



## DIPLOMA IN RADIATION TECHNOLOGY - DRT10

- Eligibility : 10<sup>TH</sup>
- Programme Duration : 3 Years
- Programme Objectives : Radiography is the art and science of producing medical images using x-radiation. Technologists produce images for the radiologists 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 Radiography 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 DRT include: Technician in Hospitals, Nursing Homes and Diagnostic Labs

**YEAR I**

<b>Course Code</b>	<b>Course Title</b>	<b>Theory/ Practical</b>	<b>Continues Assessment (Internals)</b>	<b>Credits</b>
THEORY	Communication For Professionals	70	30	4
THEORY	Basic Human Anatomy & Physiology	70	30	5
THEORY	Basic Biochemistry	70	30	5
THEORY	Basic Microbiology	70	30	5
THEORY	Radiation Physics and Modern Imaging Techniques	70	30	5
PRACTICAL	Basic Human Anatomy & Physiology	35	15	1
PRACTICAL	Radiation Physics and Modern Imaging Techniques	35	15	1
PRACTICAL	Basic Microbiology	35	15	1
PRACTICAL	Hospital Training 45 Days after final examinations	200		1
			<b>TOTAL</b>	<b>28</b>

**YEAR II**

<b>Course Code</b>	<b>Course Title</b>	<b>Theory/ Practical</b>	<b>Continues Assessment (Internals)</b>	<b>Credits</b>
THEORY	Fundamentals of Computer Science	70	30	4
THEORY	Basics of Radiation Physics	70	30	5
THEORY	Radiation Physics and Modern Imaging Techniques	70	30	5
THEORY	Radiography and Dark Room Techniques	70	30	5
THEORY	Human Anatomy & Physiology	70	30	5
PRACTICAL	Radiation Physics and Modern Imaging Techniques	35	15	1
PRACTICAL	Radiographic and Dark Room Techniques	35	15	1
PRACTICAL	Human Anatomy & Physiology	35	15	1

PRACTICAL	Hospital Training 45 days after final examination	200		1
			TOTAL	28

**YEAR III**

Course Code	Course Title	Theory/ Practical	Continues Assessment (Internals)	Credits
THEORY	Environmental & Bio Medical Waste Management	70	30	4
THEORY	Patient care relevant to Diagnostic Radiology	70	30	5
THEORY	Quality Assurance in Diagnostic Radiology	70	30	5
THEORY	Radiation Hazards Prevention and Safety	70	30	5
THEORY	General Principles of Hospital Practice and Patient Care	70	30	5
PRACTICAL	Patient care relevant to Diagnostic Radiology	35	15	1
PRACTICAL	Quality Assurance in Diagnostic Radiology	35	15	1
PRACTICAL	Radiation Hazards, Control and Safety	35	15	1
PRACTICAL	Hospital Training 45 days after final examination	200		1
			TOTAL	28

## 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

### COMMUNICATION FOR PROFESSIONALS

UNIT	CONTENTS
1.	Parts of speech - (definition of all the sight parts along with examples and their use in language), definite and indefinite articles (a. an and the), definition and its uses along with examples and personal, reflexive, emphatic, demonstrative, relative, indefinite, interrogative and distributive pronouns, the noun (defining noun along with types and categories), gender, number case, the adjective, comparison, adjective used as nouns, positions of the adjective and its correct use of adjectives, the verb definition. its forms, verbs of incomplete predication, phrases (defining it along with examples), adjective, adverb and noun phrase and clauses (defining it along with examples), adverb, adjective and noun clauses, the sentence and its types, simple, compound and complex, subject and predicate (parts of a sentence), transformation of sentences, active and passive voice, mood and narration (direct and indirect speeches).
2.	Words and phrases - word formation (prefix, suffix), idioms, synonyms and antonyms, phonetics, speech sound, the phoneme, the syllable and IPA transcription.
3.	Business correspondence, paragraph writing, introductory remarks, principles, the writing of single paragraphs and precise writing, letter writing, quotations, orders and tenders, inviting and sending quotations, placing orders and inviting tenders.
4.	Notices, agenda and minutes, application letter, importance and function, drafting the application, elements structure, preparing cvs.
5.	Applied grammar - correct usage, the structure of sentences, the structure of paragraphs, enlargements of vocabulary.
6.	Written composition, precise writing and summarizing, writing of bibliography, enlargement of vocabulary.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. English Grammar and Composition Wren and Martin. S. Chand & Company Ltd.
- B. Intermediate English Grammar; Raymond Murphy Pub: Foundation Books, New Delhi
- C. Eng. Grammar usage and Composition; Tickoo & Subramanian Pub: S. Chand and Co.
- D. Living Eng. Structure; Standard Alien.

