

SANKALCHAND PATEL UNIVERSITY, VISNAGAR

Faculty of Allied Sciences



Structure, Teaching Scheme and Syllabus of Bachelor of Science (Radiation and Imaging Technology)

Program Code: AS102

With effect from: Academic Year 2022-23

INTRODUCTION:

Learning Objectives:

The Aim of B.Sc. in Radiation and Imaging Technology program is to provide highest Atomic Energy Regulatory Board (AERB) accredited educational process through formal didactic and state-of-the-art clinical experiences that will render qualified, patient focused, compassionate, Skilled graduates in Medical Radiation and Imaging Technologists for the mankind. They are engaged in lifelong learning process. The graduates of the program are eligible to apply for the Radiation Safety Officer (RSO) as per AERB norms.

Learning goals and objectives for paramedical healthcare professionals

1. To provide the professional and community with trained qualified expert technologist
2. To provide a comprehensive educational program which promotes problem solving, critical thinking and communication skills in the clinical environment
3. Students will demonstrate quality patient care skills including professionalism, ethical and moral values 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 Conventional Radiographs, Various specific radiological Investigations, CT, MRI, Mammography etc. 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's 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 including anaphylactic reactions.
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 enough and to perform all the duties diligently with utmost sincerity and honesty.

Ethics and accountability

Students will understand core concepts of clinical ethical and moral values and laws of land 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 and prejudice, 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 unbiased attitude, and appropriate physical contact to ensure safe, effective and expected delivery of healthcare.

Eligibility for admission:

He/she has passed the Higher Secondary (10+2) Science or a duly constituted Board with pass marks in Physics, Chemistry, Biology

Duration of the course:

Duration of the course is 3 years.

Attendance:

A candidate has to secure minimum 75% attendance in overall with at least-

1. 75% attendance in theoretical
2. 75% in Skills training (practical) for qualifying to appear for the final university 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 program. To achieve this, all assessment forms and feedback should be included and evaluated. Student must attain at least 40% marks in each Theory, Internal assessment and Practical independently / separately for each individual subject.

Program Name: Bachelor of Science (Radiation and Imaging Technology) **Program Code:** AS102

Abbreviation Name: B.Sc. (RIT)

Year: First

With effect from:2022-23

Course Code	Course Name	Teaching Hours		Theory (Marks)				Practical (Marks)				Total (Marks)
		L	C	University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min	Max	Min	Max	Min	Max	Min	Max	
1AS1020101	Human Anatomy	60	40	32	80	8	20	--	--	--	--	100
1AS1020102	Human Physiology	60	40	32	80	8	20	--	--	--	--	100
1AS1020103	Pathology & Microbiology	60	40	32	80	8	20	--	--	--	--	100
1AS1020104	Biochemistry	60	40	32	80	8	20	--	--	--	--	100
1AS1020105	Radiation physics	60	--	32	80	8	20	--	--	--	--	100
1AS1020106	Radiographic positioning	70	140	32	80	8	20	--	--	--	--	100
Total		370	300									600

Note:- 1. There shall be no University Practical Examination.

2. Compulsory hospital posting of 360 hours shall be applicable.

Program Name: Bachelor of Science (Radiation and Imaging Technology) **Program Code:** AS102

Abbreviation Name: B.Sc. (RIT)

Year: Second

With effect from:2022-23

Course Code	Course Name	Teaching Hours		Theory (Marks)				Practical (Marks)				Total (Marks)
		L	C	University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min	Max	Min	Max	Min	Max	Min	Max	
1AS1020201	Specialised Radiological Investigations/ Procedures CR, DR and PACs.	120	100	32	80	8	20	12	30	8	20	150
1AS1020202	General Medicine	40	-	32	80	8	20	--	--	--	--	100
1AS1020203	General Pharmacology	40	-	32	80	8	20	--	--	--	--	100
Total		200	100									350

Note:- Compulsory hospital posting of 560 hours shall be applicable.

