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

Category – I deemed to be university under UGC Act - 2018

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CURRICULUM

Master of Science

(M.Sc)

RADIO- IMAGING TECHNOLOGY

Attested CTC

15/2/2021

Vice-Chancellor

Sumandeep Vidyapeeth

An Institution Deemed to be University

Vill. Piparia, Taluka: Waghodia.

Dist. Vadodara-391 760. (Gujarat)

Dean

AMENDED UP TO DECEMBER -2020

INTRODUCTION

Learning Objectives:

The M.Sc. in Medical Radiology & Imaging Technology is specifically aimed at those pursuing a professional career in Imaging Science 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. It is designed as a higher degree course suitable for gradates having experience in the technology of imaging science. The objective of the programme is to train students in to qualified, patient focused, compassionate, critical thinkers Diagnostic Radiographer / Technologist for the community who are engaged in lifelong learning.

Upto successful completion of the M.Sc. course, students will have developed a broad knowledge of the principles, technology, instrumentation, recent developments and proper handling of the modern radiological equipments and proper execution of the various radiological procedures and be able to embark upto a successful career in their chosen direction of Imaging Science research work across a wide range of locations and sectors within acute, primary and community care.

Program outcomes

1. Verifying informed consent, assuming responsibility for patient needs during procedures.
2. Applying principles of ALARA to minimize exposure to patient, self and others. Starting and maintaining intravenous access as prescribed, Identifying, preparing and/or administering medications as prescribed
3. Evaluating images for technical quality, ensuring proper identification is recorded.
4. Performing diagnostic radiographic and non-interpretive fluoroscopic procedures
5. Assist radiologists and senior staff in complex radiological examinations.
6. Record imaging identification and patient documentation quickly and accurately and observes protocols.
7. Research and development of new techniques and procedures as assigned.
8. Promotes effective working relationships and works effectively as part of a department / unit / team inter and intra departmentally to facilitate the department/unit's ability to meet its goals and objectives.
9. Follows established safety practices including biohazards, exposure control plan
10. Demonstrates respect and regard for the dignity of all patients, families, visitors and fellow employees to ensure a professional, responsible and courteous environment.
11. Identifying and managing emergency situations.
12. Performing ongoing quality assurance activities.
13. Ensure safe custody of all the accessories of the X-ray unit of which he/she is in charge. Keeps the X-ray room locked when not in use.
14. Understands and observes health and safety precautions and instruction for self and others protection. He/she should wear dosimeter during duty hours.
15. Attends all in service education required as per hospital policy.
16. Providing education. Educating and monitoring students and other health care providers.

17. Orientation and teaching students and new employees. 18. To supervise and allocate responsibilities to level 4 and level 5.
18. Learns new technologies and technologies as required by the professional bodies.
19. Impart appropriate training to the students and other staff.
20. Should have management and research skills.
21. To exhibit keen interest, initiative & drive in the overall development of the Department and 'Leadership Qualities' for others to follow.
22. He / She is expected to be confident and to perform all the duties diligently with utmost sincerity and honesty.
23. 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.
24. Verifying informed consent, assuming responsibility for patient needs during procedures.
25. Applying principles of ALARA to minimize exposure to patient, self and others. Starting and maintaining intravenous access as prescribed, Identifying, preparing and/or administering medications as prescribed
26. Evaluating images for technical quality, ensuring proper identification is recorded.
27. Performing diagnostic radiographic and non-interpretive fluoroscopic procedures
28. Assist radiologists and senior staff in complex radiological examinations.
29. Record imaging identification and patient documentation quickly and accurately and observes protocols.
30. Research and development of new techniques and procedures as assigned.
31. Promotes effective working relationships and works effectively as part of a department / unit / team inter and intra departmentally to facilitate the department/unit's ability to meet its goals and objectives.
32. Follows established safety practices including biohazards, exposure control plan
33. Demonstrates respect and regard for the dignity of all patients, families, visitors and fellow employees to ensure a professional, responsible and courteous environment.
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39. Providing education. Educating and monitoring students and other health care providers.
40. Orientation and teaching students and new employees. 18. To supervise and allocate responsibilities to level 4 and level 5.
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46. 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: B.Sc. in Medical Radiology& Imaging Technology/B.Sc. Medical Technology Radio diagnosis and Imaging/ B.Sc. Radiological Technology/B.Sc. in Radiography/B.Sc. Medical Technology (X-ray) with a minimum 60% marks in B.Sc.

