

MMRIT 1st Semester

Course Title: Planning & Management of a Radiology & Imaging department			
Semester: I	Course code: MRT -101	Credits:07	Core
No of sessions Lectures / Tutorial: 60		No of practical hours:60	
Course Pre-requisites:		Number of sessions: 90	

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 department but 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, X-

Ray/Fluoroscopy/Mammography/Intervention/DSA/CT room design, structural shielding, protective devices.

2. Regulatory Bodies & regulatory Requirements: International Commission on Radiation Protection (ICRP) / National Regulatory 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:07	Core
No of sessions Lectures / Tutorial: 60		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

- . Interventional Radiography: Basic angiography and DSA:
 - a. History , technique, patient care
 - b. Percutaneous catheterisation, catheterization sites, Asepsis
 - c. Guidewire, catheters, pressure injectors, accessories
 - d. Use of digital subtraction- single plane and bi-plane
 All forms of diagnostic procedures including angiography, angioplasty, biliary 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, Electrophysiology
- 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 – musculoskeletal system – spine – PNS. Anatomy – clinical indications and contraindications – patient preparation – technique – contrast media types, dose, injection technique; timing, sequence - image display – patient care – utilization of available techniques & image processing facilities to guide the clinician CT anatomy and pathology of different organ systems.
- 9. MRI imaging – Head and Neck ,Thorax, Abdomen, Musculoskeletal System imaging - Clinical indications and contraindications- types of common sequences effects of sequence on imaging - Protocols for various studies- slice section- patient preparation positioning of the patient -patient care-calibration - paramagnetic agents and dose, additional techniques and recent advances in MRI - image acquisition-modification of procedures in an unconscious or un co-operative patient - plain studies- contrast studies -special procedures reconstructions- 3D images- MRS blood flow imaging, diffusion/perfusion scans - strength and limitations of MRI- role of radiographer.
- 10. Techniques of Fusion and hybrid Imaging Technology including PET CT,PET MRI, PET Ultrasound, MRI, CT, Fluoroscopy, Hybrid Imaging as well as Advanced Interventional suite.

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:07	Core
No of sessions Lectures / Tutorial: 60		No of practical hours:60	
Course Pre-requisites:		Number of sessions: 90	

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 advances and 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 and working 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: 04	Core
No of sessions Lectures / Tutorial:40		No of practical hours: --	
Course Pre-requisites:		Number of sessions:40	

1. Course Objectives

This course is designed to provide the students the basic knowledge in research process and Bio-statistics. At the conclusion of the course, the students will have the knowledge of data collection statistical application and finally presentation of the statistical data. 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 identify 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 in radiology and imaging technology Introduction to research methods, Conducting a literature review Research design, Sampling methods, Data collection and data collection tools, Data analysis: Quantitative and Qualitatively, Public health research, Issues in Research, 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, Correlation and regression Significance tests and confidence intervals

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

Research Methodology by SMIsrani