Program Name: Bachelor of Science (Radiation and Imaging Technology) **Program Code:** AS102

Abbreviation Name: B.Sc. (RIT)

Year: Third

With effect from:2022-23

Course Code	Course Name	Teaching Hours		Theory (Marks)				Practical (Marks)				Total (Marks)
		L	C	University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min	Max	Min	Max	Min	Max	Min	Max	
1AS1020301	Conventional and Recent Imaging Modalities and Recent advances Artificial Intelligence (AI)	160	260	32	80	8	20	12	30	8	20	150
1AS1020302	Radiation Physics and Darkroom Technique	120	80	32	80	8	20	--	--	--	--	100
1AS1020303	Specialised Radiological Investigations /Procedures and Radiographic Positioning	120	80	32	80	8	20	12	30	8	20	150
Total		400	420									400

Note:- Compulsory hospital posting of 310 hours shall be applicable.

**First Year Syllabus
of
Bachelor of Science (Radiation and Imaging Technology)**



Course Code: 1AS1020101	Course Name: Human Anatomy	60 Hours
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THEORY

UNIT – 1 (ORGANISATION)

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

UNIT – 2 (SKELETAL SYSTEM)

- Cartilage and ligaments
- Bones and Joints.
- Ossification,
- Blood supply
- Synovial joints

UNIT – 3 (MUSCULAR TISSUE)

- Muscle classification – I
- Muscle – II,

UNIT – 4 (NERVOUS SYSTEM)

- Neuron, Neuraglia
- Spinal cord & Spinal nerves
- Human Brain & major functions
- Cranial nerves
- Autonomic nervous system

UNIT – 5 (SENSORY ORGANS)

- Nose & Olfaction
- Tongue

UNIT – 6 (CIRCULATION & LYMPHATIC)

- Systemic, Pulmonary, Portal
- Heart, chambers, Septums, valves
- Coronary circulation, venous drainage,
- Major branches of aorta, major veins,
- Lower limb and Upper limb arteries and Veins.
- Diaphragm
- Lymphoid tissue classification, structure I
- Lymphoid tissue classification, structure II
- Lymphatic drainage, lymphatic trunks

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



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Course Code: 1AS1020102	Course Name: Human Physiology	60 Hours
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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

- Peristalsis of GIT
- Complex Mechanism of Deglutition & Vomiting
- Digestive Juices in proximal alimentary canal.
- Digestive juices in distal digestive canal.

UNIT-5 EXCRETORY SYSTEM

- Kidneys- Normal Anatomy, and abnormal variants.
- Functions of Kidneys.
- Blood supply of Kidneys.
- Glomerular filtration rate (GFR)
- Mechanism of concentration of urine, Mechanism of voiding/ Micturition.
- Diuretics
- Renal Transplant.
- Renal function tests (RFT)
- Skin
- Regulation of body Temperature

UNIT-6 RESPIRATORY SYSTEM

- Mechanism of Breathing
- Hypoxia
- O₂ and CO₂ transport
- Pulmonary volume & Capacities
- Air way Obstruction

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, ECHO, TMT
- Coronary circulation, Cutaneous circulation-Triple response ,Shock
- Effects of exercise on CVS and Respiratory system

UNIT-8 LYMPH AND LYMPHATIC SYSTEM

UNIT- 9 ENDOCRINE SYSTEM

- Hormones of Pituitary, Thyroid
- Hormones of Parathyroid Glands
- Hormones of Adrenal Glands,
- Hormones of 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
- ESR & PCV
- Blood Pressure
- Pulse
- Revision
- Heart rate & heart sound
- Breathing rate & breathing sounds during inspiration and expiration
- Identification of blood cells by peripheral smear. RBC, WBC, Platelets.
- Revision

Course Code: 1AS1020103	Course Name: Pathology & Microbiology	60 Hours
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PATHOLOGY

30 Hours

UNIT-1: CELL INJURY AND ADAPTATION:

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

UNIT-2: INFLAMMATION AND REPAIR:

Inflammation: Definition

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

Healing and repair:

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

UNIT-3: FLUID AND HEMODYNAMIC DERANGEMENTS:

Edema:

- Definition
- Types of edema
- Pathogenesis of renal and cardiac edema
- Deep vein thrombosis
- Lymph edema

Shock:

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

Thrombosis:

- Definition
- Factors influencing thrombosis
- Fate of thrombosis

UNIT-4: NEOPLASIA

- Introduction: nomenclature, metaplasia, dysplasia, anaplasia, hyperplasia, hypertrophy
- Definition
- Differences between benign and malignant tumors
- Spread of tumors
- Short notes: Gross features and clinical features of:

- Squamous papilloma
- Squamous cell carcinoma
- Lipoma
- Fibrosarcoma.

