

निजामती कर्मचारी अस्पताल
प्राविधिक सेवा, रेडियोलोजी समूह, रेडियोग्राफी उपसमूह, बरिष्ठ रेडियोग्राफी टेक्नोलोजिष्ट पद, सातौं 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	उत्तीर्णाङ्क	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 :

- यो परीक्षा योजनालाई प्रथम चरण (लिखित परीक्षा) र द्वितीय चरण (अन्तर्वार्ता) गरी दुई चरणमा विभाजन गरिएको छ ।
- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।
- प्रथम र द्वितीय पत्रको पत्रको विषयवस्तु एउटै हुनेछ ।
- प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
- परीक्षामा सोधिने प्रश्नसंख्या, अङ्क र अङ्कभार यथासम्भव सम्बन्धित पत्र/विषयमा तोकिए अनुसार हुनेछ ।
- 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 ।
- 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 ।
- बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।
- विषयगत प्रश्नका लागि तोकिएका १० अङ्कका प्रश्नहरूको 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 टिप्पणीहरू (Short notes) सोध्न सकिने छ ।
- विषयगत प्रश्नमा प्रत्येक पत्र/विषयका प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । परीक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डका उत्तरपुस्तिकामा लेख्नुपर्नेछ ।
- 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 ।
- प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।
- पाठ्यक्रम लागू मिति :-

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Civil Service Hospital

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Paper I and II: Technical subject
Section (A): 50 %

1. Anatomy and Physiology

1. Introduction
 - 1.1.1 General anatomical terms
 - 1.1.2 Human cell structure and function
 - 1.1.3 The tissues
2. Musculo-Skeletal System
 - 1.2.1 Formation, growth and development of bones
 - 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
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
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)
5. Lymphatic System
 - 1.5.1 Lymphatic System
 - 1.5.2 Lymph nodes
 - 1.5.3 Spleen
 - 1.5.4 Thymus gland
6. 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)
7. 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
8. Urinary System
 - 1.8.1 Organs of urinary system: Kidneys, ureters, bladder, and urethra

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- 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
- 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
- 9. 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
- 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
- 11. Endocrine System
 - 1.11.1 Endocrine glands - pituitary gland, thyroid gland, parathyroid glands, adrenal gland, islets of langerhans, pineal gland, testis, ovaries, thymus
 - 1.11.2 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

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- 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 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

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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
- 2.9.5 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

3. RADIOGRAPHIC TECHNIQUE

3.1 UPPER LIMB

- 3.1.1 Technique for whole hand, fingers, thumb, wrist joint, Radio ulnar joints
- 3.1.2 Supplementary technique: carpal tunnel, scaphoid, ulnar groove, head of radius
- 3.1.3 Supplementary views of elbow, humerus & Supra-condylar projection

3.2 SHOULDER GIRDLE AND THORAX

- 3.2.1 Technique for shoulder joint, acromio-clavicular joint, and scapula
- 3.2.2 Supplementary views: projection to show recurrent dislocation of shoulder, infero-superior projection of clavicle, sterno-clavicular joint, sternum, ribs

3.3 LOWER LIMB

- 3.3.1 Technique for whole foot, toes, great toe, calcaneum, talo-calcaneal joint, ankle joint, lower leg with ankle joint
- 3.3.2 Knee joint, patella, tibio-fibular joints
- 3.3.3 Supplementary technique for torn ligaments, flat feet, axial view of calcaneum, skyline view of patella, intercondylar notch view

3.4 VERTEBRAL COLUMN

- 3.4.1 Technique for crano-vertebral joint, atlanto-occipital joint, first three cervical vertebra, odontoid peg view
- 3.4.2 Cervical spine for intervertebral joints and foramina, cervico thoracic vertebrae
- 3.4.3 Thoracic spine, thoraco-lumbar vertebrae
- 3.4.4 Lumbar spine, intervertebral joints and foramina, lumbo-sacral joint, sacrum, coccyx
- 3.4.5 Supplementary techniques, to demonstrate scoliosis, kyphosis, spondylolisthesis

3.5 PELVIC GIRDLE AND HIP REGION

- 3.5.1 Technique for whole pelvis, ileum, ischium and pubic bones
- 3.5.2 Sacroiliac joints, symphysis pubis, hip joints, acetabulum, neck of femur
- 3.5.3 Supplementary projections: acetabulum view, judet view, Von-Rosen view and frog leg view for hip joint (CDH)

3.6 SKULL

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

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- 3.6.2 Technique for mastoids, styloid process, IAM
- 3.6.3 Routine views for facial bones, mandible, zygomatic arches, nasal bone, maxilla, temporo-mandibular joints
- 3.6.4 Optic foramina, macroradiography for optic foramina
- 3.6.5 Routine and special views for Paranasal sinuses
- 3.7 CHEST RADIOGRAPHY
 - 3.7.1 Routine radiography of chest, High kV technique for Chest
 - 3.7.2 Supplementary views: apicogram, lordotic and oblique views, lateral decubitus, diaphragmatic excursions double exposure technique
- 3.8 WARD AND OPERATION THEATRE RADIOGRAPHY
 - 3.8.1 Knowledge of Electrical supply, radiation protection
 - 3.8.2 Radiography of bed-ridden patients
 - 3.8.3 Radiography in operation theatre
- 3.9 MAMMOGRAPHY
 - 3.9.1 Soft tissue radiography
 - 3.9.2 Principle and technique of mammography
- 3.10 MACRO-RADIOGRAPHY
 - 3.10.1 Definition, principles and its applications
 - 3.10.2 Magnification factors and uses of magnification radiography

