

Re-Accredited 'B++' 2.86 CGPA by NAAC

VEER NARMAD SOUTH GUJARAT UNIVERSITY

University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.

વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી

યુનિવર્સિટી કેમ્પસ, ઉદ્ધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.

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ક્રમાંક:ઓથો./સિલેબસ/૨૦૬૬૦/૨૦૨૪

તા.૦૧/૧૦/૨૦૨૪

પ્રતિ,
ડીનશ્રી,
સ્મીમેર મેડીકલ કોલેજ,
સુરત.

વિષય:— M.Sc. (Radiography and Medical Imaging Technology) 2 Year
Degree Course નું સ્ટ્રક્ચર અને સીલેબસ અંગે.

મહાશય,

સવિનય જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૪-૨૫ થી અમલમાં આવનાર M.Sc. (Radiography and Medical Imaging Technology) 2 Year Degree Course નું સ્ટ્રક્ચર અને સીલેબસને જનરલ મેડીસીન અભ્યાસ સમિતિનાં ચેરમનેશ્રીએ સદર સ્ટ્રક્ચર અને અભ્યાસક્રમને અભ્યાસ સમિતિ વતી અને તબીબી વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ તબીબી વિદ્યાશાખા વતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણને એકેડેમિક કાઉન્સિલની તા.૦૧/૦૩/૨૦૨૪ની સભાના ઠરાવ ક્રમાંક:૧૦૪ અન્વયે માનનીય કુલપતિશ્રીને આપેલ સત્તા અંતર્ગત માનનીય કુલપતિશ્રી દ્વારા મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

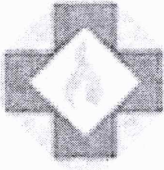
W. J. S.
કુલસચિવ

બિડાણ : ઉપર મુજબ

પ્રતિ,

- ૧) ડીનશ્રી અને એસોસિએટ ડીનશ્રી, તબીબી વિદ્યાશાખા
- ૨) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
- ૩) કાર્યાલય અધિક્ષક, જોડાણ વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
- ૪) મદદનીશ કુલસચિવ, અનુસ્નાતક વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

....તરફ જાણ તેમજ અમલ સારૂ.



Surat Municipal Institute of
Medical Education & Research

M.Sc. (Radiography and Medical Imaging Technology)

(2 Years Degree Course)

Name of the Course : M.Sc. (Radiography and Medical Imaging Technology)

OBJECTIVES OF THE COURSE :

The M.Sc. in Radiography and Medical Imaging Technology is a higher degree course suitable for graduates, who aim to pursue a professional career in Medical Radiology & Imaging Technology. It is designed to provide specialized training in the scientific principles of modern imaging science and in the application of these principles in the field of radio diagnosis and imaging.

The objectives of the program are:

- To equip the students with the skills and expertise in carrying out all routine and sophisticated medical diagnostic procedures efficiently.
- To impart a broad knowledge and understanding of the principles, technology, instrumentation, recent developments and proper handling of the modern radiological equipments and proper execution of the various radiological procedures to gain professional competence in the arena of medical imaging technology and be able to embark up to a successful career in their chosen direction of Imaging Science research.

• **DURATION OF COURSE:**

The course shall be of 2 years duration from the date of commencement of academic session.

• **ELIGIBILITY FOR ADMISSION:**

For admission a candidate should have passed the B.Sc. (any subject)

• **SELECTION OF CANDIDATES:**

- Selection for the Course shall be done on the basis of merit.
- Selection of the students will be based on the Roster followed for the post graduation medical admission by the university (letter no. v.n.s.g.uni.surat-inward no.7356/12-4-19) which is attached as annexure :1
- If the two students having same marks in B.sc. , then the student with more marks in subject physics will be selected. If both these students have same marks in physics also , then marks of subject Biology will be considered. Even if same marks in Biology also then the marks of chemistry will be considered. And if the Students have same marks in all 3 subjects , then marks of 12 th standard and then marks of 10 th standard will be considered.

Documents Required:

- 1. Birth Certificate as proof of date and birth.
- 2. proof of Nationality and Address
- 3. Four passport size photographs
- 4. Copy of Mark sheets and Degree Certificate
- 5. 10th and 12 th Marksheet/certificate
- 6. Caste certificate

- **TRAINING:**

1. The period of training for M.Sc. course shall be of 2 years from the date of admission.
2. The course of study for M.Sc. shall extend over a period of four semesters (two academic years).
3. The candidate will undertake the post graduate training as a full time post graduate in the department concerned.

