



# NATIONAL RURAL INSTITUTE OF SKILL DEVELOPMENT

SYLLABUS

OF

DIPLOMA IN X-ray TECHNOLOGY - DRIT12

REGULAR PROGRAMME

## DIPLOMA IN X-ray TECHNOLOGY - DRIT12

|                      |   |
|----------------------|---|
| Eligibility          | : 10+2 with PCB/PCM   |
| Programme Duration   | : 2 Years   |
| Programme Objectives | : X-Ray is the art and science of producing medical images using x-radiation. Technologists produce images for the radiologist's interpretation to aid in medical diagnoses. The program prepares you, under the direction of a medical specialist (radiologist), to work in the hospital medical imaging department, at the patient's bedside, in the operating room or Emergency or in private imaging clinics. Our Diploma program in X-Ray Technology has been designed to integrate the academic environment with the clinical setting. We are one of the few premium institutes in India to offer this program. |
| Job Prospects        | : Upon successful completion of the Diploma you can explore a career as a radiologist technician. You will find ample opportunities in Hospitals, Clinics and Doctors' offices. You may further pursue a bachelor's degree to continue your education and specialize. Common job profiles of students after completing DXRT include: Technician in Hospitals, Nursing Homes and Diagnostic Labs.  |

**YEAR I**

| <b>Course Code</b> | <b>Course Title</b>                           | <b>Theory/<br/>Practical</b> | <b>Continuous<br/>Assessment<br/>(Internals)</b> | <b>Credits</b> |
|--------------------|---|------------------------------|--|----------------|
| 101T               | Fundamentals of Computer Science              | 70                           | 30   | 4              |
| 102T               | Patient Care Relevant to Diagnostic X-Ray     | 70                           | 30   | 5              |
| 103T               | X-Ray Physics and Modern Imaging Techniques-I | 70                           | 30   | 5              |
| 104T               | X-Ray and Dark Room Techniques                | 70                           | 30   | 5              |
| 105T               | Human Anatomy & Physiology                    | 70                           | 30   | 5              |
| 106P               | X-Ray Physics and Modern Imaging Techniques-I | 35                           | 15   | 1              |
| 107P               | X-Ray and Dark Room Techniques                | 35                           | 15   | 1              |
| 108P               | Patient Care Relevant to Diagnostic X-Ray     | 35                           | 15   | 1              |
| 109                | Hospital Training-I                           | 200                          |  | 1              |
|                    |   |                              | <b>TOTAL</b>                                     | <b>28</b>      |

**YEAR II**

| <b>Course Code</b> | <b>Course Title</b>                                      | <b>Theory/<br/>Practical</b> | <b>Continuous<br/>Assessment<br/>(Internals)</b> | <b>Credits</b> |
|--------------------|--|------------------------------|--|----------------|
| 201T               | Environmental & Biomedical Waste Management              | 70                           | 30   | 4              |
| 202T               | Radiation Physics and Modern Imaging Techniques-II       | 70                           | 30   | 5              |
| 203T               | Quality Assurance in Diagnostic X-Ray                    | 70                           | 30   | 5              |
| 204T               | Radiation Hazards, Prevention and Safety                 | 70                           | 30   | 5              |
| 205T               | General Principles of Hospital Practice and Patient Care | 70                           | 30   | 5              |
| 206P               | Radiation Physics and Modern Imaging Techniques-II       | 35                           | 15   | 1              |
| 207P               | Quality Assurance in Diagnostic Radiology                | 35                           | 15   | 1              |
| 208P               | Radiation Hazards, Prevention and Safety                 | 35                           | 15   | 1              |
| 209                | Hospital Training-III                                    | 200                          |  | 1              |
|                    |  |                              | <b>TOTAL</b>                                     | <b>28</b>      |

## DETAILED SYLLABUS

**INSTRUCTIONAL METHOD:** Personal contact programmes, Lectures (virtual and in-person), Assignments, Labs and Discussions, Learning projects, Industrial Training Programmes and Dissertation.