Duration of the course:
Duration of the course is 2 years

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:
The examination to the first/second year shall be open to a student who:
Has remained on the rolls of the course concerned for full on academic year preceding the examination and having attendant not less than 75% of the full course of lectures and practical separately held for the purpose in each year. The lectures/practical will be

conducted up to the last day when the classes break up for the appearing in the examination. Student must attain at least 50% marks in each Theory, Internal assessment and Practical independently / separately for each individual subject. The practical and viva voice examination will be held at the end of each year. The candidate will be examined on the subject matter prescribed for that year.

COURSE OF INSTRUCTION

Course Name	Course Code	Theory (In hrs.) (Class and lab)	Practical (In hrs.) (Clinical)	Total (in Hours)
1st Year - Total Hours 500				
Management and Planning of radiology department with compliance to national & international guidelines	MRIT101	60	40	100
Modern Imaging Techniques including Fusion and hybrid imaging technologies	MRIT102	60	40	100
Advanced Physics of Radiology & Imaging	MRIT103	60	40	100
Radiation safety in diagnostic Radiology	MRIT104	60	40	100
Radiological and Imaging Procedures	MRIT105	60	40	100
2nd Year - Total Hours 300				
Newer Imaging Modalities	MRIT201	60	40	100
Intervention Radiological Techniques and Care of Patient	MRIT202	60	40	100
Biostatistics & Basic Research Methodology	MRIT203	60	40	100
Dissertation - 6 months				

SCHEME OF EXAMINATION

First year				
SUBJECT CODE	**SUBJECTS**	**EXAMINATION PATTERN**		
		Internal	Final	TOTAL
PAPG00I	Management and Planning of radiology department with compliance to national & international guidelines	20	80	100
PAPG002	Modern Imaging Techniques including Fusion and hybrid imaging technologies	20	80	100
PAPG003	Advanced Physics of Radiology & Imaging	20	80	100
PAPG004	Radiation safety in diagnostic Radiology	20	80	100
PAPG005	Radiological and Imaging Procedures	20	80	100

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Practical- 50 Viva- 40 Journal- 10 Total marks: 100				
Second Year				
PAPG006	Newer Imaging Modalities	20	80	100
PAPG007	Intervention Radiological Techniques and Care of Patient	20	80	
PAPG008	Biostatistics & Basic Research Methodology	20	80	100
	Dissertation	20	80	100
	Thesis/Dissertation - 200 Presentation– 20 Viva – 20			240

FIRST YEAR M.SC RADIO IMAGING TECHNOLOGY

MRIT101-MANAGEMENT AND PLANNING OF RADIOLOGY DEPARTMENT WITH COMPLIANCE TO NATIONAL & INTERNATIONAL GUIDELINE- 60 HOURS

1. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding materials Protection for primary radiation, work load, use factor, occupancy factor, protection from scatter radiation and leakage radiation, X-Ray/Fluoroscopy/Mammography/Intervention/DSA/CT room design, structural shielding, protective devices.
2. 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).
3. **Surveys and regulations**. Radiation protection survey: Need for survey. - Performance standards for beam directing, beam defining and limiting devices in radiation protection equipment survey 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.
4. **Personal monitoring and occupational exposures**: Personal monitoring for Radiation workers. Monitoring devices. Body badges and ring badges. Thermo-luminescent dosimeters, Pocket ionization chambers. Applications, advantages and limitations of each device, Values for dose equivalent limits for occupational radiation exposures.
5. NABH guidelines, AERB guidelines and code, Basic safety standard, PNDT Act and guidelines.
6. Procedural safety
7. Achievable safety through compliance on the regulations in India and recommendations of ICRT, IAEA. 8. Role of Radiographer in Planning & Radiation