TEACHING PROGRAMME

Timings:

Monday to Friday : 9:00 AM TO 5:00 PM with 1 hour lunch break

Saturday : 9:00 AM TO 1:00 PM

Language of the course :English

Theory work- Departmental teaching program includes:

Regular class Lectures- 3 days in a week (1 hour each) so, 3-4 hours/week

Lectures will be taken by Faculties of radiology department and senior technicians.

Expert faculties will be appointed as visiting faculties, as and when required.

Few related lectures will also be taken by biomedical engineer of the hospital.

Practical work:

- i) Students are posted in various radiographic rooms to learn practically and their day to day work is supervised and reviewed by senior staff members.
- ii) Students are also given practical in physics pertaining to radiology as well as in checking and rectification of common faults in the x-ray equipments/accessories.
- iii) Film discussions are also held to teach them the quality control and its importance in radio-diagnosis.

Practical : 35 Hours / Week

Each First year student will be given monthly rotational duties in different modalities in Radiology department as well as wards as per following :

- X-Ray room with DR system
- X-Ray room with CR system
- Portable X-Rays in ward as well as X-rays at casualty
- Mammography room
- Server room for processing of X-ray images and filming (Printing).

Each second year student will be given monthly rotational duties in different modalities in Radiology department as per following :

- CT Scan
- MRI
- DSA/Interventional Radiology
- X-Ray room with CR system
- X-Ray room with DR system

Each student will maintain log book. Each student will be given assignment to complete in a year.

ATTENDANCE:

1. A candidate is required to have at least 80% attendance in theory and practical separately.

EXAMINATION AND ASSESSMENT:

At the end of each semester ,Internal examination will be taken.

At the end of each Year External examination will be taken.

Exam Pattern of External exam :

2 Theory papers (Paper 1 + Paper 2) – 80 marks each

2 practical exams (Paper 1 + Paper 2) – 80 marks each

Internal Exam marks to be counted –

Theory -40 marks(paper 1 + paper 2)

Practical – 40 marks(paper 1 + paper 2)

SCHEME OF EXAMINATION:

1 st Year							
paper	Subjects	Theory Examination		Practical Examination		Total Marks	Credits
		University Exam	Internal Exam	University Exam	Internal Exam		
1	Radiographic Anatomy, Physics And Radiographic Position	80	20	80	20	200	25
2	Special radiographic procedures , patients care and management, Radiation hazard and safety	80	20	80	20	200	20
Total		160	40	160	40	400	45
2 nd Year							
	Subjects	Theory Examination		Practical Examination		Total Marks	Credits
		University Exam	Internal Exam	University Exam	Internal Exam		
1	Computerized Tomography Imaging Physics And DSA/IR Physics	80	20	80	20	200	24
2	Magnetic Resonance Imaging / Mammography/ Ultrasonography	80	20	80	20	200	23
Total		160	40	160	40	400	47

Notes:

1. Each theory paper shall be 3 hours duration.
2. Practical examination shall be conducted by one Internal, one External Examiner which will be appointed by the university. Professor / Associate professor / Assistant professor of Radiology department can be appointed as Examiners.
3. In order to pass the examination the candidate must secure a minimum of 50% marks in Theory papers and 50% marks in Practical separately
4. A candidate shall be permitted a maximum of Four Attempts or 2 years to complete the first and second year of examinations.
5. Only those candidates will be allowed to appear at M.Sc. 2nd year examination, who have passed M.Sc. 1st year examination completely.

1st Year :**Credits****Paper 1 : Radiographic Anatomy, Physics And Radiographic Position**

- Radiographic anatomy. 05
- Radiation physics & x-ray properties. 03
- Image production & evaluation. 03
- Modern radiological imaging equipment . 04
- Chemistry for developing of film (dark room technology). 03
- Artifacts in radiography. 02
- Positioning for radiographs. 05

Total - 25**Paper 2 : Special radiographic procedures , patients care and management, Radiation hazard and safety**

- Special radiographic procedures. 03
- Contrast media & emergency drugs in radiology department. 02
- Orthopantomogram 01
- Management of radiography & imaging department. 02
- Patient care and management in radiology. 02

- Emergency patients handling , OT patients handling & care (c-arm machine handling). 03
- Indoor & ICU patients portable x-ray & handling. 02
- Radiation hazards , prevention and safety and Radiation protection. 03
- Atomic energy regulatory board, guidelines & concept of ALARA , TLD , PC-PNDT Act. 02