### YEAR I

### **FUNDAMENTALS OF COMPUTER SCIENCE- 101T**

| UNIT | CONTENTS   |
|------|--|
| 1.   | <b>Computer Application:</b><br>Characteristic of computers, Input, output, storage units, CPU, Computers system.  |
| 2.   | <b>Computers Organization:</b><br>Central Processing Unit, Control Unit, Arithmetic Unit, Instruction Set, Register, Processor Speed.  |
| 3.   | <b>Memory:</b><br>Main Memory, Storage Evaluation Criteria, Memory Organization, Memory Capacity, Random Access Memories, Read Only Memory, Secondary Storage Devices, Magnetic Disk, Floppy and Hard Disk, Optical Disks CD-ROM, Mass Storages Devices.   |
| 4.   | <b>Input Devices:</b><br>Keyboard, Mouse, Trackball, Joystick, Scanner, Optical Mark Reader, Bar-code reader, Magnetic ink character reader, Digitizer, Card reader, Voice recognition, Web cam, Video Cameras.  |
| 5.   | <b>Output Devices:</b><br>Monitors, Printers, Dot Matrix Printers, Inkjet Printers, Laser Printers, Plotters, Computers Output Micro Files (Com), Multimedia Projector.  |
| 6.   | <b>Operating System:</b><br>Microsoft Windows, An overview of different version of windows, Basic windows elements, File managements through windows, Using essential accessories: System tools Disk cleanup Disk defragmenter, Entertainments, Games, Calculator, Imagine-Fax, Notepad, paint, Word Pad, Recycle bin, windows Explorer, Creating folders icons.   |
| 7.   | <b>Word Processing:</b><br>Word processing concepts, Saving, closing opening and existing documents, Selecting text, edition text, Finding and replacing text, Printing documents, Creating and printing merged documents, Mail merge, Character and paragraph formatting, Page designs and Layout, Editing and proofing tools checking and correcting spelling, Handling graphics, Creating tables and charts, Documents templates and wizards.                       |
| 8.   | <b>Presentation Package:</b><br>Creating opening and saving presentations, Creating the look of your presentation, Working in different views working with slides, Adding and formatting text, formatting paragraphs, Checking spelling and correcting typing mistakes, Making notes pages and handouts, Drawing and working with objectives, Adding clip art and other pictures, Designing slides shows, Running and controlling a slid show, Printing Presentations. |
| 9.   | <b>Internet and Email:</b><br>Use of Internet and Email, Internet, Websites (Internet Sites), The Mail protocol suite.   |
| 10.  | <b>Hospital Management System:</b><br>Types and Uses, Hospital Management & System Package, Advanced Hospital Management System, X O Hospital Management System, LCS Hospital Management Information System, NVISH Hospital Management System, CSPM-Hospital Management System.  |

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Foundations of computing first edition, 2002: P.K. Sinha and P. Sinha.
- B. Microsoft office 2000 for window, second Indian Print, person education S. Sagman.

**PATIENT CARE RELEVANT TO DIAGNOSTIC RADIOLOGY -102T**

| UNIT | CONTENTS  |
|------|---|
| 1    | <b>Radiological Contrast Agents:</b><br>Opaque agents and gases-<br>Relationship of x-ray transmission to density and atomic number of the elements of contrast medium.<br>Types of Barium Sulphate Solutions, Concentration and its particular uses, Flavouring agents.  |
| 2    | <b>Iodine Preparation:</b><br>Organic compounds, Water - soluble group; Significance of iodine content, Proprietary preparations, Iodised oil, Application of various systems of human body , Volume, Contra-indications, Methods of administration and route.  |
| 3    | <b>Iodine Preparation II:</b><br>Sensitivity test, Side effects and management, Elimination from the body.<br>Gases- Air, Oxygen and Carbon dioxide application and dangers.  |
| 4    | <b>Emergencies in the X-ray Department and Management:</b><br>External defibrillation, Direct cardiac massage, Internal defibrillation<br>Complications-<br>Cardiac arrest, Respiratory arrest. Bronchography<br>Local anaesthetics-<br>Reactions, Treatment.   |
| 5    | <b>Special Procedures in Diagnosis Radiology:</b><br>The Gastro intestinal tract-<br>Barium meal, Barium swallow, Small bowel enema, Barium enema<br>The Renal tract-<br>Intravenous urography, Intravenous cholangiography, Operative and post operative cholangiography, Percutaneous transhepatic cholangiography. |
| 6    | <b>Special Procedures in Diagnosis Radiology-II:</b><br>The Respiratory tract-<br>Bronchography, Gynecology, Hysterosalpingography<br>Cardio Vascular System-<br>Angiography, Aortography, Cerebral angiography, Splenoportovenography  |

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|  | The Lymphatic System-<br>Lymphangiography<br>Central Nervous System-<br>Myelography, Sialography<br>Ultrasound +Guided procedures<br>General preparation, Care<br>CT scan+guided procedures<br>Safety measures<br>MRI. |
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**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Care of patient in diagnostic Radiography Chesney & Chesney (Blackwell Scientific)
- B. Chesney's Care of the patient in Diagnostic Radiography Pauline J Clumer (Black well Scientific)
- C. Aid to Tray and Trolley Setting Marjorie Houghton (Bacilliere)
- D. First Aid Haugher & Gardner (Hamlyn)

## **RADIATION PHYSICS AND MODERN IMAGING TECHNIQUES-I-103T**

| UNIT | CONTENTS   |
|------|--|
| 1    | <b>Radiography:</b><br>Primary radiological image produced by Contrast Media Attenuation<br>Linear and Mass Attenuation<br>Coefficient factors affecting attenuation<br>Application in radiology<br>Filters-<br>Inherent and Added Filters, Heavy metal filters<br>X-ray beam restrictor aperture diaphragm cones and cylinder collimators<br>Function of restrictors. |
| 2    | <b>Scattered Radiation:</b><br>Significance of Scatter Grid principle- design and type<br>Evaluation of grid performance lead content<br>Grid cut off<br>Moving grids<br>Grid selection<br>Air gap technique.  |

