अटल बिहारी वाजपेयी चिकित्सा विश्वविद्यालय, उ0 प्र0 लखनऊ
Atal Bihari Vajpayee Medical University, U.P., Lucknow.

Ordinance & Syllabus

For

Master in Medical Radiology and Imaging Technology (MMRIT)

Academic Programme

Duration: 2 years (4 Semesters)

25/4/22 कुलपति अटल बिहारी वाजपेयी चिकित्सा विश्वविद्यालय उत्तर प्रदेश, लखनऊ

25/4/22 Dr. Mukul Vishwakarma.

28/04/2022 (Dilshad Ahmad)

25/4/2022 (SUNIL KUMAR SEKSANA)

25/4/2022 (Dr. KAMAL PANT)

Master in Medical Radiology and Imaging Technology (MMRIT)

Introduction:

Learning Objectives:

The Aim of Master in Medical Radiology & Imaging Technology (MMRIT) is 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. This is designed as a higher degree course suitable for gradates having experience in the technology of imaging science. The objective of this programme is to train students in to qualified, patient focused, compassionate, critical thinkers Diagnostic Radiographer /Technologist for the community who are engaged in life long learning.

After successful completion of the master degree the 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 Up to a successful career in their chosen direction of Imaging Science research.

Performa range of radiographic examinations on patient to produce high quality images.

1. Verifying informed consent, assuming responsibility for patient needs during procedures.
2. Applying principles of radiation protection to minimize exposure to patient, self and others.
3. Evaluating images for technical quality, ensuring proper identification is recorded.
4. Research and development of new techniques and procedures as assigned.
5. 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.
6. Follows established safety practices including biohazards, exposure control plan
7. Demonstrates respect and regard for the dignity of all patients, families, visitors and fellow employees to ensure a professional, responsible and courteous

environment.

8. Performing ongoing quality assurance activities.
9. Attends all in service education required as per hospital policy.
10. Providing education, Educating and monitoring students and other health care providers.
11. Should have management and research skills.

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 50% marks in B.Sc.

OR

A candidate with Bachelor degree in any science discipline with a minimum of 60% marks in the BSc. Exam and diploma holders in Medical Radiology and Imaging Technology with 3-5 years of professional experience may be considered as the eligible candidates for the MSc. Program. (Only for sponsored candidates)

Candidates who have obtained qualification from a Foreign University/Board should obtain equivalency certificate of their qualification from AtalBihari Vajpayee Medical University, Lucknow.

Selection to the Master in Radiology and Medical Imaging Technology course shall be on the performance in written exam or interview conducted by AtalBihari Vajpayee Medical University. Medical fitness certificate needs to be submitted by the candidate on the day of Admission.

Duration of the course:

Duration of the course:2 Years (Four semester)

Maximum Duration: 4 years

Number of Seats:

Two seats for each available modality (Maximum 20)

Medium of instruction:

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

TEACHINGMETHODS

Teaching methods include the help of audio-visual aids i.e. transparencies, slides, video cassettes as well as use of multimedia and computers etc.

TEACHINGPROGRAMME:

Theory work: Departmental teaching, programme includes:

Regular classes/Lectures	5 days in a week
Journal clubs/seminars/discussions	Once in a week
Demonstration of equipment/accessories	Once a week
Demonstration of special radiographic techniques	Once a week

PRACTICALWORK:

i) Students are posted in various radiographic rooms to work independently and their day to day work is 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.

Examination:

There shall be a Semester University Examination at the end of each academic semester in the form of theory papers examination and practical examinations. The candidate shall be required to appear in every subject as specified in the course for each Semester.

Duration of Examination:

Each theory paper examination shall be of three hours.

Examiners:

The Board of examiners for theory papers examination shall consist of 50 % internal and 50% external examiners and for practical examination there should be one external examiner and one internal examiner (of the institute). All examiners shall be decided by honorable vice-chancellor of the Atal Bihari Vajpayee Medical University.

Eligibility for Examiner:

PG in concern subject(s).

Minimum five years of experience as Lecturer/Assistant Professor or above.

Evaluation:

The answer books of the University Semester examination shall be evaluated as per the university rules.

Attendance:

The permission to appear in University semester examination shall be granted to such candidate only who have fulfill the condition of 75% attendance in each subject separately in theory and 85% attendance in practical.

The dean on the recommendation of head of department will have the authority to condone deficiency up to 5% of the lecturers/practicals. The director/Head of the institution in exceptional cases can also condone deficiency up to another 5% of the lectures/ practicals.

Master in Medical Radiology &Imaging Technology (MMRIT)

University Examination (SEMESTER – I)

Course Code	Subject(s)	External Marks	Internal Marks	Minimum Marks	Total Credits
MRT-101	Planning & Management of a Radiology & Imaging department	75	25	100	06
MRT-102	Modern Imaging Techniques	75	25	100	06
MRT-103	Advanced Physics of Radiology & Imaging	75	25	100	06
MRT-104	Research Methodology and Biostatics –I	75	25	100	05
MRT-111	Planning & Management of a Radiology & Imaging department	75	25	100	03
MRT-112	Modern Imaging Techniques	75	25	100	03
MRT-113	Advanced Physics of Radiology & Imaging	75	25	100	03
			Total	700	32

University Examination (SEMESTER – II)

Course Code	Subject(s)	External Marks	Internal Marks	Minimum Marks	Total Credits
MRT-201	Radiation Safety and Protection- AERB guidelines	75	25	100	04
MRT-202	Modern Radiological and Imaging Equipment	75	25	100	04
MRT-203	Radiological and Imaging Procedures	75	25	100	04
MRT-204	Research Methodology and Biostatics – II	75	25	100	05
MRT-211	Radiation Safety and Protection- AERB guidelines	75	25	100	02
MRT-212	Modern Radiological and Imaging Equipment	75	25	100	02
MRT-213	Radiological and Imaging Procedures	75	25	100	02
			Total	700	23

University Examination (SEMESTER – III)

Course Code	Subject(s)	External Marks	Internal Marks	Minimum Marks	Total Credits
MRT-301	Quality Assurance and Quality Control in Diagnostic Radiology and Imaging	75	25	100	04
MRT-302	Newer Imaging Modalities	75	25	100	04
MRT-303	Intervention Radiological Techniques and Care of Patient	75	25	100	04
MRT-311	Quality Assurance and Quality Control in Diagnostic Radiology and Imaging	75	25	100	02
MRT-312	Newer Imaging Modalities	75	25	100	02
MRT-313	Intervention Radiological Techniques and Care of Patient	75	25	100	02
MRT-314	Workshop/Seminars/Projects/Residency-I			100	04
			Total	700	22

University Examination (SEMESTER – IV)

Course Code	Subject(s)	External Marks	Internal Marks	Total Marks	Minimum Marks	Total Credits
MRT-401	Newer Developments in Advanced Imaging Technology and Biostatics	75	25	75	100	05
MRT-402	Nuclear Medicine Imaging Techniques	75	25	75	100	05
MRT-411	Newer Developments in Advanced Imaging Technology and Biostatics	75	25	75	100	03
MRT-412	Nuclear Medicine Imaging Techniques	75	25	75	100	03
MRT-413	Seminars, Journal Club and Group Discussions/ Project Work				100	02
MRT-414	Seminar/ Journal Club/Residency-II				100	04
				Total	600	22

INTERNALASSESSMENT

- It will be for theory and practical both.
- It will be done in each semester.
- Candidate must obtain atleast 35% marks in theory and practicals separately in internal assessment to be eligible for the university examination.
- Internal assessment (Theory) will be done as follows:

a) Mid-term and term examinations	=10marks
b) Assignments/Projects/Class test/ClinicalPresentations	=10marks
c) Attendance	=05marks
	Total=25marks

- Internal assessment (Practical) will be done as follows:

a) Laboratory manual	=10marks
b) Dayto day performance	= 10marks
c) Attendance	=05marks
	Total=25marks

CRITERIA FOR PASSING

Theory and practical component of the same course shall be considered as separate head.A candidate is declared to have passed University examination in a subject, if he/she secures 50% of the marks in theory and 50% in practicals separately. For computation of 50% marks in theory, the marks scored in the internal assessment (theory) shall be added to the University conducted written examination and for passing in practical the marks scored in University conducted practical examination and internal assessment (practical) shall be added together.