Total - 20**2nd Year :**

Paper 3 : Computerized Tomography Imaging And DSA/IR (Interventional Radiology)

- Patients positioning in CT 03
- Interventional CT guided procedures 02
- Image reconstruction 2D & 3D & filming process 03
- Basic diagnostic aspects in CT 02

- Contrast material & safety consideration 02
- Instrumentation of CT scan 03
- Special investigation & protocols in CT 03
- DSA - introduction & basic principles , equipments, DSA procedures 03
- Basic physics in nuclear medicine 03

Total - 24

Paper 4: Magnetic Resonance Imaging / Mammography/ Ultrasonography

- Basic principles of MRI 02
- MRI instrumentation. 03

- Pulse sequences 03
- MR contrast media & safety aspects 02
- Image formation 03
- Protocols in MRI 03
- MRI artifacts: 02

- Basic and advancement in mammography and Ultrasonography 03
- Recent advancement in modern imaging technology 02

Total - 23

Pattern of questions to be set and answered shall be as follows:

Name of Paper	No. of questions to be set	No. of questions to be answered
Paper I	4	4
Paper II	4	4

No of Question of To Set - 4

Multiple choice question : 19 questions 1 mark each - 19 Marks

Short questions : 7 question 3 marks each - 21 Marks

Short notes : 5 question 4 marks each - 20 Marks

Long questions : 4 question 5 marks each - 20 Marks

Total – 80 Marks

Syllabus -Radio imaging technician

First Year-

Principles Of Radiation Production, Detection And Measurement:

Gas-Filled Detectors (Ionization Chambers, Proportional Counters And Geiger Muller Counters)
Scintillation Detectors, Thermoluminescent Dosimeters (Tld). Reasons For Choice Of Airlonization.
Roentgen And Rad. Simple Principles Of Dosimeters.

Biological Effects Of Radiation : Chemical Effects Of Radiation - Radiolysis Of Water ; Production Of Free Radicals, Radicals Reactions, G-Value. Effects Non-Stochastic Effects, Chromosome Aberrations And Mutations. Radiation Effects On Whole Body (Early Effects And Late Effects). Concept Of Doubling Dose. Risk Factors.

Radiation Protection: Principle Of Radiation Protection - Historical Development, Maximum Permissible Exposure Concept ; Annual Dose Equivalent Limits (Adel) A.L.A.R.A.(As Low As Reasonably Achievable) Concept ;

Regulatory Bodies & regulatory Requirements: International Commission on Radiation Protection (ICRP) / National Regularity body (AERB - Atomic Energy Regulatory Board) - Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements. (ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection).

Surveys and regulations. Radiation protection survey: Need for survey. - Performance standards for beam directing, beam defining and limiting devices in radiation protection equipment survey (QA tests) of the following. a. Radiographic equipment b. Fluoroscopic equipment c. CT and special equipment. Controlled and non-controlled areas and acceptable exposure levels. State and local regulations governing radiation protection practice.

Personal monitoring and occupational exposures: Personal monitoring for Radiation workers. Monitoring devices. Body badges and ring badges. Thermo-luminescent dosimeters (TLD), Pocket ionization chambers. Applications, advantages and limitations of each device, Values for dose equivalent limits for occupational radiation exposures.

NABH guidelines, AERB guidelines and code, Basic safety standard, PNDT/PCPNDT Act and guidelines.

Protective iMaterials: Lead, Lead - Impregnated Substances, Building Materials, Concept Of Barriers, Lead Equivalents And Variations With Quality. Design Of X-Ray Tubes Related To Protection. Structural Shielding Design (Work-Load, Use Factor, Occupancy Factor, Distance) Departmental Protection.

Radiation Protection Of Staff Members, Patients And Public. Protection Instruments & Personnel And Area Monitoring.

Suggested Books For Reference: Farr RF & Allisy-Roberts PJ : Physics for Medical Imaging (Saunders-An imprint of Elsevier) 1st Edition 2006

Medical Physics

Switching And Timing: Exposure Timers, Spring Activated, Synchronous, Electronic, Auto Timers, Exposure Switching -Mechanical Contactors, Electronic Switching In Low Tension And High Tension Circuits. Interlocking Circuits - Use Of Relays, Tube Overload Protection. Circuit Diagrams - Simple Circuit Diagrams As Illustration Of Sequence From Mains Supply To Controlled X-Ray Exposures, Block Diagrams.

