

वी.पी. कोइराला मेमोरियल क्यान्सर अस्पताल
प्राविधिक (स्वास्थ्य) सेवा, मेडिकल (एलाइड हेल्थ) समुह, रेडियोडायग्नोसिस तथा इमेजिङ टेक्नोलोजी उपसमुह,
अधिकृत सातौं तह, रेडियोलोजीकल टेक्नोलोजिष्ट पदको खुला र 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

परीक्षा योजना (Examination Scheme)

प्रथम चरण (First Phase) : लिखित परीक्षा

Paper	Subject	Full Marks	Pass Marks	No. Questions & Weightage	Time Allowed
I	Technical Subject & Organizational Knowledge	100	40	100× 1= 100 (Objective Multiple Choice Questions)	1.15 hrs
II		100	40	4 × 5 = 20 8 × 10 = 80 (Subjective Descriptive Type)	3.00 hrs

द्वितीय चरण (Second Phase)

Subject	Full Marks	Examination
Interview	30	Oral

द्रष्टव्य :

१. यो पाठ्यक्रमको योजनालाई प्रथम चरण र द्वितीय चरण गरी दुई भागमा विभाजन गरिएको छ ।
२. प्रथम र द्वितीय पत्रको पत्रको विषयवस्तु एउटै हुनेछ ।
३. प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
४. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।
५. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरूको 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 ।
६. 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 ।
७. बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।
८. परीक्षामा सोधिने प्रश्नसंख्या, अङ्क र अङ्कभार यथासम्भव सम्बन्धित पत्र /विषयमा दिइए अनुसार हुनेछ ।
९. परीक्षामा परीक्षार्थीले मोबाइल वा यस्तै प्रकारका विद्युतीय उपकरण परीक्षा हलमा लैजान पाइने छैन ।
१०. विषयगत प्रश्न हुने पत्रका हकमा प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । परीक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्ने छ ।
११. यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जेसुकै लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम तथा नीतिहरू परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्झनु पर्दछ ।
१२. प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।
१३. पाठ्यक्रम लागू मिति :- २०७८/०२/०१

Paper I & II : - Technical Subject & Organizational Knowledge

Section (A): 45% 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
 - 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

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- 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
 - 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

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- 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. 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 Radioactive elements, radioactive disintegration
 - 2.5.2 Properties of radioactive particles
 - 2.5.3 Radioactive decay law, half-life, mean life
 - 2.5.4 Artificial radioactivity: Radioactivity induced by neutron bombardment and proton bombardment
 - 2.5.5 Nuclear binding energy, nuclear stability
 - 2.5.6 Alpha, beta and gamma disintegration
 - 2.5.7 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, Brag'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 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 Objective and principle of radiation protection
 - 2.9.2 Radiation and Radiation units
 - 2.9.3 Personnel monitoring
 - 2.9.4 Protective materials

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2.9.5 ICRP recommendations on dose limits

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

4. **Radiographic Technique**

4.1 Upper Limb

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

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

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

4.2 Shoulder Girdle and Thorax

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

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

4.3 Lower Limb

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

4.3.2 Knee joint, patella, tibio-fibular joints

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

4.4 Vertebral Column

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

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

4.4.3 Thoracic spine, thoraco-lumbar vertebrae

4.4.4 Lumbar spine, intervertebral joints and foramina, lumbo-sacral joint, sacrum, coccyx

4.4.5 Supplementary techniques, to demonstrate scoliosis, kyphosis, spondylolisthesis

4.5 Pelvic Girdle and Hip Region

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

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

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

4.6 Skull

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

4.6.2 Technique for mastoids, styloid process, IAM

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

4.6.4 Optic foramina, macroradiography for optic foramina

4.6.5 Routine and special views for Paranasal sinuses

4.7 Chest Radiography

4.7.1 Routine radiography of chest, High kV technique for Chest

4.7.2 Supplementary views: apicogram, lordotic and oblique views, lateral decubitus, diaphragmatic excursions double exposure technique

