

# SUMANDEEP VIDYAPEETH

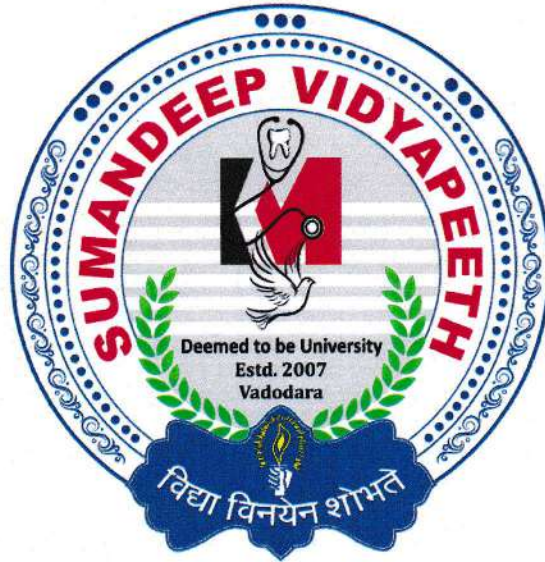
(Declared as Deemed to be University under Section 3 of the UGC Act 1956)

Accredited by NAAC with a CGPA of 3.53 out of four-point scale at 'A' Grade

At & Post Piparia, Tal: Waghodia 391760 (Gujarat) India.

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## CURRICULUM

### Master of Science (M.Sc)

### RADIO- IMAGING TECHNOLOGY

Attested CTC

*Sharaney*  
15/2/2021

Vice-Chancellor

Sumandeep Vidyapeeth

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## Introduction:

## Learning Objectives:

1. At the completion of this course, the student should be –
1. Able to work in the hospital medical imaging department, at the patient's bedside, in the operating room or Emergency or in private imaging clinics/ centers.
2. S/he to assist the use of X-ray, CT scan, angiography, fluoroscopy, ultra sound and MRI to produce images of organs and body parts.
3. Demonstrate sufficient understanding of basic science related to the technology and be able to integrate such knowledge in his/her work.
4. Act upon his/her job description ethically keeping in mind the requirements of the community at large.
5. Demonstrate empathy and humane approach towards communities and exhibit interpersonal behavior in accordance with the societal norms and expectations.
6. To integrate the academic environment with the clinical setting.
7. Manage information to enable effective, timely, accurate, and cost-effective reporting of related information.
8. Have knowledge of Research design/practice sufficient to evaluate published studies as an informed consumer.

## Learning goals and objectives for paramedical healthcare professionals

1. Provide the profession and community with trained qualified technologist
2. Provide education a comprehensive program that promotes problem solving, critical thinking and communication skills in the clinical environment
3. Students will demonstrate quality patient care skills including professionalism and ethical behaviors as specified in the code of ethics
4. Graduate students with specific skills necessary to be competent entry level

## Program outcomes

1. Should be able to undertake Mammography, CT scan and MRI procedures independently.
2. Assist in specialized radiological procedures.
3. Able to do the image processing.
4. Should be able to handle all radiological and imaging equipment independently.
5. Should ensure radiation protection and quality assurance.
6. Undertake care and maintenance of all radiological and imaging equipment.
7. Able to evaluate images for technical quality.
8. Able to identify and manage emergency situations.
9. Able to receive and document verbal, written and electronic orders in the patient's medical record.
10. Should have computer skills.
11. Should be able to provide empathetic professional patient care.
12. Able to demonstrate professional growth, sense of professionalism and desire to learn.
13. Able to demonstrate the core values of caring, integrity and discovery.
14. To exhibit keen interest, initiative & drive in the overall development of the Department and 'Leadership Qualities' for others to follow.
15. He / She is expected to be confident and to perform all the duties diligently with utmost sincerity and honesty.

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16. Any other duty/task/work assigned by any higher authority like Director, Dean, Medical Superintendent, Head of the Department from time to time; either in "Public Interest" or in the interest of upkeep / development of the Department / Institutions.

### **Ethics and accountability:**

Students will understand core concepts of clinical ethics and law so that they may apply these to their practice as healthcare service providers. Program objectives should enable the students to:

- Describe and apply the basic concepts of clinical ethics to actual cases and situations
- Recognize the need to make health care resources available to patients fairly, equitably and without bias, discrimination or undue influence
- Demonstrate an understanding and application of basic legal concepts to the practice
- Employ professional accountability for the initiation, maintenance and termination of patient-provider relationships
- Demonstrate respect for each patient's individual rights of autonomy, privacy, and confidentiality

### **Commitment to professional excellence**

The student will execute professionalism to reflect in his/her thought and action a range of attributes and characteristics that include technical competence, appearance, image, confidence level, empathy, compassion, understanding, patience, manners, verbal and non-verbal communication, an anti-discriminatory and non-judgmental attitude, and appropriate physical contact to ensure safe, effective and expected delivery of healthcare.

### **Eligibility for admission:**

1. Candidate should have passed 10 + 2 with science (PCB).

### **Duration of the course:**

Duration of the course is 3 year including internship.

### **Attendance:**

A candidate has to secure minimum 80% attendance in overall with at least-

1. 75% attendance in theoretical
2. 80% in Skills training (practical) for qualifying to appear for the final examination.

*No relaxation, whatsoever, will be permissible to this rule under any ground including indisposition etc.*

### **Medium of instruction:**

English shall be the medium of instruction for all the subjects of study and for examination of the course.

**Assessment:** Assessments should be completed by the academic staff, based on the compilation of the student's theoretical & clinical performance throughout the training programme. To achieve this, all assessment forms and feedback should be included and evaluated. Student must attain at least 70% marks in each Theory, Internal assessment and Practical independently / separately for each individual subject.