X-Ray Tubes: Rotating Anode X-Ray Tubes, Design, Rating, And Use Of Rating Charts, Care Of The X-Ray Tubes; Inherent Filtration And Additional Filtration; Practical Considerations In The Choice Of Focus; Speed Of Anode Rotation; Angle Of Anode Inclination. Grid-Controlled X-Ray Tube.

Control of Scattered Radiations: Cones, Tube Diaphragms, Single And Multileaf Grids, Structure And Materials; Grid Ratio And Lines /Cm. Parallel And Focussed Grids, Stationary Grids, Crossed Hatched Grids. Gridded Cassettes, Grid Movements, Potter-Bucky Diaphragms ; Single Stroke, Reciprocating And Oscillating Mechanisms; Beam Centring Devices - Centre Finders, Optical Centring Devices, Light Beam Collimators.

Equipments: I Fluoroscopy and Image Intensifiers: Direct Fluoroscopy, Fluoroscopy Image, Fluoroscopic Screen, Explorators (Serial Changers, Spot Film Devices) And Accessories. Radiation Protection Including Integrating Timer. Tilting Tables. Principles And Construction Of Image Intensifiers, Television Camera Tubes And Cathode Ray Tubes. Recording The Intensified Image, Methods Of Viewing The Intensified Image, Equipment For Fluorography And Cine-Fluorography. Radiographic and Fluoroscopic Tables, Telecommand Tables.

ii Equipment for Special Procedures: Special Trolleys And Chairs, Portable And Mobile X-Ray Units, Cordless Mobile X-Ray Equipment, Capacitor Discharge Mobile Equipment, Equipments For O.T. Bi-Plane Radiography, Cranial And Dental Equipment, Skull Tables, Orthopantomograms, Mass-Miniature Radiography, Tomography (Conventional X-ray Tomography is obsolete after availability of computed Tomography (CT) scan. Only historical importance), Multi Section Cassettes, Rapid Cassette Changer, Rapid Film Changer, Magnification Radiography, Subtraction Radiography.

iii Care and Maintenance of X-Ray Equipment: General Principles Of routine care. General Care In Use And Special Care Of Mobile Equipments. Simple Test. Uses Of Spinning Top And Step Wedge, Checks On Generator Output; Check For Integrity Of Tomographic Equipment; Procedure For Obtaining Radiograph Of The small area of body. Use Of Ma (milli Amper) And Timer Wisconsin Test Tool, Test Of Kilo Voltage, Wisconsin Test Cassette, Use Of Focal Spot Test Tool, Testing Light Beam Diaphragm, Failures Of X-Ray Tubes And Ht Cables.

Radiography Techniques -I

Preparation Of The Room, Apparatus And Instruments Positions Of The Patient: Erect, Sitting, Supine, Prone, Lateral, Oblique, Decubitus Etc., Relative Position Of X-Ray Tube And Patient, Relevant Exposure Factors. Use Of Accessories Such As Radiographic Cones, Grid And Positioning Aids. Anatomic And Physiological Basis Of The Procedure, Association of Theory With Practical Work. Radiographic Appearances, Both Normal And Common Abnormal Conditions Where Elementary Knowledge Of The Pathology Involved Will Ensure The Application Of The Appropriate Radiographic Technique. Modifications In technique For Various Disabilities And Types Of Subject. Radiation Protection, Use Of Gonad & Thyroid Shield, Practical Methods Reducing Radiation Dose To The Patient.

Upper limb: Routine Projections For The Whole Hand, Fingers, Wrist Joint, Forearm, Elbow Joint And Humerus. Supplementary Projections For Scaphoid, Carpal Tunnel Ball Catchers Projections, Head Of The Radius, Supracondylar Fracture And Olecranon Process.

Lower limb: Routine Projections For The Whole Foot, Toes, Calcaneum, Ankle Joint, Leg, Knee-Joint, Patella And Femurs. Supplementary Projections For Talo-Calcaneal Joint, Forced Projections For Torn Ligaments, Flat Feet, Club Feet, Intercondylar Projections For Loose Bodies In The Knee, Axial Projection For Patella.

Shoulder Girdle And Thorax: Routine Projections For The Shoulder Joint, Scapula, Acromio-Clavicular Joint, Clavicle, Sternoclavicular Joint, Sternum And Ribs.

Supplementary Projections For The Axial Projection Of Clavicle, Bicipital Groove Carotid Process, Classification Of Tendons, Subluxation, Upper Ribs, Lower Ribs And Axillary Ribs.

Pelvic Girdle And Hip Region : Routine Projections For The Whole Pelvis, Sacro-Iliac Joints, Hip Joint And Neck Of Femur.