GRACE MARKS:

- If a candidate fails in one subject (theory only) in the annual University examination, five grace marks will be given to the candidate by the University before the declaration of result.
- Candidate failing in practical examination will be considered as failed.

PROMOTION:

- A candidate appear in odd/even semester university examination and fails in a subjects not more than 50% of the subjects and also secured at least 30% aggregate marks will be promoted to next semester and will be required to appear in next odd/even semester university examination and his/her internal and practical marks will be carry over. Those who secure less than 30% aggregate marks or fail in practical will be shifted back by one semester.
- The candidate will have to take admission in the previous semester and pay the tuition fee for that semester.

DIVISION:

Candidate will be awarded division at the end of 6th Semester as follows:
- Distinction - 75% and above marks in any subject.

- First division - 60% and above in the aggregate of marks of all subjects
- Second division- 50% or more but less than 60% in the aggregate of marks of all subjects.

DEGREE:

The degree of MasterinMedical Radiology&Imaging Technology (MMRIT)) course of the University shall be conferred on the candidates who have pursued the prescribed course of study for not less than four semesters and have passed examinations as prescribed under the relevant scheme.

PART – "C"

Fee Structure

Tuition Fee: As decided by University/ UP Government/Governing body of the Institute.

Examination Fee: As decided by University/Governing body of the Institute.

Security Deposit / Caution Money (Refundable after completion of the course): As decided by governing body of the Institute,

PART – "D"

Faculty and Staff Requirement:

Student Teacher Ratio = 3:1

The teaching faculty for the department should have a minimum of

Principal/Dean: 01

Professor - 01

Associate Professor - 04

Assistant Professor/Lecturer – 08

Designation	Essential Qualification
Principal/ Dean	Master in Medical Imaging Technology or Equivalent with at least fifteen years' teaching experience. Senior-most Professor shall be designated as the Principal/ Dean (Medical Imaging Technology) Desirable: PhD in Concern Subject.
Professor:	Master in Medical Imaging Technology or Equivalent with 10 years' teaching experience of which at least 3 years should be at the level of Associate Professor in concern specialty. Desirable: PhD in Concern Subject.
Associate Professor:	Master in Medical Imaging Technology or Equivalent with eight years' experience as Lecturer/Assistant Professorfrom UGC recognized University. Desirable: PhD in Concern Subject.
Assistant Professor/ Lecturer	Master in Medical Imaging Technology or Equivalent degree with at least 55% marks (or an equivalent grade in a point scale wherever the grading system is followed) from UGC recognized University

Non-Teaching Staff: (full time)

(a) Office staff

(i) Steno-Typist - one

(ii) Clerk - one

(b) Laboratory staff

(i) Laboratory Assistant - one

(ii) Attendant - one

PART – "E"

INFRASTRUCTURE

A. For Academic:

1. Minimum Land requirement

   4000Sq.Meters (43040 Sq. Ft) in Urban Area and 8000 Sq. Meter (86080 Sq. Ft.). In case of more than one course in that building there must be an additional 2000 Sq. meter more area per course.

2. Space for Administration:

   (a) Principal Room - One

(b) HOD Room - One

(c) Faculty Room (Professor) – One

(d) Faculty Room (Associate Professor) – Four

(e) Faculty Room (Assistant Professor/Lecturer) - Eight

(f) Departmental Office – One

(g) Staff room – one

3. Space for Teaching
   (i) Class rooms – 2
   (ii) Toilets (1:6 boys & girls separately)
4. Girls Common Room
5. Anatomy & Physiology Museum – 900 sq. ft.
6. Computer Lab – 1500 sq. ft.
   Essential: Adequate Hardware and Software facilities with Internet connections. Minimum 50 computers should be available in the first year itself.
7. Multipurpose Hall – 3000 sq. ft.
8. OHP & Slide Projector, Multimedia / Computer and its accessories / LCD Projector.
9. Auditorium (with 250 seating capacity)
10. Seminar Hall (with 100 seating capacity)
11. Departmental Library – it should provide adequate number of text books, Reference books, Journals, in the core subjects, medical subjects and Allied subjects.
12. Lab facilities for Basic Medical Sciences as per the criteria mentioned in Basic Medical Sciences requirements.
13. Lab equipments for Basic Medical Sciences as per the criteria mentioned in Basic Medical Sciences requirements.

B. For Practical:

The institute or College conducting MasterinMedical Radiology&Imaging Technology (MMRIT) should mandatorily be associated with minimum 100 beds hospital whereby they can make use of the available patient load and medical infrastructure as a part of their training curriculum. For the institutes to be capable of providing high quality training to the student and exposure to all the related modalities, it should have the following:

1. Processing Equipment:
   Automatic and manual Processing

2. Conventional and CR/DR X-ray Unit
   - High Capacity (500 mA and above)
   - Dedicated Chest X-Ray / Orthopedic / Casualty X-Ray Units
   - C-arm
3. Mobile X-ray unit
4. Fluoroscopic unit
   - High Capacity (500 mA and above) with I.I.T.V/Flat panel
5. Ultrasonography including Colour Doppler Equipment
6. Multi-slice (Above 16 slice) C.T. Scanner
   - with accessories like laser camera, Pressure injector, Phantom for QCT and all application software
7. Mammography Equipment
8. MRI Scanner (1.5 Tesla or above)
   - With accessories like laser camera and all application software like for functional MRI, MR Spectroscopy.
9. Cath lab/DSA Lab (preferably)
10. DEXA (Preferably)
11. Quality Assurance Tool Kits with all accessories

First Semester

Course Code	Course Titles	Lectures (L)/Tutorial(T) Hours Per Semester	Practical (P)Hours Per Semester	Total Contact Hours	Total Credits
MRT-101	Planning& Management of a Radiology & Imaging department	60	60	120	09
MRT -102	Modern Imaging Techniques	60	120	180	09
MRT -103	Advanced Physics of Radiology & Imaging	60	60	120	09
MRT -104	**Research Methodology and Biostatics –I**	30	40	70	05
TOTAL		**210**	**280**	**390**	**32**

SECOND SEMESTER

Course Code	Course Title	Lectures (L)/Tutorial (T)Hours Per Semester	Practical (P)Hours Per Semester	Total Contact Hours	Total Credits
MRT -201	Radiation Safety and Protection-AERB guidelines	30	60	90	6
MRT -202	Modern Radiological and Imaging Equipment	30	60	90	6
MRT -203	Radiological and Imaging Procedures	30	60	90	6
MRT -204	Research Methodology and Biostatics – II	30	40	70	05
MRT -205	Workshop	-	10	10	01
TOTAL		**120**	**230**	**350**	**24**

THIRD SEMESTER

Course Code	Course Title	Lectures (L)/Tutorial (T)Hours Per Semester	Practical (P)Hours Per Semester	Total Contact Hours	Total Credits
MRT -301	Quality Assurance and Quality Control in Diagnostic Radiology and Imaging	30	60	90	06
MRT -302	Newer Imaging Modalities	30	60	90	06
MRT -303	Intervention Radiological Techniques and Care of Patient	30	60	90	06
MRT -304	Workshop/Seminars/Project		40	40	02
MRT -305	Residency-I		10	10	01
TOTAL		**90**	**230**	**320**	**21**