## **BASIC HUMAN ANATOMY & PHYSIOLOGY**

UNIT	CONTENTS
1.	The Human Body - Definitions, sub-divisions of Anatomy, Terms of location and position, fundamental planes, vertebrate structure of man, organization of the body cells, Tissues.
2.	The Skeletal System - Types of bones, structure and growth of bones, Division of the skeleton Appendicle skeleton, axial skeleton name of all the bones and their parts. Joints classification, types of movements with examples.
3.	Anatomy of Circulatory System - Heart Size, position coverings, chambers, Blood supply, never supply, the blood vessels, general plan of circulation, pulmonary circulation, Names of arteries and veins and their position - lymphatic system general plan.
4.	Anatomy of the respiratory System - Organs of respiratory, Larynx, trachea, bronchial tree, Respiratory portion, Pleurae and lungs, Brief knowledge of parts and position.
5.	Anatomy of the Digestive System - 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.	Anatomy of the Nervous System - 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.	Anatomy of the endocrine system - Name of all endocrine glands their position, hormones, and their functions– pituitary, thyroid, parathyroid, adrenal glands, gonads & islets of pancreas.
8.	Anatomy of Excretory system and reproductive system - 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.	Blood - Definitions, composition, properties and function of Blood, Haemogram (RBC, WBC, Platelet count, HB concentrations), Function of plasma proteins Haemopoiesis, Blood Group – ABO and RH grouping, Coagulation & Anticoagulants, Anemia causes effects & treatment, Body fluid compartments, composition, Immunity Lymphoid tissue, Clotting factors, mechanism of blood clotting, Disorders of white blood cells, Disorders of platelets, Disorders of clotting.
10.	Cardio vascular system - 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.	Respiratory system - Function of respiratory system, functional (physiological), Anatomy of Respiratory system, Mechanism of respiration, lung volumes & capacities, Transport of respiratory gases.
12.	Digestive system - 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.	Muscle Nerve Physiology - Type of muscle, structure of skeletal muscle, Sarcomere, Neuromuscular junction & transmission, Excitation and contraction coupling (mechanism of contraction).
14.	Structure and function of skin - body temperature, fever, regulation of temperature.
15.	Excretory system - Excretory organs, kidneys, function, Nephron, Juxta Glomerular apparatus, renal circulation, mechanism of urine formation, mechanism of micturition, cystometrogram, diuretics, artificial kidney.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

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

**BASIC BIOCHEMISTRY**

UNIT	CONTENTS
1.	Introduction to medical lab technology - General introduction role of medical lab technologist's ethics, responsibility safety measures and first aid, Cleaning and care of general laboratory glassware and equipments.
2.	Distilled water - Types of distilled water plants preparation & storages.
3.	Analytical balance - principle & maintenance, preparation of reagents.
4.	Standard Solutions - Various std, solutions used their preparation & storage of chemicals.
5.	Units of measurements - S.I. units, Definitions conversions, Measurement of volume, Strength Normality.
6.	Molarity, Molality: volumetric apparatus calibration of volumetric apparatus.
7.	Carbohydrate - Definition, classification, functions, properties and osazone formation.
8.	Proteins and amino acids - Definition, classification, functions and chemical reactions.
9.	Nucleic acids - Definition, types and functions.
10.	Lipids - Definition, Classification, function of lipids and lipoproteins.
11.	Enzyme - Definition, classification, factors affecting enzyme action, inhibition Diagnostic importance of enzymes and isoenzymes.
12.	Carbohydrate metabolism - Definition and importance of Glycolysis, Glycogenesis, Glycogenolysis, Gluconeogenesis, Kreb's cycle, Cori;s Cycle.
13.	Blood glucose regulation - glycosuria, glucose tolerance tests, protein metabolism.
14.	Deamination and Transamination and Urea formation.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Reading 1 .....
- B. Reading 2.....