Supplementary Projections For The Greater And Lesser Trochanters Of Femur. Frog Leg Projection, Ischium Symphysis Pubis, Ilium, Acetabulum And Congenital Dislocation Of Hip Arthrodesis.

Vertebral Column: Routine Projections For Atlanto-Occipital Joint, Cervical Spine, Cervico Thoracic Junction, Thoracic Spine, Lumbar Spine, Lumbo-Sacral Region, Sacrum And Coccyx.

Supplementary Projections For The Intervertebral Foramina, Posterior Arch Of Atlas, Flexion And Extension Of Cervical Spine, Scoliosis And Kyphosis, Sacro Iliac Joint.

Skeletal Survey: Skeletal Survey For Metabolic Bone Diseases, Metastases, Hormonal Disorders, Renal Disorders.

Skull: Routine Projections For Cranium And Facial Bones. Supplementary Projections For Trauma, Towne's & Method, Sella, Turcica, Optic Foramina, Jugular Foramina, Temporal Bones, Mastoids Petrous Bone, Zygomatic Arches, Orbits, Maxillae, Nasal Bones, Mandible, Temporomandibular Joints.

Nasal Sinuses: Techniques For Frontal, Maxillary, Ethmoidal And Sphenoid Sinuses, Erect And Horizontal Projections For Fluid Levels.

Teeth: Routine Projections Of All Teeth –: Intra-Oral And Extra-Oral Projections. Supplementary Projections For Localisation Of Roots, Children, Edentulous Subjects And Use Of Occlusals And Bitewings, Orthopantomography.

Chest: Routine Projections For Lungs, Cardia And Diaphragm.

Supplementary Projections For Opaque Swallow, Thoracic Inlet, Soft Tissue Neck, Decubitus, 'Apicograms, Paediatric Cases.

Abdomen: Kub, Erect Abdomen And Decubitus Projection, Supplementary Projections For Acute Abdomen.

Radiographic Photography And Image Processing

Dark Room Planning: For A Small Hospital, For A Large Hospital, Location Of Dark Room Construction Of Dark Room, Ventilation, Wall Protection, Entrance To Dark Room - Single Door, Double Door, Labyrinth

Dark Room: Instruction To Staff, Dry Bench, Hopper, Drawer, Cupboard, Loading And Unloading Cassettes Hangers, Types Of Hangers And Storage Of Hangers, Printing, Wet Bench, Cleanliness, Control Of Dust, Dark Room Sink, Hatches, Drier, Safe Lights, Direct And Indirect, Uses, Factors Affecting Safelight Performance, Safelight Tests, Viewing Room, Film Dispensing

X-Ray Films: Glass, Cellulose And Polyester Bases Structure Of X-Ray Films - Emulsion, Gelatin, Base And Supercoating Types Of X-Ray Films, Single Coated, Duplitised, Spectral Sensitivity, Colour Sensitivity Graininess Of Films, Speed Of Films, Screen & Non-Screen Films, Various Formats Of Films

Films For Special Procedures Storage Of Film Materials And Radiographs, Record Of Film Stock And Radiographs Deterioration Of Films On Storage, Characteristic Curves - Uses Of Step Wedge Information On Basic Fog, Film Gamma, Contrast, Speed, Film Latitude, Effects On Development

Intensifying Screens: Fluorescence - Phosphors Phosphors Employed :- Calcium Tungstate, Barium Fluochloride etc. Rare Earths Construction Of Intensifying Screens The Influence Of Kilovoltage In Different Phosphors Intensification Factor Resolving Power Of Intensifying Screens Speed Of Screens Screen Film Contact Tests Types Of Intensifying Screens Advantages And Limitations Of Intensifying Screens.

X-Ray Cassette: Construction Of X-Ray Cassettes, Types Of Cassettes, Mounting Intensifying Screens On Cassettes, Identification Of Cassettes, Care Of Cassettes

Photochemistry: Chemistry Of Image Formation, Formation Of Latent Image, Conversion Of Latent Image To Visible Image, Meaning Of Ph, Importance Of Ph In Processing Films

Processing Methods: Preparation Of Solution , Manual Processing Apparatus, Control Of Temperature, Replenishment, Rapid Processing Automatic Processor - Principle And Features, Water Supply, Use Of Thermostat, Regeneration Of Solutions, Maintenance, Advantage And Limitations. Processing Of Cut Films And Roll Films.

Computer Radiography and Direct Digital Radiography

Digital Radiography - Principles, Processing, Equipments, Advantages. Radiological Information Systems.