Protection: Role of technologist in radiology department - Personnel and area monitoring., Setting up of a new X-Ray unit, staff requirement, AERB specifications for site planning and mandatory guidelines – Planning of X-ray/CT rooms, Inspection of X-Ray installations - Registration of X-Ray equipment installation- Certification - Evaluation of workload versus radiation factors – Occupational exposure and protection Tools/devices.

8. Introduction to Management of a Radiology Department
    - Strategic Management
    - Decision Making, conflict and stress management
    - Managing Change and Innovation
    - Understanding Groups and Teams
    - Leadership
    - Time Management
    - Cost and efficiency

MRIT102-MODERN IMAGING TECHNIQUES INCLUDING FUSION AND HYBRID IMAGING TECHNOLOGIES-60 HOURS

1. **Interventional Radiography:** Basic angiography and DSA: a. History , technique, patient care b. Percutaneous cauterisation, catheterization sites, Asepsis c. Guide wire, catheters, pressure injectors, accessories d. Use of digital subtraction- single plane and bi-plane
1. All forms of diagnostic procedures including angiography, angioplasty, biliary examination, renal evaluation and drainage procedure.
2. **Central Nervous System**:
    - Pyelography.
    - Cerebral studies.
    - Ventriculography
3. **Arthrography:** Shoulder, Hip, Knee, Elbow
4. **Angiography:**
    - Carotid Angiography (4 Vessel angiography).
    - Thoracic and Arch Aortography.
    - Selective studies: Renal, SMA, Coeliac axis.
    - Vertebral angiography.
    - Femoral arteriography.
    - Angiocardiography.
5. **Venography:**
    - Peripheral venography.
    - Cerebral venography.
    - Inferior and superior venocavography.
    - Relevant visceral phlebography.
6. **Ultrasonography/ Doppler studies:** Techniques of sonography-selection-Preparations - instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities- patient care and maintenance protocols clinical applications display methods –quality image reproducible extend – biopsy procedures, assurance to patients.

7. **Cardiac catheterization procedures:** PTCA, BMV, CAG, Pacemaker, Electrophysiology
8. **CT scan studies acquisition/ protocols /techniques**: CT of head and neck – thorax – abdomen – pelvis – Musculo skeletal system – spine – PNS. Anatomy – clinical indications and contraindications – patient preparation – technique – contrast media-types, dose, injection technique; timing, sequence - image display – patient care – utilization of available techniques & image processing facilities to guide the clinician- CT anatomy and pathology of different organ systems.
9. **MRI imaging** – Head and Neck ,Thorax, Abdomen, Musculoskeletal System imaging clinical indications and contraindications- types of common sequences effects of sequence on imaging - Protocols for various studies- slice section- patient preparation-positioning of the patient -patient care-calibration - paramagnetic agents and dose, additional techniques and recent advances in MRI - image acquisition-modification of procedures in an unconscious or un co-operative patient - plain studies- contrast studies -special procedures- reconstructions- 3D images- MRS blood flow imaging, diffusion/perfusion scans - strength and limitations of MRI- role of radiographer.
10. Techniques of Fusion and hybrid Imaging Technology including PET CT,PET MRI, PET Ultrasound, MRI, CT, Fluoroscopy, Hybrid Imaging as well as Advanced Interventional suite.