UNIT- 5: INFECTIOUS DISEASES:

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

UNIT-6: 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) thrombocytopenia including ITP(SN)

UNIT-7: DISEASES OF WHITECELL AND LYMPH NODES

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

UNIT-8: NUTRITIONAL DISEASES

- Vitamin A, B, C, D deficiency including a brief account of rickets and scurvy

PRACTICAL:

20 HOURS

- Receiving of Specimen in the laboratory
- Gross 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 and Haemoglobin estimation
- Various Anticoagulants used in Haematology

UNIT-1: 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, IMViCTESTS

UNIT-2: IMMUNOLOGY

- Infection
- Immunity
- Antigen
- Antibody

UNIT-3: COLLECTION, TRANSPORT AND PROCESSING OF CLINICAL SPECIMENS:

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

UNIT-4: SYSTEMIC BACTERIOLOGY

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

UNIT-5: HEALTH CARE ASSOCIATED INFECTIONS:

- Sources, Method of transmission and Prevention: Hepatitis B,C, HIV and Aids

UNIT-6: 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, Mac conkeys agar.
- Functioning of Autoclave and Hot air oven
- Visit to hospital for the demonstration of Biomedical Waste Management
- Aseptic practices in laboratory and safety precautions

Course Code: 1AS1020104	Course Name: Biochemistry	60 Hours
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UNIT -1: 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-2:

- Haemoglobin (Haem Synthesis), Blood Clotting Factors

UNIT-3:

- Brief Note on Vitamins

UNIT-4:

- Plasma Proteins and their Clinical Importance

UNIT- 5: 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 H₂SO₄).
- 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.

Course Code: 1AS1020105	Course Name: Radiation Physics	60 Hours
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UNIT-1: REVIEW OF IDEAS ON ATOMIC AND NUCLEAR PHYSICS

- Alpha decay, beta decay gamma emission
- Internal conversion and nuclear isomerism
- Nuclides and its classification
- Radio activity
- Half life

UNIT-2: ELECTROMAGNETIC RADIATION

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

UNIT-3: 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 of X rays.

UNIT-4: 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-5: 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-6: Radiation protection

- Introduction
- Maximum permissible Dose, the code of practice
- Protective materials for X and γ radiation
- Radiation monitoring
- Evaluation of workload, occupancy & use factors in diagnostic x-ray departments
- Department planning,
- Protection regulation fluoroscopy & radiography.

UNIT-7: 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-8: 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-9: 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-10: 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

UNIT-11: NEWER X-RAY TUBES

- Types in detail

UNIT-12: FILTERS

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

UNIT-13: X-RAY BEAM RESTRICTORS

- Definition
- Functions of restrictors
- Patient protection

UNIT-14: GRIDS

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

UNIT-15: FLUOROSCOPY

- Image intensifier
- Direct fluoroscopy
- Principles of image intensification
- Image quality : unsharpness, noise, resolution, distortion
- Spectral emission ; gas spots
- Multi field image intensifiers(IITV, C arm)
- Lens system and image distribution
- Viewing and recording of fluoroscopic image

UNIT-16: FACTORS EFFECTING IMAGE QUALITY

- Radiographic image.
- Geometry of the radiographic image

Course Code: 1AS1020106	Course Name: Radiographic Positioning	70 Hours
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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 bones
- Internal auditory canals
- Zygomatic arches
- Mandible
- Para nasal sinuses