The Radiographic Image: The Emergent Beam Related To Densities On Film Contrast - Objective And Subjective, Long Scale And Short Scale, Radiation Contrast, Film Contrast And Radiographic Contrast, Density Sharpness, Sources Of Unsharpness, Avoiding Different Unsharpness Resolution Factors Affecting Resolution Choice Of Kilovoltage And Milliampere Choice Of Short Focus And Broad Focus Selection Of Focus To Film Distance And Object To Film Distance Selection Of Cassettes Avoiding Scatter Radiation, Magnification, Distortion, Penumbra Presentation of a Radiograph - Identification Markers - Name Printer Viewing Equipment Magnifiers for Cut Films and Roll Films

Developer: Constituents, Characteristic, Manual and Automatic Processors, Effects on Developing Time, Temperature, Agitation, Replenisher, Exhaustion

Rinsing: Acid Stop-Bath, Methods, Objects

Rinsing: Acid Stop-Bath, Methods, Objects

Fixer: Constituents, Characteristics, Manual and Automatic Processors, Fixing Time and Clearing Time Factors Affecting Fixing Time, Replenisher, Exhaustion

Washing and Drying: Objects, Methods, Factors Affecting Washing and Drying, Wetting Agents, Comparison of Different Methods

Day Light Film Handling: Day Light System Using Cassettes Day Light System without Cassettes

Film Faults: Fog - Various Fogging In Films, Causes And Prevention. Stains - Types, Causes And Prevention Spots And Splashes - Types, Causes And Prevention Marks And Prints - Types, Causes And Prevention Drying Marks - Types, Causes And Prevention Faults In Automatic Processor - Types, Causes.

Reproduction Of Radiographs: Copying Radiographs Magnification and Minification. Contact Prints Types Of Paper Equipment

Special Radiographic/Radiological procedures -Barium studies,gastrograffin studies,Intravenous urography,micturating cystourethrography, Hysterosalpingography, Sinogram,fistulogram,sialography, Endoscopic retrograde cholangio- pancreatography (ERCP), T-tube Cholangiography (general considerations, responsibility of radiographers. Patient Preparation, Indications Contraindications Technique Post Care and Preparation of Drug Trolley/Tray, Radiation Safety.)

Contrast Media - Positive and Negative, Ionic & Non – Ionic, Adverse Reactions To Contrast Media and Patient Management, Emergency Drugs in the Radiology Department ,Aseptic technique for the following procedures.

Patient care and management in radiology- Describe about patient transfer, patient records, Handle independently seriously ill and traumatized patients, visually impaired, speech and hearing impaired, mentally impaired, Unconscious patient, providing general comfort and reassurance to the patient, Describe about First aid, Emergency treatment to the collapsed patient. Artificial respiration and resuscitation.

Practicals

A). Cassette And Intensifying Screens B). Chemical Used In Film Processing C). Films Used In Photography And Printers D). Diagnostic Image Processing

Imaging Technology: Practical Course:

Radiographic Technique I

Radiography - Plain Views of Upper Limb: Hands Fingers ,Thumb, Wrists, Forearm, Elbow, Humerus

Radiography - Plain Views of Shoulder: Shoulder Joint, Acromio - Clavicular Joint, Scapula Various Views And Projections, Clavicle, Sterno - Clavicular Joint

Radiography - Plain Views of Lower.Limb: Foot, Toes,Tarsus & Oscalcis, Ankle, Tibia, Fibula & Patella, Knee Joint, Femur, Hip Joint Pelvis & Sacro-Ilic Joint

Radiography Of Vertebrae: Cervical Spine Upper, Cervical Spine Lower, Cervico-Thoracic, Cervico-Middle, ThoracoLumbar, Lumbo-Sacral, Sacrum & Coccyx, Ribs-Upper & Lower, Sternum

Radiography of Skull Plain Views: Ap, Lateral & Towns, Sinuses, Mandible, Equipment, Teeth Mastoids

Radiography Of Chest: Lungs & Trachea; Heart-Diaphragm Radiography of G.I. Tract Plain X-Rays
Abdomen-Erect; Liver, Spleen.