FOURTH SEMESTER

Course Code	Course Title	Lectures (L)/Tutorial (T)Hours Per Semester	Practical (P)Hours Per Semester	Total Contact Hours	Total Credits
MRT -401	Newer Developments in Advanced Imaging Technology and Biostatics	40	60	100	08
MRT -402	Nuclear Medicine Imaging Techniques	40	60	100	08
MRT -403	Seminars, Journal Club and Group Discussions		40	40	02
MRT -404	Project Work	-	60	60	03
MRT-405	Residency-II		10	10	01
TOTAL		**60**	**240**	**320**	**22**

Course Title: Planning & Management of a Radiology & Imaging department			
Semester: I	**Course code:MRT-101**	**Credits:09**	**Core**
No of sessions Lectures / Tutorial: 60		**No of practical hours:60**	
Course Pre-requisites:		**Number of sessions: 120**	

Course Introduction

A rapid change in investigation technology has increased the continuous changing demand in the field of radio diagnosis and imaging service. To full fill this demand, requires an advanced, and detailed systematic planning and organization of department which having a foresight to fulfill into future developments and requirements.

Course Objectives

1. **Course Objectives:** The purpose of this course is to provide the basic understanding of Radiology and imaging department. This course also provides fundamental idea about Regulatory Bodies & regulatory Requirements to set Radiology and imaging department. The main objectives are:

1. To understand the Planning consideration for radiology and imaging department.
2. To know about the various Regulatory Bodies & regulatory Requirements.

2. **Course Learning Outcomes**

Upon successful completion of the course, the students should be able to (knowledge based):

CLO1: Understood the basic requirements to set radiology and imaging department. .

CLO2: To understand the role of various Regulatory Bodies & regulatory Requirements setting radiology and imaging department.

4. Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments an physical demonstration. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of Planning & Management of a Radiology & Imaging departmentbut also improve skills and techniques for Patient safety, radiation safety and patient management.

5. Course Contents

Management and Planning of radiology department with compliance to national &international guidelines

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, XRay/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.

9. Introduction to Management of a Radiology Department

a. Strategic Management

b. Decision Making, conflict and stress management

c. Managing Change and Innovation

d. Understanding Groups and Teams

e. Leadership

f. Time Management

g. Cost and efficiency

Course Assessment Scheme

Students would be assessed continuously throughout the semester in the form of continuous evaluation. Periodic tests and surprise tests will be conducted. Students will have to submit written assignments, make charts and posters, make models, and conduct quiz for the topics. Practical will be conducted with viva. Midterm and end term evaluation will be done theoretically and practically. Students will also be assessed on the basis of presentations of various topics.

Course Title: Modern Radiological and Imaging Equipment			
Semester: I	**Course code: MRT-102**	**Credits:09**	**Core**
No of sessions Lectures / Tutorial: 60		**No of practical hours: 120**	
Course Pre-requisites:		**Number of sessions:180**	

Course Objectives

The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications of mammography and computed radiography and DSA. Should able to scanning also in mammography,computed radiography and DSA.

Course learning Outcomes

CLO 1-Perform the procedure of mammography scanning.
CLO 2-Enumerate and able to know the principle computed radiography.
CLO 3-Able to know and perform vascular imaging with PACS

Course Pedagogy
The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of physics of mammography and CT scan but also improve skills and techniques for tackling practical problems.

Course contents

Interventional Radiography: Basic angiography and DSA:
a. History , technique, patient care
b. Percutaneous catherisation, catheterization sites, Asepsis
c. Guidewire, catheters, pressure injectors, accessories
d. Use of digital substraction- single plane and bi-plane
All forms of diagnostic procedures including angiography, angioplasty, bilary examination, renal evaluation and drainage procedure.
2. Central Nervous System:
a. Myelography.
b. Cerebral studies.
c. Ventriculography
3. Arthrography: Shoulder, Hip, Knee, Elbow
4. Angiography:
a. Carotid Angiography (4 Vessel angiography).
b. Thoracic and Arch Aortography.
c. Selective studies: Renal, SMA, Coeliac axis.
d. Vertebral angiography.
e. Femoral arteriography.

f. Angiocardiography.
5. Venography:
a. Peripheral venography.
b.Cerebral venography.
c. Inferior and superior venocavography.
d. Relevant visceral phlebography.
6. Cardiac catheterization procedures: PTCA, BMV, CAG, Pacemaker, Electrophyiology
7. 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.
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 mediatypes, dose, injection technique; timing, sequence - image display – patient care – utilization of available techniques & image processing facilities to guide the clinicianCT 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 preparationpositioning 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 proceduresreconstructions- 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.

Text Books:

1. S.K Bhargawa text book of Radiological Physics
2. Joseph Selman Fundamental of X Rays and Radium
3. Text book for Radiotherapy ,Radiation Physics by Walter and Miller's

Course Title: Advanced Physics of Radiology & Imaging			
Semester: I	**Course code:MRT-103**	**Credits:09**	**Core**
No of sessions Lectures / Tutorial: 60		**No of practical hours:60**	
Course Pre-requisites:		**Number of sessions: 120**	

Course Introduction

Advanced Physics of Radiology & Imaging helps to understand physics behind the radiological and imaging equipment. It is applied for particular technological or practical use. The course covers the study of the application of the theories and principles of science to practical purposes

Course Objectives

3. **Course Objectives:** The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications. This course also provides idea of advancesand development in radiological and imaging equipment. In addition, the course is expected to develop scientific temperament and analytical skill in students, to enable them logically tackle complex engineering problems in their chosen area of application. The main objectives are:

1. To understand the scientific concepts of complex radiological and imaging equipment.
2. Understand the basic concepts of physics of MRI, CT scan an Ultrasonography.

4. **Course Learning Outcomes**

Upon successful completion of the course, the students should be able to (knowledge based):

CLO1: Understood the basic concepts andworking principles related to MRI, CT scan an Ultrasonography.

CLO2: Acquired the skills in handling MRI, CT scan an Ultrasonography.

4. Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand Advanced Physics of Radiology & Imaging but also improve skills and techniques for tackling practical problems.

Course Contents

1. Physics of Imaging including conventional radiography, computed radiography and flat panel DR 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

Course Assessment Scheme
Students would be assessed continuously throughout the semester in the form of continuous evaluation. Periodic tests and surprise tests will be conducted. Students will have to submit written assignments, make charts and posters, make models, and conduct quiz for the topics. Practical will be conducted with viva. Midterm and end term evaluation will be done theoretically and practically. Students will also be assessed on the basis of presentations of various topics.