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## COURSE OF INSTRUCTION

Course Name	Course code	Theory (In hrs.) (Class and lab)	Practical (In hrs.) (Clinical)
<b>First Year - Total Hours 740</b>			
Anatomy	DRIT101	60	40
Physiology	DRIT102	60	40
Pathology & Microbiology	DRIT103	60	40
Biochemistry	DRIT104	60	40
Radiation physics	DRIT105	60	-
Radiographic positioning	DRIT106	160	120
<b>Total</b>		<b>460</b>	<b>280</b>
<b>Second Year - Total Hours 360</b>			
Radiological Special Procedures	DRIT201	120	100
Radiographic positioning and Patient care	DRIT203	40	100
<b>Total</b>		<b>160</b>	<b>200</b>
<b>Third Year -</b>			
Darkroom technique & new imaging modalities	DRIT301	160	40

## SCHEME OF EXAMINATION

Course	Course Code	Assessment			
		Hours	Internal	External	Total
<b>First Year</b>					
Anatomy	DRIT101	3	20	80	100
Physiology	DRIT102	3	20	80	100
Pathology & Microbiology	DRIT103	3	20	80	100
Biochemistry	DRIT104	3	20	80	100
Radiation physics	DRIT105	3	20	80	100
Radiographic positioning	DRIT106	3	20	80	100
<b>Total</b>			<b>120</b>	<b>480</b>	<b>600</b>
<b>Second Year</b>					
Radiological Special Procedures	DRIT201	3	20	80	100
Radiographic positioning and Patient care	DRIT203	3	20	80	100
<b>Total</b>			<b>40</b>	<b>160</b>	<b>200</b>
<b>Third Year</b>					
Darkroom technique & new imaging modalities	DRIT301	3	20	80	100

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## FIRST YEAR DIPLOMA RADIOLOGY IMAGING TECHNOLOGY

**DRIT101-ANATOMY**

**60 HOURS**

### THEORY

#### **UNIT – I (ORGANISATION)**

- Terms, terminology, planes
- Tissues of the body (General) Epithelial tissue
- Glands, mucous membrane

#### **UNIT – II (SKELETAL SYSTEM)**

- Cartilage
- Bones
- Ossification, blood supply
- Joints
- Synovial joint

#### **UNIT – III (MUSCULAR TISSUE)**

- Muscle classification – I
- Muscle – II,
- UNIT – IV (Nervous system)
- Neuron, Neuroglia
- Spinal cord & Spinal nerves
- Parts of brain & major functions
- Cranial nerves
- Autonomic nervous system

#### **UNIT – V (SENSORY ORGANS)**

- Nose & Olfaction
- Tongue

#### **UNIT – VI (CIRCULATION & LYMPHATIC)**

- Systemic, Pulmonary, Portal
- Heart, chambers, valves
- Coronary circulation, venous drainage, applied
- Major branches of aorta, major veins, pulse
- Femoral and Auxiliary artery
- Diaphragm
- Lymphoid tissue classification, structure I
- Lymphoid tissue classification, structure II
- Lymphatic drainage, lymphatic trunks

**PRACTICAL:**

**40 HOURS**

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1.	Human skeleton
2.	Organ systems
3.	Organs – 1
4.	Organs – 2

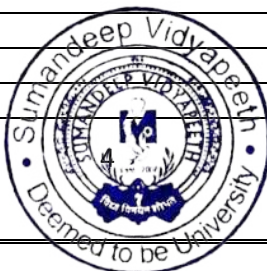
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5.	Organs – 3
6.	Organs – 4
7.	Organs – 5
8.	Types of Cartilages
9.	Bones -1
10.	Bones -2
11.	Bones -3
12.	Histology of compact bones
13.	Muscles of body as functional groups
14.	Histology of types of muscles

## DRIT102-PHYSIOLOGY

60 HOURS

### UNIT-1 GENERAL PHYSIOLOGY

- Introduction to cell physiology,
- Transport across cell membrane
- Homeostasis, Body Fluid compartment & measurement

### UNIT-2 BLOOD

- Introduction - composition and function of blood
- Plasma proteins
- Red blood cells.
- Hemoglobin
- WBC
- Platelets
- Homeostasis
- Blood Group

### UNIT-3 NERVE – MUSCLE PHYSIOLOGY

- Resting membrane potential & Action potential
- Types of muscle & Mechanism of Muscle Contraction
- Neuromuscular Junction
- Neuron and neuroglia
- Properties of nerve fibre
- Secretion & Composition & function of CSF

### UNIT-4 GIT

- Movement of GIT
- Deglutition & Mechanism of Vomiting
- Digestive Juices in upper digestive tract
- Digestive juices in lower digestive tract

### UNIT-5 EXCRETORY SYSTEM

- Kidneys-structure, function
- Glomerular filtration rate
- Counter-current mechanism of concentration of urine
- micturition, Diuretics

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- Artificial kidney, renal function tests
- Skin
- Regulation of body Temperature

#### UNIT-6 RESPIRATORY SYSTEM

- Mechanism of Breathing
- Hypoxia
- O<sub>2</sub> and CO<sub>2</sub> transport
- Pulmonary volume & Capacities

#### UNIT -7 CARDIO VASCULAR SYSTEM

- Introduction to CVS & general principles of circulation
- Properties of Cardiac muscle
- Cardiac cycle, heart sounds, Pulse
- Cardiac output, Heart rate ,BP ,ECG
- Coronary circulation, Cutaneous circulation-Triple response ,Shock
- Effects of exercise on CVS and Respiratory system

#### UNIT-8 LYMPHATIC SYSTEM

#### UNIT- 9 ENDOCRINE SYSTEMS

- Hormones of pituitary, Thyroid
- Parathyroid Gland
- Hormones of Adrenal Gland & Pancreas

#### UNIT 10 REPRODUCTIVE SYSTEM

- Introduction to reproductive system, Puberty
- Male reproductive system,
- Female reproductive system,
- Physiological changes during pregnancy, pregnancy tests, parturition & lactation
- Male & Female contraceptive methods
- Special senses
- Vision
- Audition
- Olfaction
- Gustation

#### PRACTICAL:

40 HOURS

- Introduction and Laboratory guidelines
- Demonstration of estimation of Hemoglobin
- Practical of estimation of Hemoglobin
- Practical of BT & CT
- Practical of Blood Grouping

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- ESR & PCV
- Blood Pressure
- Pulse
- Respiration
- Heart rate & heart sound