Reference Book: 1. Philip W. Ballinger: Merrill's Atlas Of Radiographic Positioning And Radiological Procedures (Mosby) 2. Ra Swallow, E Naylor: Clarks Positioning In Radiography E J Roebuck, A S Whitley 3. Sante Lr: Roentgenologic Technique (Edwards Inc) 4. Goldman: A Radiographic Index 5. Ross And Gailway: A Handbook Of Radiography (Lewis) 6. Glenda J. Bryan: Diagnostic Radiography (Mosby) 7. Piles: Medical Radiographic Technique (Thoms). 8. L.C.Gupta & U.C.Sahn : Radiography for Technicians (Jayee Brothers)

Second Year-

Computed Tomography:

- Basic knowledge of History
- Basic knowledge of Principles Of Computed Tomography
- Basic knowledge of Generations - Spiral C.T.
- Basic knowledge of Instrumentation.
- Basic knowledge of Data Acquisition
- Basic knowledge of Data Presentation
- Basic knowledge of Image Reconstruction
- Basic knowledge of 2 D And 3 D Images
- Basic knowledge of Image Display
- Basic knowledge of Pixel And Voxel
- C.T. Number
- Window Level And Window Width
- Scan Artefacts
- Patient Positioning In Computed Tomography
- Scanning Protocols.
- Contrast Materials And Administration.
- Basic Diagnostic Aspects
- Interventional C.T. Guided Procedures
- Documentation.
- Safety Consideration - Radiation Dose
- Quality Assurance.

Magnetic Resonance And Imaging:

- Basic knowledge and information of History
- Basic knowledge and information of The Spinning Proton - Magnetisation, Precession, Larmor Frequency
- Basic knowledge and information of Radio Frequency Pulse And Proton - Resonance, Free Induction Decay, Relaxation, T-1 & T-2
- Basic knowledge and information of Instrumentation - Magnet, Shim Coils, Gradient Coils, Radio Frequency Transmitter And Receiver Coils, Computer.
- Basic knowledge and information of Pulse Sequences - Saturation Recovery, Spin Echo, Inversion Recovery.
- Basic knowledge and information of Image Production - 2d And 3d Pictures.
- Basic knowledge and information of Image Quality - Signal To Noise Ratio, Contrast To Noise Ratio.
- Image Artifacts.
- Flow Techniques - Magnetic Resonance Angiography Spectroscopy. MR Contrast Agents - Paramagnetic And Ferromagnetic Documentation. Safety Consideration Quality Assurance.
- Scanning protocols

Mammography :

- Basic principles of Mammography
- Equipment description
- Imaging technology
- Uses and advantages

Ultrasound Imaging:

- History
- Ultrasound Characteristics - Nature, Propagation, Frequency, Wavelength, Velocity, Amplitude, Intensity, Acoustic Impedance, Reflection, Refraction Etc. Interference With Media, Interface, Attenuation.
- Transducer - Piezoelectric Effect, Construction, Types Of Arrays - Mechanical & Electronic .
- Ultrasound Instrumentation.
- Display Modes - A Mode, B Mode, M Mode, Real Time.
- Grey Scale Imaging

- Doppler Methods - Continuous Wave Doppler, Pulsed Doppler, Duplex, Real Time Colour Flow Imaging.
- Ultrasound Artefacts.
- Patient Preparation And Handling
- Basic Diagnostic Aspects
- Interventional Techniques - Transducer Sterilisation, Needles, Diagnostic Procedures, Therapeutic Procedures.
- Documentation

Digital Substraction Angiography and Interventional Radiology-

- Basic principles of Interventional Radiology
- Interventional procedures as below :
 Angiography:
 Percutaneous Catheterization
 Catheterization Sites, Asepsis
 Guide Wire, Catheter, Pressure Injector And Accessories
 Use Of Digital Subtraction
 Head And Neck Arteriography
 Pulmonary Arteriographv
 Ascending Aortography
 Celiac Axis, Superior Mesenteric And Inferior Mesenteric Arteriography
 Renal Arteriography
 Trans Femoral Arteriography
 Peripheral Venography - Lower Limb, Upper Limb
 Central Venography, Superior Venacavography, Inferior venacavography, Pelvic Venography
 Ascending Lumbar Venography, Intra Osseous Venography, Percutaneous, plenoportography
 Transhepatic Portography, Selective Retrograde Venography - Renal Venography
 Adrenal Venography, Hepatic Venography, Internal Jugular Venography, Orbital Venography
- Imaging materials, Imaging Technology
- Radiation safety for patient and technician in Interventional Vascular Radiography

Nuclear Medicine Imaging and Recent advances

History, Isotopes And Radionuclides, Positron Emission Tomography (PET), Single Photon Emission Computed Tomography (SPECT), Radio Immune Assay (RIA), Documentation, Safety Considerations - Radiation Dose, Quality Assurance.