**BASIC MICROBIOLOGY**

UNIT	CONTENTS
1.	Introduction and Brief History of microbiology - Definition History and relationship of

	micro org. to man Safety measures in microbiology.
2.	Culture media - Preparation of various media, Standardization and use Sterilization, Definition, Different methods and principles-Moist heat dry heat Radiation & filtration, Autoclave-its structure functioning control & indicators .
3.	Antiseptics and disinfectants - Definition types, mode of action & properties, uses of disinfectant & antiseptics, testing efficiency.
4.	Glassware - Description of glassware its use handling and care.
5.	Principle of Grams & AFB staining,
6.	Aerobic and anaerobic culture methods.
7.	General characters and nature of antigen and antibody, Principle of antigen antibody reaction.
8.	Collection transportation and processing of clinical samples for microbiological investigations.
9.	Laboratory organization management recording of results and quality control in microbiology.
10.	Introduction to virology, physiochemical characteristics of viruses.
11.	General characters and classification of protozoa of medical importance.
12.	Systemic microbiology - identification of bacteria micrococci, staphylococci, pneumococci, corynebacteria, Escherichia coli, klebsiella, enterobacter, proteus, providencia salmonella, shigella, Arizona, citrobacter, Yersinia, pseudomonas, vibrio cholera, haemophilus, mycobacteria, buccella, bordetella, bacillus, clostridia, anaerobic cocci, neisseria, treponema, borrelia leptospria, mycoplasma, rickettsia, Chlamydia, trich agents.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Reading 1 .....
- B. Reading 2.....

## **RADIATION PHYSICS AND MODERN IMAGING TECHNIQUES**

UNIT	CONTENTS
1	Radiography - Primary radiological image produced by contrast media Attenuation Linear and mass attenuation coefficient Factors affecting attenuation application in radiology Filters inherent and added filters, Heavy metal filters-X-ray beam restrictor aperture diaphragm cones and cylinder collimators function of restrictors.
2	Scattered radiation - significance of scatter Grid principle design and type evaluation of grid performance lead content Grid cut off moving grids Grid selection air gap technique.
3	Direct fluoroscope Image intensifier design brightness gain Imaging characteristics multi field image intensifiers Close circuit television scanning television image quality Fluoroscopic image recorder TV image records.
4	Radiographic Image - Image clarity contrast factor affecting contrast Image quality mottle sharpness and resolution Line spread function Modulation transfer function Noise and wiener spectrum, Magnification distortion penumbra un sharpness inverse square law evaluation of resolution quantum mottle patient exposure.
5	Body section radiography - Basic method of tomography terminology blurring section thickness narrow and wide angle tomography circular tomography topographic motions phantom image tomography angle 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

**BASIC HUMAN ANATOMY & PHYSIOLOGY-(P)**

UNIT	CONTENTS
1	Practical's related to anatomy & physiology such as knowledge of surface anatomy of human body, Identification of bones and parts on x-ray film as radiological anatomy.
2	Preparing of charts of human all systems & structures of human body, Identification and knowledge of pathological specimens, Visit of anatomy & pathology museum.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Text books of Anatomy. Author: Guyton (Arthor C). Prism publishers Bangalore.
- B. Human Physiology. Author: Chaterjee (cc). Medical allied agency

**RADIATION PHYSICS AND MODERN IMAGING TECHNIQUES –  
(P)**

UNIT	CONTENTS
1	Practical of measuring instruments, ionisation chamber, TLD measuring technique, Focal spot measurement, KV measurement, linearity of mA station, Tube centring, Radiographic tech. of whole body, all sp. Investigations imaging, etc. Radiographic tech, of whole body, all sp. Investigations imaging, etc., table top dose measurement in fluoroscopy, image distortion of IITV, leakage of radiation through lead flaps, radiation level measurement during tube above table and below table, 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

