :– लिखित परीक्षा — पूर्णाङ्क :– २००

द्वितीय चरण :– सामूहिक परीक्षण र अन्तर्वार्ता — पूर्णाङ्क :– ४०

प्रथम चरण – लिखित परीक्षा योजना (Examination Scheme)

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्न संख्या x अङ्कभार	समय
प्रथम	Basic Science सम्बन्धी	१००	४०	वस्तुगत बहुवैकल्पिक (MCQs)	१०० x १ = १००	१ घण्टा १५ मिनेट
द्वितीय	समूह सम्बन्धी	१००	४०	विषयगत (Subjective)	१० x १० = १००	३ घण्टा

द्वितीय चरण

विषय	पूर्णाङ्क	परीक्षा प्रणाली	समय
सामूहिक परीक्षण (Group Test)	१०	सामूहिक छलफल (Group Discussion)	३० मिनेट
व्यक्तिगत अन्तर्वार्ता	३०	मौखिक	-

१. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुन सक्नेछ ।

२. पाठ्यक्रमको प्रथम र द्वितीय पत्रको विषयवस्तु फरक फरक हुनेछन ।

३. माथि उल्लिखित समूहको पाठ्यक्रमको प्रथम पत्रको विषयवस्तु एउटै हुनेछ । द्वितीय पत्रका विषयवस्तु समुह अनुसार फरक फरक हुनेछन् ।

४. प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।

५. प्रथम पत्रका पाठ्यक्रमका एकाईहरुबाट सोधिने प्रश्नहरुको संख्या निम्नानुसार हुनेछ । द्वितीय पत्रको पाठ्यक्रमका एकाईहरुबाट सोधिने प्रश्नहरुको संख्या द्वितीय पत्रको पाठ्यक्रम उल्लेख भएअनुसार हुनेछ ।

प्रथम पत्रका एकाई	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11
प्रश्न संख्या	4	7	5	7	4	6	6	6	5	5	5
प्रथम पत्रका एकाई	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	
प्रश्न संख्या	3	3	3	4	5	6	5	3	5	3	

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

८. 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 ।

९. द्वितीय पत्रमा प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरु हुनेछन् । परिक्षार्थीले प्रत्येक खण्डका प्रश्नहरुको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

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प्रदेश/स्थानीय स्वास्थ्य सेवा, रेडियोग्राफी समूह, रेडियोग्राफी/रेडियोथेरापी उपसमूह, सातौं तहको अन्तरतह र खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

१०. 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 लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र द्वितीय चरणको अन्तर्वार्तामा सम्मिलित गराइनेछ ।

१२. यस भन्दा अगाडि लागू भएको माथि उल्लिखित समूहको पाठ्यक्रम खारेज गरिएको छ ।

१३. पाठ्यक्रम लागू मिति :– २०८३/०७/११

प्रदेश लोक सेवा आयोग

गण्डकी प्रदेश

प्रदेश/स्थानीय स्वास्थ्य सेवा, रेडियोग्राफी समूह, रेडियोग्राफी/रेडियोथेरापी उपसमूह, सातौं तहको अन्तरतह र खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

प्रथम पत्र - Basic Science

1. ANATOMY & PHYSIOLOGY

1.1 INTRODUCTION

1.1.1 General anatomical terms
1.1.2 Human cell structure and function
1.1.3 The tissues

1.2 MUSCULO-SKELETAL SYSTEM

1.2.1 Formation, growth and development of bones. Centre of ossification
1.2.2 Function of bone according to the size and shape of bone
1.2.3 Classification of bone
1.2.4 Classification of joints and their function.
1.2.5 Different groups of muscle responsible for joint movement

1.3 NERVOUS SYSTEM

1.3.1 Neuron and nerve cells
1.3.2 Central nervous system and brain
1.3.3 Parts of ventricles of the brain and their extent
1.3.4 The cerebrospinal fluid.
1.3.5 Midbrain and brain stem
1.3.6 Peripheral nervous system
1.3.7 Autonomic nervous system
1.3.8 Cranial nerves, spinal nerves

1.4 CARDIO-VASCULAR SYSTEM

1.4.1 Blood vessels- arteries, veins, and capillaries
1.4.2 Different parts of heart and its function
1.4.3 Cardiac cycle
1.4.4 Systemic circulation
1.4.5 Pulmonary circulation
1.4.6 Coronary circulation
1.4.7 Aorta
1.4.8 Inferior venacava (IVC) & Superior venacava (SVC)

