**SYLLABUS FOR X-RAY RADIOGRAPHIC TECHNICIAN**

**TWO YEAR PROGRAMME**

**X-RAY-2ND YEAR**

**PAPER-1**

**XR-201**

**Anatomy and Physiology**

1. Types of cells, tissues, bones and joints.Introduction to system and cavities of the body.
2. Heart and Blood vessels (Circulatory system) Blood vessels: arteries, veins, capillaries, sinusoids, structure and functions. Heart: Position, structure and functions. Circulation of Blood: Pulmonary, systemic, portal, main blood vessels, their origins and distribution, diseases of blood vessels and Heart and conditions of the system.
3. The Lymphatic System:
4. The parts of the lymphatic system.Lymph channels: Capillaries. Vessels, ducts, structure and functions. Lymph nodes: Position, structure and functions.Lymphatic tissues: Tonsils, adenoids, and intestinal nodules.
5. Spleen: Position, structure and functions,diseases and conditions of the system.
6. The Digestive System:Elementary tract structure:Mouth, pharynx, salivary glands, oesophagus, stomach, liver, gall bladder,Small intestine, large intestine: Position, structure and functions of these organs. Digestion and Absorption, metabolism of carbohydrates, proteins and fats.Diseases and conditions of the system.
7. The Urinary System:Parts of urinary system. Position, structure and functions. Kidneys, ureters, urinary bladder and urethera. Formation and composition of urine. Water and electrolyte balance. Diseases and conditions of the system.

**Equipment and apparatus construction:**

No. of Lectures & Practical demonstration: 40

The following subjects will be taken up: -

(a) High Tension Generators:

The self rectified high-tension circuit. The half wave, four valve full wave, three phase full wave rectified circuit, voltage waveforms in high-tension generators. Constant potential circuits.Rectifiers-valves and solid state.

(b) The X-ray tube:

General features of the X-ray tube. The fixed anode, rotating anode X-ray tube. Rating of X-ray tubes, focal spot sizes. Methods of heat dissipation in X-ray tubes, common tube faults. Developments in the rotating anode tube, tube stands ceiling tube supports.

(c) Components and controls in the X-ray circuits:

The high-tension transformer, the rectification of high tension.The control of kilovoltage, kilovoltage indication, the circuit and control of the tube current.Exposure timers- electronic, automatic.Main voltage compensation. Main supply and the x-ray set.

(d) The control of scattered radiation:

Significance of scatter. Beam limiting devices-cones, diaphragm (colli-meters). Beam centring devices. The secondary radiation grid: its types, components of grid, grid movements. The assessment of grid functions.

(e) Portable and Mobile X-ray units:

Main requirements.Portable x-ray machines and x-ray equipment for operation theatre.

(f) Fluoroscopic Equipment:

Structure of a fluorescent screen, the fluoroscopic image. The fluoroscopic table spot film devices and explorators, protective measures and physiology of vision.

(g) Image intensifiers:

Image intensifier tube, its application, the television process and television tube.Recording of the intensified image. T.V. monitor, video tape recordings, cine radiographic cameras.

(h) Topographic Equipment:

Principle of topography.Various types of topographic movements, multi-section radiography.Transverse axial topography.Equipment for topography.

(i) Equipment for rapid serial Radiography:

The AOT changer, the roll film, cut film changer. Rapid cassette changer.

(j) Equipment for cranial and dental Radiography:

The skull table, general dental x-ray equipment, specialized dental x-ray equipment.

(k) Care, maintenance and tests of x-ray equipment:

General care like cleanliness, practical precautions pertaining to Brakes and locks, cables, meters and controls, tube stands and tracks as well as accessory equipment.

**PAPER II**

**XR-202**

**RADIATION PHYSICS INCLUDING RADIATION PROTECTION**

Atomic structure as applied to generation of x-rays and radioactivity spectrum of diagnostic imaging and therapy x-rays.

Effects of variation of tube voltage, current, filtration, HT waveform and target material on x-ray production.Laws of radioactivity and decay schemes of different alpha, beta, gamma ray, negatron and position emitters as used in medicine especially in radiotherapy.

Artificial radionuclide generators employed in medicine in general and radiotherapy sources in particular. Interaction of radiation with matter attenuation absorption and scattering phenomena.

Photoelectric absorption, Compton scattering, pair production and annihilation process, ionisation, effects of geometry of thickness of the absorber.

Dependence on the nature and atomic number of the absorber and on radiation quality.Transmission of x-ray through body tissues.

Linear energy transfer. Range of secondary electrons and electron build up. Relative amounts of scatter from homogeneous and heterogeneous beam during the passage through a patient.

Physical requirements of beam defining devices e.g. cones, diaphragm, collimators etc.

Units of radiation measurement specification of quality and half-valve thickness (HVT) and its measurements, filters and filtration.Measurements of radiation and dosimetric procedures.Radiation detectors and their principles of working.

Definitions of Bragg-peak, percentage depth dose, and peak scatter factor, tissue air-ratio, tissue maximum ratios scatter air ratio, isodose curves and radiation penumbra of different beams.

Wedge filters, scattering foils. Physics properties of phantoms, phantom materials, bonus and bolus substitutes.

Factors used for treatment dose calculation method. Physical aspects of electron and neutron beam therapy.

**Radiation Protection:**

Definition of radiation hazards maximum permissible dose and annual limit of intake (ALI), permissible dose levels on and around sealed source housing and installation principles of radiation protection and MPD’s of different ICRP rules, stochastic and non-stochastic effects.

Importance of ‘ALARA’ physical principles of design and planning of radiation installation.Safe work practice in tele therapy and Brach therapy.

Shielding materials, radiation surveys and personnel monitoring devices film badges. TLD badges, pocket dosimeters.

**PAPER III**

**XR-203**

**BASIC RADIOGRAPHIC TECHNIQUES**

1. **Skull:** Radiography of cranial bones, cranium, sellaturcica, orbit, optic foramina, superior orbital fissure and inferior orbital fissure. **Facial Bones:** Para nasal sinuses. Temporal bone. **Dental Radiography:**Radiography of teeth-intra oral, extra oral and occlusal view.
2. **Alimentary Tract:**Preparation of patients, contrast media for swallow, meal and enema.
3. **Abdomen:**Preparation of patient. General, acute positioning for fluid and air levels.Plain film examination. Radiography of female abdomen to look for pregnancy: Intravenous Pyelography and cystography. **Macro radiography:**Principle, advantage, technique and applications. **Stereography:**Procedure- presentation for viewing, stereoscopes, stereometry.**Soft tissue techniques: -**Mammography. Localisation of foreign bodies. Ward mobile radiography – electrical supply, radiation protection, equipments and instructions to be followed for portable radiography.
4. **Operation theatre techniques:** General precautions, asepsis in techniques – checking of mains supply and functions of equipment, selection of exposure factors, explosion risks, radiation protection and rapid processing techniques.
5. Orthovoitage equipment with special reference to physical 88888 requirements of tube and its accessories and interlocks, gamma ray and source housing and handling mechanism. Principle of isocentricteleotope machines magvoltage X-ray and electron beam accelerator like tube design, wake guide, target design beam bending system. Radio-frequency generators like magnetron and Klystron. Basic principle of remote after-loading system/ machines and source used.Principle of simulators and vacuum forming machines for making caste.Steroform template cutting system introduction to radio-surgery equipment and dosimetry equipment.