MRIT103-ADVANCED PHYSICS OF RADIOLOGY & IMAGING 60 HOURS

1. Physics of Imaging including conventional radiography, computed radiography and flat panel detector imaging.
2. **Computed Tomography**- Basic principles of CT, generations of CT, CT instrumentation, image formation in CT, CT image reconstruction, Hounsfield unit, CT image quality, CT- image display.
3. **Advanced Computed Tomography** -Helical CT scan: Slip ring technology, advantages, multi detector array helical CT, cone – beam geometry, reconstruction of helical CT images, CT artifact, CT angiography, CT fluoroscopy, HRCT, post processing techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose Index.
4. **MRI- Basic Principles:** Spin – precession – relaxation time – pulse cycle – T1 weighted image – T2 weighted image – proton density image. a. Pulse sequence : Spin echo pulse sequence – turbo spin echo pulse sequence - Gradient echo sequence – Turbo gradient echo pulse sequence - Inversion recovery sequence – STIR sequence – SPIR sequence – FLAIR sequence – Echo planar imaging – Advanced pulse sequences b. MR Instrumentation: Types of magnets – RF transmitter – RF receiver – Gradient coils – shim coils – RF shielding – computers. c. Image formation: 2D Fourier transformation method – K-space representation – 3D Fourier imaging – MIP. d. MR Spectroscopy – functional MRI
5. **Ultrasonography Basic Acoustics, Ultrasound terminologies**: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity. Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients. US machine controls, US focusing. Production of ultrasound:

Piezoelectricity, Medical ultrasound transducer: Principle, construction and working, characteristics of US beam. Ultrasound display modes: A, B, M Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducers: mechanical and electronic arrays, ultrasound artifacts, ultrasound recording devices, and Distance, area & volume measurements. Doppler Ultrasound, Doppler artifacts, vascular sonography

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 maneuvering 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.
Medical Emergencies Trauma care & Emergency Radiography: procedures in the event of an accident-Special positioning procedures & projections -modification of techniques needed for seriously injured patients. Radiographic factors -patient care & responsibilities-Search of profession confidence-maintenance decorum of the job responsibility -the importance of records maintenance. Fluoroscopy and its application in emergency radiology -Medicolegal aspects of the radiographers work. Common medical emergencies-helping in first aids & zero hour care / know to help in critical hour care -Trauma patients handling – trauma ward bed X-rays – mass casualty managements-selection of study / procedures & radiographic views. Knowing the emergency care places in the hospital & preplanning- checking & readiness of mobile units in functioning status -screening of the high risk patients in various procedure-supportive facilities to encounter emergency-practical training.

MRIT104-RADIATION SAFETY IN DIAGNOSTIC RADIOLOGY 60 HOURS

1. Introduction to Radiation protection-Need for protection, Aim of radiation protection.
2. **Limits for radiation exposure:** Concept of ALARA, maximum permissible dose, exposure in pregnancy, children. Occupational Exposure Limits - Dose limits to public
3. **Radiation Protection in:** Radiography, Fluoroscopy, Mammography, Mobile Radiography, CT scan, DSA and Interventional Radiology.
4. **Radiation measuring instruments:** survey meters, area monitor, personnel dosimeters, film badge, thermo luminescent dosimeter, pocket dosimeter.
5. **Radiation Quantities and Units:** Radiation, Radioactivity, Sources of radiation - natural radioactive sources, cosmic rays, terrestrial radiation, manmade radiation sources. Kerma, Exposure, absorbed dose, Equivalent Dose, Weighting Factors, Effective Dose
6. **Biological Effects of radiation:** Direct & Indirect actions of radiation ,concept of detriment ,Deterministic & stochastic effect of radiation ,somatic and genetic effects,

dose relationship , effects of antenatal exposure Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell-Chromosomal aberration and its application for the biological dosimetry- Effects of whole body and acute irradiation, dose fractionation, effects of ionizing radiation on each of major organ system including foetus -Somatic effects and hereditary effects- stochastic and deterministic effects-Acute exposure and chronic exposure-LD50 - factors affecting radio sensitivity. Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields. 7. Radiation detection and Measurements: Ionization of gases, Fluorescence and Phosphorescence, Effects on photographic emulsion. Ionization Chambers, proportional counters, G.M counters, scintillation detectors, liquid semiconductor detectors, Gamma ray spectrometer. Measuring systems: free air ionization chamber, thimble ion chamber, condenser chamber, Secondary standard dosimeters, film dosimeter, chemical dosimeter- thermo luminescent Dosimeter, Pocket dosimeter, Radiation survey meter- wide range survey meter, zone monitor, contamination monitor -their principle function and uses. Advantages & disadvantages of various detectors & appropriateness of different detectors for different type of radiation measurement.

