



DIPLOMA IN RADIO IMAGING TECHNOLOGY

DURATION :- 2 YEARS

ELIGIBILITY :- 10TH

1<sup>ST</sup> YEAR

CODE	SUBJECT	MAX MARKS	CREDIT
101	HUMAN ANATOMY	100	4
102	HUMAN PHYSIOLOGY	100	4
103	GENERAL BIOCHEMISTRY	100	4
104	ENGLISH COMMUNICATION & SOFT SKILLS	100	3
105	FUNDAMENTAL OF MEDICAL IMAGING & RADIOTHERAPY	100	4
106	COMPUTER FUNDAMENTALS	100	3
107	PRACTICAL -I	100	3
108	CLINICAL POSTING	100	2

2<sup>ND</sup> YEAR

CODE	SUBJECT	MAX MARKS	CREDIT
201	BASIC RADIATION PHYSICS	100	4
202	IMAGE PROCESSING TECHNIQUES	100	4
203	CARE OF PATIENTS IN DIAGNOSTIC RADIOLOGY	100	4
204	EQUIPMENTS OF RADIOTHERAPY	100	3
205	POSITIONING IN RADIOGRAPHY	100	4
206	SPECIAL RADIOGRAPHIC TECHNIQUE & PROCEDURES	100	3
207	PRACTICAL -II	100	3
208	CLINICAL POSTING	100	2

**101 HUMAN ANATOMY**

Unit -1

Terminology and General Plan of the Body, Body Parts and Areas,  
Terms of Location and Position, Body Cavities and Their Membranes, Dorsal cavity, Ventral cavity,  
Planes and Sections

Unit -II

Cells: Structure, function and location, Prokaryotic and eukaryotic cells, Cell organelles, Cell division  
Tissue, Types, Structure, Location and Function of Epithelial Tissue, Connective Tissue, Muscle  
Tissue, Nerve Tissue, Membranes, Glandular tissue

The Integumentary System: structure and function of The Skin, Subcutaneous Tissue

Unit-III

Musculoskeletal System: Basic anatomy of important muscles and bones

Unit-IV

Respiratory system: Basic anatomy of nose, larynx, trachea, bronchi and lungs

Unit - V

Digestive system: basic anatomy of oesophagus, stomach, small intestine, large intestine, liver, gall  
bladder, pancreas

## **102 HUMAN PHYSIOLOGY**

### **Unit-I**

Cell physiology: Structure, membrane, transport across cell membrane, Active, Passive, Organization of the Body, Body Composition, Body Fluid Volumes and its measurement, Diffusion, Osmosis, Tonicity, Homeostasis

### **Unit-II**

Blood-composition, function, cellular component & their function, haemoglobin & anaemia, blood groups and coagulation

Lymphatic system-Composition & function of lymph, lymphatic tissue, Immunity with the role of thymus

### **Unit-III**

Cardiovascular system-general arrange, heart, arteries, veins and capillaries, heart structure and function, cardiac cycle, heart sounds, heart rate, blood pressure, mechanism of circulation, definition of hypertension & shock

### **Unit-IV**

Respiratory system: parts of respiratory system, mechanism of respiration, pulmonary function, pulmonary circulation, lungs volume, Gas transport between lungs and tissues, Definition of hypoxia, dyspnoea, cyanosis, asphyxia and obstructive airways diseases

### **Unit- V**

Gastrointestinal physiology: Organs of GIT and their structure & function, secretion, digestion, absorption and assimilation, gastrointestinal hormones, physiology of digestion of carbohydrates, proteins & lipids, Structure & function of liver, spleen, gall bladder & pancreas, Jaundice, Cirrhosis & Pancreatitis

## **103 GENERAL BIOCHEMISTRY**

### **Unit-I**

Introduction to Clinical Biochemistry and role of Medical Lab Technologist , ethics, responsibility, safety measure and hazards in clinical biochemistry lab and first aid in laboratory accidents.

