

# **CURRICULUM FOR**

## **Diploma in Medical Radiology & Imaging Technology**

(Applicable w.e.f. academic session 2017-18)

**COURSE NAME:** Diploma in Medical Radiology & Imaging Technology

**DURATION OF COURSE:** TWO YEARS

**FULL-TIME/ PART – TIME:** FULL-TIME

**SRI GURU RAMDAS UNIVERSITY OF HEALTH  
SCIENCES, SRI AMRITSAR, PUNJAB**

## **1. Diploma in Medical Radiology & Imaging Technology (DRIT)**

This course is aimed at training technician level functionaries in the area of Radiology & Imaging technology. The main objective of the course is to train the technical assistants in radio-diagnosis department in the hospital.

This course is designed as a comprehensive and practical oriented program. This is a regular theory & practical oriented program. The mode of teaching will be in the form of regular classrooms, lectures/ demonstrations supplemented by handouts, manuals, brochures, checklists, performance with supervised clinical practices.

## **2. Duration of Course**

The Diploma in Medical Radiology & Imaging Technology Course is proposed to be a 2 years diploma course.

## **3. Eligibility Criteria for Admission**

The students shall be admitted as per the admission criteria and qualification prescribed in the Notification issued by the Board of Management of Sri Guru Ram Das University of Health Sciences from time to time.

## **4. Medium of Instructions**

The Medium of instruction during the course and for the university examination shall be in English.

## **5. Examination Scheme**

- 5.1 The examination for the first and second shall ordinarily be held twice year in the months of May/June and November/ December by the Institute as per University rules.
- 5.2 Annual Examination shall be held in May/June and supplementary within 6 months of annual examination.
- 5.3 The examination in theory/practical shall be held at the end of the 1<sup>st</sup> academic year (1<sup>st</sup> Year) and the end of 2<sup>nd</sup> academic year (2<sup>nd</sup> Year) with one internal and one external examiners.
- 5.4 Date of examination and appointment of examiner will be made by the Board of Management on recommendation of Faculty of Medical Sciences.
- 5.5 The examination for the first, second year of Diploma in Medical Radiology & Imaging Technology Course would be held according to the prescribed syllabus.

## **6. Rules of Examination for Diploma in Medical Radiology & Imaging Technology Course:**

- 6.1 The students shall submit his/her application for admission to the examination to Controller of Examinations SGRDUHS, Sri Amritsar through the Director Principal of the SGRDIMSAR, Sri Amritsar on the prescribed form with the required fee (the last date of which will be updated on university website after notification issued

from Board of Management time to time).

- 6.2 The candidates will be given 25 marks for theory and 15 marks for practical as internal assessment in each subject on the basis of their performance during the year. That a candidate be eligible to appear in the examination provided he/she secured a minimum of 35% marks in internal assessment in theory and practical.
- 6.3 There will be fresh internal assessment and compulsory attendance for the students for the examination in which he/she has failed at the time of subsequent examination in that subject.
- 6.4 The students will not be allowed to appear in the examination unless he/she attends 75% of the total theory and practical in each subject separately.
- 6.5 Director Principal of the college is empowered to condone the shortage of attendance of lectures to the extent of 5% lectures delivered in each course of theory and practical.
- 6.6 A student will be deemed to have passed in the examination if he/she passes in each subject separately.
- 6.7 In case of students joining late owing to the late admission with the approval of the Vice-chancellor, their lecturers are to be counted from the date of joining. Deficiency in studies should be made up by attending special classes for them at the level of Head of the Department.