7. Dose and Dosimetry, CT Dose Index (CTDI, etc.), Multiple Scan Average Dose (MSAD), Dose Length Product (DLP), Dose Profile, Effective Dose, Phantom Measurement Methods, Dose for Different Application Protocols, Technique Optimization. Dose area product in fluoroscopy and angiography systems, AGD in mammography.
8. **Radiation protection, Hazard evaluation and control:** Philosophy of Radiation protection Radiation protection of self and patient and General Public, Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey, Calculation of Work load, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology.
9. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding materials Protection for primary radiation, work load, use factor, occupancy factor, protection from scatter radiation and leakage radiation, XRay/Fluoroscopy/Mammography/Intervention/DSA/CT room design, structural shielding, protective devices.
10. **Regulatory Bodies & regulatory Requirements:(professional ethics)** 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).
11. NABH guidelines, AERB guidelines, PNDT Act and guidelines.
12. Procedural safety
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MRIT105-RADIOLOGICAL AND IMAGING PROCEDURES 60 HOURS

1. Special Radiographic/Radiological procedures
2. Selection of Fluoroscopy Equipment, 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.
3. **Gastrointestinal Tract:** Barium swallow, pharynx and oesophagus. Barium meal and follow through. Hypotonic duodenography. Small bowel enema. Barium Enema routine projections for colon and rectum, colonic activators; double contrast studies; colostomy. Special techniques for specific disease to be examined. Including water soluble contrast media - e.g. gastrograffin studies. Including CT, US and MRI Special Imaging Techniques.
4. **Salivary glands:** Routine technique, procedure - sialography. 5. Biliary system: Plain film radiography. Intravenous cholangiography. Percutaneous cholangiography, Endoscopic retrograde cholangio- pancreatography (ERCP). Operative cholangiography, Post-Operative cholangiography (T-tube Cholangiography). Including CT, US and MRI Special Imaging Techniques.
5. **Urinary system:** Intravenous urography, retrograde pyelography. Antegrade pyelography. Cystography and micturating cystouresthrography. Urethrography (ascending) renal puncture. Including CT, US and MRI Special Imaging Techniques.
6. **Reproductive system:** All the Techniques relating to Male and Female reproductive system including Hysterosalpingography.
7. **Breast Imaging**: Mammography: Basic views, special views, wire localization. Ductography, Tomosynthesis, ABVS, Various Biopsy Techniques including Prone Table Biopsy, CT, US and MRI Special Imaging Techniques
8. **Respiratory system:** - Bronchography: Including CT, US and MRI Special Imaging Techniques.
9. **Sinography:** Routine technique and procedure.
10. **Central Nervous System:** Myelography. Cerebral studies. Ventriculography etc. including CT, US and MRI Special Imaging Techniques.
11. **Arthrography:** Shoulder, Hip, Knee, Elbow joints etc. including CT, US and MRI Special Imaging Techniques.
12. **Angiographic Studies**: Carotid Angiography (4 Vessel angiography). Thoracic and Arch Aortography. Selective studies: Renal, SMA, Coeliac axis. Vertebral angiography. Femoral arteriography. Angiocardiography, Peripheral angiography
13. **Venography:** Peripheral venography. Cerebral venography. Inferior and superior venocavography. Relevant visceral phlebography.
14. **Microbiology:** Introduction and morphology - Introduction of microbiology, Classification of microorganisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria. Growth and nutrition -nutrition, culture media, types of medium with example and uses of culture media in diagnostic bacteriology, antimicrobial sensitivity test Sterilization and disinfection - principles and use of equipment's of sterilization namely hot air oven, autoclave and serum

inspissator, pasteurization, anti-septic and disinfectants. Introduction to immunology, bacteriology, parasitology, mycology