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|---|---|
| 3 | <b>Fluoroscopy Equipment:</b><br>Direct fluoroscope<br>Image intensifier design<br>Brightness gain<br>Imaging characteristics<br>Multi field image intensifiers<br>Close circuit television scanning- Television image quality<br>Fluoroscopic image recorder<br>TV image records.  |
| 4 | <b>Radiographic Image:</b><br>Image clarity contrast<br>Factors affecting contrast<br>Image quality<br>Mottle sharpness and resolution<br>Line spread function, Modulation transfer function<br>Noise and wiener spectrum<br>Magnification Distortion<br>penumbra unsharpness<br>Inverse square law<br>Evaluation of resolution<br>Quantum mottle patient exposure. |
| 5 | <b>Body Section Radiography:</b><br>Basic methods of Tomography, Terminology, Blurring section thickness, Narrow and Wide angle Tomography, Circular Tomography.<br>Topographic motions<br>Phantom Image Tomography<br>Angel Determination.   |

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Physics for Radiographer-Hay & Hughes.
- B. Fundamental of X-ray and Radium Physics-Joseph Selman
- C. Basic Medical Radiation Physics-Stanton
- D. [rsstudents.files.wordpress.com/2008/03/fluoroscopy.ppt](http://rsstudents.files.wordpress.com/2008/03/fluoroscopy.ppt)

## **RADIOGRAPHY AND DARK ROOM TECHNIQUES- 104T**

| UNIT | CONTENTS   |
|------|--|
| 1    | <b>X-ray Materials:</b><br>Types of emulsion-characteristic and control<br>Screen and non-screen films<br>Dental films<br>X-ray paper<br>Under and Over exposure speed contrast. |
| 2    | <b>Intensifying Screens:</b>   |

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|    | Fluorescence<br>Application of fluorescence in Radiography<br>Types of Intensifying screens and Intensifying factors<br>Cleaning and general care of screen-after glow.  |
| 3  | <b>X-ray Cassettes</b><br>Testing and proving good screen<br>Contract, General care.   |
| 4  | <b>X-ray Developers:</b><br>Characteristics, Details and contrast<br>Freedom from chemical fog and staining<br>Function and constituent of developer<br>Standardization by time and temperature<br>Exhaustion of developer   |
| 5  | <b>Replenishes:</b><br>Powder and liquid solution - Radium and high contrast developer<br>Ultra rapid development methods<br>Automatic processing.   |
| 6  | <b>X-ray Fixers and Fixing:</b><br>Fixing agent's<br>Acid and preservative in fixer<br>Inclusion of hardener<br>Time of fixation<br>Silver recovery.   |
| 7  | <b>Rinsing, Washing and Drying:</b><br>Objects<br>Methods employed<br>Methods of drying films  |
| 8  | <b>Processing:</b><br>Preparation of solution<br>Suitable water supply<br>Nature of mixing vessels<br>Order mixing solutions<br>Filtrations<br>Making of stock solutions<br>Storage of dry chemical<br>Storage of solution.  |
| 9  | <b>Processing Apparatus:</b><br>Processing units<br>Hanger's, Care of hanger's, Refrigeration and use of ice.  |
| 10 | <b>OT Processing:</b><br>Operation theatre processing, Dish units.   |
| 11 | <b>Technical and Processing faults:</b><br>Chemical reduction<br>Chemistry and characteristics of Farmer's reducer<br>Local and general application.   |
| 12 | <b>X-Ray Dark Room:</b><br>Size, Light proof entrance, Hatches, Construction of walls of protection against chemical and Radiation, Ceiling, Colour Schemes, Waterproofing of floors, Loading bench design, Disposition of processing and accessory, Equipment for efficient working, Arrangement of |



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|    | drying cabinets in Dark Room or in adjacent room, Dark Room illumination and testing for safety, Ventilation.  |
| 13 | <b>The Radiographic Image:</b><br>Radiographic factors affecting image contrast and sharpness<br>Variation in exposure time in accordance with quality of Radiation filters, Distance, Intensifying screens, Grids, Film Speed, Developer and Development.   |
| 14 | <b>Presentation of Radiograph:</b><br>Identification of films<br>Aspect for direct and stereo (univeraprimatic) viewing<br>Mounting dental films<br>Accessories-<br>Viewing boxes, Spot light illuminator, Projectors and viewing screens for miniature and cine radiography, magnifiers, Film identification, Lead letters and numbers, Actinic marker embossing machine, Film trimmers, Corner cutters, Dental mounts and cutter, Filling units. |
| 15 | <b>Dark Room Procedures and Techniques:</b><br>Dark room adaptation techniques<br>Safe light test, Preparation of developer<br>Fixer And its chemistry<br>Design and planning of dark room, processing of exposed films, care of intensifying screens, storage of unexposed films<br>Accessories of dark room-<br>AFP tech. Dry camera and presentation of films etc.<br>Manual and automatic processing, AFP tech. and presentation of films etc. |