UNIT-2: NECK

- Related radiological anatomy
- Positioning- AP, LAT

UNIT-3: CHEST

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

UNIT-4: 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

UNIT-5: KUB

- Related radiological anatomy
- Positioning- AP
- To include male urethra

UNIT-6: 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)

UNIT-7 HIP AND PROXIMAL FEMUR

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

UNIT-8: SHOULDER GIRDLE

- Related radiological anatomy
- Basic and special projections

Shoulder non trauma routine:

- AP(external rotation)
- AP(internal rotation)
- Infero superior axial(Lawrence method)
- Infero superior shoulder projection(west point method)
- Posterior oblique – glenoid cavity(grashey method)
- Inter tubercular groove (kisk method)
- In erect with weight bearing for clavicle & acromioclavicular joint

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

UNIT-9: HUMOURS

- Related radiological anatomy
- AP

- LAT
- Horizontal beam LAT
- Proximal humerus views

UNIT-10: 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

UNIT-11: FOREARM

- Related radiological anatomy
- AP
- LAT

UNIT-12: WRIST

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

UNIT-13: HAND

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

UNIT-14: FINGERS

- Related radiological anatomy
- PA
- Oblique
- LAT

UNIT-15: THUMB

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

UNIT-16: FEMUR

- Related radiological anatomy
- Mid and distal femur

- AP
- Lateral
- Mid and proximal femur
- AP
- Lateral

UNIT-17: 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
- Skyline view

UNIT-18: 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
- Planto dorsal(axial)
- Lateral

UNIT-19: CERVICAL SPINE

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

Special views

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

UNIT-20: THORACIC SPINE

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

UNIT- 21: 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

UNIT-22: SACRUM AND COCCYX

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

UNIT-23: PAEDIATRIC RADIOGRAPHY

- Positioning, care and radiation protection while handling babies

Each student shall undergo training in Skill Simulation Laboratory for learning certain basic clinical skills like IV/IM injection, setting IV-line, Cardio-pulmonary resuscitation (CPR), and Life support skills in the beginning of second year, for duration of continuous four days.

**Second Year Syllabus
of
Bachelor of Science (Radiation and Imaging Technology)**



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Course Code: 1AS1020201	Course Name: Specialised Radiological Investigations/ Procedures CR, DR and PACs.	120 Hours
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UNIT-1: INTRODUCTION TO THE SUBJECT

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

UNIT-2: CONTRAST MEDIA

- Definition
- Classification
- Chemistry
- Physiology
- Toxicity
- Treatment- emergency drugs
- Contrast used in USG
- Contrast used in CR
- Contrast used in MRI

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UNIT-3: 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

UNIT-4: M C U

- Anatomy of lower urinary tract
- Indication & contra indication
- Procedure & filming
- Complications
- RGU (Retrograde Urethrogram)
- Other techniques

UNIT-5: MYELOGRAM

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

UNIT-6: 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

UNIT-7: BARIUM SWALLOW

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

UNIT-8: 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

UNIT-9: Barium meal follow through

- 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

UNIT-10: ENTEROCLYSIS

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- 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

UNIT-11: BARIUM ENEMA

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

UNIT-12: HSG

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

UNIT-13: FTR

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

UNIT-14: SIALOGRAPHY

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

UNIT-15: CATHETERS

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

UNIT-16: ANGIOGRAPHY (CEREBRAL, VISCERAL, PERIPHERAL)

- Anatomy of blood vessels
- Definition indication & contraindication

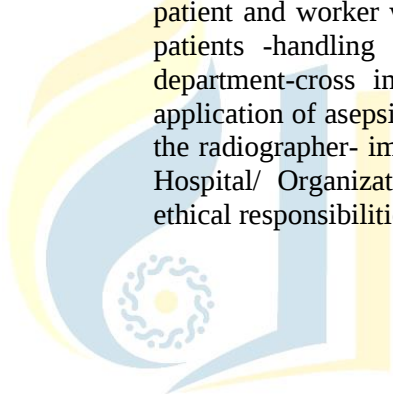
- Patient preparation and precautions
- Local anaesthesia
- Direct needle puncture
- Catheter angiography
- Percutaneous transluminal angioplasty
- CT angiography
- MR Angiography

UNIT-17: DACROCYSTOGRAPHY

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

UNIT-18: 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-shifting of patients -hazards of lifting and 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.



