DIPLOMA IN RADIODIAGNOSTIC TECHNOLOGY (DRDT) COURSE :

SYLLABUS OF RADIATION PHYSICS

1.1 Basic Radiation Physics:

Atomic structure, atomic number, mass number, bound and free electrons, binding energy, ionization, excitation, fluorescence, characteristic x-ray, stability of nucleus, isotopes, radioisotopes, types of radioactive disintegration, directly and indirectly ionizing radiations, x-rays and gamma rays, energy of ionizing radiation, half-life, effective half-life and production of radioisotopes.

1.2 **Production of X-rays**; Interaction of accelerated electrons with target atoms, conversion of kinetic energy of electrons into x- rays, Bremsstrahlung and characteristic x-rays, x-ray spectrum, types of x-ray tubes (anode, cathode, inherent filters, focal spot), heat production in the anode and cooling mechanism, quality and quantity of x-rays (effect of kV, mA).

1.3 **Interaction of Radiation with Matter:** Interaction of electrons with matter, Bremsstrahlung, interaction of photon with matter (photoelectric, compton and pair production), influence of photoelectric effect and compton effect on image quality and patient dose, absorption, scattering and attenuation of photons, Half Value Thickness (HVT) and Tenth Value Thickness (TVT), beam hardening, importance of x-ray beam filtration in diagnostic radiology

1.4 **Radiation Quantities and Units Activity** (Becquerel & Curie), energy, exposure(C/kg &Roentgen), air kerma, absorbed dose (Gray & Rad), radiation weighting factors (WR), tissue weighting factors(WT), equivalent dose (Sievert & rem), effective dose (Sievert & rem).

1.5 **Biological Effects of Radiation** :Interaction of radiation with cell, direct and indirect interactions, effect of radiation on living cells, chromosomal aberration, somatic and genetic effects, deterministic and stochastic (probabilistic) effects, effects of partial and whole body exposures.

1.6 **Operational Limits:** Introduction to natural background radiation, concept of occupational risk, philosophy of radiation protection, system of dose limitation, ALARA, dose limits to radiation workers and general public, AERB recommendations, guidance level for patient dose reduction in radio-diagnosis, dose constraints for comforters of patients.

1.7 **Radiation Detection and Measurement:** Principle of radiation detection, gas detectors (ionization chamber, proportional counter and GM counter), solid state detectors {Scintillator, semiconductors and Thermo luminescent Dosimeter (TLD)}, radiation monitoring instruments, personnel monitoring, area monitoring, survey meters, direct reading devices, calibration and response of radiation monitoring instruments.

1.8 **Radiation Hazard, Evaluation and Control** : External hazard and their perspective, evaluation and control of hazard due to external radiation: individual and workplace monitoring, application of time, distance and shielding; shielding calculation, requirement of filters with respect to kV of the machine, leakage radiation assessment by workload consideration, radiation protection in diagnostic radiology and radiation protection accessories.

1.9 **Principles of Diagnostic Radiology:** Fundamentals of diagnostic radiology, physical principle of image formation, limitations of conventional x-ray imaging, image contrast, contrast media, intensifying screens, optical density, characteristics of x-ray film, fluoroscopic screens, image intensified fluoroscopy, methods to reduce scattered radiation, Bucky grids and image quality.

1.10 **X-ray Imaging Techniques**: Radiography and fluoroscopy, CT scanning, digital subtraction angiography (DSA), mammography, interventional radiology, digital radiology, bone densitometry, dental radiology.

1.11 **Planning of Diagnostic X-ray Installation** : General principles of planning of diagnostic installations, site selection, workload, shielding material, openings and ventilation, illumination control, X-ray installation layout, control panel, patient waiting area, warning light and placard, model layouts of diagnostic radiology installations.

1.12 **Quality Assurance in Diagnostic Radiology** : Importance of QA in Diagnostic radiology, test parameters and test procedures for congruence of optical and radiation fields, central beam alignment, effective focal spot size, exposure time, applied tube potential, total filtration, table top transmission, linearity of timer loading station, linearity of mA loading station, consistency of radiation output, low and high contrast resolution, table top dose rate, radiation leakage though tube housing and collimator, dark room procedures, QA procedures for CT scanner and mammography.

1.13 **Regulatory Aspects for Diagnostic Radiology**: Regulations with respect to diagnostic radiology, relevant regulatory documents such as Act, Rules, Code, Standards and Guides, responsibilities of employer, licensee, Radiological Safety Officer (RSO), radiologist and Medical Radiographer (Technician); regulatory requirements for import, procurement, installation, commissioning, operation, transfer, dismantling and decommissioning of diagnostic equipment, Radiation Protection Programme (RPP).

1.14 **Radiation Incidents and Case Studies**: Radiation incidents involving X-ray equipment, over-exposure investigation and case studies.

1.15 **Operational Safety Aspects** : Proper use of modality specific radiation protection devices (lead protective barrier, lead aprons, ceiling suspended lead screen, couch-hanging lead rubber flaps etc.), Proper use and storage of TLD badges, Use of modality specific operational safety guidelines for minimizing occupational exposure in diagnostic radiology.

2. **Practical Demonstrations:**

2.1 Radiation protection survey of a diagnostic x-ray installation

2.2 Quality assurance (QA) of medical diagnostic x-ray equipment