#### 7. First Year Diploma in Medical Radiology & Imaging Technology Examination:

The First Year Diploma in Radiology & Imaging Technology examination shall be in the following subjects and candidate shall be required to pass all the subjects:-

##### **B.Sc. Part – I**

Paper	Subject	Theory			Practical			Grand Total
		Marks	Internal Assessment	Total	Marks	Internal Assessment	Total	
Paper-I	Human Anatomy, Physiology and Pathology	75	25	100	35	15	50	150
Paper-II	Radiation Physics- I	75	25	100	35	15	50	150
Paper-III	Radiography- I	75	25	100	35	15	50	150
<b>Supportive Subject</b>	Basics of Computer	----	----	----	----	----	----	----

**Note.** The Examination in the subject of Basics of Computer will be conducted at college level and Grade will be sent to University for final inclusion in the result.

##### **Grading System**

Marks Range	81 - 100	76 - 80	71 - 75	61 - 70	51 - 60	41 - 50	31 - 40	0 - 30
Grade	<b>A+</b>	<b>A</b>	<b>B+</b>	<b>B</b>	<b>C+</b>	<b>C</b>	<b>D</b>	<b>E</b>

## **8. Second Year Diploma in Medical Radiology & Imaging Technology Examination:**

The First Year Diploma in Medical Radiology & Imaging Technology Examination shall be open to a person who has previously passed the Second Year Diploma in Radiology & Imaging Technology Examination of this University.

### **Diploma Part – II**

S. No.	Subject	Theory			Practical			Grand Total
		Marks	Internal Assessment	Total	Marks	Internal Assessment	Total	
Paper-I	Radiation Physics- II	75	25	100	35	15	50	150
Paper-II	Clinical Radiography- I	75	25	100	35	15	50	150
Paper-III	Clinical Radiography- II	75	25	100	35	15	50	150

## **9. Promotion and Number of Attempts allowed**

- 9.1 A candidate who fails in all the subjects in the First Year Diploma in Medical Radiology & Imaging Technology examination shall not be promoted to Second Year class.
- 9.2 A Candidate who fails in one more or more subjects will be given four attempts including first attempt as a regular candidate, plus one mercy chance at the discretion of the Vice-Chancellor at six monthly intervals. However, he/she will have to clear all these attempts within 4 years of admission to the said course.
- 9.3 The candidate who will absent himself/herself from the examination will be deemed to have been failed in that subject.
- 9.4 A candidate who passes in at least one subject of University level First Year Diploma in Medical Radiology & Imaging Technology examination will be permitted to attend classes of Second Year. However, the candidate will be required to pass in all subjects of 1<sup>st</sup> Year examination at least 6 months before the final examination of 2<sup>nd</sup> Year examination.
- 9.5 Candidate who passes in one or more subjects of Second Year Diploma in Medical Radiology & Imaging Technology examination shall be exempted from appearing in these subject at a subsequent examination, but the candidate must pass the examination in a maximum of four attempts including first attempt, as a regular candidate plus one mercy chance at the discretion of the Vice-Chancellor at six monthly intervals. However, he/she will have to clear all these attempts within 4 years of admission to the said course.

## **10. Appointments of Examiners:**

- 10.1 There shall be two examiners – One internal and one external.
- 10.2 Professor & head of the Department shall be Convener. The Examiner at least 3 years post PG teaching experience in that specification field will be appointed as Internal Examiner.
- 10.3 The external examiner shall be appointed from other Universities at least 3 years post PG teaching experience in that specification field.

## **11. Paper Setting and moderation of Question Papers**

The questions papers for 1<sup>st</sup> Year and 2<sup>nd</sup> Year will be set under the direction of Controller of Examinations.

Each Question Paper covering entire course consists of seven questions out of which six questions carry 10 Marks and one question carry 15 marks.

## **12. Evaluation of Answer Books**

The answer books shall be got evaluated by putting fictitious roll numbers thereon or spot evaluation (Table marking) or any other method under the direction of the Controller of Examinations.

## **13. Minimum Pass Marks**

During all the three annual examinations in each subject paper the candidate shall have to obtain 50% in theory including internal assessment 50% practical including internal assessment.