## **BASIC MICROBIOLOGY– (P)**

UNIT	CONTENTS
1.	Compound Microscope.
2.	Demonstration and sterilization of equipments – Hot Air oven, Autoclave, Bacterial filters.
3.	Demonstration of commonly used culture media, Nutrient broth, Nutrient agar, Blood agar,
4.	Chocolate agar, Macconkey medium, LJ media, Robertson Cooked meat media, Potassium Telluride media with growth, Macconkey medium with LF & NLF, NA with staph.
5.	Antibiotic susceptibility test
6.	Demonstration of common serological tests – Widal, VRDL, ELISA.
7.	Grams staining
8.	Acid Fast staining
9.	Stool exam for Helminth ova
10.	Visit to hospital for demonstration of biomedical waste management.
11.	Anaerobic culture methods.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Reading 1 .....
- B. Reading 2.....

## **HOSPITAL TRAINING AFTER THE FINAL EXAMINATION 45 DAYS**

**YEAR II**

## **FUNDAMENTALS OF COMPUTER SCIENCE**

UNIT	CONTENTS
1.	Computer Application - Characteristic of computers, Input, output, storage units, CPU, Computers system.
2.	Computers Organization - Central Processing Unit, Control Unit, Arithmetic Unit, Instruction Set, Register, Processor Speed.
3.	Memory - 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.	Input Devices - 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.	Output Devices - Monitors, Printers, Dot Matrix Printers, Inkjet Printers, Laser Printers, Plotters, Computers Output Micro Files (Com), Multimedia Projector.
6.	Operating System - 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.	Word Processing - 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.	Presentation Package - 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.	Use of Internet and Email, Internet, Websites (Internet Sites), The Mail protocol suite.
10.	Hospital Management system - 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.

## **BASICS OF RADIATION PHYSICS**

UNIT	CONTENTS
1	Dosimeter and Radiation Biology - Radiation units, Exposure Coulombs/kg, Air Kerma-gray absorbed dose-gray, equivalent dose-sievert, Effective dose-sievert, Interaction mechanisms, Lionization excitation free radicals, Introduction to concept of linear energy transfer (LET).
2	Interactions of charged particles interaction of electromagnetic radiation Neutron interactions. Introduction to thermography and microwave equipment and interactions. Optical interaction ultra sound interactions.
3	Basic concepts of electromagnetic radiation - Electromagnetic waves Relationship between frequency and wavelength The electromagnetic spectrum sources of Electromagnetic radiation. Risks from occupational exposure-public, occupational exposure of pregnant women. Diagnostic reference levels (DRL)
4	Basics of NMR and MRI - Basic Nuclear Magnetic Resonance (NMR) nuclear magnetic

	moments effect of external magnetic field, Nuclear precession. Equilibrium magnetization significance of Radio frequency (RF) pulse OIMR) and microwave (EPR) Equipment, Resonance and Larmor frequency. Free induction Decay (FID)
5	Radiation detectors - Radiation protection-biological aspects, Measurement of detriment, ICRP frame work of radiological protection.
6	Nuclear medicine In vitro and in vivo testing gamma rays for imaging radio pharmaceuticals, Preparation and quality control chemistry and radio pharmacology of radionuclide's gamma Camera SPECT PET.
7	Ultrasound in medicine-Ultrasound imaging generation and detection of ultrasound propagation choice of frequency A-scan B-scan M-mode imaging and echo cardiography Use of Doppler techniques for blood flow etc.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. First year Physics for Radiographer-Hay & Hughes.
- B. Fundamental of X-ray and Radium Physics-Joseph Selman
- C. Basic Medical Radiation Physics-Stanton
- D. Christensen's Physics of Diagnostic Radiology-Christensen.

