

Annexure "N"

Syllabus for the post of Junior X-Ray Technician

Marks :-120
Time :- 2.00 Hours

Semester - I

- **Anatomy and Physiology** (Marks : 15)
 ✓ General:

Introduction to the Human body. Terms used in Anatomy, (Surface anatomy, markings and locations of different body parts and important body planes. Planes and Regions of Thoracic, Abdominal and pelvic Cavities.

- ### ✓ Animal Cell :

Structure of cell, function and cell divisions.

- ### ✓ **Tissue System:**

Definition, structure & S function of epithelium, connective, Muscular, Fluid and nervous tissues.

- ### ✓ **Cardiovascular System.**

Heart, pericardium, Arterial system, Venous system, Capillary, systemic circulation.

- ### ✓ **Digestive System:**

Mouth , oesophagus, stomach, small intestine, large intestine, spleen, liver, Salivary Gland , Gall Bladder, pancreas, Physiology and Digestion Absorption and Assimilation of Food.

- ## ✓ **Respiratory System:**

Noise , pharynx, larynx, trachea, Bronchi, lungs, pleura, physiology of Respiration-Expiration and Inspiration, Internal and External Respiration, Breathing control, vital capacity . Tidal volume and Dead space.

- ## ✓ Reproductive system:

- Male Reproductive system: Male Reproductive organs,
 - Spermatogenesis, Testosterone and Secondary sexual characters.

Female Reproductive System: Vulva, internal reproductive organs menstrual cycle, ovarian hormones & Female breast.

- ## ✓ Excretory System:

Introduction to Excretory body organs, structure of kidneys , ureters, Urinary, Bladder, Urethra, Physiology of filtration Reabsorption and secretion.

- ## ✓ Nervous System:

Brain Meninges , ventricles spinal cord nerves and cerebro spinal fluids.

✓ **Lymphatic System:**

Lymph Glands, Thoracic Ducts. Composition & Circulation of Lymph.

✓ **Endocrine system –**

Definition, Pituitary Gland, Pineal gland. Thymus Gland Adrenal Glands Thyroid, Parathyroid Glands.

✓ **Sense Organs-**

Structure and function of Eye , Skin , Ear and Tongue.

✓ **Musculoskeletal System-**

Skull, vertebral column, shoulder girdle, Thoracic cage. Bones upper limbs, Bones of lower limbs, type of bony joints and movements.

➤ **General Physics**

(Marks : 10)

Unit, Measurements, Motion, Newton's Law of Gravitation Work energy, Properties of matter & Archimedes principle.

✓ **Heat -**

Thermometry & Kinetic Molecular Picture of Heat, Thermal Expansion Transference of heat, heat energics, Calorimeter and hygrometry Practical points of heat in X-Ray equipment.

✓ **Light -**

Rectilinear propagation, Photometry reflection laws. Spectroscopy optical instruments, velocity of Light X-Ray spectrometer.

✓ **Magnetism -**

Properties of Magnetism, Molecular Theory of Magnetism, magnetic field, Lines of Force, Magnetic forces and Territorial magnetism, Hysteresis.

✓ **Electricity -**

Simple electronic phenomenon, potential difference and electric current capacitor of condenser inductance, impedance, Electro magnetism resistance heating and chemical effect of current, electromagnetic induction, Laws, Ohm's law, Safety fuses Galvanometer, AC and DC currents, RMS value, Peak value.

✓ **Sound -**

Production of sound, wave motion, velocity of sound, Superimposition of sound musical sounds, vibration of strings, Air Columns etc. Production ultrasonic waves, Clinical application of ultra sound.

✓ **Transformers**

Principles construction of step up & down and Auto transformers, construction of high tension .Transformers rectification . Self rectification.

✓ **X-Ray**

Production of x-ray, properties, interaction with matter (Photo electric compton effect and pair production) luminescent effect, photographic effect, ionizing effect & biological effects.

✓ **Units and Measurements of X-Rays-**

Ionization, Roentgen, Rad Rem, R.B.E. Radiation badges, ionization chambers.