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- Breathing rate & breathing sound
- Identification of blood cells by peripheral smear. RBC, WBC, Platelets.
- Revisions

## DRIT103-PATHOLOGY

30 HOURS

### UNIT I-CELL INJURY AND ADAPTATION:

- Necrosis:
- Definition.
- Types of necrosis.
- Short notes: Coagulative necrosis.
- Liquefactive necrosis
- Caseous necrosis
- Fat necrosis
- Gangrene

### UNIT II- INFLAMMATION AND REPAIR:

#### Inflammation: Definition

- Types of inflammation
- Vascular changes, Hemodynamic changes
- Changes in vascular permeability
- Cellular events: Margination, Adhesion, Emigration, Chemotaxis, Phagocytosis.
- Shortnotes: Phagocytosis, Chemotaxis and Granulomas

#### Healing and repair:

- Process of healing by primary intention.
- Process of healing by secondary intention.
- Shortnotes: factors influencing wound healing.

### UNIT III-FLUID AND HEMODYNAMIC DERANGEMENTS:

#### Edema:

- Definition
- Types of edema
- Pathogenesis of renal and cardiac edema
- Lymph edema

#### Shock:

- Definition
- Types of shock
- Pathogenesis of septic and hypovolemic shock

#### Thrombosis:

- Definition
- Factors influencing thrombosis
- Fate of thrombosis

### UNIT IV-NEOPLASIA

- Introduction: nomenclature, metaplasia, dysplasia, anaplasia, hyperplasia, hypertrophy

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- Definition
- Differences between benign and malignant tumors
- Spread of tumors
- Shortnotes: Gross features and clinical features of:
- Squamous papilloma
- Squamous cell carcinoma
- Lipoma
- Fibrosarcoma.

#### UNIT V-INFECTIOUS DISEASES:

- Tuberculosis: Etiology and clinical features.
- Geon complex
- Secondary tuberculosis
- Leprosy: Etiology, classification and morphology of Lepromatous and Tuberculoid
- leprosy
- Etiology, mode of infection, clinical features and gross pathology of HIV infection

#### UNIT VI-DISEASES OF RED CELLS AND BLEEDING DISORDERS

- Anaemia: definition and classification
- Clinical features of:
- Iron deficiency anaemia
- Vit B 12 deficiency anaemia
- Sickle cell anemia
- Coagulation disorders: classification, capillary fragility and platelet disorders.
- Haemophilia(SN) thrombocytopeniaincluding ITP(SN)

#### UNIT VII-DISEASES OF WHITECELL AND LYMPH NODES

- Leukaemia: definition, classification and clinical features
- Lymphoma: definition, types and clinical features

#### UNIT VIII-NUTRITIONAL DISEASES

- Vit A, B, C, D deficiency including a brief account of rickets

#### PRACTICAL:

20 HOURS

- Receiving of Specimen in the laboratory
- Grossing Techniques
- Mounting Techniques – various Mutants
- Maintenance of records and filing of the slides
- Tissue processing for routine paraffin sections
- Section Cutting
- Staining of tissues - H& E Staining
- Collection, Transport, Preservation, and Processing of various clinical Specimens
- Urine Examination – Collection and Preservation of urine. Physical, Chemical, Microscopic
- Examination
- Urine Examination –Chemical and Microscopic Examination
- Collection of Blood samples
- Various Anticoagulants used in Haematology

DRIT103-MICROBIOLOGY

30 HOURS

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## UNIT I: GENERAL MICROBIOLOGY

- History: Louis Pasteur, Robert Koch
- Microscope: Parts, function and its types
- Morphology of bacteria: classification of microorganisms, bacteria cell, staining of bacteria- Gram and ZN stain.
- Physiology of bacteria: Growth and nutrition of bacteria, Growth curve
- Sterilization and disinfection: Dry heat, moist heat sterilization, filtration, Radiation, disinfectants use in hospital
- Culture media: simple and complex media, preparation and its use
- Culture methods: aerobic and anaerobic
- Identification of bacteria: catalase test, coagulase test, oxidase test, Urease test, IMViC TESTS

## UNIT II: IMMUNOLOGY

- Infection
- Immunity
- Antigen
- Antibody

## UNIT III: COLLECTION, TRANSPORT AND PROCESSING OF CLINICAL SPECIMENS:

- Throat swab
- Sputum
- Urine
- Pus
- Blood
- CSF

## UNIT IV: SYSTEMIC BACTERIOLOGY

- Staphylococcus aureus
- Streptococcus pyogenes
- Pneumococcus
- E.coli, Klebsiella and Pseudomonas

## UNIT V: HEALTH CARE ASSOCIATED INFECTIONS:

- Sources, Method of transmission and Prevention

## UNIT VI: Principle and Practices of Biomedical waste management

### PRACTICAL:

20 HOURS

- Microscope: parts function, focus, care and handling
- Hanging drop preparation
- Performance of Gram's stain
- Performance of ZN stain
- Culture media preparation: Nutrient agar, Blood agar, Chocolate agar, NA slant, MacConkey's agar.
- Functioning of Autoclave and Hot air oven

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- Visit to hospital for the demonstration of Biomedical Waste Management
- Aseptic practices in laboratory and safety precautions

## DRIT104-BIOCHEMISTRY

60 HOURS

### UNIT I-BASIC CONCEPTS OF ENZYMES

- Clinical enzymology
- Carbohydrates proteins and lipids (structure and function)
- Primary metabolic pathways involving proteins, lipids and carbohydrates
- Biosynthesis of Proteins, Membrane, Lipids and Glucose – Basic Steps

### UNIT II

- Haemoglobin (Haem Synthesis), Blood Clotting Factors

### UNIT III

- Brief Note on Vitamins

### UNIT IV

- Plasma Proteins and their Clinical Importance

### UNIT V-CLINICAL BIOCHEMISTRY AND INTERPRETATION

- Test for liver function/gastric function
- Test for renal function
- Lipid profile
- Glucose –gtt, rbs, fbs
- Electrolytes
- Blood collection/anticoagulants

## PRACTICALS:

40 HOURS

- To demonstrate glassware's, apparatus and plastic wares used in laboratory.
- Preparation of different percentage solutions
- Preparation of normal and molar solutions. (0.1 N NaOH, 0.2N HCl, 0.1 M H<sub>2</sub>SO<sub>4</sub>).
- Reactions of Carbohydrate
- Reactions of Protein: - Precipitation and Color reaction.
- Analysis of Normal Urine:- Physical, Chemical and Microscopic
- Analysis of abnormal Urine:- Physical, Chemical and Microscopic
- Qualitative analysis of Saliva.
- Qualitative analysis of Milk
- Qualitative analysis of Bile.
- Qualitative analysis of CSF.
- Qualitative analysis of Gastric juice.