Text Books:

1. S.K Bhargawa text book of Radiological Physics
2. Joseph Selman Fundamental of X Rays and Radium
3. Text book for Radiotherapy ,Radiation Physics by Walter and Miller's

Course Title: Research Methodology and Biostatics -I			
Semester: I	**Course code: MRT-104**	**Credits: 05**	**Core**
No of sessions Lectures / Tutorial:30		**No of practical hours: 40**	
Course Pre-requisites:		**Number of sessions:70**	

1. **Course Objectives**

Thiscourseisdesignedtoprovidethestudentsthebasicknowledgein research process and Bio-statistics. At the conclusion of the course, the students will have the knowledge of data collection statisticalapplicationand finally presentationofthestatisticaldata. The first part shall be conducted in second semester and second part shall be covered in third semester

2. **Course Learning Outcome**

Upon successful completion of the course, the students should be able to:
CLO1: Understand the need of research in vision science and to understand the basic concept of research methods which includes basic errors in research, data collection methods and formulation of research question.
CLO2: Able to indentify different research study designs used in research and application of different sampling methods and understanding of biological variability
CLO3: Able to apply and calculate fundamental statistical concepts of sensitivity and specificity and formulation of questionnaire
CLO4: Able to write a research proposal after clear understanding of existing literature and research gap.
CLO5:to have a fairly good knowledge about the central tendencies and dispersion and successfully able to calculate descriptive statistics using manual and digital method

3. **Course contents**

Module I

Need for Research inoptometryIntroduction to research methods, Conducting a literature review Researchdesign, Samplingmethods,Datacollectionanddatacollectiontools,Dataanalysis: Quantitative andQualitatively,Publichealthresearch;IssuesinResearch.of research problems and writing research questions, Hypothesis, Null and Research Hypothesis, Type I and Type II errors in hypothesis testing.

Module II:

Introduction of epidemiology, Descriptive epidemiology, Experimental and nonexperimental research designs, Screening, Sampling methods, Biological variability, normal distribution

Module III

Bias and Confounding, Association and causation, Odds ratio and relative risk, sensitivity and specificity Data collection methods- Observation method, Interview method, Questionnaires and schedules Construction,

Module IV:

Critical analysis of research papers, Conducting a literature review, Writing Research proposals, Development of conceptual framework in research

Module V: Introduction to Biostatistics

Introduction to Statistics, Classification of data, Source of data, Method of scaling - nominal, ordinal, ratio and interval scale, measuring reliability and validity of scales, Measures of Central tendency, Measures of Dispersion, Skewness and kurtosis, Sampling, Sample size determination, Introductionandmethodofcollectingandpresentingofstatisticaldata. Calculationandinterpretationofvariousmeasureslikemean,median,standarddeviations, Skewness andKurtosis, Probabilitydistribution, Correlation andregressionSignificance tests and confidenceintervals

4. **Course Assessment**

Students would be assessed continuously throughout the semester in the form of continuous evaluation.

5. **Course References**

1. Research Methodology : Kothari
2. Methods in Biostatistics by B.KMahajan
3. Probability and Statistics byMurray
4. Research Methodology by SMIsrani

Course Title: Radiation Safety and Protection- AERB guidelines			
Semester: II	**Course code:MRT-201**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:60**	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives: The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications. This course also provides fundamental idea about circuit analysis, working principles of machines. In addition, the course is expected to develop scientific temperament and analytical skill in students, to enable them logically tackle complex engineering problems in their chosen area of application.

Course Learning Outcomes

CLO 1- Use X-ray equipment and maintenance of equipment.
Should know the Warm-up procedures of X-ray machine and cooling methods.
CLO 2-To be able to know how to use X-Ray exposure switches.
CLO 3- Demonstrate work flow Digital/IITV fluoroscopy equipment handling
Demonstrate Handling, care and maintenance of equipment & accessories

Course Pedagogy
The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of applied physics but also improve skills and techniques for tackling practical problems.

Course contents
Radiation safety in diagnostic Radiology 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 fetus -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.
8. 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.
9. 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.
10. 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
11. 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).
12. NABH guidelines, AERB guidelines, PNDT Act and guidelines.
13. Procedural safety
14. Achievable safety through compliance on the regulations in India and recommendations of ICRT, IAEA. Newer Radiation safety protocols and recent advances in radiation safety. 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.

Course Assessment Scheme

Students would be assessed continuously throughout the semester in the form of continuous evaluation. Periodic tests and surprise tests will be conducted. Students will have to submit written assignments, make charts and posters, make models, and conduct quiz for the topics. Practical will be conducted with viva. Midterm and end term evaluation will be done theoretically and practically. Students will also be assessed on the basis of presentations of various topics.

Text Books:

1. S.K Bhargawa text book of Radiological Physics
2. Joseph Selman Fundamental of X Rays and Radium
3. Text book for Radiotherapy ,Radiation Physics by Walter and Miller's

Course Title: Modern Radiological and Imaging Equipment			
Semester: II	**Course code: MRT-202**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives

The purpose of this course is to provide an understanding of physical concepts and underlying various technological applications of mammography and computed radiography and DSA. Should able to scanning also in mammography,computed radiography and DSA.

Course learning Outcomes

CLO 1-Perform the procedure of mammography scanning.
CLO 2-Enumerate and able to know the principle computed radiography.
CLO 3-Able to know and perform vascular imaging with PACS

Course Pedagogy
The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of physics of mammography and CT scan but also improve skills and techniques for tackling practical problems.

Course contents

1. High Frequency X-Ray Generators and their types and applications.
2. Modern x-ray tubes-their types and advancements.
3. Special radiological equipment: Computed radiography: its principle, physics & equipment. Digital Radiography, Direct and indirect digital radiography Digital Fluoroscopy , Digital Mammography; including cones compression devices Stereotactic Biopsy system including Prone Table Biopsy system.
4. Image Receptors:Flat Panel Detectors, Image Processing Workstation and Imaging Cameras.
5. Tomography: Body section radiography, basic principle and equipment, multi section tomography, various types of topographic movements,
6. Tomosynthesis, Stitch radiography
7. Dual energy x-ray absorptionometry (DEXA) scan.
8. Vascular Imaging Equipment: Introduction, historical developments DSA Equipment- Principle, applications and definition of terms, Single Plane, Biplane, Hybrid DSA Lab- digital subtraction techniques.
9. Scatter radiation its formation and control: beam centering devices, collimators, cone diaphragms and grids.

10. Fluoroscopy and IITV systems including cine radiography with various recording devices.
11. Computed Tomography -Principle, data acquisition concepts, image reconstruction, instrumentations, image manipulation Historical developments - Various generations, spiral/helical, single slice/multislice CT, Electron beam CT, mobile CT, Advances in volume scanning, continuous, sub-second scanning. Real time CT fluoroscopy, interventional guidance tool, 3D CT, CT angiography. Virtual reality imaging, including image quality and quality control in CT Scanners.
12. Ultrasonography: :Basic principle of U.S., various types of transducers, mechanism of image formation, various advancements including Doppler, Elastography, HIFU,ABVS and image artifacts.
13. MRI: Basic principle of MRI, complete imaging equipment and various requirements, T1 and T2 Relaxation behaviors of tissues, T1, T2 and proton density images, spatial localization of images. Types of imaging sequences (spin echo, fast spin echo, flash, inversion recovery, gradient echo etc. MR spectroscopy, principle and techniques, Contrast Agents in MRI, Image quality, Image artifacts and its compensators,NMR hazard and safety. Advances in MRI.
14. Radionuclide scanning including rectilinear scanner, gamma camera, PET, SPECT, their principles, working, applications and advancements.
15. Care and maintenance of radiological equipments

Course Assessment:

Students would be assessed continuously throughout the semester in the form of continuous evaluation. Periodic tests and surprise tests will be conducted. Students will have to submit written assignments, make charts and posters, make models, and conduct quiz for the topics. Practical will be conducted with viva. Midterm and end term evaluation will be done theoretically and practically. Students will also be assessed on the basis of presentations of various topics.

Text Books:

4. S.K Bhargawa text book of Radiological Physics
5. Joseph Selman Fundamental of X Rays and Radium
6. Text book for Radiotherapy ,Radiation Physics by Walter and Miller's

Course Title: Radiological and Imaging Procedures			
Semester: II	**Course code: MRT 203**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:60**	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives-
Thiscourseisdesignedtoprovidethestudentsthebasicknowledgein systematic investigations with using contrast media and image intensifier.