Semester - II

➤ **X-Ray Tube -** (10 Marks)

- Construction of x-ray tube Targets, cooling and insulation, X-Ray Circuits , timers and rectifiers in x-ray, circuits, inter locking circuits, stationary and Rotatory anode tube.
- Quantity and Quality x-ray , H.V.T or WL linear absorption co-efficient grids, cones cylinders, filters, focal spot size LBD FFD or LSD and OFD Fluoroscopy and Image intensifier

✓ **Radioactivity :-**

- Curie, Half life period, decay factor, radium, cobalt, caesium, dose. Dose rate exposure dose, Exit dose, Depth dose, isotopes and isobars, isodose charts and their uses.
- Gamma of X-Ray film (toe & shoulder region linear and Solarization) X-Ray tube calibration, sensitometer, densitometer.

✓ **Musculoskeletal System :-**

- Skull, vertebral column, Shoulder girdle, Thoracic cage. Bones upper limbs, Bones of lower limbs, Types of bony joints and movements.

➤ **Radiographic photography Technique (Dark room Techniques)**

(30 Marks)

✓ **Dark Room-**

- Definition and location of dark room, ideal design of dark room , light and radiation protection devices , safe light test, ventilation, dry and wet benches, Duplicator.

✓ **Radiographic Films-**

- Ortho-chromatic films , panchromatic films, Base, Bonding layer, emulsion and super coating of films. Non screen films CTA base and polyester base films. The structure of Double coated & single coated film.

✓ **X-Ray Cassettes -**

- Construction of various cassettes, cassettes care, mounting of intensifying screen in cassettes.

✓ **Intensifying screens-**

- Luminescence (Phosphorescence and fluorescence) construction of screens. Type of phosphors and pigments film screen contact, speed of screens-slow parfast care of intensifying screens . Intensification factors numeral proof and rare earth screens.

- a) Mounting of intensifying screens.
- b) Screen film contact.

✓ **Film Processing -**

Auto processing material for processing equipment and annual processing control on temperature chemical in Dark room the PH Scale.

- X-ray Developer
- X-Ray Fixer
- Film Rinsing Washing & Drying
- Preparation of processing chemicals, loading and unloading of cassettes,

✓ **Presentation of Radiograph-**

- Film identification- Direct or Stereoscopic views, trimming legends, record filling and report distribution..

✓ **Film Artifacts-**

- Definition, type and causes of radiation and photographic artifacts, factors affecting the quality control of radiograph.

Semester - III

- **Radiographic General Procedures** **(30 Marks)**

- Introduction- The Radiographic image (image formation, magnification image Distortion, Image, sharpness, Image contrast) Exposure factor and Anatomical Terminology.

✓ **Skeletal System-**

Upper Limb- Procedure for thumb, fingers, meta carpal, hand carpometacarpal joints, wrist joint, carpo-radio-ulnar joint, forearm, elbow joint, arm, special views for scaphoid bone, olecranon process , supra condylar projection in various type of injured patients.

- **Lower limb-** Procedure for toes, meta tarsals, complete foot, tarsoancaneal, talo calcaneal joint, leg with ankle joint leg with knee joint knee joint, thigh with hip joint.
- **Shoulder Girdle and Bony thorax-** Procedures for scapula clavicle and head of humerus sternoclavicular joint , special views for clavicle. Head of humerus and scapula in various types of injured or dislocation cases.

- **Vertebral Column-** Normal curvature relative levels of vertebrae, procedures for atlanto-occipital joint, odontoid process, cervical spine , cervicodorsal spine , dorsal spine, dorso-lumbar spine, and spondolysis.
- **Pelvic Girdle and Hip Joints :** - Procedure for whole pelvis, ileum, ischium and public bones, sacro – iliac joint symphysis pubis, acetabulum, neck of femur greater & lesser trochanter. Hip Joint with upper one third femur, special view for orthosis. S.M. pinning and S.P. nailing and plating.
- **Skull :-** Procedure for whole skull, localized for frontal occipital, temporal, external and internal auditory meatus, sella turcica, jugular foramen, foramen magnum, optic foramen maxillae zygomatic bones, mandible, temporo-mandibular joints, styloids processes, crano-vertebral junction.
- **Teeth :-** National and International formulae and D.T and P.T. Procedures for maxillary and mandibular teeth (incisors canine, premolar and molar) for D.T and P.T cephalometry, orthopantogram, occlusal view for maxilla and mandible.

✓ **Chest-**

- Procedures for chest at six feet, lying down and erect positions, inspiration and expiration views , special views like lordotic , decubitus, MMR portable teleradiography, chest in pregnancy. High Kilovoltage technique.