## DRIT105-RADIATION PHYSICS

60 HOURS

### UNIT I-REVIEW OF IDEAS ON ATOMIC AND NUCLEAR PHYSICS

- Alpha decay, beta decay gamma emission
- Internal conversion and nuclear isomerism
- Nuclides and its classification

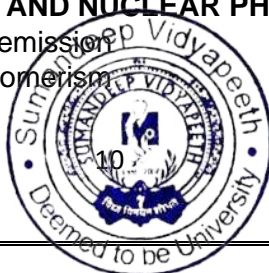
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- Radio activity
- Half life

## UNIT II-ELECTROMAGNETIC RADIATION

- Electromagnetic spectrum
- Common properties of electromagnetic radiation
- Relationship between energy, frequency, wavelength and velocity eg, x- ray and gamma rays

## UNIT III-REVIEW OF X-RAYS

- Properties of x-rays
- Production of x-rays
- Interaction of x-rays with the target
- Spectra of x-rays
- Quality and intensity of x-rays
- The factors influencing quality and intensity

## UNIT IV-INTERACTIONS OF X-RAYS, GAMMA RAYS AND BETA RAYS WITH MATTER

- Transmission through matter
- Law of exponential attenuation
- Half value layer
- Linear attenuation coefficient
- Interaction of radiation with matter
- Classical scattering
- Compton scatter
- Photo electric absorption
- Pair production
- Practical aspects of radiation absorption and transmission through body tissue

## UNIT V-METHODS OF MEASUREMENT OF X AND GAMMA RAY

- Principles of radiation detection and measurement
- Ionization chamber
- G M counter
- Scintillation detector
- Photo film method
- Pocket dosimeter
- TLD
- Solid state detectors
- Chemical dosimeters
- Exposure meters and rate meters
- Measurement of half value layer
- Unit of quantity of radiation exposure, Definition and application of roentgen and relationship with RAD, unit of Dose equivalent(REM)

## UNIT VI-Radiation protection

- Introduction
- Maximum permissible Dose, the code of practice
- Protective materials for X and  $\gamma$  radiation
- Radiation monitoring
- Evaluation of workload, occupancy & Use factors in diagnostic x-ray departments

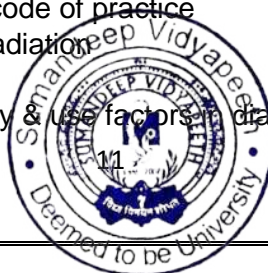
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- Department planning,
- Protection regulation fluoroscopy & radiography.

#### UNIT VII-MAIN POWER SUPPLY

- Generators and transformers
- AC and DC power supply with examples
- Single phase and poly phase power supply
- Switches, fuses, circuit breakers, earthing etc
- Main voltage drop: causes and remedy
- Cables: low and high tensions

#### UNIT VIII-RECTIFICATION

- Vacuum diode- variation of anode current with anode voltage and filament temperature
- Gas filled diode and triode
- Principles of rectification
- Wave form of half wave and full wave current/voltage wave form
- Rectifiers: valves, metal rectifiers, semiconductor rectifiers and relative merits and demerits
- Silicon, germanium diodes

#### UNIT IX: X-RAY CIRCUITS

- Principle of transformers, design efficiency of transformer, source of power loss
- H.T generators for x-ray machines
- High frequency circuits
- Self-rectifier half wave rectifier, bridge rectifier and three phase rectifier circuits
- Capacitance filter control and stabilizing equipment
- Main voltage compensators and main resistance compensators
- Compensation for frequency variation
- Control of tube voltage, including kv compensator
- High tension selector switch
- Filament circuit
- Control of tube current, space charge compensation

#### UNIT X: X-RAY TUBE

- Gas filled x-ray tube: construction, working and limitations; thermionic emission
- Stationary anode x-ray tube : construction, working, methods of cooling anode; rating chart and cooling chart
- Rotating anode x-ray tube: construction, working rating chart, speed of anode rotation, angle of anode inclination
- Dual focus with particular consideration in choice of focus
- Anode heel effect
- Grid controlled x-ray tube
- Effect of variation of anode voltage and filament temperature
- Continuous and characteristic spectrum of x-rays
- Inherent filter and added filter; their effect on quality of the spectrum

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#### UNIT XI MODERN X-RAY TUBES

- Types in detail

#### UNIT XII-FILTERS

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- Definition of filtration
- Types of filtration
- Effect of filtration on patient as well as exposure factor
- Types of filters

### UNIT XIII: X-RAY BEAM RESTRICTORS

- Definition
- Functions of restrictors
- Patient protection

### UNIT XIV-GRIDS

- Definition and types
- Evaluation of grid performance
- Grid cut-off
- Air gap technique

### UNIT XV: FLUOROSCOPY

- Image intensifier
- Direct fluoroscopy
- Principles of image intensification
- Image quality : unsharpness, noise, resolution, distortion
- Spectral emission ; gas spots
- Multifield image intensifiers
- Lens system and image distribution
- Viewing and recording of fluoroscopic image

### UNIT XVI: FACTORS EFFECTING IMAGE QUALITY

- Radiographic image.
- Geometry of the radiographic image

## DRIT106-RADIOGRAPHIC POSITIONING

160 HOURS

### UNIT 1-SKULL AND CRANIAL BONES AND FACIAL BONES

- Related radiological anatomy
- **Basic & special projections**
- Cranium
- Base of skull
- Sella turcica
- Mastoids
- Optic foramina and Orbits
- Nasal bone
- TM joint
- Facial bone
- Zygomatic arches
- Mandible
- Para nasal sinuses