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Physics for Radiographer-Hay & Hughes.
- B. Fundamental of X-ray and Radium Physics-Joseph Selman
- C. Basic Medical Radiation Physics-Stanton

## **HUMAN ANATOMY & PHYSIOLOGY- 105T**

| UNIT | CONTENTS   |
|------|--|
| 1.   | <b>The Human Body:</b><br>Definitions, sub-divisions of Anatomy, Terms of location and position, Fundamental planes, Vertebrate structure of man, Organization of the body cells, Tissues.   |
| 2.   | <b>The Skeletal System:</b><br>Types of bones, Structure and growth of bones, Name of all the bones and their parts. Joints classification, Types of movements with examples.<br><b>Division of the Skeleton-</b> Appendicle Skeleton, Axial Skeleton. |
| 3.   | <b>Anatomy of Circulatory System:</b><br>Heart Size, Position coverings, Chambers, Blood supply, Nerve supply, Blood vessels.<br>General plan of circulation, Pulmonary circulation<br>Names of Arteries and Veins, Their position.                    |

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|     | Lymphatic System General Plan.  |
| 4.  | <b>Anatomy of the Respiratory System:</b><br>Organs of respiratory, Larynx, Trachea, Bronchial Tree, Respiratory portion, Pleurae and Lungs, Brief knowledge of parts and position.   |
| 5.  | <b>Anatomy of the Digestive System:</b><br>Components of Digestive system, Alimentary tube, Anatomy of organs of Digestive tube, Mouth, Tongue, Tooth, Salivary glands, Liver, Biliary apparatus, Pancreas, Names and position and brief functions.   |
| 6.  | <b>Anatomy of the Nervous System:</b><br>Central nervous system, The Brain, hind brain, midbrain, forebrain, brief structure, locations, and peripheral nervous system, Spinal cord, Anatomy, functions, reflex – Arc, ménages. Injuries to spinal cord and brain.  |
| 7.  | <b>Anatomy of the Endocrine System:</b><br>Name of all endocrine glands their position, hormones, and their functions– pituitary, thyroid, parathyroid, adrenal glands, gonads & islets of pancreas.  |
| 8.  | <b>Anatomy of Excretory System and Reproductive System:</b><br>Kidneys location, gross structure, excretory ducts, urethras, urinary bladder, urethra, Male reproductive system, Testis, duct system, Female reproductive system, Ovaries Duct system, accessory organs.  |
| 9.  | <b>Blood:</b> Definitions, Composition, Properties and function of Blood, Haemogram (RBC, WBC, Platelet count, HB concentrations), Function of plasma proteins, Haemopoiesis. <b>Blood Group</b> –ABO and RH grouping, Coagulation & Anticoagulants.<br><b>Anemia</b> - Anemia causes effects & treatment, Body fluid compartments, composition, Immunity<br><b>Clotting</b> - Lymphoid tissue, Clotting factors, Mechanism of blood clotting, Disorders of white blood cells, Disorders of platelets, Disorders of clotting. |
| 10. | <b>Cardio Vascular System:</b><br>Function of cardiovascular system, Structure of cardiovascular system, Cardiac cycle, Functional tissue of heart & their function, Cardiac output, E.C.G., blood pressure, Heart Rate.  |
| 11. | <b>Respiratory System:</b><br>Function of Respiratory System, Functional (physiological), Anatomy of Respiratory system, Mechanism of respiration, Lung volumes & capacities, Transport of respiratory gases.   |
| 12. | <b>Digestive System:</b><br>Function of digestive system, Functional Anatomy of Digestive System, Composition and functions of all digestive juices, Movements of Digestive System (intestine), Digestion & absorption of carbohydrate, proteins & fats.  |
| 13. | <b>Functions of Nervous System:</b><br>Neuron – Conduction of impulses, Factors effecting, Synapse – Transmission, Reception, Reflexes, Ascending tracts, Descending tracts, Functions of various parts of the Brain, Cerebro Spinal Fluid (CSF), Composition, Functions & Circulation, Lumbar Puncture, Autonomic Nervous System – and its types, Functions of (ANS).  |
| 14. | <b>Special Senses:</b><br>Vision – Structure of Eye, function of different parts Refractive errors of and correction. Visual pathways, color vision & tests for color blindness. Hearing, structure and function of ear, mechanism of hearing, test for hearing (deafness).   |
| 15. | <b>Muscle Nerve Physiology:</b><br>Type of muscle, Structure of skeletal muscle, Sarcomere, Neuromuscular junction & transmission, Excitation & contraction coupling (mechanism of contraction).  |
| 16. | <b>Structure and Function of Skin:</b><br>Body temperature, Fever, Regulation of temperature.   |
| 17. | <b>Excretory System:</b><br>Excretory organs, Kidneys, Function, Nephron, Juxta Glomerular Apparatus, Renal Circulation, Mechanism of Urine Formation, Mechanism of Micturition, Cystometrogram, Diuretics, Artificial Kidney.  |