13.1 The successful candidates shall be classified into divisions as under:-

- a) Those who obtain 60% or more marks First Division.
- b) Those who obtain 50% or more marks but below 60% marks Second Division.
- c) A candidate who will obtain 75% or more marks of the total marks in any subject shall be declared to have obtained distinction in that subject provided he/she passed in all the subjects of the courses in all the parts in the first attempt.

A candidate is eligible to appear in the examination provided he/she secures a minimum of 35% marks in internal assessment in theory and practical separately.

## **14. Grace Marks**

There shall be no provision for grace marks.

## **15. Declaration of Result**

The results will be tabulated and declared by the Controller of Examination's office.

## **16. Award of Diploma**

On successfully passing the Second Year Diploma in Medical Radiology & Imaging Technology examination the students shall be awarded the Diploma of Diploma in Medical Radiology & Imaging Technology.

## **Syllabus for Diploma in Medical Radiology Imaging Technology 1<sup>st</sup> Year**

### **Theory**

#### **Paper-I: Human Anatomy, Physiology & Pathology**

#### **Anatomy**

#### **Theory Syllabus (50 Hrs)**

##### **1. Introduction:**

- 1.1 Definition of anatomy and its divisions, Terms of location, positions and planes.
- 1.2 Cell and its organelles, Tissues & its classification, Glands.

##### **2. Musculoskeletal system:**

- 2.1 Structure of Bone & its types.
- 2.2 Joints- Classification of joints with examples; details of synovial joint.
- 2.3 Bones & joints of upper limb, lower limb and their movements.
- 2.4 Axial skeleton & appendicular skeleton.
- 2.5 Skull, spine & its movements, intervertebral disc.
- 2.6 Muscles & its types.
- 2.7 Muscles of the upper limb, lower limb, trunk and neck.

##### **3. Cardiovascular System:**

- 3.1 Arteries & veins, Capillaries & arterioles.
- 3.2 Heart- size, location, chambers, blood supply of heart, pericardium.
- 3.3 Systemic & pulmonary circulation.
- 3.4 Major blood vessels of Heart- Aorta, pulmonary artery, common carotid artery, subclavian artery, axillary artery, brachial artery, common iliac artery, femoral artery.
- 3.5 Inferior vena cava, portal circulation, great saphenous vein.

##### **4. Lymphatic System:**

- 4.1 Lymph & Lymph vessels.
- 4.2 Structure of lymph node, names of regional lymphatics, axillary and inguinal lymph nodes.

##### **5. Gastro-intestinal System:**

- 5.1 Parts of GIT, structure of tongue, pharynx, salivary glands.
- 5.2 Location & Gross structure of Oesophagus, stomach, intestine (small and large), liver, gall bladder, pancreas, spleen.

##### **6. Respiratory system:**

- Parts of Respiratory system; Structure of nose, nasal cavity, larynx, trachea, lungs, pleura, bronchopulmonary segments.

##### **7. Urinary System:**

- Parts of Urinary system, location and gross structure of kidney, ureter, urinary bladder, urethra.

**8. Reproductive system:**

- 8.1 Parts of male reproductive system, gross structure of testis, vas deferens, epididymis, prostate.
- 8.2 Parts of female reproductive system, gross structure of uterus, ovary, fallopian tube, mammary gland.

**9. Endocrine glands:**

- Name of all endocrine glands, gross structure & functions of pituitary gland, adrenal gland, thyroid gland and parathyroid gland.

**10. Nervous system:**

- 10.1 Neuron, classification of NS.
- 10.2 Meninges, ventricles, CSF.
- 10.3 Gross features of cerebrum, midbrain, pons, medulla oblongata, cerebellum, name of basal nuclei.
- 10.4 Blood supply of brain, cranial nerves.
- 10.5 Spinal cord and spinal nerves.
- 10.6 Autonomic nervous system.
- 10.7 Visual & auditory pathways

**Practical Syllabus(20 Hours):**

- 1. **Demonstration** of all bones of the human body.
- 2. **Demonstration** of all organs of the human body.
- 3. **General Histology:**

Epithelium: Simple (squamous, cuboidal, columnar, ciliated), Stratified, Transitional.  
Bone, muscles (skeletal, smooth, cardiac) • Cartilage (hyaline, elastic, fibro cartilage). Connective Tissue (loose and dense).  
Arteries (large & medium sized), Veins.