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## UNIT2-NECK

- Related radiological anatomy
- Positioning- AP, LAT

## UNIT3-CHEST

- Related radiological anatomy
- **Basic & special projections**
- AP,LAT
- AP supine & semierect
- Lateral decubitus
- AP lordotic
- Anterior oblique
- Posterior oblique
- Upper airway: AP, LAT

## UNIT4-ABDOMEN

- Related radiological anatomy
- Basic & special projection
- Basic:**
- AP supine (KUB)
- Special:**
- PA prone
- Lateral decubitus
- Erect AP
- Dorsal decubitus
- Lateral
- Acute abdomen: three-way series

## UNIT5-KUB

- Related radiological anatomy
- Positioning- AP

## UNIT6-PELVIC GIRDLE AND PROXIMAL FEMUR

- Related radiological anatomy
- Basic & special projections
- Pelvic girdle
- AP pelvis
- Frog lateral(modified cleaves method )
- AP axial for pelvic outlet(tailor method)
- AP axial for pelvic inlet(modified linenfold method)
- Posterior oblique- acetabulum( judge method)

## UNIT6-HIP AND PROXIMAL FEMUR

- AP unilateral hip
- Axiolateral inferosuperior (danielius – miller method)
- Unilateral frog leg( modified cleaves method)
- Modified axiolateral(clements- nakayama method)
- Sacroiliac joints: AP, posterior oblique

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## UNIT7-SHOULDER GIRDLE

- Related radiological anatomy
- Basic and special projections
- Shoulder non trauma routine:**
- AP(external rotation)
- AP(internal rotation)
- Inferosuperior axial(Lawrence method)
- Inferosuperior shoulder projection(west point method)
- Posterior oblique – glenoid cavity(grashey method)
- Intertubercular groov(kisk method)

### Shoulder (trauma routine):

- AP neutral rotation
- Transthoracic lateral (Lawrence method)

### Scapula Y view

- Tangential projection- supraspinatus outlet(neer method)
- Apical oblique projections (garth method)

### Clavicle

- AP and AP axial

### Acromioclavicular joints:

- AP bilateral with and without weight

### Sternoclavicular joints

#### Scapula

- AP
- Lateral erect
- Lateral recumbent

## UNIT8-HUMOURS

- Related radiological anatomy
- AP
- LAT
- Horizontal beam LAT
- Proximal humerus views

## UNIT9-ELBOW

- Related radiological anatomy
- AP- fully extended, partially flexed
- AP oblique- external and internal rotation
- Lateral
- Acute flexion(jones method)
- Transaxial lateral(coyle method)
- Radial head lateral

## UNIT10- FOREARM

- Related radiological anatomy

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- AP
- LAT

#### UNIT11-WRIST

- Related radiological anatomy
- PA, AP
- PA oblique
- Lateral
- Radial deviation
- Carpal canal- inferiosuperior (gaynor-hart method)
- Carpel bridge

#### UNIT12- HAND

- Related radiological anatomy
- PA
- PA oblique
- Lateral
- Lateral- flexion and extension
- AP bilateral oblique(nirgaard method)

#### UNIT13- FINGERS

- Related radiological anatomy
- PA
- Oblique
- LAT

#### UNIT14-THUMB

- Related radiological anatomy
- AP
- PA oblique
- Lateral
- AP (Roberts method)
- Skiers thumb (folio method)

#### UNIT15-FEMUR

- Related radiological anatomy
- Mid and distal femur
- AP
- Lateral
- Mid and proximal femur
- AP
- Lateral

#### UNIT16-KNEE

- Related radiological anatomy
- Knee
- AP
- Oblique- medial and lateral rotations
- Lateral
- AP( weight bearing)

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- Knee- intercondylar fossa
- PA axial(camp coventry and holmblad method)
- AP axial

#### UNIT17-LEG

- Related radiological anatomy
- AP
- LAT

#### Ankle

- Related radiological anatomy
- AP
- AP mortise (15° oblique)
- Lateral
- AP stress

#### Foot

- Related radiological anatomy
- AP
- Oblique
- Lateral
- AP and lateral weight bearing

#### Calcaneus

- Related radiological anatomy
- Plantodorsal(axial)
- Lateral

#### UNIT18-CERVICAL SPINE

- Related radiological anatomy
- Basic views
- AP open mouth (C1 and C2)
- AP axial
- Oblique
- Lateral
- Erect
- Trauma lateral(horizontal beam)
- Cervicothoracic junction (swimmers view)

#### Special views

- Lateral- hyperflexion and hyperextension
- AP (fuchs method) or PA (judd method)
- AP wagging jaw (ottonello method)
- AP axial (pillars)

#### UNIT19-THORACIC SPINE

- Related radiographic anatomy and projections
- AP
- Lateral
- Oblique

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## UNIT20-LUMBAR SPINE, SACRUM AND COCCYX

- Related radiographic anatomy
- AP
- Oblique
- Lateral
- Lateral (L5 – S1)
- AP axial (L5 – S1)

### Scoliosis series

- AP or PA
- Erect lateral
- AP(ferguson method)
- AP – R and L bending

### Spinal fusion series

- AP or PA – R and L bending
- Lateral – hyperextension and hyperflexion

## UNIT21-SACRUM AND COCCYX

- AP axial sacrum
- AP axial coccyx
- Lateral sacrum
- Lateral coccyx

## UNIT22-PAEDIATRIC RADIOGRAPHY

- Positioning, care and radiation protection while handling babies

## SECOND YEAR DIPLOMA RADIOLOGY IMAGING TECHNOLOGY

### DRIT201-RADIOLOGICAL SPECIAL PROCEDURES

120 HOURS

#### UNIT1-INTRODUCTION TO THE SUBJECT

- All radiographic procedures including:
- IVU
- MCU
- Retrograde pyelourethrogram
- Myelogram
- Ba studies
- HSG/ FTR
- Sialography
- T- tube cholangiography
- Simultaneous transhepatic cholangiography
- Direct portal venography
- Bronchography
- Angiography
- Phlebography