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Course Code: 1AS1020202	Course Name: General Medicine	40 Hours
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UNIT-1: INTRODUCTION

- Modes of transfer of communicable diseases & general preventive measures.

UNIT-2: BACTERIAL DISEASES:

- Tuberculosis, Leprosy, Rheumatic fever, Tetanus, Typhoid fever, Pneumonia, Bacillary Dysentery, Diphtheria, Measles, Pertussis

UNIT-3: VIRAL DISEASES:

- Simplex and zoster, Varicella, Measles Mumps, Hepatitis B & C, HIV-AIDS & Influenza.

UNIT-4: METABOLIC AND DEFICIENCY DISEASES:

- Diabetes, Anemia, Vitamin & Nutritional,
- Deficiency diseases, diseases of the endocrine glands.
- Diseases of Respiratory System
- Diseases of Circulatory System:
- Diseases of Digestive System
- Diseases of Liver
- Diseases of kidney.
- Diseases of Skin.



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Course Code: 1AS1020203	Course Name: General Pharmacology	40 Hours
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UNIT-1: Describe pharmaco-dynamics, pharmacokinetics, classification and the Principles of drug administration.

UNIT-2: Introduction to pharmacology

Definitions Sources Terminology used

UNIT-3: Types : Classification

Pharmaco-dynamics: Actions, therapeutic, Adverse, toxic

UNIT-4:

Pharmacokinetics: absorption, distribution, metabolism, interaction, Excretion

UNIT-5:

Review : Routes and principles of Administration of drugs

UNIT-6:

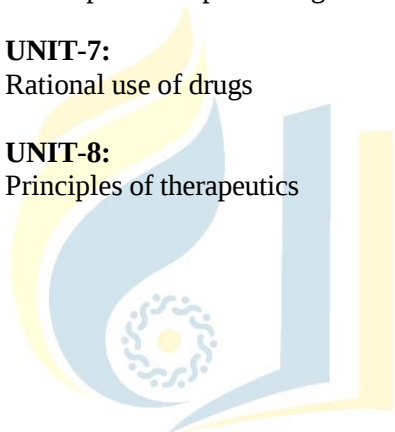
Indian pharmacopoeia: Legal issues

UNIT-7:

Rational use of drugs

UNIT-8:

Principles of therapeutics



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**Third Year Syllabus
of
Bachelor of Science (Radiation and Imaging Technology)**



Course Code: 1AS1020301	Course Name: Conventional and Recent Imaging Modalities and Recent Advances Artificial Intelligence (AI)	160 Hours
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UNIT-1: COMPUTED RADIOGRAPHY (CR)

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

UNIT-2: DIGITAL RADIOGRAPHY (DR)

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

UNIT-3: PACS

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

UNIT-4: DSA

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

UNIT-5: MACRO RADIOGRAPHY

- Definition
- Principle
- Unsharpness
- Scattered radiation
- Cassette support
- Examples of macro radiography

UNIT-6: DENTAL RADIOGRAPHY

- Introduction
- Terminology
- Dental formula
- Intra – oral radiography
- Bite wing
- Periapical radiography

- Occlusal radiography
- Extra oral oblique lateral
- Cephalometry
- Orthopantomography

UNIT-7: NUCLEAR MEDICINE

- History
- Isotopes and radionuclides
- Production of radionuclides
- Radio activity
- Radioactive transformations
- Specific activity
- Introduction to radiopharmaceuticals
- Precautions while handling radiopharmaceuticals
- Instrumentation- gamma camera, computer and monitor
- PET
- SPECT

UNIT-8: MAMMOGRAPHY

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

UNIT-9: COMPUTED AXIAL TOMOGRAPHY (CAT)

- 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
- Multi slice technology (MSCT)
- CT detector, Multi Detector CT (MDCT)

UNIT-10: IMAGE RECONSTRUCTION

- Basic principle
- Image reconstruction from projections
- Reconstruction algorithms