Glassware's & plastic ware's used in lab, calibration of volumetric apparatus, cleaning& care and maintenance

### **Unit II**

Principle, working, care & maintenance and calibration of Weighing balance, Hotplate, Magnetic stirrer, Centrifuges, Incubator, Hot air oven, Colorimeter, Spectrophotometer, Water distillation plant, Deionizers Henderson Hassel balch equation, pH paper, pH meter, method of pH measurement,

### **Unit-III**

Preparation of solution and reagents, normal solution, molar solutions, percent solution, buffer solution, dilutions, w/v, v/v, standard solution, aqueous solutions, concepts of acid and base

Units of measurement: SI unit, reference range, conversion factor, units for measurement of bio metabolite, enzymes, protein, drugs, hormones, vitamins

### **Unit-IV**

Specimen collection and processing of blood, urine & CSF, separation of serum and plasma, deproteinization of sample, Handling of specimens for testing, preservation of specimen, transport of specimen, factors affecting the clinical results, effect of storage on sample

### **Unit- V**

Physical, chemical and microscopic examination of urine, Bence Jones Proteinuria and its clinical significance, qualitative test of urine for reducing sugars, protein, ketone bodies, bile Salt, bile pigments, urobilinogen, occult blood, uric acid, urea and Creatinine, quantitative estimation of 24 hrs urine for protein and their clinical significance.

## **104 ENGLISH COMMUNICATION & SOFT SKILLS**

UNIT-I: Introduction to English language

- a) Role and significance of English language in the present scenario
- b) English Language: Its relevance for the Indian industry
- c) Introduction to Listening, Speaking, Reading, Writing (LSRW) and benchmarking of the class

UNIT-II: Phonetics & Functional Grammar

- a) Pronunciation and daily usage correction (speak with differences between p/b, s/sh, f/ph, t/d, v/w sounds)
- b) Parts of speech, articles, tenses, verbs and modals
- c) Practice of daily use words, numerals and tongue twisters
- d) Vocabulary building, Construction of simple sentences: Basic sentence pattern, subject and Predicate

*[Note: As part of classroom activity, language games, tongue & jaw exercises, simple passages from the newspapers for oral drills in the classroom and practice tests (written and oral)]*

UNIT-III: English Communication- About Myself

- a) Let's talk, making conversation, meeting and greeting
- b) Introducing myself, my family and my friends
- c) My opinions, my likes and dislikes
- d) Life at college, hostel and workplace

*[Note: As part of classroom activity, use the Workbook for reference for classroom and home assignments, carry out practice tests (written and oral)]*

UNIT-IV: Personality Development

- a) First impression: Dressing sense, good manners, speaking well and respectably
- b) Positive Attitude: Being happy and alert, a good listener and a good friend
- c) Consultation among peers: Soliciting advice and giving advice
- d) Goal setting, confidence building & handling rejection

*[Note: As part of classroom activity, refer Workbook for classroom and home assignments, carry out practice tests (written and oral)]*

## **105 FUNDAMENTAL OF MEDICAL IMAGING & RADIOTHERAPY**

The X-Ray machine

1. X-ray Production, Emission & Interactions with Matter
2. Radiographic Film, latent Image, Intensifying Screens, Grids
3. Radiographic Exposure, Film Developing & Processing, Radiographic Quality
4. Physical Principles of Diagnostic Ultrasound Piezoelectric Effect.
5. Acoustic Intensity, Reflection, Impedance & Absorption
6. Ultra Sound Transducer, Beam, Operational Modes & Biological Effects.
7. Compound Tomography Principles of Operation System Components & Image Reconstruction.
8. Physical Principles of Magnetic Resonance Imaging: Basic concept, System Components, Biological Hazards, Advantage over CT

## **106 COMPUTER FUNDAMENTALS**

Unit-I

Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages. Input output devices: Input devices(keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices(monitors, pointers, plotters, screen image projector, voice response systems).

Processor and memory: The Central Processing Unit (CPU), main memory. Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.

Unit-II

Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).

#### Unit-III

Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.

Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.

Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.

#### Unit-IV

Introduction of Operating System: introduction, operating system concepts, types of operating system, Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.

Electronic Payment Systems: Introduction, Types of Electronic Payment Systems, Digital Token-Based, Electronic Payment Systems, Smart Card and Electronic Payment Systems, Credit Card- Based Electronic Payment Systems, Risk and Electronic Payment Systems.

#### Unit-V

Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.