**Books Recommended**

- 1. Ross and Wilson, Anatomy and Physiology, Churchill Livingstone.
- 2. Companion Pocketbook for quick review B.D. Chaurasia's Human Anatomy:  
-Vol. (1,2,3)
- 3. B.D. Chaurasia's Human Anatomy -Vol. (1,2,3)
- 4. B.D. Chaurasia's Handbook of General Anatomy
- 5. Textbook of Anatomy & Physiology for Nurses- Nachiket Shankar/ Mario Vaz
- 6. Anatomy for B.Sc. Nursing – Dr Renu Chauhan

# PHYSIOLOGY

## THEORY SYLLABUS (50 Hrs)

### 1. The Cell:

- Cell Structure and functions of the various organelles.
- Endocytosis and exocytosis
- Acid base balance and disturbances of acid base balances (Alkalosis, Acidosis)

### 2. The Blood:

- Composition of Blood, functions of the blood and plasma proteins, classification and protein.
- Pathological and Physiological variation of the RBC.
- Function of Hemoglobin
- Erythrocyte Sedimentation Rate.
- Detailed description about WBC-Total count (TC), Differential count (DC) and functions.
- Platelets – formation and normal level and functions
- Blood groups and Rh factor

### 3. Cardio-Vascular System:

- Physiology of the heart
- Heart sounds
- Cardiac cycle, Cardiac output.
- Auscultatory areas.
- Arterial pressures, blood pressure
- Hypertension
- Electro cardiogram (ECG)

### 4. Respiratory system:

- Respiratory movements.
- Definitions and Normal values of Lung volumes and Lung capacities.

### 5. Excretory system:

- Normal Urinary output
- Micturation
- Renal function tests, renal disorders.

### 6. Reproductive system:

- Formation of semen and spermatogenesis.
- Brief account of menstrual cycle.

### 7. Central Nervous system:

- Functions of CSF.

### 8. Endocrine system:

- Functions of the pituitary, thyroid, parathyroid, adrenal and pancreatic Hormones.

### 9. Digestive system (for the students of Diploma in Scope Support Technology)

- Physiological Anatomy of the GIT.
- Food Digestion in the mouth, stomach, intestine



- Absorption of foods
- Role of bile in the digestion.

### **PRACTICAL SYLLABUS**

- The compound Microscope
- Determination of ESR-By westergren's method
- Determination of Blood Groups.
- Measurement of human blood pressure.
- Examination of Respiratory system to count respiratory rate and measure inspiration and respiration

### **Books Recommended**

1. Ross and Wilson, Anatomy and Physiology, Churchill Livingstone.
2. Basics of medical physiology- D Venkatesh, HH Sudhakar
3. Textbook of anatomy and physiology for nurses-Nachiket Shankar, Mario Vaz
4. Manual of practical physiology for BDS-DR. A.K.Jain

### **PATHOLOGY (30 hrs)**

- 1) Cellular adaptation, Cell injury & cell death. Introduction to pathology.  
 Overview: Cellular response to stress and noxious stimuli.  
 Cellular adaptations of growth and differentiation.  
 Overview of cell injury and cell death.  
 Causes of cell injury.  
 Mechanisms of cell injury.  
 Reversible and irreversible cell injury.  
 Examples of cell injury and necrosis
- 2) Inflammation.  
 General features of inflammation  
 Historical highlights  
 Acute inflammation  
 Chemical mediators of inflammation  
 Outcomes of acute inflammation  
 Morphologic patterns of acute inflammation  
 Summary of acute inflammation  
 Chronic inflammation
- 3) Immunity disorders.  
 General features of the immune system  
 Disorders of the immune system
- 4) Infectious diseases.  
 General principles of microbial pathogenesis  
 Viral infections  
 Bacterial infections-Rheumatic heart disease.