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- Dacrocystography

## UNIT2 -CONTRAST MEDIA

- Definition
- Classification
- Chemistry
- Physiology
- Toxicity
- Treatment- emergency drugs
- C M used in USG

## UNIT3-I V U

- Anatomy of urinary system
- Indication & contra indication
- Risk factors
- Contrast media
- Patient preparation
- Procedure and filming techniques
- Nephrotomogram
- Modification of urogram
- Complication and aftercare

## UNIT4-M C U

- Anatomy of lower urinary tract
- Indication & contra indication
- Procedure & filming
- Complications
- Other techniques

## UNIT5-MYELOGRAM

- Anatomy of spinal coard
- Definition, indication & contraindication
- Preparations, requirements & contrast media
- Lumbar, cisternal & lateral cervical puncture
- C T myelogram
- M R myelogram

## UNIT6-CONTRAST MEDIA IN GIT

- Introduction
- Properties of an ideal barium preparation
- Advantages of barium sulphate preparation
- Manufacture
- Characteristics influencing coating
- Adverse effects
- Other contrast media used
- Contrast media used for CT in GIT
- Contrast media for MRI in GIT

## UNIT7-BARIUM SWALLOW

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- Anatomy of upper GI tract
- Indications & contraindications
- Contrast
- Procedure and techniques
- Specific conditions
- Complications

#### UNIT8-BARIUM MEAL

- Anatomy of stomach
- Indications & contraindications
- Preparation
- Contrast media
- Standard views
- Conventional single contrast study
- Double contrast barium study
- Biphasic study of upper GIT
- Hypotonic duodenography
- After care & complications

#### UNIT9-BMFT

- Anatomy of GI tract
- Indications & contraindication
- Contrast medium
- Patient preparation
- Small bowel follows through
- Dedicated small bowel follow through
- Peroral pneumocolon
- Retrograde small bowel examination
- Advantages, disadvantages & complications

#### UNIT10-ENTEROCLYSIS

- Anatomy of small bowel
- Indication contraindication
- Equipment, contrast medium
- Preparation
- Techniques
- Single contrast study
- Double contrast study
- Air D C enteroclysis
- Comparison
- Advantages, disadvantages & after care

#### UNIT11-BARIUM ENEMA

- Anatomy of large bowel
- Definition, indication, contraindication
- Contrast
- Preparation and positioning
- DCBE, SCBE
- Special barium enema studies
- Aftercare & complications

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## UNIT12-HSG

- Anatomy of female reproductive system
- Definition, indication and contraindication
- Equipments, procedures & techniques
- After care & complications
- Sonosalpingiography

## UNIT13-FTR

- Definition, indication and contraindication
- Instrumentation
- Timing of the study, patient preparation
- Technique and filming
- Other methods
- Post procedure follow up and complications

## UNIT14-SIALOGRAPHY

- Anatomy of salivary glands
- Definition, indication & contraindication
- Equipments
- Preparation of the patient
- Procedure & filming

## UNIT15-CATHETERS

- Classification
- Catheters used for different studies
- Sterilization of catheters
- Balloon angioplasty catheters

## UNIT16-ANGIOGRAPHY (CEREBRAL, VISCERAL, PERIPHERAL)

- Anatomy of blood vessels
- Definition indication & contraindication
- Patient preparation and precautions
- Local anaesthesia
- Direct needle puncture
- Catheter angiography
- Percutaneous transluminal angioplasty

## UNIT17-DACROCYSTOGRAPHY

- Anatomy of nasolacrimal duct
- Definition, indication & contraindication
- Materials & technique
- Complications
- Other techniques

## UNIT18-PATIENT CARE & PROFESSIONAL ETHICS

- Development of communication skills with patient - general comfort and reassurance to the patient - patient education and explaining about the study - drugs used in the preparation of the patient. Handling of an unconscious patient - lifting of patients - hazards of lifting and

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manoeuvring patients -rules for correct lifting- transfer from chair/wheel chair or trolley to couch and vice-versa -safety of patient and worker while lifting & shifting of patients- handling of geriatric, paediatric and trauma patients -handling female patients-pregnant women. Communicable diseases - hygiene in the department-cross infection and prevention-handling of infectious patients in the department -application of asepsis. Ethics of medical practice- Radiography professionalism-essential qualities of the radiographer-improving professional and personal qualities- Radiographer as a part of Hospital /Organization-responsibilities. Medico-legal considerations - radiographers clinical and ethical responsibilities- misconduct and malpractice.

## **DRIT202-RADIOGRAPHIC POSITIONING AND PATIENT CARE**

**70 HOURS**

### **UNIT 1-SKULL AND CRANIAL BONES AND FACIAL BONES**

- Related radiological anatomy
- **Basic & special projections**
- Cranium
- Base of skull
- Sella turcica
- Mastoids
- Optic foramina and Orbits
- Nasal bone
- TM joint
- Facial bone
- Zygomatic arches
- Mandible
- Para nasal sinuses

### **UNIT2-NECK**

- Related radiological anatomy
- Positioning- AP, LAT

### **UNIT3-CHEST**

- Related radiological anatomy
- **Basic & special projections**
- AP,LAT
- AP supine & semierect
- Lateral decubitus
- AP lordotic
- Anterior oblique
- Posterior oblique
- Upper airway: AP, LAT

### **UNIT4-ABDOMEN**

- Related radiological anatomy
- **Basic & special projection**

#### **Basic:**

- AP supine (KUB)

#### **Special:**

- PA prone

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- Lateral decubitus
- Erect AP
- Dorsal decubitus
- Lateral
- Acute abdomen: three-way series

#### UNIT5-KUB

- Related radiological anatomy
- Positioning- AP

#### UNIT6-PELVIC GIRDLE AND PROXIMAL FEMUR

- Related radiological anatomy
- Basic & special projections
- Pelvic girdle
- AP pelvis
- Frog lateral(modified cleaves method )
- AP axial for pelvic outlet(tailor method)
- AP axial for pelvic inlet(modified linenfold method)
- Posterior oblique- acetabulum( judge method)