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- 4.8 Ward and Operation Theatre Radiography
 - 4.8.1 Knowledge of Electrical supply, radiation protection
 - 4.8.2 Radiography of bed-ridden patients
 - 4.8.3 Radiography in operation theatre
- 4.9 Mammography
 - 4.9.1 Soft tissue radiography
 - 4.9.2 Principle and technique of mammography
- 4.10 Macro-Radiography
 - 4.10.1 Definition, principles and its applications
 - 4.10.2 Magnification factors and uses of magnification radiography

Section (A): 45% Marks

5. Special Radiological Procedures

- 5.1 First Aids and Emergency Care
 - 5.1.1 Introduction to Shock, emergency treatment, Cardio-Pulmonary resuscitation
 - 5.1.2 Introduction to Haemorrhage, primary management of haemorrhage
- 5.2 Contrast Media
 - 5.2.1 Introduction to contrast media
 - 5.2.2 Definition, types and uses of contrast media
 - 5.2.3 Properties of contrast media
 - 5.2.4 Adverse effects of contrast media and their management
 - 5.2.5 Emergency trolley setting
 - 5.2.6 Life saving drugs and emergency trays
- 5.3 Alimentary Tract
 - 5.3.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming & post procedure care for following investigations:
 - 5.3.1.1 Barium swallow
 - 5.3.1.2 Barium meal
 - 5.3.1.3 Barium follow-through
 - 5.3.1.4 Small bowel enema
 - 5.3.1.5 Barium enema -single contrast, -double contrast
 - 5.3.1.6 Loopogram
- 5.4 Biliary Tract
 - 5.4.1 Definition, indications, contraindications, equipment required contrast media, preparation of the patient, technique / procedure, filming, post procedure care for following investigations:
 - 5.4.1.1 Percutaneous transhepatic cholangiography (PTC)
 - 5.4.1.2 Endoscopic retrograde cholangio-pancreatography (ERCP)
 - 5.4.1.3 Per operative cholangiography (POC)
 - 5.4.1.4 T-tube cholangiography
- 5.5 Urinary Tract
 - 5.5.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming, post procedure care for following investigations:
 - 5.5.1.1 Intravenous urography (IVU), Modification of IVU and additional techniques
 - 5.5.1.2 Percutaneous nephrostomy (PCN)

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- 5.5.1.3 Retrograde pyelography (RGP)
- 5.5.1.4 Micturating cysto-urethrography
- 5.6 Reproductive System
 - 5.6.1 Definition, indications, contraindications, equipment required contrast media, preparation of the patient, technique/procedure, filming, post procedure care for Hysterosalpingography
- 5.7 Cardio-Vascular System
 - 5.7.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming, post procedure care for following investigations:
 - 5.7.1.1 Carotid angiography
 - 5.7.1.2 Abdominal aortography
 - 5.7.1.3 Portal venography
 - 5.7.1.4 Peripheral and lower limb venography
- 5.8 Myelography
 - 5.8.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming, post procedure care for following investigations:
 - 5.8.1.1 Lumabr, Thoracic and Cervical Myelography
 - 5.8.1.2 Post Myelo-CT (CT Myelography)
- 5.9 Arthrography
 - 5.9.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming, post procedure care for following investigations:
 - 5.9.1.1 Knee Arthrography
 - 5.9.1.2 Hip Arthrography
- 5.10 Sinography
 - 5.10.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique /procedure, filming, post procedure care for Sinography
- 5.11 Sialography
 - 5.11.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming, post procedure care for following investigations:
 - 5.11.1.1 Parotid sialography
 - 5.11.1.2 Sub-mandibular sialography
- 5.12 Dacryocystography
 - 5.12.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming, post procedure care for Dacryocystography.
- 6. Equipment for Diagnostic Radiology**
 - 6.1 X-Ray Tubes
 - 6.1.1 Overview of production of x-rays, Historical background
 - 6.1.2 Components of an x-ray tube: Cathode assembly, Anode assembly
 - 6.1.3 Stationary and rotating anodes
 - 6.1.4 Line focus principle, anode heel effect, Off-focus radiation
 - 6.1.5 Glass envelope, tube shielding, care of x-ray tubes
 - 6.1.6 X-ray tube faults