## 107 PRACTICAL-I

### **Practical Human Anatomy**

1. Demonstration of Major organs through models and permanent slides.
2. Demonstration of parts of circulatory system from models.
3. Demonstration of parts of respiratory system from models.
4. Demonstration of digestive system from models.
5. Demonstration of excretory system from models.
6. Demonstration of nervous system from models.
7. Structure of eye and ear
8. Demonstration of structural differences between skeletal, smooth and cardiac muscles.
9. Demonstration of various bones
10. Demonstration of various joints
11. Demonstration of various parts of male & female reproductive system from models

### **Practical Human Physiology**

1. To measure pulse rate
2. To measure blood pressure
3. Demonstration of ECG
4. To perform Hemoglobin by Sahli's Method
5. To perform Hemoglobin by CMG method.
6. Haemoglobin by CMG method.
7. To perform Total RBC count.
8. To perform total leucocyte count.
9. To perform differential leucocyte count.
10. To perform PCV

### **Practical Fundamental of Medical Imaging & Radiotherapy**

1. X-ray tubes general features and mobile equipments.
2. Care and maintenance of X-ray equipments and image intensifier
3. To study effects of Kilo Voltage Peak (KVP) and Milli Ampere Second (MAS)
4. To check the safety of dark room.

5. To check the speed of intensifying screen.
6. To check the developing time test and function.
7. Silver recovery method

### **Practical Fundamentals of Biochemistry**

1. To study general laboratory safety rules.
2. To demonstrate glasswares, apparatus and plasticwares used in laboratory.
3. Collection of blood sample
4. To separate serum and plasma.
5. Preparation of different percentage solutions
6. Preparation of normal and molar solutions. (0.1 N NaOH, 0.2N HCl, 0.1 M H<sub>2</sub>SO<sub>4</sub>)
7. Demonstration of photocolorimeter
8. Demonstration of spectrophotometer
9. Demonstration of pH meter
10. Deproteinization of blood sample

### **Practical: Basics of Computer**

Computer fundamental and internet lab

1. Using basic DOS commands.
2. Using external DOS commands
3. Creating a email account
4. Using web browser for searching and surfing.
5. Creating and formatting a document in MS office
6. Using autocorrect, auto text and spell check operation in MS office .
7. Create tables in MS Word.
8. Inserting different kinds of object in MS word.
9. Use main merge options in MS office.
10. Create a Excel work sheet with following options rows and columns alignment..
11. Using excel formulas.
12. Create a graph with available data in MS excel.
13. Create a PPT presentation using auto content wizard.
14. Use Clip art animation effects and word art galleries in presentations.
15. Using transition and setting timings for slide show.
16. Use MS access to create data base and tables.

### **108 CLINICAL POSTING**

Students shall be deputed to various labs of Radiology department wherein they shall undergo practical training of handling patients, collection and processing of investigation (X Ray, Special procedures, CT Scan, MRI, Ultrasound etc) and equipment.

Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection to different labs.

Process of performing various tests in different labs

Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.

### **201 BASIC RADIATION PHYSICS**

Fundamental of Physics

1. Matter & energy
2. Radiation & spectra
3. Electricity and Magnetism
4. Atoms & nuclei
5. Radioactivity

X-rays

1. Production

2. Properties

3. Measurement

4. Interaction of X-rays- Gamma rays and electron radiation with matter and principles of differential absorption in biological materials.

## **202 IMAGE PROCESSING TECHNIQUES**

X-ray Films- X-ray cassettes - Intensifying screens X-ray films types - basic film structure & quality - choosing films for different studies - basics on hard copies of radiographic images - dry & wet processing - Fixer -Developer -film processing methods - manual and automatic processing - conventional & modern image processing rooms - image processing equipments - types & maintenance - day light systems advantages & disadvantages - processing faults -- glossy prints, paper prints etc - production of best quality images. Intensifying screen- Fluorescence - structure of Intensifying screens - Cassette types - screen un-sharpness etc.

## **203 CARE OF PATIENTS IN DIAGNOSTIC RADIOLOGY**

Unit -I :

Introduction To Patient Care:

Clinical Responsibility, Legal Responsibility, Hospital And The Radiographer.