Section (B): 50 %

4. SPECIAL RADIOLOGICAL PROCEDURES

- 4.1 FIRST AIDS AND EMERGENCY CARE
 - 4.1.1 Introduction to Shock, emergency treatment, Cardio-Pulmonary resuscitation (CPR)
 - 4.1.2 Introduction to Haemorrhage, primary management of haemorrhage
- 4.2 CONTRAST MEDIA
 - 4.2.1 Introduction to contrast media
 - 4.2.2 Definition, types and uses of contrast media
 - 4.2.3 Properties of contrast media
 - 4.2.4 Adverse effects of contrast media and their management
 - 4.2.5 Emergency trolley setting
 - 4.2.6 Lifesaving drugs and emergency trays
- 4.3 ALIMENTARY TRACT
 - 4.3.1 Definition, indications, contraindications, equipment required, contrast media, preparation of the patient, technique/procedure, filming & post procedure care for following investigations:
 - 4.3.1.1 Barium swallow
 - 4.3.1.2 Barium meal
 - 4.3.1.3 Barium follow -through
 - 4.3.1.4 Small bowel enema
 - 4.3.1.5 Barium enema -single contrast, -double contrast
 - 4.3.1.6 Loopogram
- 4.4 BILIARY TRACT
 - 4.4.1 Definition, indications, contraindications, equipment required contrast media, preparation of the patient, technique / procedure, filming, post procedure care for following investigations:
 - 4.4.1.1 Percutaneous transhepatic cholangiography (PTC)
 - 4.4.1.2 Endoscopic retrograde cholangio-pancreatography (ERCP)

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4.4.1.3 Per operative cholangiography (POC)

4.4.1.4 T-tube cholangiography

4.5 URINARY TRACT

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

4.5.1.1 Intravenous urography (IVU), Modification of IVU and additional techniques

4.5.1.2 Percutaneous nephrostomy (PCN)

4.5.1.3 Retrograde pyelography (RGP)

4.5.1.4 Micturating cysto-urethrography

4.6 REPRODUCTIVE SYSTEM

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

4.7 CARDIO-VASCULAR SYSTEM

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

4.7.1.1 Carotid angiography

4.7.1.2 Abdominal aortography

4.7.1.3 Portal venography

4.7.1.4 Peripheral and lower limb venography

4.8 MYELOGRAPHY

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

4.8.1.1 Lumabr, Thoracic and Cervical Myelography

4.8.1.2 Post Myelo-CT (CT Myelography)

4.9 ARTHROGRAPHY

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

4.9.1.1 Knee Arthrography

4.9.1.2 Hip Arthrography

4.10 SINOGRAPHY

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

4.11 SIALOGRAPHY

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

4.11.1.1 Parotid sialography

4.11.1.2 Sub-mandibular sialography

4.12 DACRYOCYSTOGRAPHY

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

5. EQUIPMENT FOR DIAGNOSTIC RADIOLOGY

5.1 X-RAY TUBES

- 5.1.1 Overview of production of x-rays, Historical background
- 5.1.2 Components of an x-ray tube: Cathode assembly, Anode assembly
- 5.1.3 Stationary and rotating anodes
- 5.1.4 Line focus principle, anode heel effect, Off-focus radiation
- 5.1.5 Glass envelope, tube shielding, care of x-ray tubes
- 5.1.6 X-ray tube faults
- 5.1.7 Modification and recent advances in x-ray tube

5.2 RADIOGRAPHIC COUCHES, STANDS AND TUBE SUPPORTS

- 5.2.1 X-ray tube supports
- 5.2.2 Radiographic couches
- 5.2.3 Chest stands and vertical bucky
- 5.2.4 Modern basic radiographic units

5.3 EXPOSURE TIMERS

- 5.3.1 Clockwork timer, synchronous motor and impulse timers
- 5.3.2 Electronic timers
- 5.3.3 Autotimers (photoelectric timer and ionization chamber timer)

5.4 BEAM CENTERING & BEAM LIMITING DEVICES

- 5.4.1 Cones and cylinders, Aperture diaphragms
- 5.4.2 Light beam diaphragms, Positive beam limitation

5.5 PORTABLE AND MOBILE RADIOGRAPHIC EQUIPMENTS

- 5.5.1 Main features of portable and mobile equipment
- 5.5.2 Mains dependent mobile equipment
- 5.5.3 Capacitor discharge equipment
- 5.5.4 Battery powered generators