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- 6.1.7 Modification and recent advances in x-ray tube
- 6.2 Radiographic Couches, Stands and Tube Supports
 - 6.2.1 X-ray tube supports
 - 6.2.2 Radiographic couches
 - 6.2.3 Chest stands and vertical bucky
 - 6.2.4 Modern basic radiographic units
- 6.3 Exposure Timers
 - 6.3.1 Clockwork timer, synchronous motor and impulse timers
 - 6.3.2 Electronic timers
 - 6.3.3 Autotimers (photoelectric timer and ionization chamber timer)
- 6.4 Beam Centering & Beam Limiting Devices
 - 6.4.1 Cones and cylinders, Aperture diaphragms
 - 6.4.2 Light beam diaphragms, Positive beam limitation
- 6.5 Portable and Mobile Radiographic Equipments
 - 6.5.1 Main features of portable and mobile equipment
 - 6.5.2 Mains dependent mobile equipment
 - 6.5.3 Capacitor discharge equipment
 - 6.5.4 Battery powered generators
- 6.6 Control of Scattered Radiation
 - 6.6.1 Significance of scattered radiation
 - 6.6.2 Reduction in the amount of scatter radiation produced (field size, use of appropriate exposure factors, compression band)
 - 6.6.3 Reduction in the amount of scatter radiation reaching to the film (metal backing of cassettes, filters, air-gap technique, cones and diaphragms, Grids)
 - 6.6.4 Grid: construction, function, grid characteristics, grid types and patterns. Grid movement
 - 6.6.5 Reduction in the effect of scatter (use of intensifying screens)
- 6.7 Fluoroscopic Equipment
 - 6.7.1 Conventional fluoroscopy
 - 6.7.2 Mobile and specialised fluoroscopic units
 - 6.7.3 Image intensified fluoroscopy
 - 6.7.4 Image intensifier- construction and working principle
 - 6.7.5 TV camera and TV monitor
 - 6.7.6 Digital fluoroscopy
- 6.8 Equipment for Dental Radiography
 - 6.8.1 A simple dental radiographic unit, Orthopantomography (OPG)
- 6.9 Vascular Imaging Equipment
 - 6.9.1 Generators and x-ray tubes
 - 6.9.2 C-Arm/U-Arm assembly
 - 6.9.3 Angiographic tables
 - 6.9.4 Automatic pressure injectors
 - 6.9.5 Digital subtraction Angiography
- 6.10 Mammographic Equipment
 - 6.10.1 Mammography x-ray tube
 - 6.10.2 Image receptors in mammography
 - 6.10.3 Apparatus for magnification radiography in mammography
 - 6.10.4 Digital mammography/ Digital Breast tomosynthesis
- 6.11 Digital Imaging