Course learning outcomes-
CLO 1- Explain indication, contraindication and reactions of contrast mediaDemonstrate how to take in minimum numbers of exposures in each special investigation.
CLO 2-Demonstratethe positioning and technique of the special studies.
CLO 3-Explainthe technique of all GIT study according to investigation.
CLO 4- Demonstrate surface anatomy. To be able to know the technique behind the radiography.

Course Contents :

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 - eg. 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.
6. Urinary system: Intravenous urography, retrograde pyelography. Antegrade pyelography. Cystography and micturating cystouresthrography. Urethrography (ascending) renal puncture. Including CT, US and MRI Special Imaging Techniques.
7. Reproductive system: All the Techniques relating to Male and Female reproductive system including Hysterosalpingography.

8. 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
9. Respiratory system: - Bronchography: Including CT, US and MRI Special Imaging Techniques.
10. Sinography:Routine technique and procedure.
11. Central Nervous System: Myelography. Cerebral studies.Ventriculography etc including CT, US and MRI Special Imaging Techniques.
12. Arthrography: Shoulder, Hip, Knee, Elbow joints etc including CT, US and MRI Special Imaging Techniques.
13. Angiographic Studies: Carotid Angiography (4 Vessel angiography). Thoracic and Arch Aortography.Selective studies: Renal, SMA, Coeliac axis. Vertebral angiography. Femoral arteriography. Angiocardiography, Peripheral angiography
14. Venography: Peripheral venography.Cerebral venography.Inferior and superior venocavography.Relevant visceral phlebography.
15. 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.Introduction to immunology, bacteriology, parasitology, mycology

Course Assessment:
Students would be assessed continuously throughout the semester in the form of continuous evaluation. Periodic tests and surprise tests will be conducted. Students will have to submit written assignments, make charts and posters, make models, and conduct quiz for the topics. Practical will be conducted with viva. Midterm and end term evaluation will be done theoretically and practically. Students will also be assessed on the basis of presentations of various topics.

Course References:
www.wikipedia.co.in/www.information.net

Course Title: Research Methodology and Biostatics -II			
Semester: I	**Course code: MRT-204**	**Credits: 05**	**Core**
No of sessions Lectures / Tutorial:30		**No of practical hours: 40**	
Course Pre-requisites:		**Number of sessions:70**	

1. **Course Objectives:**
   This is an extension of part one of RM course and focuses more on statistics .At the end of the semester the student is expected to do statistical analysis independently
2. **Course contents**

Module I: Introduction and revision
Introduction to Statistics, Classification of data, Source of data, Method of scaling - nominal, ordinal, ratio and interval scale, measuring reliability and validity of scales
Module II
Measures of Central tendency, Measures of Dispersion, Skewness and kurtosis, Sampling, Sample size determination, Testing hypothesis- Chi - Square test, Student's t test, ANOVA
Module III
Concept of probability and Probability distributions – Binomial Probability distribution, Poisson Probability distribution and Normal Probability distribution
Module IV
Correlation-Karl Person, Spearman's Rank correlation methods, Regression Analysis
Module V

- Parametric tests–
  a. Test for singleproportion
  b. Test for Equality ofproportions
  c. Test for singlemean
  d. Test for equality ofmeans
- ANOVA:-
  - Oneway
  - Twoway
- Non parametric tests–
  - Chi-squaretests
  - Fisher's exacttest
  - McNemartest
  - Mann-whitneyU-test
  - Mediantest
  - Signtest
  - Wilcoxontest

3. Course Assessment

Assessment Scheme: (shall be in detail given by the faculty)

4. Course References

1. Text books:

• B.K. Mahajan. Methods in Biostatistics, Jaypee Brothers

• P.S.S. Sundar Rao. An Introduction to Biostatistics: A manual for students in Health Sciences, J.Richard Prentice Hall, 1996.

2. Reference Books :

• Daniel, Wayne.W. Bio-Statistics: A foundation for Analysis in the Health Sciences, John Wiley and Sons Pub, 1991.

• K. Vishwas Rao. Bio-Statistics: A Manual of statistical methods for use in the Health, Nutrition and Anthropology, Jaypee Brothers Medical Pub, 1996.

• Verma B.L., Shukla G.D. Bio-Statistics perspective in Health care research and practice, C.B.S. Pub, 1993.

• Krishnaiah, P.K. Rao, C.R. (ed), Handbook of Statistics, Elsevier Science Pub, 1988.

Course Title: Workshop			
Semester: II	**Course code: MRT205**	**Credits:01**	**Core**
No of sessions Lectures / Tutorial: 00		**No of practical hours: 10**	
Course Pre-requisites:		**Number of sessions:10**	

1.Course Introduction

To demonstrate the students of bacheolar level and patient handling method of various aspects the importance of sterilization and proper disposals is only way to prevent it. Well known sayings, prevention is better than cure, the main objective of this course is to focus mainly on the preventive measures and quality assurance to the patients. This course emphasizes more on risk management principles and safe handling of disposals, basic emergency care and basic life support skills which can prove remedy in emergency cases.

2. Course Objectives: The main objective of this course is to teach students quality measures to provide patients with effective methods of treatment with more focus on proper handling of infected specimens and proper treatment with best sterilized and disinfected means to reduce the cross-infection scenario and nosocomial infections, which occurs due to poor handling of infected specimens and improper disposal means polluting environment too. Students are made to learn basic concepts of quality in health care and develop skills to implement sustainable quality assurance program. Introducing students to basic emergency care, infection prevention& control with knowledge of biomedical waste management and antibiotic resistance.

3. Course Learning Outcomes

Upon successful completion of the course, the students should be able to:

CL01: Understood quality improvement approaches, NABH, NABL,guidelines which purely focuses on the quality measures and proper handling of disposals providing quality facility to patients. (Understanding Based)

CL02: Understood basic life support skills which can save many lives in urgent cases. (Applying Based)

CL03: Understood proper disposals of biomedical waste, reducing risk of infection to waste handling personnel and cross infection which can occur due to improper handling of infected waste polluting surroundings too. (Applying Based)

CL04: Understood effective hand hygiene, prevention and control of common health care associated infections. (Remembering Based)

CL05: Understood fundamentals of emergency management, disaster preparedness. (Remembering Based)

4. Course Pedagogy

This course will use mixed technique of interactive lectures, digital learning methodologies, regular assignments and power point presentations. Students will be made to prepare project reports by interacting directly with laboratory personnel and visits to hospital to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day to day real world applications. This course will focus mainly on applying based methodologies, students will not be made limited to theory only, but hands on practices and analyzing every aspect of the module by themselves.

Course Contents

In the residency the professional is expected to work and contribute in the medical imaging unit.

Recommended book

Clark's Radiography- Clark
Radiographic positioning- Garkal
www.wikipedia.co.in
www.radiopedia.co.in

Course Title: Quality Assurance and Quality Control in Diagnostic Radiology and Imaging			
Semester: III	**Coursecode: MRT-301**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives

Thiscourseisdesignedtoprovidethestudentsthebasicknowledgeinradiography.At theend of the course, the student should be able to:
1-Radiation protection
2-Biological effects of radiation
3-Planning of radiation installation-protection primary &secondaryradiation
4-Personnel monitoring systems

Course learning Outcomes

CLO 1-Enumerate the guidelines of all respective organization. Enumerate the risk and effects of the radiation.