General Patient Care:

A. Patient Transfer Technique

B. Turning The Patient (Patient Conditions, Mechanic Safety).

C. Restraint Techniques - Trauma, Paediatric, Geriatric, Physically Handicapped Emotionally Disturbed Patients, Anaesthetised Patient, Moving Chair And Stretcher Patients.

D. Specific Patient Conditions.

Tubes And Catheters, Nasogastric, Chest, Urinary, Intravenous, Oxygen And Other. (Cast Surgical And Cardiac) Alcoholic, Bed Pans And Urinals.

E. Security Of Patient Properties.

Out Patient, Inpatient.

F. General Comfort And Reassurance For The Patient.

Unit -II :

I. Practical Nursing Procedures In Radiology :

Temperature, Pulse, Respiration, B.P., Laying Up A Sterile Trolley, Assisting At An Iv Injection, A Simple Sterile Dressing, O<sub>2</sub> Therapy And Resuscitation, Giving A Patient Bed Pan, Giving An Enema, The Catheterized Patient, The Use Of A Sucker.

II. Preparation Of The Patient:

General Abdominal Preparation, Clothing Of The Patient.

Unit -III :

I. Sterilization and sterile techniques:

Methods Of Sterilization, Central Sterile Supply, Preparation Of The Hands For Aseptic Procedures.

II. Drugs in the X-Ray department:

Poisons And Dangerous Drugs, Units Of Measurement, Drugs Used In Preparation Of The Patient, Contrast Agents Used In X Ray Examinations, Drugs Used In Resuscitation, Labeling And Issuing.

Unit -IV :

Infection Control :

A. Infections Pathogens, Communicable Disease

Nasocomial Infection, Other  
 B. Isolation Technique:  
 Category, Purpose, Procedure.  
 C. Infection Sources:  
 Bacteria Virus, Other.  
 D. Transmission Modes:  
 Aerobic, Contact, Other.  
 E. Procedures:  
 Institutional, Departmental  
 F. Physiological Considerations:  
 G. The Infection Patient In The X Ray Department.  
 The Infections Patient In The Ward.  
 Unit -V :  
 Contrast Media:  
 A. Definitions:  
 I) Air, Gasses.  
 II) Radiopaque: Barium Compounds, Aqueous  
 Iodine Compounds, Oily Iodine Compounds, Other.  
 B. Pharmacology:  
 Barium Compounds & Iodine Compounds : Patient History/Allergy, Chemical  
 Composition, Patient Precautions, Patient Reactions, Emergency Care.  
 C. Methods of Administration:  
 I) Systemic: Oral, Rectal, Tube, Catheter, Inhalation.  
 II) Parental: Intravenous, Intra-Arterial, Intra Spinal.  
 D. Administration Technic: Oral (Spoon, Cup, Capcule), Tube/Catheter,  
 Nasogastric, Urinary, Enema, Other.  
 E. Intravenous : Syringe, Needle/Infusion Container, Catheter, Needle  
 Unit-VI :  
 I. Patient's Care During Investigation:  
 G.I. Tract, Renal Tract, Biliary Tract, Respiratory Tract, Gynecology,  
 Cardiovascular, Lymphatic System, C N S.  
 II. First Aid In The X Ray Department:  
 Radiological Emergencies, Shock, Hemorrhage, Burns, Scalds, Cpr, Loss Of  
 Consciousness, Asphyxia, Fractures, Electricshock.  
 III. Medico-Legal Aspects Of The Radiographers Work:  
 Breach Of Professional Confidence, Negligence, Procedure In The Event Of  
 Accident, The Importance Of Records.  
 IV. The Patient And The Radiation Hazards:  
 The Nature Of The Risk, Significant Examinations And Protective Measures.

### **204 EQUIPMENTS OF RADIOTHERAPY**

1. Orthovoltage equipment with special reference to physical design equipment of tube and its accessories and interlocks, gamma ray sources used radiotherapy especially cobalt 60 source its construction and source housing and handling mechanism.
2. Principles of isocentric Tele-isotope machines, megavoltage x-ray and electron beam accelerators and betatron.
3. Salient features of components of Linear Accelerator like tube design, wake guide, target design, beam bending system.
4. Radio-frequency generators like magnetron and klestron.
5. Basic principle of remote after-loading system/machines and sources used.
6. Principles of simulators and vacuum forming machines for making casts.
7. Sterofoam template cutting system introduction to radio-surgery.
8. Equipment and dosimetry equipment.