Fungal infections

Parasitic infections

5) Neoplasia.

Definitions

Nomenclature

Biology of tumor growth benign and malignant neoplasms

Epidemiology

Carcinogenic agents and their cellular interactions

Clinical features of tumors

6) Environmental and nutritional disorders.

Environmental and disease

Common environmental and occupational exposures

Nutrition and disease.

Coronary artery disease.

**Pathology relevant to radiology (50 hours)**

Outline on pathology of various systems of CVS, RS, CNS, musculoskeletal systems, GIT, GUT, Reproductive systems, pathology of radiation injury, Basics in pathology of malignancies.

**Paper-II: Radiation Physics-I**

**Theory**

**General Physics, Radiation Physics & Physics of Diagnostic Radiology (30hrs)**

- Basic concepts of power, work, force, energy, electricity, magnetism and their units and measurements
- Einstein's formula – electromagnetic induction
- Atomic structure
- Radioactivity- ionization and excitation
- Electromagnetic waves
- X-rays production and properties
- X-ray tube - quality of x-rays
- Factors affecting quality and intensity of x-rays. X-ray circuits
- interaction of X and gamma rays
- X-radiation measurements etc.
- Principles of Radiation detection and measurements
- TLD, Pocket Dosimeter
- Radiation Survey meter and radiation zone monitor.

## **Practicals - (20hrs)**

Study with charts, models & power point presentations Atomic structure, X-ray tubes, X-ray circuits involving students to present and discuss.

## **Paper-III: Radiography-I**

### **Theory**

- Whole Upper limb with special reference to Hand:  
Wrist joint  
Forearm  
Elbow joint and upperarm.
- Supplementary techniques for carpal tunnel
- Scaphoid bone fracture
- Head of radius and supra-condylar fracture.
- Whole Lower limb which includes all the bones with special reference to:  
Foot  
Ankle joint  
Lower leg  
Knee joint  
Patella and upper leg.
- Supplementary techniques for calcaneum bone for flat foot
- Intercondylar notch and head of femur etc.
- Shoulder girdle and humerus.
- The Hip
- Pelvis and Sacro-iliac Joints
- The Vertebral and Upper Airways
- The Skull

### **Practicals - (200hrs)**

Radiographic positioning of above mention parts of the body.

## **Syllabus for Diploma in Medical Radiology & Imaging Technology 2<sup>nd</sup> Year**

## **Paper-I: Radiation Physics-II**

### **Theory**

Properties of matter, heat, light, magnetism, electricity and electromagnetism applied in radiological instruments. Physical principles in the design and working of x-ray tube technology. Construction and working principals of transformers and autotransformers used in xray circuits. Measuring instruments voltage of KV meters. Measurement of tube current in milli and micro amperes. Principles of thermionic emission and rectification in xray technology. High voltage circuits in x-ray Units. Electrical hazards and safety. X-ray tube rating in imaging and therapy xray tube and distance, KV, MA. Introduction to electro- magnetic spectrum, definition of wave length and its quantum relationship with peak kilovoltage physical principles of radiation and optical field coverage and the factors affecting the field projected on patient during x-ray imaging. Exponential and trigonometric functions used in radiological calculations.