CLO 2-Label &Demonstrate how to use and care of all types of lead aprons
CLO 3-Demonstrate the handling and how to use TLD's and badges as per guidelines

Course contents-

1. Objectives of Quality Control: Improve the quality of imaging thereby increasing the diagnostic value; to reduce the radiation exposure; Reduction of film wastage and repeat examination;to maintain the various diagnostic and imaging units at their optimal performance.
2. Quality Assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance.
3. Quality assurance programme in the radiological faculty level: Responsibility; Purchase; Specifications; Acceptance; Routine testings; Evaluation of results of routine testings; Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing; Radiographic equipment; Fluoroscopic equipment; Mammographic equipment; Conventional tomography; Computed tomography; Film processing, manual and automatic; Consideration for storage of film and chemicals; Faults tracing; Accuracy of imaging- image distortion for digital imaging devices. LASER printer calibration
4. Quality assurance programme tests: General principles and preventive maintenance for routine, daily, weekly, monthly, quarterly, annually – machine calibration. Basic concepts of quality assurance – LASER printer - Light beam alignment; X-ray out-put and beam quality check; KVp check; Focal spot size and angle measurement; Timer check; mAs test; Grid alignment test; High and low contrast resolutions; Mechanical and electrical checks; Cassette leak check; Proper screen-film contact test; Safe light test; Radiation proof test; Field alignment test for fluoroscopic device; Resolution test; Phantom measurements - CT, US and MRI.

5. Quality assurance of film and image recording devices:Sensitometry; Characteristic curve; Film latitude; Film contrast; Film speed Resolution; Distortion; Artifacts of films and image recording. Monitor calibration. SMPTE pattern.
6. Maintenance and care of equipment:Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipments; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme.
7. Care and maintenance of diagnostic equipment:General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment.
8. Quality Assurance and quality control of Modern Radiological and Imaging Equipment which includes Digital Radiography, Computed Radiography, CT scan, MRI Scan, Ultrasonography and PACS related. Image artifacts their different types, causes and remedie

Course Assessment:
Students would be assessed continuously throughout the semester in the form of continuous evaluation. Periodic tests and surprise tests will be conducted. Students will have to submit written assignments, make charts and posters, make models, and conduct quiz for the topics. Practical will be conducted with viva. Midterm and end term evaluation will be done theoretically and practically. Students will also be assessed on the basis of presentations of various topics.

Books Recommended-
Clark's Radiography- Clark / Text book of radiology for residents and technicians- s k bhargava
Radiographic positioning- Garkal
Radiology- Special investigation – champman.
www.wikipedia.co.in // www.radiopedia.co.in

Course Title: Newer Imaging Modalities			
Semester: III	**Course code: MRT-302**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours:** 60	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives

Thiscourseisdesignedtoprovidethestudentsthebasicknowledgein Radiography with using newer modalities of radiology. At the end of the course, the student should be able to know about ultrasonography Computed Tomography, Generation of CT Scanner, Magnetic resonance imaging, fusion imaging PET, Contrast media using, handling and tele radiology.

Course learning Outcomes

CLO 1 Able to know Computed Tomography its principle, various generations and advancements

CLO 2 Able to know Magnetic Resonance Imaging- its principle, advancements and applications.

CLO 3. Explain and able to know Ultrasonography, Color Doppler- its principle, advancements and applications. Digital Radiography and Digital subtraction angiography equipment- principle, advancements and applications.

CLO 4 Able to know Fusion Imaging including PET-CT, PET- MRI. Digital Mammography, DEXA equipment- principle, advancements and applications.

CLO 5 Able to know tele radiology HIS,RIS and PACS, Image processing in digital radiography systems: Post processing techniques in console using CR, DR and flat panel fluoroscopy systems

Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of physics of mammography and CT scan/ultrasound/ PACS but also improve skills and techniques for tackling practical problems.

Course contents-

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,
14. Elastography, HIFU, ABVS etc.
15. Fusion Imaging -PET CT & PET MRI

Course Assessment:

Students would be assessed continuously throughout the semester in the form of continuous evaluation. Periodic tests and surprise tests will be conducted. Students will have to submit written assignments, make charts and posters, make models, and conduct quiz for the topics. Practical will be conducted with viva. Midterm and end term evaluation will be done theoretically and practically. Students will also be assessed on the basis of presentations of various topics.

Course References

Clark's Radiography- Clark / Text book of radiology for residents and technicians- s k bhargava
Radiographic positioning- Garkal
Radiology- Special investigation – champman.www.wikipedia.co.in // www.radiopedia

Course Title: Intervention Radiological Techniques and Care of Patient			
Semester: III	**Course code: MRT-303**	**Credits:06**	**Core**
No of sessions Lectures / Tutorial: 30		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 90**	

Course Objectives-
This course is designed to provide the students the basic knowledge in systematic investigations with using contrast media and image intensifier.

Course learning outcomes-
CLO 1- Explain indication, contraindication and reactions of contrast media Demonstrate how to take in minimum numbers of exposures in each special investigation.
CLO 2-Demonstrate the positioning and technique of the special studies.
CLO 3-Explainthe technique of all GIT study according to investigation.
CLO 4- Demonstrate surface anatomy. To be able to know the technique behind the radiography.
Course contents

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.

Care of Patient in Interventional Radiology

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, Gynecology, 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

Course Assessment:

Students would be assessed continuously throughout the semester in the form of continuous evaluation. Periodic tests and surprise tests will be conducted. Students will have to submit written assignments, make charts and posters, make models, and conduct quiz for the topics. Practical will be conducted with viva. Midterm and end term evaluation will be done theoretically and practically. Students will also be assessed on the basis of presentations of various topics.

Reference and Text Books-

Clark's Radiography- Clark / Text book of radiology for residents and technicians- s k bhargava
Radiographic positioning- Garkal
Radiology- Special investigation – champman.www.wikipedia.co.in //**www.wikiedia.co.in**

Course Title: Workshops /Seminars and Project			
Semester: III	**Course code:MRT- 304**	**Credits:02**	**Core**
No of sessions Lectures / Tutorial: 00		**No of practical hours: 40**	
Course Pre-requisites:		**Number of sessions: 40**	

1.Course Introduction

To demonstrate the students of bacheolar level and patient handling method of various aspects the importance of sterilization and proper disposals is only way to prevent it. Well known sayings, prevention is better than cure, the main objective of this course is to focus mainly on the preventive measures and quality assurance to the patients. This course emphasizes more on risk management principles and safe handling of disposals, basic emergency care and basic life support skills which can prove remedy in emergency cases.

2. Course Objectives: The main objective of this course is to teach students quality measures to provide patients with effective methods of treatment with more focus on proper handling of infected specimens and proper treatment with best sterilized and disinfected means to reduce the cross-infection scenario and nosocomial infections, which occurs due to poor handling of infected specimens and improper disposal means polluting environment too. Students are made to learn basic concepts of quality in health care and develop skills to implement sustainable quality assurance program. Introducing students to basic emergency care, infection prevention& control with knowledge of biomedical waste management and antibiotic resistance.

3. Course Learning Outcomes

Upon successful completion of the course, the students should be able to:

CL01: Understood quality improvement approaches, NABH, NABL,guidelines which purely focuses on the quality measures and proper handling of disposals providing quality facility to patients. (Understanding Based)

CL02: Understood basic life support skills which can save many lives in urgent cases. (Applying Based)

CL03: Understood proper disposals of biomedical waste, reducing risk of infection to waste handling personnel and cross infection which can occur due to improper handling of infected waste polluting surroundings too. (Applying Based)

CL04: Understood effective hand hygiene, prevention and control of common health care associated infections. (Remembering Based)

CL05: Understood fundamentals of emergency management, disaster preparedness. (Remembering Based)

4. Course Pedagogy

This course will use mixed technique of interactive lectures, digital learning methodologies, regular assignments and power point presentations. Students will be made to prepare project reports by interacting directly with laboratory personnel and visits to hospital to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day to day real world applications. This course will focus mainly on applying based methodologies, students will not be made limited to theory only, but hands on practices and analyzing every aspect of the module by themselves.