**RADIATION PHYSICS AND MODERN IMAGING TECHNIQUES**

UNIT	CONTENTS
1	Radiography - Primary radiological image produced by contrast media Attenuation Linear and mass attenuation coefficient Factors affecting attenuation application in radiology Filters inherent and added filters, Heavy metal filters-X-ray beam restrictor aperture diaphragm cones and cylinder collimators function of restrictors.
2	Scattered radiation - significance of scatter Grid principle design and type evaluation of grid performance lead content Grid cut off moving grids Grid selection air gap technique.
3	Direct fluoroscope Image intensifier design brightness gain Imaging characteristics multi field image intensifiers Close circuit television scanning television image quality Fluoroscopic image recorder TV image records.
4	Radiographic Image - Image clarity contrast factor affecting contrast Image quality mottle sharpness and resolution Line spread function Modulation transfer function Noise and wiener spectrum, Magnification distortion penumbra un sharpness inverse square law evaluation of resolution quantum mottle patient exposure.
5	Body section radiography - Basic method of tomography terminology blurring section thickness narrow and wide angle tomography circular tomography topographic motions phantom image tomography angle determination.
6	Mammography - Technical aspects of Mammography generator x-ray tubes Accessories Resolutions quality control Application and role in medicine.
7	Ultrasound - Physical characteristics of sound transducer characteristics of ultrasound beam interaction of ultrasound and matter quarter wave matching ultrasonic display imaging principles Doppler technique real time 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

**RADIOGRAPHIC AND DARK ROOM TECHNIQUES**

UNIT	CONTENTS
1	X-ray materials - Types of emulsion-characteristic and control screen and non-screen films dental films X-ray paper under and over exposure speed contrast.
2	Intensifying screens - Fluorescence application of fluorescence in Radiography type of intensifying screens intensifying factors cleaning and general care of screen after glow.
3	X-ray cassettes- Testing and proving good screen contract general care.
4	X-ray developers - Characteristics details and contrast freedom from chemical fog and staining function and constituent of developer standardization by time and temperature exhaustion of developer replenishes.
5	Powder and liquid solution - medium and high contrast developer ultra rapid development methods automatic processing.
6	X-ray fixers and fixing - Fixing agents acid and preservative in fixer inclusion of hardener time of fixation silver recovery.
7	Rinsing washing and drying - Object methods employed method of drying films.
8	Processing - Preparation of solution suitable water supply nature of mixing vessels order missing solutions filtrations making of stock solutions storage of dry chemical storage of solution.
9	Processing apparatus - Processing units hangers care of hangers refrigeration and use of ice.
10	Operation theatre processing, Dish units.
11	Technical and processing faults - Chemical reduction, Chemistry and characteristics of Farmer's reducer, local and general application.
12	X-ray Dark Room - Size light proof entrance hatches construction of walls for protection against chemicals and radiation ceiling color schemes water proofing of floors loading bench designing disposition of processing and necessary equipment for efficient working arrangement of drying cabinets in dark room or in adjacent rooms dark room illumination and testing for safety ventilation.
13	The Radiographic Image - Radiographic factors affecting image contrast and sharpens variation in exposure time in accordance with quality of radiation filters distance intensifying screens grids film speed developer and development.
14	Presentation of Radiograph - Identification of film aspect for direct and stereo (univeraprimatic) viewing mounting dental films, Accessories, Viewing boxes spot light illuminator projectors and viewing screens for miniature and cine radiography magnifiers film identification lead letter number actinic marker embossing machine film trimmers corner cutters dental mounts and cutter filling units.

15	Dark room procedures technique - Dark room adaptation techniques, safe light test, preparation of developer, fixer And its chemistry, design and planning of dark room, processing of exposed films, care of intensifying screens, storage of unexposed films, Accessories of dark room, AFP tech. dry camera and presentation of films etc. Chemistry for processing of exposed films manual and automatic processing, care of intensifying screens, storage of unexposed films, AFP tech. and presentation of films etc.
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**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**