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| 18. | <b>Structure and Function of Reproductive System:</b><br>Male reproductive system, Spermatogenesis, Testosterone, Female reproductive system, Ovulation, Menstrual cycle, oogenesis, Tests for ovulation, Estrogen & progesterone, Pregnancy test, Parturition, Contraceptive, Lactation, Composition of milk, Advantages of breast feeding. |
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**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Text books of Physiology. Author: Guyton (Arthur C). Prism publishers Bangalore.
- B. Human Physiology. Author: Chatterjee (cc). Medical allied agency
- C. Concise Medical physiology. Author: Choudhary (Sujit km.). New central books Kolkata.
- D. Review Medical physiology. Author: Ganong. Application and Lange.

## **RADIATION PHYSICS AND MODERN IMAGING TECHNIQUES-I-106P**

| UNIT | CONTENTS   |
|------|--|
| 1    | Practical I-<br>Practical of measuring instruments<br>Ionisation chamber<br>TLD measuring technique-Focal spot measurement, KV measurement<br>Linearity of mA station<br>Tube centering<br>Radiographic tech. of whole body, all sp. Investigations imaging, etc.<br>Table top dose measurement in fluoroscopy<br>Image distortion of IITV<br>Leakage of radiation through lead flaps<br>Radiation level measurement during tube, Above table and Below table<br>Removal of grids. |

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Physics for Radiographer-Hay & Hughes.
- B. Fundamental of X-ray and Radium Physics-Joseph Selman
- C. Basic Medical Radiation Physics-Stanton

## **RADIOGRAPHY AND DARK ROOM TECHNIQUES – 107P**

| UNIT | CONTENTS  |
|------|---|
| 1    | Practical I-<br>Dark room adaptation techniques<br>Safe light test, Preparation of developer<br>Fixer And its chemistry<br>Design and planning of dark room, processing of exposed films, care of intensifying screens, storage of unexposed films<br>Accessories of dark room-<br>AFP tech. Dry camera and presentation of films etc.<br>Manual and automatic processing, AFP tech. and presentation of films etc. |

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Physics for Radiographer-Hay & Hughes.
- B. Fundamental of X-ray and Radium Physics-Joseph Selman
- C. Basic Medical Radiation Physics-Stanton

**PATIENT CARE RELEVANT TO DIAGNOSTIC RADIOLOGY- 108P**

| UNIT | CONTENTS   |
|------|--|
| 1    | Practical I-<br>Practical knowledge of patient care<br>Measuring of pulse, Measuring of BP<br>Preparation for radiological investigations, Contrast media application, reaction management, allergy test<br>Care of Anaesthetic patient<br>Knowledge of catheterization<br>Oxygen administration, Biopsy Method, Sympathetic and behavioral treatment<br>Care of ambulatory patients<br>Care of pregnant patient<br>Non cooperating child<br>Dignity of patient etc. |

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Care of patient in diagnostic Radiography Chesney & Chesney (Blackwell Scientific)
- B. Chesney's Care of the patient in Diagnostic Radiography Pauline J clumer (Black well Scientific)
- C. Aid to Tray and Trolley Setting Marjorie Houghton (Bacilliere)

## **HOSPITAL TRAINING-I-109**

### **YEAR II**

### **ENVIRONMENTAL & BIOMEDICAL WASTE MANAGEMENT- 201T**

| <b>UNIT</b> | <b>CONTENTS</b>  |
|-------------|--|
| 1           | <b>Environment Introduction:</b><br>Biotic and Abiotic environment, Adverse effects of Environmental Pollution, Control Strategies, Various Acts and Regulation.   |
| 2           | <b>Water Pollution:</b><br>Water Quality Standards for potable water, Surface and underground water sources, Impurities in water and their removal, Denomination, Adverse effects of domestic waste water and industrial effluent to surface water sources, Eutrophication of lakes, Self purification of streams. |
| 3           | <b>Air Pollution:</b><br>Sources of air contaminations, Adverse effects on human health, Measurement of air quality standards and their permissible limits, Measure to check air pollution, Greenhouse effect, Global warming, Acid rain, Ozone depletion.   |
| 4           | <b>Bio Medical Waste Management:</b><br>Introduction to Bio-Medical Waste, Types of Bio-Medical Waste, Collection of Bio-Medical Waste, Treatment and safe disposal of Bio-Medical Waste.  |
| 5           | <b>Solid Waste Management:</b><br>Introduction to Solid Waste, Its collection and disposal, Recovery of resources, Sanitary land-filling, Vermin-composting, Hazardous waste management.   |
| 6           | <b>Land Pollution:</b><br>Soil Conservation, Land Erosion, Aforestation, Ecology Business of Species, Biodiversity, Population Dynamics, Energy flow, Ecosystems   |
| 7           | <b>Social Issues and the Environment:</b><br>Sustainable development and life style, Urban problems related to energy, Resettlement and rehabilitating of people, Environmental ethics, Consumerism and waste products, Water Harvesting and Rural Sanitation-   |

