



مؤلانا آژاڈ نیشنل اردو یونیورسٹی

MAULANA AZAD NATIONAL URDU UNIVERSITY

(A Central University established by an Act of Parliament in 1998)

Accredited 'A+' grade by NAAC

SCHOOL OF SCIENCES

B.Voc. & M.Voc. Program (MIT & MLT)



M. Voc. Medical Imaging Technology (M.Voc. MIT)

SEMESTER - III

| Component | Title of The Paper | Credits |
|---------------------|---|-----------|
| Theory | | |
| Paper - 1 | Computerized Tomography (CT) -Basic principle and techniques (Theory) | 06 |
| | Computerized Tomography (CT) -Basic principle and techniques (practical) | 03 |
| Paper - 2 | Magnetic Resonance Imaging- principle and techniques (Theory) | 06 |
| | Magnetic Resonance Imaging- principle and techniques (practical) | 03 |
| Paper - 3 | Hospital Management & Care of Patient (Theory) | 06 |
| Paper - 4 | Quality Control, Radio-biology and Radiation Safety in Radio-diagnosis/Imaging other than X-ray related. (Theory) | 06 |
| Total Credit | | 30 |

M. Voc. Medical Imaging Technology (M.Voc. MIT)

SEMESTER-III

(Paper - 1) Computerized Tomography (CT) -Basic principle and techniques (Theory)

Credits – 06

Unit 1 C.T. Scan

Basic principle of CT scan history of CT Scan

EMI- History, System design etc

CT Equipment description & Instrumentation CT gantry, patient table, CT computer & image processing system, image display, storage & recording, CT control console, other accessory

Unit 2 Computed Tomography Scanning principle

Data acquisition, Data processing, Image display

Image reconstruction & its types

Image manipulation & Post processing

Introduction, clinical use, advantages, disadvantages of

MPR, MIP, SSD, CPR, VR

Scanning parameters

Unit 3 Generation of CT Scanner

1st generation, 2nd generation, 3rd generation, 4th generation, Slip ring technology, spiral/helical scanning, EBCT, Dual source scanning, flat panel detector

Advantages and disadvantages

Unit 4 Image Quality in CT

pixel, voxel, Image Brightness, spatial resolution, Contrast resolution, quantum mottle, Sharpness, Window width, Window level, Isotropic Imaging, CT

Number, Pitch

Unit 5 CT Scan Radiation Dose & Radiobiology

Attenuation of X-ray in tissue, Equivalent dose, effective dose, absorbed dose, tissue weighting factor, Organ dose from X-Ray procedure, CT dosimetry, CTDI, DLP, KERMA, occupancy factor, CT phantom,

Patient Dose

Radiation risk, Risk to generic Patient, Increasing radiation burden from Medical Imaging.

Unit 6 QA & QC of CT scanner & artefacts

Purpose benefit, record maintaining of QA & QC.

Artefacts

Definition, manifestation & Remedy

Motion artefact, metal artefact, out of field artefact,

beam hardening artefact, partial volume averaging artefact, ring artefact, pitch artefact, stair step artefact,

M. Voc. Medical Imaging Technology (M.Voc. MIT)

SEMESTER-III

(Paper - 1) Computerized Tomography (CT) -Basic principle and techniques (Theory)

Credits – 03

- 1) Physics, scanning principle and image formation in CT
- 2) Identification of different parts of CT scanner
- 3) Applications of various procedures in well-equipped Hospitals and Diagnostic Centers
- 4) Quality control of CT

M. Voc. Medical Imaging Technology (M.Voc. MIT)

SEMESTER-III

(Paper - 2) Magnetic Resonance Imaging- principle and techniques (Theory)

Credits – 06

Unit 1. Introduction of MRI

Basic principle of MRI history of MRI

Introduction, atomic structure, motion within the atom, Hydrogen nucleus, alignment, precession, Larmor equation, resonance, MR signal, FID, law of electromagnetism

T1 relaxation time, T2 decay time, pulse timing parameter, Extrinsic parameter & Intrinsic parameter.