UNIT-11: 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

UNIT-12: DATA ACQUISITION

- Basic scheme for data acquisition
- CT detector technology
- Detector electronics
- Data acquisition and sampling

UNIT-13: IMAGE DISPLAY

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

UNIT-14: CT ARTIFACTS

- Classification
- Types
- Causes
- Remedies

UNIT-15: IMAGE QUALITY

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

UNIT-16: BASIC DIAGNOSTIC ASPECTS

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

UNIT-17: CT CONTRAST MEDIA

- Types
- Use and administration
- Suspected contraindications

UNIT-18: CT GUIDED PROCEDURES

- Types
- Protocols
- Both invasive and non invasive

UNIT-19: SAFETY CONSIDERATION

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

UNIT- 20: DOCUMENTATION

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

UNIT-21: CROSS SECTIONAL ANATOMY

- Head
- Neck
- Thorax
- Abdomen
- Pelvis
- Extremities

UNIT-22: ULTRASOUND IMAGING

- Introduction
- Ultrasound imaging
- Doppler imaging
- Basic principle
- Advantages and disadvantages
- PNDT

MAGNETIC RESONANCE IMAGING (MRI).

PHYSICS UNIT-1: INTRODUCTION

- Basic principle
- Introduction
- Atomic structure
- Motion within the atom
- The hydrogen nucleus, alignment
- Precession
- Larmor equation
- Resonance
- MR signal
- Free induction decay signal
- Relaxation
- T1 recovery
- T2 decay
- Pulse timing parameters

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UNIT-2: ENCODING AND IMAGE FORMATION

- Encoding
- Introduction
- Gradients
- Slice selection
- Frequency encoding
- Phase encoding
- Sampling
- Data collection and image formation
- Introduction
- K space
- Fast fourier transformation
- Matrix
- Scan timing
- K space filling
- Partial or fractional echo imaging & averaging
- Pre- scan
- Types of acquisition

UNIT-3: PARAMETERS AND TRADE- OFFS

- Introduction
- Signal To Noise Ratio(SNR) & How to increase SNR
- Contrast to Noise Ratio (CNR)
- Spatial resolution & how to increase the spatial resolution
- Scan time & how to reduce time
- Trade-offs
- Decision making
- Volume imaging

UNIT-4: PULSE SEQUENCES

- Introduction
- Spin echo sequences
- Conventional spin echo
- Fast spin echo
- Inversion recovery
- STIR
- FLAIR
- Gradient echo pulse sequences
- Conventional gradient echo
- Coherent residual transverse magnetization
- Incoherent residual transverse magnetization
- SSFP
- Ultra- fast sequences
- EPI

UNIT-5: FLOW PHENOMENA

- Introduction
- The mechanisms of flow
- Time of flight phenomenon
- Entry slice phenomenon
- Intra- voxel dephasing
- Flow phenomena compensation
- Gradient moment rephrasing
- Pre saturation
- Even echo rephrasing

UNIT-6: ARTIFACTS AND THEIR COMPENSATION

- Introduction
- Phase mismapping
- Aliasing or wrap around
- Chemical shift artifact
- Chemical misregistration
- Truncation artifact
- Magnetic susceptibility artifact
- Zipper artifact
- Shading artifact
- Motion of the patient
- Cross excitation and cross talk

UNIT-7: INSTRUMENTATION AND EQUIPMENTS

- Introduction
- Magnetism
- Permanent magnets
- Electromagnets
- Super conducting magnets
- Fringe fields
- Shim coils
- Gradient coils
- Radio-frequency coils
- The pulse control units
- Patient transportation system
- Operator interface

UNIT-8: Vascular and cardiac imaging

- Introduction
- Conventional vascular imaging techniques
- MRA
- Perfusion and diffusion imaging
- Cardiac imaging
- Peripheral gating
- Pseudo-gating
- Multi-phase cardiac imaging
- Cine
- SPAMM