1.5 THE LYMPHATIC SYSTEM

1.5.1 Lymphatic System
1.5.2 Lymph nodes
1.5.3 Spleen
1.5.4 Thymus gland

1.6 THE RESPIRATORY SYSTEM

1.6.1 Respiration, Alveolar respiration
1.6.2 Lungs and Pleura

1.6.3 Organs of the respiratory system, Respiratory passages (Nose, Pharynx, Larynx, Trachea, Bronchioles, Alveoli)

1.7 THE DIGESTIVE SYSTEM

1.7.1 Organs of the digestive system, Mouth, Pharynx, Esophagus, Stomach, Small intestine, large intestine, rectum and anal canal Salivary glands,

1.7.2 Function of alimentary tract

1.7.3 Pancreas, Liver, biliary tract and their function

1.7.4 Metabolism of Carbohydrates, Protein and fat

1.8 THE URINARY SYSTEM

1.8.1 Organs of urinary system: Kidneys, ureters, bladder, and urethra

1.8.2 Kidneys-position, gross structure, cortex, medulla pelvis

1.8.3 Functional unit of kidney: nephron, function of kidneys

1.8.4 Formation of urine, water-electrolyte balances in body, etc.

1.8.5 Ureters: Position structure and function

1.8.6 Micturation-reflex control

1.8.7 Structure and function of the urinary bladder and urethra

1.8.8 Supra-renal glands, prostate gland.

1.9 THE REPRODUCTIVE SYSTEM

1.9.1 Female Reproductive System & Breast

1.9.1.1 External genitalia, Uterus, Ovaries: Position, structure functions

1.9.1.2 Menstrual cycle, Reproduction & menopause

1.9.1.3 Breast-Position, structure and its functions

1.9.1.4 Puberty

1.9.2 Male Reproductive System:

1.9.2.1 Position structure and functions of scrotum, testes, epididymis, deferent ducts, seminal vesicles, ejaculatory ducts and penis

1.9.2.2 Puberty

1.10 SPECIAL SENSES

1.10.1 Skin- structure and function

1.10.2 The ear (external, middle & internal ear)-structure and function

1.10.3 The Eyes- structure & functions.

1.10.4 Nose- structure and functions

1.10.5 Tongue-structure, functions,

1.10.6 Taste buds and Sense of taste

1.11 THE ENDOCRINE SYSTEM

1.11.1 Endocrine glands - pituitary gland, thyroid gland, parathyroid glands, adrenal gland, islets of langerhans, pineal gland, testis, ovaries, thymus etc.

1.11.2 Endocrine glands - Position, structure, functions and hormone secretion,

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2. BASIC RADIATION PHYSICS

2.1 REVIEW OF ELECTRICITY

2.1.1 Electromagnetic induction and its laws,
2.1.2 Self and mutual induction,
2.1.3 A.C generator, Peak and effective values of AC
2.1.4 Concept of Reactance, Impedance & phase angle.

2.2 TRANSFORMER

2.2.1 Theory, construction, Losses & Efficiency, Transformer ratings,
2.2.2 Filament transformer,
2.2.3 High-tension transformer,
2.2.4 Autotransformer or variac transformer

2.3 THERMIONIC EMISSION AND RECTIFIERS

2.3.1 Diode - construction, principle & characteristics
2.3.2 Rectifiers: Self-rectification, Half-wave, Full-wave (two valves and four valves) and constant voltage rectifiers.
2.3.3 The cold cathode gas filled diode and its use

2.4 ATOMIC STRUCTURE AND ELECTROMAGNETIC RADIATION

2.4.1 Electron, proton, neutron, mass number, and atomic number,
2.4.2 Isotopes, isobars and isomers
2.4.3 Electron shells & energy levels
2.4.4 Excitation and ionization
2.4.5 Emission of electromagnetic waves, spectra
2.4.6 Properties of electromagnetic waves
2.4.7 Concept of photon and quanta
2.4.8 Photoelectric effect, photocell

2.5 RADIOACTIVITY

2.5.1 Introduction.
2.5.2 Radioactive elements, radioactive disintegration
2.5.3 Properties of radioactive particles
2.5.4 Radioactive decay law, Half-life, mean life.
2.5.5 Artificial radioactivity: Radioactivity induced by neutron bombardment and proton bombardment.
2.5.6 Nuclear binding energy, nuclear stability
2.5.7 Alpha, beta and gamma disintegration
2.5.8 Introduction to fission and fusion

2.6 X-RAYS

2.6.1 Historical background
2.6.2 X-ray tube,
2.6.3 Mechanism of x-ray production

2.6.4 Properties of x-rays, Intensity & quality of x-rays, continuous and characteristic spectra,

2.6.5 Effects of variation of tube current and voltage, Bragg's law for wavelength determination.

2.6.6 X-ray control and indicating equipment: simple circuit diagram as illustration of sequence from mains supply to exposure control.