- Electrical system and mains supply:

The electrical system, generation of electricity, distribution of electric energy, use, ofelectric energy,

- High Tension Generators: Rectifications- Types of rectifier-valve and solid state. Self rectified high tension circuit. Half wave, four valve full wave, three phase, full wave rectified circuit voltage wave forms in high tension generators. Constant potential circuits. High frequency generators, falling load generators, Anatomically programmed generators and modular generators.
- The X-ray Tube: Historical developments including General features of the X-ray tube. The fixed anode, rotating anode xray tube. Rating of X- ray tubes, focal spot sizes. Methods of heat dissipation in xray tubes, common tube faults. Developments in the rotating anode tube. Tube stands and ceiling tube supports. Mammography tubes and equipment, accessories. Different types of tubes and choice of an x-ray tube.
- Fuses, switches and interlocks: fuses, switches and circuit breakers, interlocking circuits.
- Components and controls in the X-ray circuits:The high tension transformer, the rectification of high tension. The control of kilovoltage, kolovoltage indication. The filament circuit and control of the tube current . Milliamperes indications. Main voltage compensation. Mains supply and the xray set.
- Exposure Switches and Exposure Timers: Switching systems timing system, exposure switching and its radiographic applications
- The control of scattered Radiation:Significance of scatter. Beam limiting devices-cones, diaphragm(collimeters) .Beam centring devices . The secondary radiation grid: its types, components of grid, grid movements. The assessment of grid functions, grid-errors, other Scatter reduction methods- air gap technique.
- Mains requirements. Portable x-ray machines, Mobile X-ray equipment, Capacitor discharge mobile x-ray unit and x-ray equipment for operation Theatre and forward radiography.
- Fluoroscopic Equipment:Structure of a fluorescent screen. The fluoroscopic image. The fluoroscopic table, spot film devices and explorators. Protective measures and physiology of vision, image quality.
- Image Intensifiers (I,I.T.V. System):An Image intensifier tube, its design, its application. The television process and television tube its various types. Recording of the intensified image.

T.V.monitor, video tape recording, cine radiographic cameras, Remote Control table.

- Tomographic Equipment:Principal of tomography. Various types of tomographic movements, multi-section radiography. Transverse axial tomography. Equipment for tomography.
- Equipment for Rapid Serial radiography and angiography:
- Rapid film changer. Rapid cassette changer, X-ray generator, x-ray tube, angiographictables, contrast medium injection device.
- Equipment for cranial and Dental Radiography:The skull table, general dental X-ray equipment, specialized dental X-ray equipment. Equipment for mammography-general or dedicated
- Care, maintenance and tests of X-ray equipment:General care; functional tests; testing the performance of exposure timers, assessing the MA setting , testing the available KV, measurement of focal spot of an xray tube, testing the light beam diaphragm, practical precautions pertaining to brakes and locks, H.T. cables, meters and controls, tube stands and tracks as well as accessory equipment.
- Basics of CT & MRI Physics

**Practical** Radiographic positioning of above mention parts of the body.

### **Paper-II: Clinical Radiography-I Theory**

- The Facial Bones and Sinuses
- The Abdomen and Pelvic Cavity
- Ward Radiography
- Theatre Radiography
- Paediatric Radiography
- Mammography
- Miscellaneous
  - Foreign Body Localisation,
  - Forensic Radiology
  - Soft Tissue Radiology

### **Practical**

Positioning and imaging of all kinds of contrast & special radiographic procedures

### **Paper-III: Clinical Radiography-II**

## **Theory**

### **Contrast & Special Radiography procedures:- (100hrs)**

- Barium swallow
- Barium meal
- Barium enema (single and double contrast),
- Enteroclysis
- PTBD
- Sinograms
- Fistulograms
- IVU
- AUG
- MCU
- RGU
- HSG
- Sialogram
- T-tube
- Cholangiography
- Fluoroscopy
- Image intensifiers
- Tomography basics, etc

### **Practicals - (150hrs)**

Positioning and imaging of all kinds of contrast & special radiographic procedures.

## **READING MATERIAL**

### ***Text Books to be Read***

1. Radiographic latent image processing – W. E. J Mckinney
2. Radiographic Imaging - Derrick
3. Physics and photography principles of Medical Radiography – Seeman and Herman.
4. Care of patient in diagnostic Radiography – Chesney & Chesney.
5. First Aid – Haugher and Gardner.
6. Practical Nursing and First Aid – Ross and Wilson.

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