SECOND YEAR M.SC RADIO IMAGING TECHNOLOGY

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. (Board of Studies letter No.:FPMS/SV/BOS-MIN/0006/2016-17, dated 19/04/2017, and vide notification of Board of Management resolution Ref.:No. SVDU/R/2017-18/5056, dated 09/01/2018).

MRIT201-NEWER IMAGING MODALITIES 60 HOURS

1. **Basic Computed Tomography**- Basic principles of CT, generations of CT, CT instrumentation, image formation in CT, CT image reconstruction, Hounsfield unit, CT image quality, CT image display
2. **Advanced Computed Tomography** - Helical CT scan: Slip ring technology, advantages, multi detector array helical CT, cone – beam geometry, reconstruction of helical CT images, CT artifact, CT angiography, CT fluoroscopy, HRCT, post processing techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose, patient preparation, Imaging techniques and protocols for various parts of body, CT contrast enhanced protocols – CT angiography – (Aortogram, selective angiogram head, neck and peripheral) image documentation and Filing, maintenance of equipment and accessories.
3. Advanced technique & instrumentation of MRI
4. **Basic Principle:** Spin – precession – relaxation time – pulse cycle – T1 weighted image – T2 weighted image – proton density image.
5. **Pulse sequence :** Spin echo pulse sequence – turbo spin echo pulse sequence - Gradient echo sequence – Turbo gradient echo pulse sequence - Inversion recovery sequence – STIR sequence – SPIR sequence – FLAIR sequence – Echo planar imaging – Advanced pulse sequences.
6. **MR Instrumentation:** Types of magnets – RF transmitter – RF receiver – Gradient coils – shim coils – RF shielding – computers.
7. **Image formation:** 2D Fourier transformation method – K-space representation – 3D Fourier imaging – MIP.
8. **MR contrast media** – MR angiography – TOF & PCA – MR Spectroscopy – functional MRI Ultrasonography Basic Acoustics, Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity. Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients, US machine controls, US focusing.
9. **Production of ultrasound**: Piezoelectricity, Medical ultrasound transducer: Principle, construction and working, characteristics of US beam.
10. **Ultrasound display modes:** A, B, M

11. **Real-time ultrasound:** Line density and frame rate, Real-time ultrasound transducers: mechanical and electronic arrays, ultrasound artifacts, ultrasound recording devices, and Distance, area & volume measurements.
12. Techniques for imaging different anatomic areas, ultrasound artifacts, biological effects and safety. 13. Doppler Ultrasound- Patient preparation for Doppler, Doppler artifacts, vascular sonography,
13. Elastography, HIFU, ABVS etc.
14. Fusion Imaging -PET CT & PET MRI

MRIT202-INTERVENTION RADIOLOGICAL TECHNIQUES AND RIGHT TO HEALTH-60 HOURS

1. **Basic Angiography and DSA:** History , technique, patient care, Percutaneous catherisation, catheterization sites, Asepsis ,Guide wire, catheters, pressure injectors, accessories, Use of digital substraction- single plane and bi-plane. All forms of diagnostic procedures including angiography, angioplasty, biliary examination, renal evaluation and drainage procedure and aspiration cytology under flouro, CT, US, MRI guidance.
2. **Central Nervous System:** Myelography. Cerebral studies, Ventriculography.
3. **Arthrography:** Shoulder, Hip, Knee, Elbow
4. **Angiography:** Carotid Angiography (4 Vessel angiography).Thoracic and Arch Aortography. Vertebral angiography, femoral arteriography. Selective studies: Renal, SMA, Coeliac axis. Angiocardiography.
5. **Venography**: Peripheral venography, Cerebral venography, Inferior and superior venocavography. Relevant visceral phlebography.
6. **Cardiac catheterization procedures**: PTCA, BMV, CAG, Pacemaker.
7. **Microbiology Introduction and morphology** - Introduction of microbiology, Classification of microorganisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria. Growth and nutrition -nutrition, culture media, types of medium with example and uses of culture media in diagnostic bacteriology, antimicrobial sensitivity test. Sterilization and disinfection - principles and use of equipments of sterilization namely hot air oven, autoclave and serum inspissator, pasteurization, anti-septic and disinfectants.