2.6.7 Mains voltage circuit

2.6.8 Mains cables, Switches and fuses

2.6.9 Mains voltage compensation, earthing, insulation, Voltage drops in cables.

2.6.10 X-ray tube voltage control and indication,

2.6.11 Exposure controls. Contactors and timers

2.6.12 X-ray tube current control and filament supply, mA compensation, Generator regulation

2.7 INTERACTION OF RADIATION WITH MATTER

2.7.1 Thompson scattering

2.7.2 Photoelectric interaction

2.7.3 Compton scattering

2.7.4 Pair production

2.7.5 Transmission of a homogenous and heterogeneous x-ray beam through matter

2.7.6 Effects of filtration

2.7.7 Relative amount of scatter from an x-ray beam during the passage through matter

2.7.8 Effects of collimation

2.8 RADIATION DETECTION AND MEASUREMENT

2.8.1 Principle of measurement

2.8.2 Ionization chamber, Electrometer

2.8.3 Scintillation counter

2.8.4 Gieger-muller counter

2.8.5 Thimble chamber

2.8.6 Condenser chamber

2.9 RADIATION PROTECTION

2.9.1 Introduction.

2.9.2 Hazards of Radiation.

2.9.3 Objective and principle of radiation protection

2.9.4 Radiation and Radiation units

2.9.5 Personnel monitoring

2.9.6 Protective materials

2.9.7 ICRP recommendations on dose limits

2.10 ULTRASOUND

2.10.1 Longitudinal waves
2.10.2 Principles of ultrasound, intensity, power and fields,
2.10.3 Transmission of ultrasound,
2.10.4 Velocity of ultrasound in different media,
2.10.5 Ultrasonic interactions, absorption and scattering mechanism in tissue, refraction and reflection of ultrasound,
2.10.6 Damping of ultrasound in media,
2.10.7 Doppler effect

--- The End---

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प्रदेश/स्थानीय स्वास्थ्य सेवा, रेडियोग्राफी समूह, रेडियोग्राफी/रेडियोथेरापी उपसमूह, सातौं तहको अन्तरतह र खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

द्वितीय पत्र - सेवा सम्बन्धी

Section A- 30 Marks

1. RADIOGRAPHIC TECHNIQUE

1.1 UPPER LIMB

1.1.1 Technique for whole hand, fingers, thumb, wrist joint, Radio ulnar joints

1.1.2 Supplementary technique: carpal tunnel, scaphoid, ulnar groove, head of radius

1.1.3 Supplementary views of elbow, humerus & Supra-condylar projection

1.2 SHOULDER GIRDLE AND THORAX

1.2.1 Technique for shoulder joint, acromio-clavicular joint, and scapula

1.2.2 Supplementary views: projection to show recurrent dislocation of shoulder, infero-superior projection of clavicle, sterno- clavicular joint, sternum, ribs

1.3 LOWER LIMB

1.3.1 Technique for whole foot, toes, great toe, calcaneum, talo-calcaneal joint, ankle joint, lower leg with ankle joint,

1.3.2 Knee joint, patella, tibio-fibular joints,

1.3.3 Supplementary technique for torn ligaments, flat feet, axial view of calcaneum, skyline view of patella, intercondylar notch view