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|  | Water harvesting techniques, Different schemes of Rural Water Supply in Rajasthan, Rural Sanitation, Septic Tank, Collection and disposal of wastes, Bio-gas, Community Awareness and participation, Miscellaneous, Non-Conventional (Renewable) sources of energy, Solar energy, Wind energy, Bio-mass energy, Hydrogen energy. |
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**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Paryavaran Shiksha. Author : Dr. A.N. Mathur, Dr. N.S. Rathore, Dr. V.K. Vijay.
- B. Paryavaran Adhyayan. Author : Dr. Ram Kumar Gujar, Dr. B.C. Jat
- C. Parayavaran Avabodh. Author : Dr. D.D. Ojha.
- D. Environmental Chemistry and Pollution Control. Author : S.S. Dora
- E. Ecology concepts and application. Author : Manuel C. Muller.

## **RADIATION PHYSICS AND MODERN IMAGING TECHNIQUES-II 202T**

| UNIT | CONTENTS   |
|------|--|
| 1    | <b>Radiography:</b><br>Primary radiological image produced by Contrast Media Attenuation<br>Linear and Mass Attenuation coefficient<br>Factors affecting attenuation<br>Application in radiology<br>Filters-<br>Inherent and Added Filters, Heavy metal filters<br>X-ray beam restrictor aperture diaphragm cones and cylinder collimators<br>Function of restrictors. |
| 2    | <b>Scattered Radiation:</b><br>Significance of Scatter Grid principle- design and type<br>Evaluation of grid performance lead content<br>Grid cut off<br>Moving grids<br>Grid selection<br>Air gap technique.  |
| 3    | <b>Fluoroscopy Equipment:</b><br>Direct fluoroscope<br>Image intensifier design<br>Brightness gain<br>Imaging characteristics<br>Multi field image intensifiers<br>Close circuit television scanning- Television image quality<br>Fluoroscopic image recorder<br>TV image records.   |
| 4    | <b>Radiographic Image:</b><br>Image clarity contract<br>Factors affecting contrast<br>Image quality  |

|   |  |
|---|--|
|   | Mottle sharpness and resolution<br>Line spread function, Modulation transfer function<br>Noise and wiener spectrum<br>Magnification Distortion<br>penumbra unsharpness<br>Inverse square law<br>Evaluation of resolution<br>Quantum mottle patient exposure.   |
| 5 | <b>Body Section Radiography:</b><br>Basic methods of Tomography, Terminology, Blurring section thickness, Narrow and Wide angle Tomography, Circular Tomography.<br>Topographic motions<br>Phantom Image Tomography<br>Angel Determination.  |
| 6 | <b>Mammography:</b><br>Technical aspects of Mammography<br>Generator x-ray tubes, Accessories, Resolutions and quality control<br>Application and role in medicine.  |
| 7 | <b>Ultrasound:</b><br>Physical characteristics of sound transducer<br>Characteristics of ultrasound<br>Beam interaction of Ultrasound with Matter<br>Quarter wave matching<br>Ultrasonic display imaging principles<br>Doppler technique<br>Ultrasound instrumentation, Bio effect and Safety consideration. |

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Physics for Radiographer-Hay & Hughes.
- B. Fundamental of X-ray and Radium Physics-Joseph Selman
- C. Basic Medical Radiation Physics-Stanton

## **QUALITY ASSURANCE IN DIAGNOSTIC RADIOLOGY-203T**

| UNIT | CONTENTS   |
|------|--|
| 1.   | <b>QA Activities:</b><br>Equipment selection phase, Equipment installation and acceptance phase, Operational phase, Preventive maintenance.  |
| 2.   | <b>QA Programme at Radiological Faculty Level:</b><br>Responsibility, Purchase, Specifications, Acceptance's Routine testing, Evaluation of results of routine testing, Record keeping Quality assurance practical exercise in the X ray |