UNIT	CONTENTS
1.	The Human Body - Definitions, sub-divisions of Anatomy, Terms of location and position, fundamental planes, vertebrate structure of man, organization of the body cells, Tissues.
2.	The Skeletal System - Types of bones, structure and growth of bones, Division of the skeleton Appendicle skeleton, axial skeleton name of all the bones and their parts. Joints classification, types of movements with examples.
3.	Anatomy of Circulatory System - Heart Size, position coverings, chambers, Blood supply, never supply, the blood vessels, general plan of circulation, pulmonary circulation, Names of arteries and veins and their position - lymphatic system general plan.
4.	Anatomy of the respiratory System - Organs of respiratory, Larynx, trachea, bronchial tree, Respiratory portion, Pleurae and lungs, Brief knowledge of parts and position.
5.	Anatomy of the Digestive System - 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.	Anatomy of the Nervous System - 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.	Anatomy of the endocrine system - Name of all endocrine glands their position, hormones, and their functions– pituitary, thyroid, parathyroid, adrenal glands, gonads & islets of pancreas.
8.	Anatomy of Excretory system and reproductive system - 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.	Blood - Definitions, composition, properties and function of Blood, Haemogram (RBC, WBC, Platelet count, HB concentrations), Function of plasma proteins Haemopoiesis, Blood Group – ABO and RH grouping, Coagulation & Anticoagulants, Anemia causes effects & treatment, Body fluid compartments, composition, Immunity Lymphoid tissue, Clotting factors, mechanism of blood clotting, Disorders of white blood cells, Disorders of platelets, Disorders of clotting.
10.	Cardio vascular system - 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.	Respiratory system - Function of respiratory system, functional (physiological), Anatomy of Respiratory system, Mechanism of respiration, lung volumes & capacities, Transport of respiratory gases.
12.	Digestive system - 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.	Functions of nervous system - neuron – conduction of impulses, factors effecting, synapse – transmission, reception, reflexes, ascending tracts, descending tracts, functions of various parts of the Brain, cerebrospinal fluid (CSF), composition, functions & circulation, lumbar puncture, Autonomic nervous system – and its types function of (ANS).
14.	Special Senses - 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.	Muscle Nerve Physiology - Type of muscle, structure of skeletal muscle, Sarcomere, Neuromuscular junction & transmission, Excitation and contraction coupling (mechanism of contraction).
16.	Structure and function of skin - body temperature, fever, regulation of temperature.
17.	Excretory system - Excretory organs, kidneys, function, Nephron, Juxta Glomerular apparatus, renal circulation, mechanism of urine formation, mechanism of micturition, cystometrogram, diuretics, artificial kidney.
18.	Structure and function of reproductive system - Male reproductive system, Spermatogenesis, testosterone, Female reproductive system, Ovulation, menstrual cycle cogogenesis, tests for ovulation, estrogen & progesterone, pregnancy test, parturition, contraceptive, Lactation, Composition of milk, advantages of breast feeding.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

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

**RADIATION PHYSICS AND MODERN IMAGING TECHNIQUES –**

**(P)**

UNIT	CONTENTS
1	Practical of measuring instruments, ionization chamber, TLD measuring technique, Focal spot measurement, KV measurement, linearity of mA station, Tube centring, Radiographic tech. of whole body, all sp. Investigations imaging, etc. Radiographic tech, of whole body, all sp. Investigations imaging, etc., table top dose measurement in fluoroscopy, image distortion of IITV, leakage of radiation through lead flaps, radiation level measurement during tube above table and below table, 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

### **RADIOGRAPHIC AND DARK ROOM TECHNIQUES – (P)**

UNIT	CONTENTS
1	Dark room adaptation techniques- safe light test, preparation of developer, fixer And its chemistry, design and planning of dark room, processing of exposed films, care of intensifying screens, storage of unexposed films, Accessories of dark room, AFP tech, dry camera and presentation of films etc., Chemistry for processing of exposed films manual and automatic processing, care of intensifying screens, storage of unexposed films, 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 – (P)**

UNIT	CONTENTS
1	Practical's related to anatomy & physiology such as knowledge of surface anatomy of human body, Identification of bones and parts on x-ray film as radiological anatomy.
2	Preparing of charts of human all systems & structures of human body, Identification and knowledge of pathological specimens, Visit of anatomy & pathology museum.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Text books of Anatomy. Author : Guyton (Arthor C). Prism publishers Bangalore.
- B. Human Physiology. Author : Chaterjee (cc). Medical allied agency