UNIT 9-MR SAFETY AND MR ARTEFACTS

- Introduction
- The main magnetic field
- Projectiles
- Medical emergencies
- Implants and prostheses
- Pacemakers
- Gradient magnetic field
- Radio-frequency fields
- Claustrophobia
- Quenching
- Safety education
- Patient monitoring
- Monitors and devices in MRI
- Safety tips
- Site planning

UNIT-10: CONTRAST AGENTS IN MRI

- Introduction
- Uses and methodology
- Review of weighting
- Mechanism of action
- Dipole-dipole interactions
- Magnetic susceptibility
- Relaxivity
- Gadolinium safety

- Feridex safety
- Current applications of contrast

UNIT-11: ADVANCED IMAGING TECHNIQUES

- Introduction
- High speed gradient system
- Developments in fast spin echo
- Developments in gradient echo
- Applications of echo planar imaging
- Diffusion imaging
- Perfusion imaging
- Functional imaging
- Interventional MRI

UNIT-12: MRI CROSS SECTIONAL ANATOMY

- Brain
- Neck
- Thorax
- Abdomen
- Pelvis
- Extremities
- Spine

PRACTICAL	130 Hours
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MRI

Specific Procedural Requirements

- The 5 categories include:
- Head and Neck
- Spine
- Thorax
- Abdomen and Pelvis
- Musculoskeletal

General Guidelines

When performing the MRI procedures, the candidate must demonstrate

- Evaluation of requisition and/or medical record
- Identification of patient
- Documentation of patient history including allergies
- Safety screening and patient education
- Patient care and assessment
- Preparation of examination room
- select optimal imaging coil
- Patient positioning
- Protocol selection
- Parameter selection
- Image display, filming, and archiving
- Documentation of procedure and patient data in appropriate records
- Patient discharge with post-procedure instructions
- Universal precautions
- MRI safety procedures and precautions and evaluate the resulting images for image quality

- Optimal demonstration of anatomic region
- Proper identification on images and patient data
- Exam completeness

A. Head and Neck

- Routine brain
- Internal auditory canal
- Orbit
- Pituitary
- Vascular head
- Cranial nerves
- Posterior fossa
- Head trauma
- Sinuses
- Soft tissue neck
- Vascular neck

B. Spine

- Thoracic
- Lumbar
- Cervical
- Sacrum / coccyx
- Spinal trauma
- Bony pelvis

C. Thorax

- Brachial plexus
- Mediastinum
- Cardiovascular
- Breast
- Aorta
- Heart and great vessels

D. Abdomen and Pelvis

- Liver / spleen / pancreas
- Kidneys
- Adrenals
- MRCP
- Vascular
- Male pelvis
- Female pelvis

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PRACTICAL CT

Specific Procedural Requirements

The 8 categories include:

- Head
- Neck
- Spine and Musculoskeletal
- Chest
- Abdomen
- Pelvis

- Special Procedures
- Image Display and Post Processing

PROTOCOLS

A. Head

- Routine head
- Sinuses
- Facial / orbit
- Temporal bones
- Trauma head
- Vascular head (CTA)

B. Neck

- Soft tissue neck
- Larynx and vocal cords
- Vascular neck (CTA)

C. Spine and Musculoskeletal

- Lumbar
- Cervical
- Thoracic
- Spinal trauma
- Upper extremity
- Lower extremity
- Pelvic girdle; hips
- Musculoskeletal trauma

D. Chest

- Routine chest
- HRCT
- Vascular chest (e.g., PE)
- Chest trauma
- Airway (trachea, bronchus)
- Heart (e.g., cardiac scoring, Angiography)

E. Abdomen

- Routine abdomen
- Liver (multi-phase)
- Kidneys (with contrast)
- Pancreas
- Adrenals
- GI tract
- Renal stone
- Abdominal trauma
- Vascular abdomen (CTA)

F. Pelvis

- Routine pelvis
- Bladder
- Pelvic trauma
- Vascular pelvis (CTA)

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- Colorectal studies

G. Special Procedures

- Biopsies
- Drainage / aspirations
- Radiation therapy planning

H. Image Display and Post Processing

- Geometric measurements
- (e.g., stent graft, distance)
- Retrospective reconstruction