Course Contents

In the residency the professional is expected to work and contribute in the medical imaging unit.

Course Assessment:
Continuous evaluation by faculty in-charge of the department.

Recommended book

Clark's Radiography- Clark
Radiographic positioning- Garkal
www.wikipedia.co.in
www.radiopedia.co.in

Course Title: Residency – I			
Semester: III	**Course code: MRT- 305**	**Credits:01**	**Core**
No of sessions Lectures / Tutorial: 00		**No of practical hours: 10**	
Course Pre-requisites:		**Number of sessions: 10**	

1.Course Introduction

To demonstrate the students of bachelor level and patient handling method of various aspects the importance of sterilization and proper disposals is only way to prevent it. Well known sayings, prevention is better than cure, the main objective of this course is to focus mainly on the preventive measures and quality assurance to the patients. This course emphasizes more on risk management principles and safe handling of disposals, basic emergency care and basic life support skills which can prove remedy in emergency cases.

2. Course Objectives: The main objective of this course is to teach students quality measures to provide patients with effective methods of treatment with more focus on proper handling of infected specimens and proper treatment with best sterilized and disinfected means to reduce the cross-infection scenario and nosocomial infections, which occurs due to poor handling of infected specimens and improper disposal means polluting environment too. Students are made to learn basic concepts of quality in health care and develop skills to implement sustainable quality assurance program. Introducing students to basic emergency care, infection prevention& control with knowledge of biomedical waste management and antibiotic resistance.

3. Course Learning Outcomes

Upon successful completion of the course, the students should be able to:

CL01: Understood quality improvement approaches, NABH, NABL,guidelines which purely focuses on the quality measures and proper handling of disposals providing quality facility to patients. (Understanding Based)

CL02: Understood basic life support skills which can save many lives in urgent cases. (Applying Based)

CL03: Understood proper disposals of biomedical waste, reducing risk of infection to waste handling personnel and cross infection which can occur due to improper handling of infected waste polluting surroundings too. (Applying Based)

CL04: Understood effective hand hygiene, prevention and control of common health care associated infections. (Remembering Based)

CL05: Understood fundamentals of emergency management, disaster preparedness. (Remembering Based)

4. Course Pedagogy

This course will use mixed technique of interactive lectures, digital learning methodologies, regular assignments and power point presentations. Students will be made to prepare project reports by interacting directly with laboratory personnel and visits to hospital to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day to day real world applications. This course will focus mainly on applying based methodologies, students will not be made limited to theory only, but hands on practices and analyzing every aspect of the module by themselves.

Course Contents

In the residency the professional is expected to work and contribute in the medical imaging unit.

Course Assessment:
Continuous evaluation by faculty in-charge of the department.

Recommended book

Clark's Radiography- Clark
Radiographic positioning- Garkal
www.wikipedia.co.in
www.radiopedia.co.in

Course Title: Newer Developments in Advanced Imaging Technology and Biostatics.			
Semester: IV	**Course code: MRT-401**	**Credits:08**	**Core**
No of sessions Lectures / Tutorial: 40		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 100**	

Course Objectives

This course is designed to provide the students the basic knowledge in Radiography with patient care and code of ethics. At the end of the course, the student should be able to

Course Learning Outcomes

CLO1- Understood about Introduction to hospital staffing and Medical records and documentation.

CLO2 – Must know about Legal issues and Professional ethics.

CLO3- How to handle and must know Departmental Safety and Infection control

CLO4- Understood Body mechanics and transferring of patient

Course Pedagogy

The course will use the mixed technique of interactive lectures, regular assignments and practicing numerical. Teaching in this course is aimed to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day-to-day real world applications. It will not only help students to understand the fundamentals of applied physics but also improve skills and techniques for tackling practical problems.

Course contents

1. In addition to existing Radiological and Imaging Modalities -Newer Developments in Digital Imaging CT,MRI,US and any other modality.
2. Newer Radiological and Imaging Equipment: including Computed radiography: Digital Radiography, Digital Fluoroscopy, Digital Mammography and DSA - Introduction to Newer Technology innovations, software and its applications.
3. Computed Tomography Introduction to Newer Developments/ Newer Technology innovations, software and its applications.
4. MRI Introduction to Newer Developments/Newer Technology innovations, software and its applications.
5. Advanced Ultrasonography Newer Developments/Newer, Technology innovations, software and its applications. Elastography, HIFU, ABVS etc.
6. Fusion Imaging -PET CT & PET MRI
7. Tele-radiology, HIS, RIS, PACS, Imaging processing and archiving.

Biostatistics & Basic Research Methodology

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.

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

Course Assessment:
Students would be assessed continuously throughout the semester in the form of continuous evaluation. Periodic tests and surprise tests will be conducted. Students will have to submit written assignments, make charts and posters, make models, and conduct quiz for the topics. Practical will be conducted with viva. Midterm and end term evaluation will be done theoretically and practically. Students will also be assessed on the basis of presentations of various topics.

Reference and Text Books:

Text book of radiology for residents and technicians- S K Bhargava.

Text book of Radiation physics.

www.wikiedia.co.in

Course Title: Nuclear Medicine Imaging Techniques			
Semester: IV	**Course code: MRT-402**	**Credits:08**	**Core**
No of sessions Lectures / Tutorial:40		**No of practical hours:60**	
Course Pre-requisites:		**Number of sessions: 100**	

Objectives:
1. To know basic principle and physics of nuclear medicine.
2. Preparation of patient for nuclear medicine examination.
3. Preparation and precautions while handling radiopharmaceuticals.
4. Recognizing the artefacts associated with nuclear medicine.
5. To learn the measures for improving image quality in nuclear medicine.

Course Outcomes
CLO-1. Students will be able to prepare and position the patients for nuclear medicine examination.
CLO-2 Knowledge of improving image quality in nuclear medicine.
CLO-3 Scanning of patient with various nuclear medicine protocols for better representation of images.
CLO-4 Post processing for nuclear medicine data
CLO-5 Management of patient for any late reactions associated with radiotracers in nuclear medicine.

MODULE-1
Basic atomic and nuclear physics Quantities activity Atomic composition and structure Nucleus composition Radioactivity Exponential decay Specific activity Parent/Daughter decay
Modes of Radioactive decay

MODULE-2
Radiation detectors Gas filled detectors-Basic principles Ionization chambers Proportional counters Geiger Muller counters Semiconductor detectors Scintillation detectors-basic principles

MODULE-3
Production of radio nuclides Reactor produced radio nuclide Reactor principles Accelerator produced radionuclide generators Instrumentation Basic principles System components Detector systems and electronics Collimators Image display and recording systems Scanning cameras Radio pharmacy Radiopharmaceuticals General principles of tracer technique
Preparation of different labeled compounds with technetium-99m isotope Cold kits

MODULE-4
In vivo technique Static and dynamic studies Thyroid imaging Imaging of bone Respiratory system Urinary system G.I system Cardiovascular system Iodine 131 uptake studies Iodine 131 therapy of thyrotoxicosis and thyroid ablation

MODULE-5
SPECT imaging PET imaging Radiation safety in nuclear medicine Radiation units quantities MPD Safe handling of radioactive materials Storage of radioactive materials Procudures for handiling spills Disposal of radioactive waste Radioation monitoring Survey meters Personnel dosimeters Wipe testing Contamination monitor Isotope calibrator Area monitor

Inventory of isotopes.

Course Assessment:
Students would be assessed continuously throughout the semester in the form of continuous evaluation. Periodic tests and surprise tests will be conducted. Students will have to submit written assignments, make charts and posters, make models, and conduct quiz for the topics. Practical will be conducted with viva. Midterm and end term evaluation will be done theoretically and practically. Students will also be assessed on the basis of presentations of various topics.

