Radiological Imaging Technique

SYLLABUS

SEMESTER – VI

Radiotherapy planning & Quality Control-II

Objective:

Study and planning of radiotherapy for the sufferings and how to improve the quality of life and also study about the various aspects of the quality control.

Course contents: (30Hrs)

1. Computerized treatment planning system choice of dose, time and fraction.
2. Safety of critical organs in planning methods, role of treatment shell immobilization device and laser in patient set up and positioning.
3. Acceptance tests on therapy simulator telescope megavoltage X-ray and electron beam mechanics.
4. Contribution of technologist in radiation calibration of quality control assurance in execution of radiation treatment.

Practicals: (10Hrs)

1. Evaluation and reporting deviations for a large number of points
2. Acceptance criteria for the accuracy of photon beam dose calculations
3. Anatomical structures
4. Definition of anatomical structures
5. Automated contouring
6. Manual contouring
7. Manipulation of contours
8. Construction of volumes
9. Dose and monitor unit calculation

Reference Books:

Sr.No	Author's Name	Name of the Books
1.	Walter's & Miller's	Textbook of Radiotherapy
2.	Charle's M Washington	Principle and Practice of Radiation Therapy
3.	Faiz M Khan	Treatment Planning in Radiation Oncology
4.	Jiade J Lu	Stereotactic body Radiation Therapy
5.	Anna Barrett	Practical Radiotherapy Planning
6.	Michael C Joiner	Basic clinical Radiobiology

Radiological Imaging Technique

SYLLABUS

SEMESTER – VI

Radiation Safety in Diagnostic Radiology

Objective:

To study the Radiation Quantities and Units, Biological Effects of radiation, Biological effects of non-ionizing radiation and Radiation detection and Measurements.

Course contents: (30Hrs)

1. Radiation Quantities and Units: Radiation- Radioactivity- Sources of radiation - natural radioactive sources -cosmic rays terrestrial radiation - - man made radiation sources. Units of radiation - Quality factor - Flux- Fluence-Kerma- Exposure- Absorbed dose- Equivalent Dose- Weighting Factors-Effective Dose - Occupational Exposure Limits - Dose limits to public.
2. Biological Effects of radiation: 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.
3. 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-Thermoluminescent Dosimeter. -Pocket dosimeter-Radiation survey meter- wide range survey meter -zone monitor-contamination monitor -their principle function and uses. Advantages & disadvantages of various detectors & its appropriateness of different detectors for different type of radiation measurement. 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.
4. Radiation protection: Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey – ALARA- personnel dosimeters (TLD and film batches) - occupational exposure.
5. Radiation Hazard evaluation and control: Philosophy of Radiation protection, effects of time, Distance & Shielding. Calculation of Work load, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding material.

Reference Books:

1. H. E. Jones, J. R. Cunningham, The Physics of Radiology, Charles C. Thomas, New York, 2002.

2. W. J. Meredith and J. B. Massey, Fundamental Physics of Radiology, John Wright and Sons,U. K., 2000.

3. W. R. Handee, Medical Radiation Physics, Year Book Medical Publishers Inc., London, 2003.

4. Donald T. Graham, Paul J. Cloke, Principles of Radiological Physics, Churchill Livingstone, 2003

5. R.F.Coughlin and F.F.Driscoll,'Operational amplifiers and linear integrated circuits', (6 th edition), Pearson Education Inc., New Delhi, 2001.

6. T. L. Floyd, Digital Fundamentals, (8 th deition), Pearson education Inc., New Delhi, 2003.

7. S.Brown and Z.Vranesic,'Fundamentals of digital logic with Verilog design', TataMcGraw Hill Publ Co.Ltd., New Delhi, 2003.

8. H.Skalsi, "Electronic instrumentation (2 nd edition), Tata McGraw Hill Publ. Co. Ltd., New Delhi,2004

9. J. P. Woodcock, Ultrasonic, Medical Physics Handbook series 1, Adam Hilger, Bristol, 2002.

10. J. R. Greening, Medical Physics, North Holland Publishing Co., New York, 1999.

11. R. Pratesi and C. A. Sacchi, Lasers in Photomedicine and Photobiology, Springer Verlag, West Germany, 1980.

12. Harry Moseley, Hospital Physicists' Association, Non-ionising radiation: microwaves, ultraviolet, and laser radiation, A. Hilger, in collaboration with the Hospital Physicists' Association, 1988

13. H. E. Jones, J. R. Cunningham, The Physics of Radiology, Charles C. Thomas, New York, 2002.

14. W. J. Meredith and J. B. Massey, Fundamental Physics of Radiology, John Wright and Sons,U. K., 2000.

15. W. R. Handee, Medical Radiation Physics, Year Book Medical Publishers Inc., London, 2003.

16. Donald T. Graham, Paul J. Cloke, Principles of Radiological Physics, Churchill Livingstone, 2003

Radiological Imaging Technique

SYLLABUS

SEMESTER – VI

Physics of Advanced Imaging Technology-II

Objectives:

To understand the basic physics of advance imaging techniques that what principle and theory occurs behind these technologies.

Course content: (30Hrs)

Computed Tomography

1. CT angiography
2. CT fluoroscopy
3. HRCT
4. 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.

Magnetic Resonance Imaging

1. 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.
2. Image formation: 2D Fourier transformation method – K-space representation – 3D Fourier imaging – MIP.
3. MR contrast media – MR angiography – TOF & PCA – MR Spectroscopy – functional MRI.