PRACTICAL	130 Hours
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COMPUTED TOMOGRAPHY

General Guidelines

- When performing the CT imaging procedures, the candidate must demonstrate appropriate:
- Evaluation of requisition and/or medical record
- Preparation of examination room
- Patient assessment and education concerning the procedure
- Documentation of patient history including allergies
- Patient positioning
- Protocol selection
- Parameter selection
- Image display, filming, and archiving

PROTOCOLS

A. Head

- Routine head
- Sinuses
- Facial / orbit
- Temporal bones
- Trauma head
- Vascular head (CTA)

B. Neck

- Soft tissue neck
- Larynx and vocal cords
- Vascular neck (CTA)

C. Spine and Musculoskeletal

- Lumbar
- Cervical
- Thoracic
- Spinal trauma
- Upper extremity
- Lower extremity
- Pelvic girdle; hips
- Musculoskeletal trauma

D. Chest

- Routine chest
- HRCT
- Vascular chest (e.g., PE)
- Chest trauma
- Airway (trachea, bronchus)
- Heart (e.g., cardiac scoring, Angiography)

E. Abdomen

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- Routine abdomen
- Liver (multi-phase)
- Kidneys (with contrast)
- Pancreas
- Adrenals
- GI tract
- Renal stone
- Abdominal trauma
- Vascular abdomen (CTA)

F. Pelvis

- Routine pelvis
- Bladder
- Pelvic trauma
- Vascular pelvis (CTA)
- Colorectal studies

G. Special Procedures

- Biopsies
- Drainage / aspirations
- Radiation therapy planning

H. Image Display and Post Processing

- Geometric measurements
- (e.g., stent graft, distance)
- Retrospective reconstruction

CT CROSS SECTIONAL ANATOMY OF HEAD

- Eyeball-lens
- Optic nerve.
- Bony margins of orbit, Extra ocular muscles,
- Maxillary, ethmoid, sphenoid and frontal sinuses.
- Nasal septum.
- Mastoid air cells.
- Petrous bone, Internal auditory meatus.
- Styloid process.
- Foramen magnum.
- Cerebellar hemispheres.
- Pons, 4th ventricle.
- Basilar artery.
- CP angle cistern.
- Temporal lobes, temporal horns, hippocampus.
- Dorsum sellae, clivus.
- Pituitary fossa.
- Circle of willis-aca, mca, pca.
- Mid brain.
- Third ventricle, pineal gland.
- Frontal horns, frontal lobes, occipital horns, occipital lobes.
- Sylvian fissures.
- Lateral Ventricles
- Falx cerebri.
- Superior sagittal sinus.
- Cerebral hemispheres (parietal lobes), gray and white matter.

UNIT-1: INTRODUCTION TO THE SUBJECT**UNIT-2: IMAGE CHARACTERISTICS**

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

UNIT-3: THE INVISIBLE X-RAY IMAGE

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

UNIT-4: 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

UNIT-5: THE RECORDING SYSTEM: FILM MATERIAL

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

UNIT-6: 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
- Care of screens

UNIT-7: THE RECORDING SYSTEM: FILM CASSETTES

- Cassette construction and ideal features
- Types of cassettes
- Care of cassettes; loading and unloading cassettes
- Special cassettes

UNIT-8: 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

UNIT-9: PHOTOGRAPHIC PROCESSING: PRINCIPLES-1

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

UNIT-10: 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

UNIT-11: 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

UNIT-12: FILM ARTIFACTS

- Definition
- Types
- Causes and remedies

Course Code: 1AS1020303	Course Name: Specialised Radiological Investigations/Procedures and Radiographic Positioning	120 Hours
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- All radiographic procedures including:
- IVU
- MCU
- Retrograde pyelourethrogram
- Myelogram
- Ba studies
- HSG/ FTR
- Sialography
- T- tube cholangiography
- Percutaneous transhepatic cholangiography
- Direct portal venography
- Bronchography
- Angiography
- Phlebography
- Dacrocystography
- Patient care and Radiation protection in Radiology Department

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