References :
1. Physics in Nuclear Medicine-**Sorenson**
2. Physics in Nuclear Medicine-**Powsner**

Course Title: Seminars, Journal Clubs and Group Discussions			
Semester: IV	**Course code: MRT-40**	**Credits:2**	**Core**
No of sessions Lectures / Tutorial:00		**No of practical hours:40**	
Course Pre-requisites:		**Number of sessions: 40**	

Course Introduction

To demonstrate the students of bachelor level and patient handling method of various aspects the importance of sterilization and proper disposals is only way to prevent it. Well known sayings, prevention is better than cure, the main objective of this course is to focus mainly on the preventive measures and quality assurance to the patients. This course emphasizes more on risk management principles and safe handling of disposals, basic emergency care and basic life support skills which can prove remedy in emergency cases.

2. Course Objectives: The main objective of this course is to teach students quality measures to provide patients with effective methods of treatment with more focus on proper handling of infected specimens and proper treatment with best sterilized and disinfected means to reduce the cross-infection scenario and nosocomial infections, which occurs due to poor handling of infected specimens and improper disposal means polluting environment too. Students are made to learn basic concepts of quality in health care and develop skills to implement sustainable quality assurance program. Introducing students to basic emergency care, infection prevention& control with knowledge of biomedical waste management and antibiotic resistance.

3. Course Learning Outcomes

Upon successful completion of the course, the students should be able to:

CL01: Understood quality improvement approaches, NABH, NABL,guidelines which purely focuses on the quality measures and proper handling of disposals providing quality facility to patients. (Understanding Based)

CL02: Understood basic life support skills which can save many lives in urgent cases. (Applying Based)

CL03: Understood proper disposals of biomedical waste, reducing risk of infection to waste handling personnel and cross infection which can occur due to improper handling of infected waste polluting surroundings too. (Applying Based)

CL04: Understood effective hand hygiene, prevention and control of common health care associated infections. (Remembering Based)

CL05: Understood fundamentals of emergency management, disaster preparedness. (Remembering Based)

Course Contents

Each student will be assigned topics for presentations as seminars, will explore recent innovations in MRIT for presenting topics during journal clubs and shall be holding group discussions along with other students in the presence of MRIT faculty.This will also include visits to other Institutions, Factories or Industries in the field of MRIT.

Course Assessment:

Continuous evaluation by faculty in-charge of the department.

Books Recommended

www.wikipedia.in

Course Title: **Project work**			
Semester: IV	**Course code: MRT-404**	**Credits:03**	**Core**
No of sessions Lectures / Tutorial: 00		**No of practical hours: 60**	
Course Pre-requisites:		**Number of sessions: 60**	

1.Course Introduction

To demonstrate the students of bachelor level and patient handling method of various aspects the importance of sterilization and proper disposals is only way to prevent it. Well known sayings, prevention is better than cure, the main objective of this course is to focus mainly on the preventive measures and quality assurance to the patients. This course emphasizes more on risk management principles and safe handling of disposals, basic emergency care and basic life support skills which can prove remedy in emergency cases.

2. Course Objectives: The main objective of this course is to teach students quality measures to provide patients with effective methods of treatment with more focus on proper handling of infected specimens and proper treatment with best sterilized and disinfected means to reduce the cross-infection scenario and nosocomial infections, which occurs due to poor handling of infected specimens and improper disposal means polluting environment too. Students are made to learn basic concepts of quality in health care and develop skills to implement sustainable quality assurance program. Introducing students to basic emergency care, infection prevention& control with knowledge of biomedical waste management and antibiotic resistance.

3. Course Learning Outcomes

Upon successful completion of the course, the students should be able to:

CL01: Understood quality improvement approaches, NABH, NABL,guidelines which purely focuses on the quality measures and proper handling of disposals providing quality facility to patients. (Understanding Based)

CL02: Understood basic life support skills which can save many lives in urgent cases. (Applying Based)

CL03: Understood proper disposals of biomedical waste, reducing risk of infection to waste handling personnel and cross infection which can occur due to improper handling of infected waste polluting surroundings too. (Applying Based)

CL04: Understood effective hand hygiene, prevention and control of common health care associated infections. (Remembering Based)

CL05: Understood fundamentals of emergency management, disaster preparedness. (Remembering Based)

4. Course Pedagogy

This course will use mixed technique of interactive lectures, digital learning methodologies, regular assignments and power point presentations. Students will be made to prepare project reports by interacting directly with laboratory personnel and visits to hospital to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day to day real world applications. This course will focus mainly on applying based methodologies, students will not be made limited to theory only, but hands on practices and analyzing every aspect of the module by themselves.

Course Contents

In the residency the professional is expected to work and contribute in the medical imaging unit 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 10& weightage will be given to the candidate for the dissertation at the time of clinical/practical and viva voice examination of second year. 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.

The class would meet twice in a week for a period of 10 weeks approx.

Course Assessment:

Continuous evaluation by faculty in-charge of the department.

Books Recommended

www.wikipedia.in

Course Title: Residency – II			
Semester: III	**Course code:MRT- 305**	**Credits:01**	**Core**
No of sessions Lectures / Tutorial: 00		**No of practical hours: 10**	
Course Pre-requisites:		**Number of sessions: 10**	

1.Course Introduction

To demonstrate the students of bachelor level and patient handling method of various aspects the importance of sterilization and proper disposals is only way to prevent it. Well known sayings, prevention is better than cure, the main objective of this course is to focus mainly on the preventive measures and quality assurance to the patients. This course emphasizes more on risk management principles and safe handling of disposals, basic emergency care and basic life support skills which can prove remedy in emergency cases.

2. Course Objectives: The main objective of this course is to teach students quality measures to provide patients with effective methods of treatment with more focus on proper handling of infected specimens and proper treatment with best sterilized and disinfected means to reduce the cross-infection scenario and nosocomial infections, which occurs due to poor handling of infected specimens and improper disposal means polluting environment too. Students are made to learn basic concepts of quality in health care and develop skills to implement sustainable quality assurance program. Introducing students to basic emergency care, infection prevention& control with knowledge of biomedical waste management and antibiotic resistance.

3. Course Learning Outcomes

Upon successful completion of the course, the students should be able to:

CL01: Understood quality improvement approaches, NABH, NABL,guidelines which purely focuses on the quality measures and proper handling of disposals providing quality facility to patients. (Understanding Based)

CL02: Understood basic life support skills which can save many lives in urgent cases. (Applying Based)

CL03: Understood proper disposals of biomedical waste, reducing risk of infection to waste handling personnel and cross infection which can occur due to improper handling of infected waste polluting surroundings too. (Applying Based)

CL04: Understood effective hand hygiene, prevention and control of common health care associated infections. (Remembering Based)

CL05: Understood fundamentals of emergency management, disaster preparedness. (Remembering Based)

4. Course Pedagogy

This course will use mixed technique of interactive lectures, digital learning methodologies, regular assignments and power point presentations. Students will be made to prepare project reports by interacting directly with laboratory personnel and visits to hospital to engage the students in strengthening their conceptual foundation and applying the knowledge gained to different day to day real world applications. This course will focus mainly on applying based methodologies, students will not be made limited to theory only, but hands on practices and analyzing every aspect of the module by themselves.

Course Contents

In the residency the professional is expected to work and contribute in the medical imaging unit.

Course Assessment:
Continuous evaluation by faculty in-charge of the department.

Recommended book
Clark's Radiography- Clark
Radiographic positioning- Garkal
www.wikipedia.co.in
www.radiopedia.co.in

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