LIST OF PRACTICALS:

- General radiography.
- OPG and Dental radiography.
- Portable radiography.
- Radiography in ICU.
- Radiography in Casualty / Trauma center.
- Radiography in operation theatre.

LIST OF PRACTICALS:

Hands on training of Imaging of the following under supervision:

- Imaging techniques of CT scan.
- Imaging techniques of MRI
- Imaging techniques in Interventional radiology.
- Imaging techniques in Mammography.
- Imaging techniques in CR.
- Imaging techniques in DR.
- Assessments of Knowledge of following Protocols:
- Protocols for CT scan of Brain.
- Protocols for CT scan of PNS, Neck & larynx.
- Protocols for CT scan of Thorax, Abdomen and Pelvis.
- Protocols for CT Angiography.
- Protocols for multiphase contrast CT Study.

- Protocols for multiphase contrast CT Study.
- Protocols for Dynamic CT Study.
- Protocols for MRI of Brain.
- Protocols for MRI of PNS, Neck & larynx.
- Protocols for MRI of Abdomen and Pelvis.
- Protocols for MRI of Extremities.
- Protocols for MR Angiography.
- Protocols for MRCP.
- Protocols for Dynamic MRI Study

Hands on training of Quality Assurance under supervision:

- Tests to check light leakage in the cassette.
- White light leakage test.
- Safelight efficiency test.
- Film/screen contact test.
- Sensitometry test using an aluminium step wedge.
- Collimator accuracy of scale test.
- Light beam/x-ray beam alignment test.
- Film/screen compatibility – colour of light emission test.
- Grid line damage and grid movement test.
- Test to detect cracking of lead aprons and gloves.
- Accuracy of timer and kVp test.
- Test alignment of x-ray beam to upright bucky.
- Cassette centered to the middle of the bucky test.
- Central ray centered to the middle of the bucky test

Reference Books

- 1 Piles : Medical Radiographic Technique (Thomas)
- 2 Santel.R. : Roentgenologic Technique (Edwards Inc)
- 3 Philip Wballiger : Merills Atlas Of Radiographic Positions And Radiological
Procedures
(Mosby)
- 4 Goldman : A Radiographic Index
- 5 Patesson : Printed Notes For Radiographers In India (Cmai)
- 6 Achwaz : Unit Step Radiography (Thomas)
- 7 Ross & Galloway : A Hand Book Of Radiography (Lewis)
- 8 Glenda J. Bryan : Diagnostic Radiography (Churchill Livingstone)
- 9 Jacobi & Paris : Textbook Of Radiological Technology (Mosby)
- 10 Scarrow : Contrast Radiography (Schering Chemicals)
- 11 Vanderplasts : Medical X-Ray Technique (Mac Millan)
- 12 Stephen Chapman& Richare : A Guide To Radiological Procedures (Jaypee Brothers)
Nakielny
- 13 R.F. Fatr & P.J. Ahisy : Physics For Medical Imaging (Saunders)
- 14 D.N. Chesney & M.O.
Chesney : X-Ray Equipment For Student Radiographers (Cbs)
An Introduction Of Physics To Diagnostic Radiography (Lea
& Febiger)
- 15 Christensen, Curry & Dowdey : & Febiger)
- 16 Cullinan : Illustrated Guide Techniques (Blackwell)
- 17 Jamdrell, Thompson &
Ashworth : X-Ray Physics And Equipment (Blackwell)
- 18 Adrian K.Dixon : Body C.T. - A Handbook (Churchill Livingstone)
- 19 John M. Stevens, Alan R. : Computed Cranial & Spinal Imaging (Williams & Wilkins)
Valentine & Brian E. Kendall
- 20 John R. Haaga, Charles F. : Computerised Tomography And Magnetic Resonance
Imaging Of The
Lanzion, David J. Sartoris &
Elias Whole Body (Vol.1 & li) (Saunders).
A.Aerhouni
- 21 Philip T. English & Christine : Mri For Radiographers (Springer)
Moore

- 22 Rehani: : Diagnostic Imaging - Quality Assurance.
- 23 Pablo R.Ros & W. Dean Bidgood : Abdominal Magnetic Resonance Imaging (Mosby)
- 24 Roger C. Sounders : Clinical Sonography : A Practical Guide (Little Brown & Company)
- 25 Pes Palmer : : Manual Of Diagnostic Ultrasound (Who)
- 26 Sandra L Hagen Ansert: : Text Book Of Diagnostic Ultrasonography (Bi Publications).