## **HOSPITAL TRAINING AFTER THE FINAL EXAMINATION 45 DAYS**



### YEAR III

## **ENVIRONMENTAL & BIO MEDICAL WASTE MANAGEMENT**

UNIT	CONTENTS
1.	Biotic and Abiotic environment, Adverse effects of Environmental Pollution, Control Strategies, Various Acts and Regulation.
2.	Water Pollution, 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.	Air Pollution, 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.	Bio Medical Waste Management, Introduction to bio medical waste, Type of bio medical waste, Collection of bio medical waste.
5.	Land Pollution, Soil conservation, Land erosion, Afforestation.
6.	Ecology, Basics of species, Population dynamics, Energy flow, Ecosystems, Social Issues and the Environment, Sustainable development and Life Styles, Urban problem related to energy, Resettlement and Rehabilitation of people, Energy flow, Consumerism and waste products, Water Harvesting and Rural Sanitation, 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.
7.	Non-Conventional (Renewable) source of energy, Solar energy Wind energy Bio mass energy Hydrogen energy.

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

- A. Environmental science-Coming ham Saigo.
- B. Solid waste management-C.L. men tall.
- C. Environmental Technologies for Sustainable Development Dr. Upendra Pnadel, DR M.P. Poonia.

## **PATIENT CARE RELEVANT TO DIAGNOSTIC RADIOLOGY**

UNIT	CONTENTS
1	Radiological contrast agents - Opaque agents and gases. Relationship of x-ray transmission to density and atomic number of the elements of contrast medium, Type of Barium sulphate solution concentration and its particular uses flavoring agents.
2	Lodine preparation - Organic compounds water soluble group significance of iodine content proprietary preparations iodized oil, Application of various systems of human body Volume

	Contra indications methods of administration and route.
3	Sensitivity test side effects and management elimination from the body, Gases Air Oxygen and carbon dioxide application and dangers.
4	Emergencies in the x-ray department and management, External defibrillation direct cardiac massage internal defibrillation complications cardiac arrest respiratory arrest bronchography local anesthetics reactions treatment.
5	Special Procedures in diagnosis Radiology - The Gastro intestinal tract, Barium meal, Barium swallow Small bowel enema, Barium enema, The renal tract, Intravenous urography, Intravenous cholangiography operative and post operative cholangiography percutaneous transhepatic cholangiography.
6	The respiratory tract - Bronchography, Gynecology, Hysterosalpingography, Cardio vascular system, Angiography, aortography, cerebral angiography, Splenoportovenography, The Lymphatic system Lymphangiography Central nervous system Myelography Sialography Ultrasound +Guided procedures, General preparation care and CT scan guided procedures safety measures MRI.

**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)

**QUALITY ASSURANCE IN DIAGNOSTIC RADIOLOGY**

UNIT	CONTENTS
1.	QA activities - Equipment selection phase, Equipment installation and acceptance phase, Operational phase Preventive maintenance.
2.	QA programme at radiological faculty level, Responsibility, Purchase, Specifications, Acceptance's Routine testing, Evaluation of results of routine testing, Record keeping Quality assurance practical exercise in the X ray 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 Accuracy of imaging image distortion for digital imaging devices.
3.	QA Programmed test, 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, Phantom measurements-CT, US and MRI.
4.	QA OF film and image recording devices, Sensitometry, Characteristic curve, Film latitude, Film contrast, Film speed Resolution distortion, artifacts of films and image recording, Maintenance care of equipment Safe operation of equipment, Routine cleaning of equipment and instruments-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.
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**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**