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|    | generator and tube, Image receptors from processing, Radiographs equipments Fluoroscopic equipments, Mammographic equipments, Conventional tomography, Computed tomography, Film processing, Manual and automatic, Consideration for storage of film and chemicals, Faults tracing<br>Accuracy of imaging-<br>Image distortion for digital imaging devices.  |
| 3. | <b>QA Programmed Test:</b><br>Light beam alignment, X-ray out-put and beam quality check KVp check, Focal spot size and angle measurement, Timer check, MAs test, Grid alignment test, High and low contrast resolutions, Mechanical and electrical checks, Test, Field alignment test for fluoroscopic device, Resolution test.<br>Phantom measurements-CT, US and MRI.   |
| 4. | <b>QA of Film and Image Recording Devices:</b><br>Sensitometry, Characteristic curve, Film latitude, Film contrast, Film speed Resolution, Distortion, Artifacts of films and image recording<br>Maintenance and care of equipment: Safe operation of equipment-<br>Routine cleaning of equipment and instruments-<br>Cassette, Screen maintenance of automatic processor and manual processing units, Routine maintenance of equipments, Records keeping and log book, Maintenance, Reject analysis and objective of reject analysis programme. |

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Quality assurance in Diagnostic Radiology By J.M. Mcolemore (Year book of Medical Publishers)
- B. Quality Control in diagnostic imagine” By J.E. Gray (University Park Press)
- C. Processing and Quality Control “ By: William E.J. Mckinney (J.B. Lippincott Company)
- D. Reading 4 - Concepts in Medical Radiographic imagine” By: Marianne Tortoic (W.B. Saunders Company)

## **RADIATION HAZARDS, PREVENTION & SAFETY-204T**

| UNIT | CONTENTS   |
|------|--|
| 1    | <b>Radiation Protection:</b><br>Principles<br>History & development-National & international agencies, AERB, BARC, ICRP, WHO,IAEA and their role<br>Equivalent dose, effective dose sievert-rem<br>Sources of radiation-natural man made & internal exposures. |
| 2    | <b>Biological effects of Radiation:</b><br>Effects on cell-stochastic & deterministic effects-radiation risk-tissues at risk-genetic,  |



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|---|---|
|   | Somatic& fetus risk-risk at other industries<br>Dose equivalent limits-Philosophy-ICRP (60) Concepts-AERB guidelines.   |
| 3 | <b>Planning of Radiation Installation:</b><br>Protection primary leakage and scattered radiation<br>Concepts of workload-Use factor, Occupancy factor & distance<br>Barrier design- Barrier materials-concrete, brick & lead<br>Primary & secondary barrier design calculations<br>Design of doors<br>Control of radiation-Effects of time, Distance and shielding.                               |
| 4 | <b>Personnel Monitoring Systems:</b><br>Principle and objective-film badge-guidelines for use-Thermo luminescent dosimeter, Badge-pocket dosimeter<br>Area monitoring and radiation survey-<br>Practical use of survey meter, Zone monitors and phantoms, Survey in x-ray, fluoroscopy and CT scan units.   |
| 5 | <b>AERB Safety, Code and Ethics:</b><br>Built in safety specification for diagnostic x-ray, fluoroscopy and CT units<br>Specification for radiation protection devices-room layout<br>Operational Safety-<br>Radiation protection programme-Personnel requirements and responsibilities-Regulatory controls.  |
| 6 | <b>Patient Protection:</b><br>Safe work practice in diagnostic radiology-<br>Radiation absorbed dose from general, Dental, Fluoroscopy X-ray and CT examinations-X-ray examinations during pregnancy, X-ray examinations associated with illness, not associated with illness-medico-legal or insurance purpose x-ray examination-medical research x-ray avoidance of unnecessary radiation dose. |
| 7 | <b>Patient Protection II:</b><br>Radiation emergencies-situation preparedness, Safety and prevention-legal requirements<br>Recent developments in radiation safety related topics.  |

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Radiation Protection in Hospital. Richard F. Mould
- B. Basic radiological physics. Jaypee bothers pvt. Ltd New Delhi
- C. An Introduction to Radiation Protection Allen Martin “& Samuel
- D. Radiation safety in Medical practice. M.M. Rechami