#### UNIT6-HIP AND PROXIMAL FEMUR

- AP unilateral hip
- Axiolateral, inferosuperior (danielius – miller method)
- Unilateral frog leg( modified cleaves method)
- Modified axiolateral(clements- nakayama method)
- Sacroiliac joints: AP, posterior obliques

#### UNIT7-SHOULDER GIRDLE

- Related radiological anatomy
- Basic and special projections
- Shoulder non trauma routine:**
- AP(external rotation)
- AP(internal rotation)
- Inferosuperior axial(Lawrence method)
- Inferosuperior shoulder projection(west point method)
- Posterior oblique – glenoid cavity(grashey method)
- Intertubercular groove(kisk method)

#### Shoulder (trauma routine):

- AP neutral rotation
- Transthoracic lateral (Lawrence method)

#### Scapula Y view

- Tangential projection- supraspinatus outlet(neer method)
- Apical oblique projections (garth method)

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#### Clavicle

- AP and AP axial

#### Acromioclavicular joints:

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- AP bilateral with and without weight

### **Sternoclavicular joints**

#### **Scapula**

- AP
- Lateral erect
- Lateral recumbent

### **UNIT8-HUMOURS**

- Related radiological anatomy
- AP
- LAT
- Horizontal beam LAT
- Proximal humerus views

### **UNIT9-ELBOW**

- Related radiological anatomy
- AP- fully extended, partially flexed
- AP oblique- external and internal rotation
- Lateral
- Acute flexion(jones method)
- Trauma axial lateral(coyle method)
- Radial head lateral

### **UNIT10- FOREARM**

- Related radiological anatomy
- AP
- LAT

### **UNIT11-WRIST**

- Related radiological anatomy
- PA, AP
- PA oblique
- Lateral
- Radial deviation
- Carpal canal- inferiosuperior (gaynor-hart method)
- Carpel bridge

### **UNIT12- HAND**

- Related radiological anatomy
- PA
- PA oblique
- Lateral
- Lateral- flexion and extension
- AP- bilateral oblique(nirgaard method)

### **UNIT13- FINGERS**

- Related radiological anatomy
- PA

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- Oblique
- LAT

#### UNIT14-THUMB

- Related radiological anatomy
- AP
- PA oblique
- Lateral
- AP (Roberts method)
- Skiers thumb (folio method)

#### UNIT15-FEMUR

- Related radiological anatomy
- Mid and distal femur
- AP
- Lateral
- Mid and proximal femur
- AP
- Lateral

#### UNIT16-KNEE

- Related radiological anatomy
- Knee
- AP
- Oblique- medial and lateral rotations
- Lateral
- AP( weight bearing)
- Knee- intercondylar fossa
- PA axial(camp coventry and holmblad method)
- AP axial

#### UNIT17-LEG

- Related radiological anatomy
- AP
- LAT

#### Ankle

- Related radiological anatomy
- AP
- AP mortise (15° oblique)
- Lateral
- AP stress

#### Foot

- Related radiological anatomy
- AP
- Oblique
- Lateral
- AP and lateral weight bearing

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## Calcaneus

- Related radiological anatomy
- Plantodorsal(axial)
- Lateral

## UNIT18-CERVICAL SPINE

- Related radiological anatomy
- Basic views
- AP open mouth (C1 and C2)
- AP axial
- Oblique
- Lateral
- Erect
- Trauma lateral(horizontal beam)
- Cervicothoracic junction (swimmers view)

### Special views

- Lateral- hyperflexion and hyperextension
- AP (fuchs method) or PA (judd method)
- AP wagging jaw (ottonello method)
- AP axial (pillars)

## UNIT19-THORACIC SPINE

- Related radiographic anatomy and projections
- AP
- Lateral
- Oblique

## UNIT20-LUMBAR SPINE, SACRUM AND COCCYX

- Related radiographic anatomy
- AP
- Oblique
- Lateral
- Lateral (L5 – S1)
- AP axial (L5 – S1)

### Scoliosis series

- AP or PA
- Erect lateral
- AP(ferguson method)
- AP – R and L bending

### Spinal fusion series

- AP or PA – R and L bending
- Lateral – hyperextension and hyperflexion

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## UNIT21-SACRUM AND COCCYX

- AP axial sacrum
- AP axial coccyx
- Lateral sacrum

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- Lateral coccyx

#### **UNIT22-PAEDIATRIC RADIOGRAPHY**

- Positioning, care and radiation protection while handling babies

### **THIRD YEAR DIPLOMA RADIOLOGY IMAGING TECHNOLOGY**

#### **DRIT301-NEW IMAGING MODALITIES AND RECENT ADVANCES**

**160 HOURS**

#### **UNIT1-COMPUTED RADIOGRAPHY**

- **Introduction**
- Components
- Cassettes and Imaging plates
- Digitizer
- Image formation
- Advantages and disadvantages

#### **UNIT2-DIGITAL RADIOGRAPHY**

- **Introduction**
- Work flow
- System components
- Image formation
- Advantages and disadvantages

#### **UNIT3-PACS**

- **Introduction**
- Work flow
- Components
- Types
- Storage
- Advantages and disadvantages

#### **UNIT4-DSA**

- **Introduction**
- Room layout and design
- Equipment
- Image recording system
- Automatic injection devices
- Contrast media
- Catheters and accessories
- Subtraction techniques

#### **UNIT5-MICRO RADIOGRAPHY**

- Definition
- Principle
- Unsharpness
- Scattered radiation

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- Cassette support
- Examples of macro radiography

#### **UNIT6: DENTAL RADIOGRAPHY**

- Introduction
- Terminology
- Dental formula
- Intra – oral radiography
- Bite wing
- Periapical radiography
- Occlusal radiography
- Extra oral oblique lateral
- Cephalometry
- Orthopantomography

#### **UNIT8-MAMMOGRAPHY**

- Introduction
- Physics involved in it
- Patient preparation
- Different techniques