1.4 VERTEBRAL COLUMN

1.4.1 Technique for cranio-vertebral joint, atlanto-occipital joint, first three cervical vertebra, odontoid peg view

1.4.2 Cervical spine for intervertebral joints and foramina, cervico thoracic vertebrae,

1.4.3 Thoracic spine, thoraco-lumbar vertebrae

1.4.4 Lumber spine, intervertebral joints and foramina, lumbo-sacral joint, sacrum, coccyx

1.4.5 Supplementary techniques, to demonstrate scoliosis, kyphosis, spondylolisthesis.

1.5 PELVIC GIRDLE AND HIP REGION

1.5.1 Technique for whole pelvis, ileum, ischium and pubic bones,

1.5.2 Sacroiliac joints, symphysis pubis, hip joints, acetabulum, neck of femur

1.5.3 Supplementary projections: acetabular view, judet view, Von-Rosen view and frog leg view for hip joint (CDH)

1.6 SKULL

1.6.1 Routine views of Skull, Towne's view, SMV, Emergency Skull radiography

1.6.2 Technique for mastoids, styloid process, IAM.

1.6.3 Routine views for facial bones, mandible, zygomatic arches, nasal bone, maxilla, temporo-mandibular joints,

1.6.4 Optic foramina, macroradiography for optic foramina
1.6.5 Routine and special views for Paranasal sinuses

1.7 DENTAL RADIOGRAPHY

1.7.1 Intra-oral and extra-oral projections, occlusal projection,
1.7.2 Orthopantomography (OPG)

1.8 CHEST RADIOGRAPHY

1.8.1 Routine radiography of chest, High kV technique for Chest
1.8.2 Supplementary views: apicogram, lordotic and oblique views, lateral decubitus, diaphragmatic excursions, double exposure technique.

1.9 PELVIMETRY

1.9.1 Consideration of radiation hazards,
1.9.2 Techniques for evaluation of foetal maturity, abnormalities, position and multiplicity
1.9.3 Erect lateral projection and antero-posterior projection for CPD

1.10 WARD AND OPERATION THEATRE RADIOGRAPHY

1.10.1 Knowledge of Electrical supply, radiation protection,
1.10.2 Radiography of bed-ridden patients
1.10.3 Radiography in operation theatre

1.11 MAMMOGRAPHY

1.11.1 Soft tissue radiography
1.11.2 Principle and technique of mammography

1.12 MACRO-RADIOGRAPHY

1.12.1 Definition, principles and its applications
1.12.2 Magnification factors and uses of magnification radiography

Section B- 30 Marks

2. SPECIAL RADIOLOGICAL PROCEDURES

2.1 FIRST AIDS AND EMERGENCY CARE

2.1.1 Introduction to Shock, emergency treatment, Cardio-Pulmonary resuscitation (CPR)
2.1.2 Introduction to Haemorrhage, primary management of haemorrhage

2.2 CONTRAST MEDIA

2.2.1 Introduction to contrast media
2.2.2 Definition, types and uses of contrast media
2.2.3 Properties of contrast media
2.2.4 Adverse effects of contrast media and their management
2.2.5 Emergency trolley setting
2.2.6 Life saving drugs and emergency trays

2.3 ALIMENTARY TRACT

2.3.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming & post procedure care for following investigations:

- 2.3.1.1 Barium swallow
- 2.3.1.2 Barium meal
- 2.3.1.3 Barium follow -through
- 2.3.1.4 Small bowel enema
- 2.3.1.5 Barium enema -single contrast, -double contrast
- 2.3.1.6 Loopogram

2.4 BILIARY TRACT

2.4.1 Definition, indications, contraindications, equipment required contrast media, preparation of the patient, technique / procedure, filming, post procedure care for following investigations:

- 2.4.1.1 Oral cholecystography
- 2.4.1.2 Intravenous choledochography (IVC)
- 2.4.1.3 Percutaneous transhepatic cholangiography (PTC)
- 2.4.1.4 Endoscopic retrograde cholangio-pancreatography (ERCP)
- 2.4.1.5 Per operative cholangiography (POC)
- 2.4.2.6 T-tube cholangiography

2.5 URINARY TRACT

2.5.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming, post procedure care for following investigations:

- 2.5.1.1 Intravenous urography (IVU), Modification of IVU and additional techniques
- 2.5.1.2 Percutaneous renal puncture (PcRP)
- 2.5.1.3 Percutaneous nephrostomy (PCN)
- 2.5.1.4 Retrograde pyelography (RGP)
- 2.5.1.5 Micturating cysto-urethrography

2.6 REPRODUCTIVE SYSTEM

2.6.1 Definition, indications, contraindications, equipment required contrast media, preparation of the patient, technique/procedure, filming, post procedure care for Hysterosalpingography

2.7 CARDIO-VASCULAR SYSTEM

2.7.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming, post procedure care for following investigations:

- 2.7.1.1 Carotid angiography
- 2.7.1.2 Abdominal aortography
- 2.7.1.3 Portal venography

2.7.4.4 Peripheral and lower limb venography

2.8 MYELOGRAPHY

2.8.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming, post procedure care for following investigations:

2.8.1.1 Lumbar, Thoracic and Cervical Myelography

2.8.1.2 Post Myelo-CT (CT Myelography)

2.9 ARTHROGRAPHY

2.9.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming, post procedure care for following investigations:

2.9.1.1 Knee Arthrography

2.9.1.2 Hip Arthrography

2.10 SINOGRAPHY

2.10.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique /procedure, filming, post procedure care for Sinography

2.11 SIALOGRAPHY

211.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming, post procedure care for following investigations:

2.11.1.1 Parotid sialography

2.11.1.2 Sub-mandibular sialography

2.12 DACRYOCYSTOGRAPHY

2.12.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming, post procedure care for Dacryocystography

Section C- 20 Marks

3. EQUIPMENT FOR DIAGNOSTIC RADIOLOGY

3.1 X-RAY TUBES

3.1.1 Overview of production of x-rays, Historical background,

3.1.2 Components of an x-ray tube: Cathode assembly, Anode assembly

3.1.3 Stationary and rotating anodes

3.1.4 Line focus principle, anode heel effect, Off-focus radiation

3.1.5 Glass envelope, tube shielding, care of x-ray tubes,

3.1.6 X-ray tube faults,

3.1.7 Modification and recent advances in x-ray tube

3.2 RADIOGRAPHIC COUCHES, STANDS AND TUBE SUPPORTS

3.2.1 X-ray tube supports
3.2.2 Radiographic couches
3.2.3 Chest stands and vertical bucky
3.2.4 Modern basic radiographic units

3.3 EXPOSURE TIMERS

3.3.1 Introduction
3.3.2 Clockwork timer, synchronous motor and impulse timers,
3.3.3 Electronic timers,
3.3.4 Autotimers (photoelectric timer and ionization chamber timer)

3.4 BEAM CENTERING & BEAM LIMITING DEVICES

3.4.1 Cones and cylinders, Aperture diaphragms,
3.4.2 Light beam diaphragms, Positive beam limitation

3.5 PORTABLE AND MOBILE RADIOGRAPHIC EQUIPMENTS

3.5.1 Main features of portable and mobile equipment
3.5.2 Mains dependent mobile equipment
3.5.3 Capacitor discharge equipment
3.5.4 Battery powered generators

3.6 CONTROL OF SCATTERED RADIATION

3.6.1 Significance of scattered radiation
3.6.2 Reduction in the amount of scatter radiation produced (field size, use of appropriate exposure factors, compression band)
3.6.3 Reduction in the amount of scatter radiation reaching to the film (metal backing of cassettes, filters, air-gap technique, cones and diaphragms, Grids)
3.6.4 Grid: construction, function, grid characteristics, grid types and patterns. Grid movement
3.6.5 Reduction in the effect of scatter (use of intensifying screens)

3.7 FLUOROSCOPIC EQUIPMENT

3.7.1 Introduction
3.7.2 Conventional fluoroscopy
3.7.3 Mobile and specialised fluoroscopic units,
3.7.4 Image intensified fluoroscopy,
3.7.5 Image intensifier- construction and working principle,
3.7.6 TV camera and TV monitor

3.8 TOMOGRAPHY

3.8.1 Introduction to Tomography
3.8.2 Main features of tomographic equipment,
3.8.3 Wide angle and narrow angle Tomography, Different types of tomographic movement,
3.8.4 Multi-section Tomography

