मौलाना आज़ाद नेशनल उर्दू यूनिवर्सिटी مولانا آزاد نیشنل اُردو 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)

(02 Years Duration) with 04 Semesters

SEMESTER - II

Component	Title of The Paper	Credits
Theory		
Paper – 1	Modern Radiological & Imaging Equipment (Theory)	06
Paper – 2	Quality Assurance & Quality Control in Diagnostic Radiology &Imaging(Theory)	06
Paper – 3	Management of Radiology & Imaging Department (Theory)	06
Paper – 4	Bio statistics& Research Methodology (Theory)	04
Practical		
Paper – 1	Modern Radiological & Imaging Equipment (Lab)	02
Paper – 2	Quality Assurance & Quality Control in Diagnostic Radiology & Imaging (Lab)	02
Paper – 3	Management of Radiology & Imaging Department (Lab)	02
Paper – 4	Bio statistics & Research Methodology (Lab)	02
	Total Credit	**30**

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-II

(Paper - 1)Modern Radiological & Imaging Equipment (Theory)

Credits – 06

Unit 1. High Frequency X-Ray Generators and their types and applications. Modern x-ray tubes-their types and advancements. 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. Image Receptors: Flat Panel Detectors, Image Processing Workstation and Imaging Cameras.

Unit 2. Tomography: Body section radiography, basic principle and equipment, multi section tomography, various types of topographic movements, Tomosynthesis, Stitch radiography Dual energy x-ray absorptionometry (DEXA) scan. Vascular Imaging Equipment: Introduction, historical developments DSA EquipmentPrinciple, applications and definition of terms, Single Plane, Biplane, Hybrid DSA Lab- digital subtraction techniques. Scatter radiation its formation and control: beam centering devices, collimators, cone diaphragms and grids.

Unit 3. Fluoroscopy and IITV systems including cine radiography with various recording devices. 11. Computed Tomography -Principle, data acquisition concepts, image reconstruction, instrumentation, image manipulation Historical developments - Various generations, spiral/helical, single slice/multislice CT, Electron beam CT, mobile CT, Advances in volume scanning, continuous, subsecond scanning. Real time CT fluoroscopy, interventional guidance tool, 3D CT, CT angiography. Virtual reality imaging, including image quality and quality control in CT Scanners.

Unit 4. Ultrasonography: Basic principle of U.S., various types of transducers, mechanism of image formation, various advancements including Doppler, Elastography, HIFU,ABVS and image artifacts.

Unit 5.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.

Unit 6. Radionuclide scanning including rectilinear scanner, gamma camera, PET, SPECT, their principles, working, applications and advancements.Care and maintenance of radio-logicalequipment.

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-II

(Paper - 1)Modern Radiological & Imaging Equipment (Lab)

Credits – 04

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1. High Frequency X-ray Generator.

2. Digital Radiography.

3. Procedure of taking Biopsy in Radiology department.

4. DEXA Scan

5. Computed Tomography Principle.

6. Magnetic Resonance Imaging Principle.

7. Procedure of CT Scan.

8. Procedure of MRI

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-II

(Paper - 2)Quality Assurance & Quality Control in Diagnostic Radiology & Imaging (Theory)

Credits – 06

Unit 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.

Unit 2. Quality Assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance. 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

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.

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-II

(Paper - 2)Quality Assurance & Quality Control in Diagnostic Radiology & Imaging (Lab)

Credits – 04

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1. Maintenance of automatic processor and manual processing units.

2. Maintenance of X-ray machine.

3. Maintenance of CT scan

4. Maintenance of MRI machine.

5. Quality assurance of X-ray machine.

6. Quality assurance of CT machine.

7. Quality assurance of MRI machine.

8. Quality assurance of automatic processor, laser reader, printer.

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-II

(Paper - 3)Management of Radiology & Imaging Department (Theory)

Credits – 06

Unit 1. 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.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

Unit 2. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding materials Protection for primary radiation, work load, protection from scatter radiation and leakage radiation XRay/Fluoroscopy/Mammography/Intervention/DSA/CT room design, structural shielding, protective devices.

Unit 3. 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).

Unit 4. 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.

Unit 5. 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.

Unit 6.NABH guidelines, AERB guidelines and code, Basic safety standard, PNDT /PCPNDT Act and guidelines.Achievable safety through compliance on the regulations in India and recommendations of ICRT, IAEA.

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-II

(Paper - 3)Management of Radiology & Imaging Department (Lab)

Credits – 04

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1. ELORA webpage management.

2. Management to get license of X-ray unit from AERB.

3. Management to get license of CT scan unit from AERB.

4. Management to get license of Nuclear medicine from AERB.

5. Management to get license of PET-MRI unit from AERB.

6. Management to apply for TLD badges.

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-II

(Paper - 4)Biostatistics & Research Methodology (Theory)

Credits – 04

Unit 1. Introduction to Biostatistics & research methodology, types of variables & scales of measurements, measures of central tendency and dispersion, rate, rate, ratio, proportion, incidence & prevalence.

Unit 2. Sampling Random & non-random sampling, various methods of sampling-simple random, stratified, systematic, cluster and multistage. Sampling and non-sampling errors & methods of minimizing these errors. Basic probability distributions and sampling distributions Concept of probability distribution. Normal, Poisson and Binomial distributions, parameters and applications. Concept of sampling distributions. Standard error and confidence intervals. Skewness an Kurtosis.

Unit 3. Tests of significance Basics of testing of hypothesis-Null and alternate hypothesis, type I and type II errors, level of significance (parametric) and power of the test, p value. Tests of significance –t-test (paired & unpaired), Chi square test and test of proportion, one-way analysis of variance. Repeated measures analysis of variance. Repeated measures analysis of variance. Tests of significance (non parametric) – Mann-Whitney u test, Wilcoxon test, Kruskal-Wallis analysis of variance. Friedmann's analysis of variance.

Unit 4. Correction and Regression Simple correlation-Pearson's and Spearman's; testing the significance of correlation coefficient linear and multiple regression. Multivariate analysis Concept of multivariate analysis, introduction to logistic regression and survival analysis.

Unit 5. Sample size determination General concept. Sample size for estimating means and proportion, testing of difference in means and proportions of two groups. Study designs Descriptive epidemiological methods- case series analysis and prevalence studies. Analytical epidemiological methods- case control and cohort studies. Clinical trials/intervention studies, odds ratio and relative risk, stratified analysis.

Unit 6. Format of scientific documents Structure of research protocol, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta analysis.

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-II

(Paper - 4)Biostatistics & Research Methodology (Lab)

Credits – 02