5.6 CONTROL OF SCATTERED RADIATION

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

5.7 FLUOROSCOPIC EQUIPMENT

- 5.7.1 Conventional fluoroscopy
- 5.7.2 Mobile and specialised fluoroscopic units
- 5.7.3 Image intensified fluoroscopy
- 5.7.4 Image intensifier- construction and working principle
- 5.7.5 TV camera and TV monitor
- 5.7.6 Digital fluoroscopy

5.8 EQUIPMENT FOR DENTAL RADIOGRAPHY

- 5.8.1 A simple dental radiographic unit, Orthopantomography (OPG)

5.9 VASCULAR IMAGING EQUIPMENT

- 5.9.1 Generators and x-ray tubes
- 5.9.2 C-Arm/U-Arm assembly
- 5.9.3 Angiographic tables

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- 5.9.4 Automatic pressure injectors
- 5.9.5 Digital subtraction Angiography
- 5.10 MAMMOGRAPHIC EQUIPMENT
 - 5.10.1 Mammography x-ray tube
 - 5.10.2 Image receptors in mammography
 - 5.10.3 Apparatus for magnification radiography in mammography
 - 5.10.4 Digital mammography/ Digital Breast tomosynthesis
- 5.11 DIGITAL IMAGING
 - 5.11.1 Introduction to digital imaging concepts and advantages of image digitization
 - 5.11.2 Digital image structure
 - 5.11.3 Digital radiography: Scanned projection radiography (SPR), Computed radiography (CR), Direct digital radiography (DR)
- 5.12 COMPUTED TOMOGRAPHY (CT)
 - 5.12.1 Basic principles of CT
 - 5.12.2 Generations of CT/ MDCT/Newer advances in CT
 - 5.12.3 System components
 - 5.12.4 Image characteristics & Image quality in CT
 - 5.12.5 Artifacts in CT.
- 5.13 MAGNETIC RESONANCE IMAGING (MRI)
 - 5.13.1 Fundamental concepts: magnetic moments, precession, resonance, nuclear magnetic resonance (NMR)
 - 5.13.2 Introduction to MR Scanners: imaging magnets, RF transmitter and receiver coils, shim coils and gradient coils
 - 5.13.3 Principal parameters of MRI: spin density, T1 relaxation time, T2 relaxation time
 - 5.13.4 Basic principles of MR imaging and related parameters
 - 5.13.5 Spin echo pulse sequence
 - 5.13.6 Gradient echo pulse sequence
 - 5.13.7 Artifacts in MRI
 - 5.13.8 Advances in MR technology.
- 5.14 CT AND MRI TECHNIQUE
 - 5.14.1 Technique for Brain
 - 5.14.2 Technique for Head, Chest, Abdomen and other body parts
 - 5.14.3 Technique for CTA and MRA
 - 5.14.4 Technique for Spine and Joint
- 6. RADIOGRAPHIC PHOTOGRAPHY**
 - 6.1 PHOTOGRAPHIC PRINCIPLE**
 - 6.1.1 Photographic effect
 - 6.1.2 Photosensitive materials
 - 6.1.3 Photographic emulsion
 - 6.1.4 Characteristic curve
 - 6.1.5 Spectral sensitivity
 - 6.1.6 Direct exposure film (x-ray sensitive)
 - 6.1.7 Gurney-Mott theory of latent image formation
 - 6.2 FILM MATERIALS**
 - 6.2.1 Construction of x-ray film
 - 6.2.2 Film for medical imaging
 - 6.2.3 Comparison between single coated and double coated x-ray films

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6.3 FILM STORAGE

- 6.3.1 Different storage areas
- 6.3.2 Ideal storage condition
- 6.3.3 Stock control and film ordering methods

6.4 INTENSIFYING SCREENS

- 6.4.1 Luminescence: fluorescence and phosphorescence
- 6.4.2 Construction of Intensifying screen and their types
- 6.4.3 Types of phosphors: calcium tungsten, rare earth and their comparison
- 6.4.4 Detective Quantum efficiency (DQE)
- 6.4.5 Quantum mottle
- 6.4.6 Care, monitoring and cleaning of IF screen
- 6.4.7 X-ray film cassettes
- 6.4.8 Cassette function, construction, materials used, types and care of cassettes

6.5 RADIOGRAPHIC PROCESSING

- 6.5.1 Manual and Automatic processing
- 6.5.2 Processing cycles
- 6.5.3 Processing chemical
- 6.5.4 Care and maintenance of automatic processors
- 6.5.5 The principle of dry silver imager
- 6.5.6 Silver recovery
- 6.5.7 Daylight processing

6.6 DESIGN AND CONSTRUCTION OF DARKROOM

- 6.6.1 The layout of an ideal darkroom
- 6.6.2 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

6.7 THE RADIOGRAPHIC IMAGE

- 6.7.1 Radiographic image quality
- 6.7.2 Factors affecting radiographic image quality
- 6.7.3 Image artifacts

6.8 IDENTIFICATION AND VIEWING OF RADIOGRAPHS

- 6.8.1 Methods of film

6.9 Quality assurance in radiography

7. General knowledge about Civil Service Hospital and its Bylaws