Ultrasonography

1. 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.
2. Techniques for imaging different anatomic areas, ultrasound artifacts, biological effects and safety.
3. Doppler Ultrasound- Patient preparation for Doppler, Doppler artifacts, vascular sonography.

Reference Books:

1. R.F.Coughlin and F.F.Driscoll,'Operational amplifiers and linear integrated circuits', (6 th edition), Pearson Education Inc., New Delhi, 2001.
2. T. L. Floyd, Digital Fundamentals, (8 th deition), Pearson education Inc., New Delhi, 2003.
3. S.Brown and Z.Vranesic,'Fundamentals of digital logic with Verilog design', TataMcGraw Hill Publ Co.Ltd., New Delhi, 2003.
4. H.Skalsi, "Electronic instrumentation (2 nd edition), Tata McGraw Hill Publ. Co. Ltd., New Delhi,2004
5. J. P. Woodcock, Ultrasonic, Medical Physics Handbook series 1, Adam Hilger, Bristol, 2002.
6. J. R. Greening, Medical Physics, North Holland Publishing Co., New York, 1999.
7. R. Pratesi and C. A. Sacchi, Lasers in Photomedicine and Photobiology, Springer Verlag, West Germany, 1980.
8. Harry Moseley, Hospital Physicists' Association, Non-ionising radiation: microwaves, ultraviolet, and laser radiation, A. Hilger, in collaboration with the Hospital Physicists' Association, 1988
9. H. E. Jones, J. R. Cunningham, The Physics of Radiology, Charles C. Thomas, New York, 2002.
10. W. J. Meredith and J. B. Massey, Fundamental Physics of Radiology, John Wright and Sons,U. K., 2000.
11. W. R. Handee, Medical Radiation Physics, Year Book Medical Publishers Inc., London, 2003.
12. Donald T. Graham, Paul J. Cloke, Principles of Radiological Physics, Churchill Livingstone, 2003

Radiological Imaging Technique

SYLLABUS

SEMESTER – VI

Advanced Radiographic Imaging Technology-II

Objective:

To understand the principle, working and study the various protocols underwhich various types of scan are done.

Course contents: (30Hrs)

MRI(Magnetic Resonance Imaging):

A. Basic MRI Pathologies

I. Hepatobiliary system

- Liver
- Pancreas
- Spleen
- Common bile duct
- Gall bladder
- Portal vein

II. Thorax

- Mediastinum
- Heart & Pericardium
- Malignant pleural disease
- Aorta

III. Shoulder & Knee joint

- Rotator cuff tears
- Meniscal tears

B. Mammography:

1. Introduction
2. Radiological requirements for mammography
3. X-ray equipments
    - Tubes , Filters & Spectra
    - Compression
    - Grids

- AEC
- Magnification mammography

4. Screen film mammography
5. Digital mammography
6. Display of film mammograms
7. Display of digital mammograms

C. <u>Dental radiography:</u>

- Introduction
- Technology
- Procedure
- Dental dosimetry

D. <u>Mobile radiography & Fluroscopy:</u>

- Introduction
- Technology
- Procedure
- Dosimetry

E. <u>DXA:</u>

- Introduction
- Technology
- Procedure & application
- Dosimetry

F. <u>MRI Artifacts:</u>

- Zipper Artifact
- Herringbone Artifact
- Motion Artifact
- Zebra stripes Artifact
- Moiré Artifact
- Wrap around Artifact
- Radiofrequency overflow Artifact
- Slice overlap Artifact
- Metal object Artifact
- Chemical shift Artifact or misregistration Artifact
- Dielectric effect Artifact

Practicals: (20Hrs)

1. Magnetic Resonance Imaging: Bones, Joints
   A. Temporomandibular Joint
   B. Shoulder
   C. Upper arm
   D. Elbow
   E. Forearm
   F. Wrist
   G. Finger
   H. Hip
   I. Thigh
   J. Knee
   K. Leg
   L. Ankle
2. Magnetic Resonance Imaging: Spine
   A. Cervical spine
      - Modifications
      - Suspected Tumor, Suspected Spondylodiskitis, Abscess Suspected Disseminated Encephalomyelitis or Syringo – myelia
      - Trauma, Suspected Fracture
   B. Thoracic spine
      - Modifications
      - Trauma, Suspected Fracture
      - Suspected Tumor or Abscess
   C. Lumbar spine
      - Modifications
      - After Lumbar Disk Surgery
      - Trauma, Suspected Fracture
3. Magnetic Resonance Angiography
   A. Cervical Vessels

B. Thoracic Aorta

C. Arteries of the Upper Arm

D. Arteries of the Forearm

E. Arteries of the Hand

F. Abdominal Aorta

G. Renal Arteries

H. Arteries of the Pelvis and lower extremity

Reference Books:

1.	Dr.Khanduri.S	A Textbook of CT & MRI for Technicians.
2.	Dr.Bhadury. S.	Essentials of radiology & imaging
3.	Bhargava. S.k.	Radiological procedures
4.	Bhargava, S.k.	Textbook of radiology and imaging
5.	Eisenberg	Clinical Imaging
6.	Haaga	CT and MRI of the whole body
7.	Hosten	CT of the head & Spine
8.	Leeuwen	Imaging in Hepatobiliary and Pancreatic Disease
9.	Siegel	Pediatric Body CT
10.	Moran	Tumors & Tumor-like conditions of the Lung and Pleura
11.	Bluth. E.I.	Ultrasound a practical approach to clinical problems