3.9 EQUIPMENT FOR DENTAL RADIOGRAPHY

3.9.1 A simple dental radiographic unit

3.9.2 Orthopantomography (OPG)

3.10 VASCULAR IMAGING EQUIPMENT

3.10.1 Generators and x-ray tubes

3.10.2 C-Arm/U-Arm assembly

3.10.3 Automatic film changers (roll and cut film changers)

3.10.4 Angiographic tables

3.10.5 Automatic pressure injectors

3.10.6 Program selector, cine cameras

3.11 MAMMOGRAPHIC EQUIPMENT

3.11.1 Introduction

3.11.2 Mammography x-ray tube

3.11.3 Image receptors in mammography

3.11.4 Apparatus for magnification radiography in mammography

3.12 DIGITAL IMAGING

3.12.1 Introduction to digital imaging concepts and advantages of image digitization,

3.12.2 Digital image structure

3.12.3 Digital radiography:

3.12.3.1 Scanned projection radiography (SPR)

3.12.3.2 Computed radiography (CR)

3.12.3.3 Direct digital radiography (DR)

3.13 COMPUTED TOMOGRAPHY (CT)

3.13.1 Introduction.

3.13.2 Basic principles of CT

3.13.3 Generations of CT

3.13.4 System components

3.13.5 Image characteristics & Image quality in CT

3.13.6 Artefacts in CT

3.14 MAGNECTIC RESONANCE IMAGING (MRI)

3.14.1 Fundamental concepts: magnetic moments, precession, resonance, nuclear magnetic resonance (NMR)

3.14.2 Introduction to MR Scanners: imaging magnets, RF transmitter and receiver coils, shim coils and gradient coils

3.14.3 Principal parameters of MRI: spin density, T1 relaxation time, T2 relaxation time

3.14.4 Basic principles of MR imaging and related parameters

3.14.5 Spin echo pulse sequence

3.14.6 Gradient echo pulse sequence

3.14.7 Artefacts in MRI

3.14.8 Recent advancement in MRI Machine

3.15 Artificial intelligence in Radiography

Section D- 20 Marks

4. RADIOGRAPHIC PHOTOGRAPHY

4.1 PHOTOGRAPHIC PRINCIPLE

4.1.1 Photographic effect
4.1.2 Photosensitive materials
4.1.3 Photographic emulsion
4.1.4 Characteristic curve
4.1.5 Spectral sensitivity
4.1.6 Direct exposure film (x-ray sensitive)
4.1.7 Gurney-Mott theory of latent image formation

4.2 FILM MATERIALS

4.2.1 Construction of x-ray film
4.2.2 Film for medical imaging
4.2.3 Comparison between single coated and double coated x-ray films

4.3 FILM STORAGE

4.3.1 Different storage areas
4.3.2 Ideal storage condition
4.3.3 Stock control and film ordering methods

4.4 INTENSIFYING SCREENS

4.4.1 Luminescence: fluorescence and phosphorescence
4.4.2 Construction of Intensifying screen and their types
4.4.3 Types of phosphors: calcium tungsten, rare earth and their comparison
4.4.4 Detective Quantum efficiency (DQE)
4.4.5 Quantum mottle
4.4.6 Care, monitoring and cleaning of IF screen
4.4.7 X-ray film cassettes
4.4.8 Cassette function, construction, materials used, types and care of cassettes

4.5 RADIOGRAPHIC PROCESSING

4.5.1 Manual and Automatic processing
4.5.2 Processing cycles
4.5.3 Processing chemical
4.5.4 Care and maintenance of automatic processors
4.5.5 The principle of dry silver imager
4.5.6 Silver recovery
4.5.7 Daylight processing

4.6 DESIGN AND CONSTRUCTION OF DARKROOM

4.6.1 The layout of an ideal darkroom

4.6.2 Darkroom location, size, radiation protection, floor, walls / ceiling, ventilation and heating, entrance, white lighting and safe light and its test, film hoppers loading bench and wet bench

4.7 THE RADIOGRAPHIC IMAGE

4.7.1 Radiographic image quality

4.7.2 Factors affecting radiographic image quality

4.7.3 Image artifacts

4.8 IDENTIFICATION AND VIEWING OF RADIOGRAPHS

4.8.1 Methods of film identification: opaque letters and legends, actinic marking and perforating device

4.8.2 Viewing equipment

द्वितीय पत्रको एकाई, अङ्कभार र प्रश्नसंख्या निम्न बमोजिम हुनेछ ।

द्वितीय पत्रका खण्ड	A	B	C	D
द्वितीय पत्रका एकाई	१	२	३	४
प्रश्न संख्या	३	३	२	२

सामूहिक छलफल (Group Discussion)

यस प्रयोजनको लागि गरिने परीक्षण १० पूर्णाङ्क र ३० मिनेट अवधिको हुनेछ जुन नेताविहिन सामूहिक छलफल (Leaderless Group Discussion) को रूपमा अवलम्बन गरिने छ । दिएको प्रश्न वा **Topic** का विषयमा पालैपालोसँग निर्दिष्ट समयभित्र समूहवीच छलफल गर्दै प्रत्येक उम्मेदवारले व्यक्तिगत प्रस्तुति (Individual Presentation) गर्नु पर्नेछ । यस परीक्षणमा मूल्याङ्कनको लागि दक्ष /विज्ञ सहित कम्तिमा ३ जनाको समिति रहनेछ ।

सामूहिक छलफलमा दिइने नमूना प्रश्न वा **Topic**

उदाहरणको लागि - ऊर्जा संकट, गरीबी निवारण, स्वास्थ्य बीमा, खाद्य सुरक्षा, प्रतिभा पलायन जस्ता **Topic** मध्ये कुनै एक **Topic** मात्र दिइनेछ ।

------The End-----