## **GENERAL PRINCIPLES OF HOSPITAL PRACTICE AND PATIENT CARE- 205T**

| UNIT | CONTENTS  |
|------|---|
| 1    | <b>Hospital Procedure:</b><br>Hospital staffing and organization, Records relating to patients and departmental statistics, Professional attitude of the technologist to patient and other members of the staff, Medico legal aspects, Accident in the department, Appointment, Organization, Minimizing waiting time, Outpatient and follow ups to clinics, Stock taking and Stock keeping.  |
| 2    | <b>Care of the Patient:</b><br>First contact with patients in the department, Management of chair and stretcher, Patients and aids for this, Management for the unconscious patient, Elementary hygiene, Personal cleanliness, Hygiene in relation to patient (for example clean linen and receptacles), Nursing care, Temperature, Pulse and Respiration, Essential care of the patient who has a Tracheotomy, Essential care of the patient who has Colostomy, Bedpans and Urinals, Simple application of a Sterile Dressing. |
| 3    | <b>Aims and Objective of First Aids:</b><br>Wounds and bleeding, Dressing and bandages, Pressure and splints, Supports etc., Shock insensibility, Asphyxia, Convulsions, Resuscitation.<br>Use of suction apparatus, Drug reactions, Prophylactic measures, Administration of oxygen, Electric shock, Burns, Scalds, Hemorrhage, Pressure points, Compression Band, Fracture, Splints, Bandaging, Dressing, Foreign bodies poisons.   |
| 4    | <b>Infection:</b><br>Bacteria their nature and appearance, Spread of infections, Auto infection or Cross infection, The inflammatory process, Local tissue reaction, General body reaction, Ulceration aspects and Antisepsis.  |
| 5    | <b>Principles of Asepsis:</b><br>Sterilization, Methods of sterilization, Use of central sterile supply, Departmental care and Identification of Instruments, Surgical dressings in common use including Filament Swabs, Elementary Operating Theatre procedure, Setting of trays and trolleys in the Radiotherapy Department.  |
| 6    | <b>Departmental Procedures:</b><br>Department staffing and organization, Records relating to patients and departmental statistic, Professional attitude of the technologist to patient and other members of the staff, Medico legal aspects, Accidents in the department, Appointment, Organization, Minimizing waiting time, Outpatient and follow ups to Clinic, Stock taking and Stock keeping.  |
| 7    | <b>Drugs in the Department:</b><br>Storage, Classification, Labeling and checking, Regulations regarding dangerous and other drugs, Units of measurement, Special drugs, Anti Depressive and Antihypertensive etc.  |

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Deeley-A guide to Radiotherapy nursing Living stone
- B. Care of patient in diagnostic Radiography Chesney & Chesney
- C. Chesney's Care of the patient in Diagnostic Radiography Pauline J.Culmer.
- D. Aid to Tray and Trolley Setting Marjorie Houghton

## **QUALITY ASSURANCE IN DIAGNOSTIC RADIOLOGY- 206P**

| UNIT | CONTENTS   |
|------|--|
| 1    | Practical I-<br>Practical of QA & QC<br>Knowledge of QA & QC test equipments<br>Various parameters of acceptance test of machine—KV, MA , time, x-ray output etc.<br>Inventory of machines X– ray tubes, cassettes, films etc.<br>AMC/ CMC records and review<br>Performance of machines as far as image quality<br>Grid test, Fluoroscopy device test, Phantom test, Sensitivity test, LBD test etc.<br>Resolution test of CT, MRI and USG<br>Use of Sensitometer and Densitometer. |

**LEARNING SOURCE:** Self Learning Materials

### **ADDITIONAL READINGS:**

- A. Quality assurance in Diagnostic Radiology” By J.M. Mcolemore (Year book of Medical Publishers)
- B. Quality Control in diagnostic imagine” By J.E. Gray (University Park Press)
- C. Processing and Quality Control “ By: William E.J. McKinney (J.B. Lippincott Company)
- D. Concepts in Medical Radiographic imagine” By: Marianne Tortoic (W.B. Saunders Company)

## **RADIATION HAZARDS, PREVENTION AND SAFETY- 207P**

| UNIT | CONTENTS   |
|------|--|
| 1    | Practical I-<br>Practicals based on Radiation Hazards & control safety<br>Knowledge of all hazards<br>Education of general public by posters and seminars<br>Safety of women and children , Pregnant women, Safety of patient attendants<br>Non radiation workers hospital staff<br>Checking of lead aprons<br>Leakage radiation from tube head<br>Radiation survey in and around X – ray installation<br>Use of TLD film badges and use of protective devices etc<br>Keeping of dose records of radiation workers<br>Steps after high exposure report and investigations. |

**LEARNING SOURCE:** Self Learning Materials

### **ADDITIONAL READINGS:**

- A. Radiation Protection in Hospital. Richard F. Mould Reference book
- B. Basic radiological physics. Jaypee brothers pvt. Ltd New Delhi
- C. An Introduction to Radiation Protection Allen Martin “& Samuel
- D. Radiation safety in Medical practice. M.M. Rechami

## **RADIATION PHYSICS AND MODERN IMAGING TECHNIQUES-II– 208P**

| UNIT | CONTENTS   |
|------|--|
| 1    | Practical I-<br>Practical of measuring instruments<br>Ionisation chamber<br>TLD measuring technique-Focal spot measurement, KV measurement<br>Linearity of mA station<br>Tube centering<br>Radiographic tech. of whole body, all sp. Investigations imaging, etc.<br>Table top dose measurement in fluoroscopy<br>Image distortion of IITV<br>Leakage of radiation through lead flaps<br>Radiation level measurement during tube, Above table and Below table<br>Removal of grids. |

**LEARNING SOURCE:** Self Learning Materials

### **ADDITIONAL READINGS:**

- A. Physics for Radiographer-Hay & Hughes.
- B. Fundamental of X-ray and Radium Physics-Joseph Selman
- C. Basic Medical Radiation Physics-Stanton

## **HOSPITAL TRAINING-II-209**