Unit 2. MRI Equipment description & Instrumentation-

Introduction, magnetism, permanent magnet, resistive magnet, superconducting magnet, fringe field, shim coil, gradient coil, RF coil, the pulse control unit, patient transportation system, operator interface

Unit 3. Image weighting & contrast

Introduction, image contrast, contrast mechanism, T1 contrast, T2 contrast, proton density contrast, image weighting, T1 weighting, T2 weighting, proton density weighting

Encoding & Image Display

Encoding- introduction, gradient, slice selection, frequency encoding, phase encoding gradients, K-space, K-space filling and its role

Unit 4. Factors that affect image quality & Trade off Introduction to SNR & CNR, factors effect on SNR & CNR, spatial resolution, scan time, Trade's off

Artifacts:

Introduction, phase mis-mapping, aliasing artifact, chemical shift artifacts, chemical misregistration artifact, truncation artifact, magnetic susceptibility artifact, zipper artifact, shading artifact, motion related artifacts, cross excitation or cross talk artifacts

Unit 5. Pulse Sequences

Introduction of spin Echo pulse sequence-conventional,

Fast spin echo, Inversion recovery, Gradient pulse sequence

Conventional gradient echo, The steady state,

Coherent residual transverse magnetization, incoherent gradient pulse sequence,

SSFP, EPI, Balanced gradient

Unit 6. Flow phenomena

Mechanism of flow, time of flight phenomena, entry slice phenomena, intra voxel dephasing

Flow phenomena compensation-

Introduction, gradient moment rephrasing, pre saturation, even echo rephrasing.

Unit 7. Contrast media-

Introduction, uses & methodology, mechanism of action, dipole-dipole interaction,

magnetic susceptibility, relaxivity, gadolinium safety, feridex safety, application of contrast agent

M. Voc. Medical Imaging Technology (M.Voc. MIT)

SEMESTER-III

(Paper - 2) Magnetic Resonance Imaging- principle and techniques (Practical)

Credits – 03

- 1) Physics, scanning principle and image formation in MRI
- 2) Equipment of MRI
- 3) Identification of different parts of MR scanner
- 4) Applications of various procedures in well-equipped Hospitals and Diagnostic Centers

- 5) MR artefact & its remedy.

M. Voc. Medical Imaging Technology (M.Voc. MIT)

SEMESTER-III

(Paper - 3) Hospital Management & Care of Patient (Theory)

Credits – 06

Unit 1. Patient Care

Principles of body mechanics applicable to patient care Procedures for patient transfer

Procedures for turning patients who have severe trauma, Unconsciousness, Disorientation, or Amputated limbs

Patient preparation stamps.

Contrast reaction in radiology department, Emergency Drugs, ABCD principal.

Unit 2. Infection Control

Disinfection and sterilization procedures

Procedures for scrubbing, Donning gowns and gloves, Removing gowns and gloves, and handling sterile instruments

Procedures for handling and disposing of infectious wastes Isolation techniques

Unit 3. Management of infectious patients

Psychological considerations for the management of infectious patients- Communicable disease, Patient Hygiene, Personal Hygiene and department Hygiene.

Vital signs used to assess patient condition, measurements of Vital signs- Clinical measurement and recording of temperature, pulse, blood pressure and respiration.

Unit 4. Emergency Patients Handling

Symptoms of cardiac arrest, anaphylactic shock, convulsion, seizure, hemorrhage, apnea, emesis, aspiration, fractures and diabetic coma/insulin reaction

Acute care procedures for cardiac arrest, Anaphylactic shock, Convulsion, Seizure

Hemorrhage, Apnea, Emesis, Aspiration, Fractures, diabetic coma/insulin reaction

Use of medical equipment and supplies in treating medical emergencies.

Unit 5. Medico- Legal Considerations

Communication Skills of radiographer, Informed Consent form, Clinical/General and Ethical responsibilities, Misconduct and malpractice, handling female patients

M. Voc. Medical Imaging Technology (M.Voc. MIT)

SEMESTER-III

(Paper - 4) Quality Control, Radio-biology and Radiation Safety in Radio-diagnosis/Imaging other than X-ray related. (Theory)

Credits – 06

Unit 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.

Unit 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.

Unit 3.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.

Unit 5.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. 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.

Unit 6.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. 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 remedies.