✓ **Abdominal Pelvis –**

- Preparation for procedure, procedure for upper abdomen, lower abdomen, KUB, Gallbladder, Stomach , small intestine and large intestine in Supine and erect position, special views in case of perforation etc supine and erect position, special views in case of peritonitis etc.

✓ **Sinus –**

- Procedures for paranasal sinuses (frontal, ethmoid, sphenoid and maxillary sinuses.)

✓ **Soft Tissue Radiography-**

- Procedures for STM , STN abdomen and other body organs. Invetogram procedures, manipulation of positions, immobilization , exposure, FFD in abnormal conditions of patients.

✓ **Hospital Practice and Care of Patients :-**

- Setup of Radiology department in Hospital, Hospital staffing and organization, Patients Registration, record filling, cases put up and dispatch devices, medico legal aspect of profession. Professional relationship of Radiographer with patient and organization staff.

❖ **Special Investigation (15 Marks)**

✓ **Urinary Tract –**

- Plain Radiographs for UB Intravenous Pyelogram, (IVP or IVU) Retrograde pyelography, Micturating- cystourethrogram Retrograde Urethrogram.

✓ **Gastro –Intestinal Tract -**

- Plain Radiographs, abdomen, Barium Swallow, Ba meal ET, Ba Enema, double contrast Baenema and instant Baenema, Miscellaneous Procedures, Gastigraffim study, fluoroscopy,

• **Biliary Tract**

✓

- Introduction to biliary contrast oral choleystography (OCG) pancreatography (ERCP), HCG, Fistulogram Sinogram.
- Basic principle and application of computerized tomography, ultrasound Magnetic resonance Imaging, Computer Radiography and Digital Radiography.
- Contrast Agents, Contrast Reaction and their management, Emergency Drugs used in Radiology Department.

Semester - IV

PAPER - I

➤ **Radiological special procedures and radiotherapy (10 Marks)**

- **Introduction-** Importance of special procedure, parameters for a special procedure (indication, contraindication, patient preparation, accessories, contrast media, technique aftercare etc.
- Ideal step of different special procedure Laboratories (Cath-lab, Angiolab, U/S Lab. C.T. Center & M.R.I Centers) Accessories of a special procedure center.
- Contrast and different contrast media for various procedure, Adverse effects of contrast media.
- Handling of emergencies in Radiology deptt. Preparation of different contrast media. Uses of Drugs and other equipment in procedure room. Checking of Instrument, drugs and their labellings knowledge of sterile and unsterile techniques.

✓ **Cardio-Vascular System -**

Plain Radiographs of Interested – Body part catherization technique guidewires, Catheters, General complication of catheter technique.

- **Gngiography peripheral Angiograms -** Angiogram for upper and lower limbs
 - **Central Angiogram :-** Cardiac catherization, Carohd Angiogram, Aotogram, Selective angiogram, Digital subtraction angiography.
 - **Venography :** Plain Radographs of interested body parts.

Peripheral Venography : Venography of upper and lower limbs.

Intraosseous venography

Central Venography : - Portal venography, Superior venacavography, Inferior Venacavography Retrograde selective Venography.

- **Central Nervous System -** Introduction to water soluble contrast & Oily contrast for C.N. System. Plain Radiographs of skull or vertebral column, ventriculography, Pneumo encephalography, Shuntography, Myelography, cisternography.
- **Respiratory Tract –** Plain radiographs of Face, Neck or Thorax Nasopharyngography Oropharyngography, Laryngography, Lung Biopsy.

- **Reproductive System** : - Plain Radiographs of interested body part Vesiculography Hystero Salpingography, Gynaecography.
- **Skeletal System** :- Plain Radiographs of interested bones, Arthrography (wrist, knee , Shoulder, Hip elbow, ankle joints) Fistulography and Airmeatography.
Basic Principle and application of tomography computerized Tomography Ultrasound, Magnetic resonance Imaging. Manula Substraction & Duplicating techniques.
- **Radiotherapy** :- Physical Principles of Radio Therapy general Pathology in Relation to Radiation Therapy Radiation Treatment & Types of Sources, cobalt Calcium and Radium. Radiotherapy its advantages & Disadvantages Radio therapy Tubes, Radiotherapy Techniques for skin, respiratory, Digestive Urinary, Reproductive, Endocrine and Nervous diseases, Kilovoltage techniques, External & Internal Radiation technique in various diseases. Plesiotherapy Dose data, uses of isodose chart for correction of isodose curve. Basic Principles of CT & MRI and application.