#### **UNIT9-COMPUTED TOMOGRAPHY**

- Introduction to CT
- History
- Advantage of CT
- Comparisons with other imaging modalities
- CT principle
- Basic principle
- CT number
- CT generations
- Slip ring technology
- Electron beam CT
- Multy slice technology
- CT detector

#### **UNIT10- IMAGE RECONSTRUCTION**

- Basic principle
- Image reconstruction from projections
- Reconstruction algorithms

#### **UNIT11- INSTRUMENTATION**

- CT scanner
- Imaging system
- CT computer and image processing
- Image display, storage, recording and communications
- CT control console
- Options and accessories for CT systems

#### **UNIT12-DATA ACQUISITION**

- Basic scheme for data acquisition

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- CT detector technology
- Detector electronics
- Data acquisition and sampling

### UNIT13-IMAGE DISPLAY

- Image formation and representation
- Image processing
- Pixel and voxel
- CT number
- Window level and window width

### UNIT14-CT ARTIFACTS

- Classification
- Types
- Causes
- Remedies

### UNIT15- IMAGE QUALITY

- Qualities
- Resolution
- Contrast
- Sharpness
- Noise properties in CT

### UNIT16-BASIC DIAGNOSTIC ASPECTS

- Role of the CT technologist
- Patient management
- Indication
- Patient preparation
- Patient positioning and scanning protocols

### UNIT17-CT CONTRAST MEDIA

- Types
- Use and administration
- Suspected contraindications

### UNIT18-CT GUIDED PROCEDURES

- Types
- Protocols
- Both invasive and non invasive

### UNIT19-SAFETY CONSIDERATION

- Staff safety
- Patient safety
- Universal precautions
- Knowledge of communicable and non communicable diseases

### UNIT20-DOCUMENTATION

- Role of CT Technologist

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- Documentation of information about patient care, the procedure and the final outcome

## **DARK ROOM TECHNIQUES**

### **UNIT1-INTRODUCTION TO THE SUBJECT**

### **UNIT2-IMAGE CHARACTERISTICS**

- Definition
- Reflected, transmitted and emitted light image
- Noise(fog, quantum noise), SNR, contrast, optimum contrast, sharpness
- Resolution

### **UNIT3-THE INVISIBLE X-RAY IMAGE**

- Latent image
- Subject contrast
- Differential attenuation
- Effects of scatter and its control
- Geometric & motion Unsharpness

### **UNIT4-RADIOGRAPHY (PHOTOGRAPHIC PRINCIPLE)**

- Photographic effect
- Photosensitive chemicals: latent image formation
- Manufacture of emulsion: light and x-ray sensitive emulsion
- Describing photographic performance: density, log relative exposure
- The characteristic curve  
Sensitometry

### **UNIT5-THE RECORDING SYSTEM: FILM MATERIAL**

- Film construction
- Film base, subbing layer, emulsion, super coat, backing layers
- Crossover effect; irradiation
- Types of films
- Film storage

### **UNIT6-THE RECORDING SYSTEM: INTENSIFYING SCREENS**

- Luminescence
- Screen unsharpness
- Screen construction
- Phosphors
- Quantum detection & conversion efficiency
- Types of screen
- Intensifying factor : quantum mottle
- Factors affecting speed and unsharpness

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Type of screens

### **UNIT7-THE RECORDING SYSTEM: FILM CASSETTES**

- Cassette construction and ideal features
- Types of cassettes

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- Care of cassettes; loading and unloading cassettes
- Special cassettes

#### **UNIT8-THE PROCESSING AREA**

- Siting and function of the processing area
- Darkroom design and construction
- Darkroom illuminations
- Darkroom equipments : manual & automatic processors
- Health and safety
- COSHH regulations

#### **UNIT9-PHOTOGRAPHIC PROCESSING: PRINCIPLES-1**

- Acidity, alkalinity and pH
- Development: (manual)
- Developer solution & activity
- Fixing: fixing solution and activity
- Washing & Drying

#### **UNIT10-PHOTOGRAPHIC PROCESSING: PRINCIPLES- 2 (AUTO PROCESSORS)**

- Film transport, cycle time, capacity
- Feed section
- Developer section
- Fixer section
- Washing section
- Drying section
- Replenishment; auto mixers
- Auto processors for special films
- Care & maintenance of the auto processors

#### **UNIT11-SILVER RECOVERY**

- Justification for silver recovery
- Amounts of silver in fixer
- Electrolytic recovery; high current systems
- Recovering silver deposit; recycling fixer
- Monitoring efficiency; comparison of methods
- Silver recovery from scrap films

#### **UNIT12-FILM ARTIFACTS**

- Definition
- Types
- Causes and remedies

#### **SPECIAL RADIOLOGICAL EQUIPMENT**

- Portable and mobile x-ray units
- Dental x-ray machine
- High tension Generators
- X-ray tubes-their types and advancements
- Digital radiography equipment

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- Digital subtraction techniques Tomography: Body section radiography, basic principle and equipment, multi section tomography, various types of tomographic movements, Tomosynthesis, Stinch radiography, Dual energy x-ray absorptionometry (DEXA) scan.

#### **INTERNSHIP (INTEGRATED PRACTICE) -**

- The internship will span 6 months. This will include 6 hours of practice a day. As a part of this, the students will maintain a work logbook which will be duly endorsed by the supervisor or trainer. At the end of internship, the candidate shall submit the work log book along with certificate from the training institute.
- The internship time period provides the students the opportunity to continue to develop confidence and increased skill in clinical delivery of services. Students will demonstrate competence in beginning and intermediate procedures. Students will observe the advanced and specialized procedures. The student will complete the clinical training by practicing all the skills learned in classroom and clinical instruction. The students are expected to work for minimum 6 hours per day and this may be more depending on the need and the healthcare setting.

#### **Allied and Healthcare Professions**

Allied and healthcare professionals includes individuals involved with the delivery of health or healthcare related services, with qualification and competence in therapeutic, diagnostic, curative, preventive and/or rehabilitative interventions. They work in multidisciplinary health teams in varied healthcare settings including doctors (physicians and specialist), nurses and public health officials to promote, protect, treat and/or manage a person('s) physical, mental, social, emotional, environmental health and holistic well-being.

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