UNIT	CONTENTS
1	Radiation protection - principles, history & development-National & international agencies, AERB, BARC, ICRP, WHO,IAEA and their role, Equivalent dose, effective dose sievert-rem, Sources of radiation-natural man made & internal exposures.
2	Biological effects of radiation - effects on cell-stochastic & deterministic effects-radiation risk-tissues at risk-genetic, somatic& fetus risk-risk at other industries, Does equivalent limits philosophy-ICRP (60) AERB guidelines.
3	Planning of radiation installation-protection primary - leakage and scattered radiation, Concepts of workload use factor occupancy factor & distance, Barrier design barrier materials-concrete brick & lead, Primary & secondary barrier design calculations, Design of doors. Control of radiation-effects of time distance and shielding.
4	Personnel monitoring systems - Principle and objective-film badge-guidelines for use thermo luminescent dosimeter badge-pocket dosimeter, Area monitoring and radiation survey practical use of survey meter, zone monitors and phantoms, Survey in x-ray, fluoroscopy and CT scan units.
5	AERB safety code and ethics - Built in safety specification for diagnostic x-ray, fluoroscopy and CT units, Specification for radiation protection devices-room layout, Operational safety-Radiation protection programme-Personnel requirements and responsibilities-regulatory controls.
6	Patient protection - Safe work practice in diagnostic radiology, 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	Radiation emergencies-situation preparedness - safety and prevention-legal requirements 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**

UNIT	CONTENTS
1	Hospital procedure :Hospital 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 accident in the department appointment organization minimizing waiting time out patient and follow up clinics stock taking and stock keeping.
2	Care of the patient 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 a colostomy bedpans and urinals simple application of a sterile dressing.
3	First aid : Aims and objective of first aids wounds and bleeding dressing and bandages pressure and splints supports etc Shock insensibility asphyxia convulsions resuscitation use of suction apparatus drug reactions prophylactic measure administration of oxygen electric shock burns scalds hemorrhage pressure points compression band Fracture splints bandaging dressing foreign bodies poisons.
4	Infection: 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 antiseptis, Principles of asepsis Sterilization methods of sterilization use of central sterile supply department care of identification of instruments surgical dressings in common use including filament swabs, elementary operating theatre procedure setting of trays and trolleys in the radiotherapy department (for study by radiotherapy students only).
5	Departmental procedures : 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 accident in the department appointment organization minimizing waiting time out patient and follow up clinic stock taking and stock keeping, Drugs in the department: Storage classification labeling and checking regulations regarding dangerous and other drugs units of measurement special drugs ant depressive 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

### **PATIENT CARE RELEVANT TO DIAGNOSTIC RADIOLOGY-(P)**

<b>UNIT</b>	<b>CONTENTS</b>
1	Practical knowledge of patient care, Measuring of pulse, measuring of BP, preparation for radiological investigations, Contrast media application, reaction management, allergy test care of Anaesthetic, Patient knowledge of catheterization, oxygen administration, biopsy Method, sympathetically and behavioral treatment, care of ambulatory patients Care of pregnant patient, non cooperating child 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 patent in Diagnostic Radiography Pauline J clumer (Black well Scientific)
- C. Aid to Tray and Trolley Setting Marjorie Houghton (Bacilliere)

### **QUALITY ASSURANCE IN DIAGNOSTIC RADIOLOGY-(P)**

<b>UNIT</b>	<b>CONTENTS</b>
1	Practical of QA & QC, Knowledge of QA & QC test equipments, Various parameters of acceptance test of machine—KV, MA , time, x-ray output etc. inventory of machines, x – ray tubes, cassettes, films etc. AMC/ CMC records and review, performance of machines as far as image quality, Grid test, fluoroscopy device test, phantom test, sensitivity test, LBD test etc. Resolution test of CT, MRI and USG, 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, CONTROL AND SAFETY-(P)**

<b>UNIT</b>	<b>CONTENTS</b>
1	Practical based on Radiation Hazards & control safety, Knowledge of all hazards, education of gen. Public by posters and seminars, Safety of women and children , pregnant women, safety of patient attendants, non radiation workers hospital staff, checking of lead aprons, leakage radiation from tube head, radiation survey in and around X – ray installation, Use of TLD film badges and use of protective devices etc, Keeping of dose records of radiation workers, 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 bothers pvt. Ltd New Delhi
- C. An Introduction to Radiation Protection Allen Martin “& Samuel
- D. Radiation safety in Medical practice. M.M. Rechami

### **HOSPITAL TRAINING AFTER THE FINAL EXAMINATION 45 DAYS**