Semester - IV

PAPER - II

➤ **Medical OPD / Emergency / Ward Tray with Physician.**

✓ **Electrocardiography & Techniques** -

- Definition of ECG, EMG. Introduction to Electro Cardiography. History Physiological basic, Vector concept in ECG, Conduction velocity, Impulse generation, Impulse Transmission, Normal cardiac rhythm, Blood pressure, Pulse rate, Central Terminal of Wilson, Unipolar limb leads, Bipolar limb leads, Augmentation, Esophageal leads, Jelly used in ECG different colour codes in ECG leads.

✓ **Normal Electrocardiograms** -

- Normal paper speed, standardization, Calibration, Filters, Normal heart position, Interpretation of ECG. Atrial complex (p-wave), P-R interval, QRS complex, QT Interval, ST segment, T-Wave, Purkinje fibres repolarization. Duration and amplitude of different normal waves recorded in an ECG. No. of complexes to be recorded in a normal ECG.

✓ **Abnormal Electrocardiogram** -

- Abnormal P-wave, Interventricular conduction defect, RBBB (Right bundle Branch Block) LBB (Left Bundle Branch Block). Hypertrophy, RVH (Right Ventricular Hypertrophy, LVH (Left Ventricular Hypertrophy), WPH (Wolf Parkinson white Syndrome.) Bilateral Bundle Branch Block. Trifascicular Blocks. Lown-Ganong Levine-Syndrome, Mahaim bypass, Pulmonary embolism. Chronic Obstruction. Mitral Lung disease (COPD). Biventricular Hypertrophy, Myocardial infarction Mitral Stenosis. Mitral valve prolapsed, Paroxysmal Atrial Tachycardia. Sick-Sinus-Syndrome, Supra Ventricular Tachardia. Left Posterior and anterior hemi block.

✓ **Coronary Artery Disease** -

- Ischemia, Injury, Infarction, Subtle, Atypical, Non-specific patterns. Condition defects and infarctions, Location of infarctions, ventricular premature beat and acute infarctions, coronary insufficiency. Atherosclerosis Thrombo embolism.

✓ **Drugs and Electrolytes** -

- Adrenaline, Acetyl choline, Digitalis, Quinidine, Potassium, Hyperkalemia and Hypokalemia, Hyper and Hypo Calcemia. Phenothiazines. Anthro Cyclines, Cerebro Vascular Accidents (CVA). Hypo and hyper Thermia, pericarditis, Myocarditis. Heart trauma. Pericardial effusion. Malignancy of heart. Cardiomyopathies, Electrical Alternans, Negative V-Wave, Liquid Protein diet Anaemia etc.

✓ **Exercise Test -**

- Definition, Acetyl Choline, Digitalis, Quinidine, Potassium. Hyperkalemia and Hypokalemia, Hyper and Hypo Calcemia. Phenothiazines. Anthro Cyclines, Cerebro Vascular Accidents (CVA), Hypo and Hyper thermia, pericarditis, Myocarditis. Heart Trauma. Pericardial effusion. Malignancy of heart. Cardionyopathies, Electrical Alternans, Negative V-Wave, Liquid Protein diet Anaemia Etc.

✓ **Disorders of Cardiac Rhythm -**

- Disbalance of impulse formation at SA node, disturbance of impulse conduction, Secondary disorders of rhythm, Physiology of cardiac rhythm, automaticity. A Node, Sinus rhythm, Sinus tachycardia, Sinus bradycardia, Sinus Arrhythmia, Sinoatrial block, partial SA block, complete SA block, causes of exit block, Atrial Extrasystoles, Blocked Atrial extrasystole, Wandering Pacemaker, Paroxysmal Atrial tachycardia (PAT) Chaotic atrial rhythm, Atrial Flutter, Atrial Fibrillation, Supraventricular tachycardia (SVT.) Ventricular tachycardia (VT) Ventricular fibrillation. Sick sinus syndrome etc.

✓ **ECG as a Clue to Clinical Diagnosis -**

- Pulmonary Stenosis, tricuspid atresia, Atrial septal defect, Ventricular septal defect, Ebstein Anomaly, Corrected Transposition of great vessels, Mirror image dextrocardia, Anomalous Origin of left coronary Artery, Rheumatic Heart Disease (RHD), Mitral valve prolapsed, Athlete's Heart, cardiac Pacemaker etc.