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- 6.11.1 Introduction to digital imaging concepts and advantages of image digitization
- 6.11.2 Digital image structure
- 6.11.3 Digital radiography: Scanned projection radiography (SPR), Computed radiography (CR), Direct digital radiography (DR)
- 6.12 Computed Tomography (CT)
 - 6.12.1 Basic principles of CT
 - 6.12.2 Generations of CT/ MDCT/Newer advances in CT
 - 6.12.3 System components
 - 6.12.4 Image characteristics & Image quality in CT
 - 6.12.5 Artifacts in CT
- 6.13 Magnetic Resonance Imaging (MRI)
 - 6.13.1 Fundamental concepts: magnetic moments, precession, resonance, nuclear magnetic resonance (NMR)
 - 6.13.2 Introduction to MR Scanners: imaging magnets, RF transmitter and receiver coils, shim coils and gradient coils
 - 6.13.3 Principal parameters of MRI: spin density, T1- and T2 - relaxation time
 - 6.13.4 Basic principles of MR imaging and related parameters
 - 6.13.5 Spin echo pulse sequence
 - 6.13.6 Gradient echo pulse sequence
 - 6.13.7 Artifacts in MRI
 - 6.13.8 Advances in MR technology
- 6.14 CT and MRI Technique
 - 6.14.1 Technique for Brain
 - 6.14.2 Technique for Head, Chest, Abdomen and other body parts
 - 6.14.3 Technique for CTA and MRA
 - 6.14.4 Technique for Spine and Joint
- 6.15 Bone Mineral Densitometry : Indication and techniques
- 6.16 Dual Headed Gamma Camera
- 7. Radiographic Photography**
 - 7.1 Photographic Principle
 - 7.1.1 Photographic effect
 - 7.1.2 Photosensitive materials
 - 7.1.3 Photographic emulsion
 - 7.1.4 Characteristic curve
 - 7.1.5 Spectral sensitivity
 - 7.1.6 Direct exposure film (x-ray sensitive)
 - 7.1.7 Gurney-Mott theory of latent image formation
 - 7.2 Film Materials
 - 7.2.1 Construction of x-ray film
 - 7.2.2 Film for medical imaging
 - 7.2.3 Comparison between single coated and double coated x-ray films
 - 7.3 Film Storage
 - 7.3.1 Different storage areas
 - 7.3.2 Ideal storage condition
 - 7.3.3 Stock control and film ordering methods
 - 7.4 Intensifying Screens
 - 7.4.1 Luminescence: fluorescence and phosphorescence
 - 7.4.2 Construction of Intensifying screen and their types

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- 7.4.3 Types of phosphors: calcium tungsten, rare earth and their comparison
- 7.4.4 Detective Quantum efficiency (DQE)
- 7.4.5 Quantum mottle
- 7.4.6 Care, monitoring and cleaning of IF screen
- 7.4.7 X-ray film cassettes
- 7.4.8 Cassette function, construction, materials used, types and care of cassettes
- 7.5 Radiographic Processing
 - 7.5.1 Manual and Automatic processing
 - 7.5.2 Processing cycles
 - 7.5.3 Processing chemical
 - 7.5.4 Care and maintenance of automatic processors
 - 7.5.5 The principle of dry silver imager
 - 7.5.6 Silver recovery
 - 7.5.7 Daylight processing
- 7.6 Design and Construction of Darkroom
 - 7.6.1 The layout of an ideal darkroom
 - 7.6.2 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
- 7.7 The Radiographic Image
 - 7.7.1 Radiographic image quality
 - 7.7.2 Factors affecting radiographic image quality
 - 7.7.3 Image artifacts
- 7.8 Identification and Viewing of Radiographs
 - 7.8.1 Methods of film
- 7.9 Quality assurance in radiography

Section (C): 10 % Marks

- 8. **Concept of management**
 - 8.1 Management: concept, scope, functions, principles, and its practices
 - 8.2 Hospital Management : concept, scope, function, principle and its practices
 - 8.3 Communication skills, problem solving and decision making
 - 8.4 Planning, organizing, monitoring and evaluation in health sector
 - 8.5 Participative management
 - 8.6 Social justice and social security system in Nepal
 - 8.7 Positive attitude and self-development
 - 8.8 Demographic characteristic of Nepal
- 9. **Organizational Knowledge and General Health Issues**
 - 9.1 B.P.Koirala Memorial Cancer Hospital : History, organizational structure, functions, roles, services, problems and challenges
 - 9.2 National Health Policy
 - 9.3 B.P.Koirala Memorial Cancer Hospital related act and regulations
 - 9.4 Health Service Act, 2053 and Health Service Regulation, 2055
 - 9.5 Professional council related acts and regulations
 - 9.6 Professional and medical ethics