<u>Care of Patient in Interventional Radiology</u>

1. **Introduction to patient care:** responsibilities of healthcare facility-responsibilities of the imaging technologist.
2. **General patient care**: patient transfer technique-restraint techniques-aspects of patient comfort-specific patient conditions-security of patient property-obtaining vital signs-laying up a sterile trolley-assisting in IV injection.
3. **Surgical Asepsis:** The Environment and Surgical Asepsis, Methods of Sterilization, Disinfection, Opening Sterile Packs, Changing Dressing.
4. **Nursing procedure in radiology**- general abdominal preparation, clothing of the patient giving an enema-handling the emergencies in radiology- first aid in the X-ray department
5. **Patient care during investigation:** GI tract, biliary tract, respiratory tract, Gynaecology, cardiovascular lymphatic system, CNS etc.

6. **Infection control**: definitions- isolation techniques-infection sources-transmission modes- procedures-psychological considerations – sterilization & sterile techniques.
7. **Patient education:** communication – patient communication problems – explanation of examinations-radiation safety/protection – interacting with terminally ill patient.
8. **Medical Emergencies**: Shock, Pulmonary Embolus, Diabetic Emergencies, Respiratory Failure, Cardiac Failure, Airway Obstruction, Stroke, Fainting, Seizures.
9. **Drug Administration:** System of Drug Administration, Medication Error and Documentation, Equipment for Drug Administration, Methods of Drug Administration, Care of patient with Intravenous Infusions

MRIT203-BIOSTATISTICS & BASIC RESEARCH METHODOLOGY 60 HOURS

1. **What is statistics** – importance of statistics in behaviors sciences- descriptive statistics and inferential statistics-usefulness of qualification in behavioral sciences – scales of measurements- nominal, ordinal, interval and ratio scales.
2. **Data collection** – classification of data-class intervals – continuous and discrete measurements-drawing frequency polygon-histogram-cumulative frequency curve-ogives drawing inference from graph.
3. Measures of central tendency- need-types: mean, median, mode – working out these measures with illustrations. Measures of variability – need- types range, quartile deviation, average deviation, standard deviation, variance-interpretation.
4. **Normal distribution-**general properties of normal distribution-theory of probability illustration of normal distribution-area under the normal probability curve. Variants from the normal distribution-skewness-quantitative measurements of skewness-kurtosis- measurements of kurtosis-factors contributing for non-normal distribution
5. **Correlation**-historical contribution-meaning of correlation-types: rank correlation, regression analysis.
6. **Tests of significance-** need for-significance of the mean-sampling error-significance of differences between means-interpretation of probability levels-small samples-large samples inferential statistics-parametric and non-parametric methods-elements of multivariate analysis.

Dissertation.

Each candidate will have to carry out of a dissertation on the related subject. The dissertation will be guided by one or two members of the faculty or medical Physicists of the department. The dissertation will be evaluated by the External/Internal Examiners at the time of viva voice examination of the candidate during the second year and the candidate will be asked to make presentation before the External/Internal Examiner.

The final dissertation duly approved by the External/Internal examiners will be submitted to the Dean's office with the result. The dean's office will send the dissertation to the library for record.

Attested CTC

15/2/2021

Vice-Chancellor
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