## 205 POSITIONING IN RADIOGRAPHY

Age, subject types and sex, anatomical landmarks-postural variations-erect and horizontal technique-respiratory movement and diaphragm level-regional densities-preparations-and immobilization of patient –pathological conditions-injuries, fractures and dislocations congenital, localized views-periodic examinations-use of dry bones-positioning terminology identification systems.

### **I. Positioning Radiography**

#### **Skeletal System**

##### **i) Upper Limb**

Techniques for hand-fingers-thumb-wrist joint-forearm-elbow joint-humerus-shoulder joint and sterno-clavicular joint.

##### **ii) Lower Limb**

Techniques for foot-calcaneum-ankle joint-leg-knee joint-patella-and femur(lower two thirds)

##### **iii) Pelvic Girdle**

Techniques for pelvic-iliac fossa-ischium-and sacro iliac joint.

##### **iv) Vertebral Column**

Techniques for Atlanto-occipital articulation, cervical vertebrae, cervicothoracic junction, thoracic vertebrae, lumbar vertebrae, lumbosacral articulation, sacrum

##### **v) Coccyx**

##### **vi) Bones of Thorax**

Techniques for sternum, ribs (upper and lower).

##### **vii) Skull**

Techniques for cranium, facial bones, sella turcica, temporal Bone, mastoids and optic foraminae, sinuses, mandible and temporo mandible joint.

##### **Viii) Chest**

Chest X-Ray, PA, AP lateral, decubitus etc.

##### **ix) Abdomen**

Routine and radiographs in acute condition

Bedside radiography –techniques for acute chest conditions-intestinal obstruction, abdominal perforations-vertebral injuries-skull injuries-fractures immobilized.

Theatre radiography-introduction to C-arm image intensifier- exposure & training.

### **II. Soft tissue radiography**

Neck, abdomen, skull, mammogram

## 206 SPECIAL RADIOGRAPHIC TECHNIQUE & PROCEDURES

### **Course Contents:**

#### 1. Special procedure and related Contrast Media

- Contrast Media
- Emergency in Radiology Department
- Excretory System
- a) IVP
- b) RGU
- c) MCU
- Oral Cholecystography
- Percutaneous Trans hepatic Cholecystography
- G.I. Tract
- a) Barium Swallow



- b) Barium Meal Series
- c) Barium Meal Follow Through
- d) Barium Enema
  - Hystero Salpingography
  - Angiography
  - Tomography
- 2. Radiography of body parts and their poisoning
  - Upper limb
  - Lower limb
  - Abdomen, Head and Neck
- 3. Guideline for design and location of X-ray equipments
- 4. Dark Room designing
  - Outline structure of Dark Room
  - Material used
  - Miscellaneous

## 207 PRACTICAL-II

### **PRACTICAL IMAGE PROCESSING TECHNIQUES**

X-ray Films- X-ray cassettes - Intensifying screens, other imaging hard copies, image processing equipments with demonstration.

### **Special Radiographic Technique & Procedures (Practical)**

#### **Course Contents:**

1. Radiography in various positions for all the special radiological procedures, using contrast media as per syllabus.
2. Positioning and treatment of various cases patients by using:
  - a) Prescribed filters and wedges
  - b) Protection of various organs

### **Radiographic Positioning (Practical)**

#### **Contents:**

Upper & Lower Extremities

Hand

Forearm

Arm

Thigh

Leg

Foot

Shoulder Joints

Basic & special projection

Related radiological Pathology

Basic & special positioning

Pelvis Griddle

Basic & special projection

Related radiological Pathology

Basic & special positioning

Whole Spine Positioning

Cervical spine

Thoracic spine

Lumbar spine, sacrum and coccyx

Paediatric Radiography

Special Positioning Views for all the X-Rays.

## 208 CLINICAL POSTING

**Course Contents:**

Students shall be deputed to various labs of Radiology department wherein they shall undergo practical training of handling patients, collection and processing of investigation (X Ray, Special procedures, CT Scan, MRI, Ultrasound etc) and equipment.

Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection to different labs.

Process of performing various tests in different labs

Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.

CAS