Syllabus and Curriculum of Diploma in Radiotherapy Technology (DRTT) course

(To be implemented From 2015 - 16 session)

Uttar Pradesh State Medical Faculty, Lucknow.

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OBJECTIVES OF THE COURSE

To prepare a Radiotherapy Technology (DRTT) who –

Outline of Curriculum of Diploma in Radiotherapy Technology (DRTT) course

FIRST YEAR

THEORY (Classes: 9 AM to 12 Noon)

First paper : **Syllabus covers** -
1. Fundamentals of Anatomy and Physiology and pathology.

Second paper : **Syllabus covers** -
1. Principles of Radiation Therapy, Radiation Units and Measurements**.** 2. Hand hygiene & prevention of cross infection. 3. Basics life support (BLS) & Cardio-pulmonary resuscitation (CPR).

FIRST YEAR

PRACTICAL (Classes: 1 PM to 4 PM)

Practical classes will be after lunch; from 1 PM to 4 PM.

Students must present in the hospital/ Lab for practicals.

Following subjects must be taught; though there will not be any exam from these-
1. Basic Computer skills. 2. Basic English. 2. **Soft skills like -** Interpersonal relationship skills & moral education.

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Outline of Curriculum of Diploma in Radiotherapy Technology (DRTT) course

SECOND YEAR

THEORY (claases:9 AM to 12 Noon)

First paper : **Syllabus cover**s
1. Modern Imaging and Conventional & advanced Radiotherapy Planning Techniques.

Second paper : Syllabus covers
1. Radiation Biology, Radiation Safety and Information Technology

SECOND YEAR

PRACTICAL (claases:9 AM to 12 Noon)

Practical exams syllabus should cover-

ELIGIBILITY CRITERIA FOR ADMISSION & DURATION OF THE COURSE

COURSE DURATION:-

- It is 2 years, **full time** Diploma Course.

ELIGIBITY:-

- Candidate must have passed 12th with

  Physics, Chemistry, Biology

  Or

  Physics, Chemistry, Maths

  with 35% marks in Intermediate exams.

  (From UP board or any other recognised board).

- Candidate must have completed age of 17 years of age as on 31st December of admission year. There is no maximum age limit for the admission.

SCHEDULE OF EXAMINATION

FIRST YEAR

Paper	Subjects	Mark	Internal Assessment Marks	Total Marks	Pass Marks	Duration of Exam.
First Paper Theory	1. Fundamentals of Anatomy and Physiology and pathology.	75	25	100	50	3 Hours
Second Paper Theory	1. Principles of Radiation Therapy, Radiation Units and Measurements. 2. Hand hygiene & prevention of cross infection. 3. Basics life support (BLS) & Cardio-pulmonary resuscitation (CPR).	75	25	100	50	3 Hours
Practical	Oral & Practical	75	25	100	50	3 Hours

SCHEDULE OF EXAMINATION

SECOND YEAR

Paper	Subjects	Mark	Internal Assessment Marks	Total Marks	Pass Marks	Duration of Exam.
First Paper Theory	1. Modern Imaging and Conventional & advanced Radiotherapy Planning Techniques. .	75	25	100	50	3 Hours
Second Paper Theory	1. Radiation Biology, Radiation Safety and Information Technology	75	25	100	50	3 Hours
Practical	Oral & Practical	75	25	100	50	3 Hours

SCHEDULE OF COURSE

(List of holidays, Total hours, Subject wise allottement of hours)

- **List of Holidays:-**

Sundays	- 52 days
Summer vacation	- 10 days
Winter vacation	- 10 days
Gazetted holidays	- 23 days
Preparatory holidays	- 10 days
Total Holidays	- 105 days

- **Total Hours :-**

Theory classes per day	- 3 Hours
Practical classes per day	- 3 Hours
Total hours per day	- 6 Hours
Total days & hours in One year (after deduction of holidays)	- 260 days or - 1560 Hours

SCHEDULE OF COURSE

Subject wise allottement of hours

FIRST YEAR

Theory (780 Hours) Practical (780 Hours)

First Paper Theory	1. Fundamentals of Anatomy and Physiology and pathology.	
Second Paper Theory	1. Principles of Radiation Therapy, Radiation Units and Measurements**.**	
	2. Hand hygiene & prevention of cross infection.	
	3. Basics life support (BLS) & Cardio-pulmonary resuscitation (CPR).	
Third Paper Practical	As described in curriculum	780 Hrs
Theory: Other Subjects (These subjects must be taught; though there will not be any exam from these)	**1.** Basic Computer skills.	30 Hrs
	2. .Basic English.	30 Hrs
	3. Soft skills like - Interpersonal relationship skills & moral education	10 Hrs

SCHEDULE OF COURSE

Subject wise allottement of hours

SECOND YEAR

Theory (780 Hours) Practical (780 Hours)

First Paper Theory	1. Modern Imaging and Conventional & advanced Radiotherapy Planning Techniques.	
Second Paper Theory	1. Radiation Biology, Radiation Safety and Information Technology	
Third Paper Practical	As described in curriculum	780 Hrs

Details of Curriculum for First Year
Diploma in Radiotherapy Technology (DRTT)

PAPER 1st Theory	Topics	Hours.
1.**Fundamentals of Anatomy and Physiology and pathology.**	1.Introduction to Anatomy as a whole, Skeleton-bones & joints, formation of bones, structure of bones, classification of bones according to shape, Developmental classification, Regional classification, structural classification & growth of skeleton. Centre of ossification, type of bone, type of joints. Gross structure of human long bone, parts of young bone. Medico-legal & anthropological aspects of skeletal system, Estimation of age, sex, stature (height) and race. Classification & characters of joints, structural, functional & regional. Applied anatomy of joints, dislocation of joints. embryology, cell division, fertilization, development of embryo, gamete formation, menstrual cycle, formation of germ layers, development of embryonic disc, Placenta, formation of tissues, organs &systems of human body, congenital malformations.	
	2.Fundamentals of The Respiratory System: Heart and blood vessels (Circulatory system)	
	3.Heart: Position, structure and functions.	
	4.The lymphatic system.	
	5.The Urinary System.	
	6.The reproductive system.	
	7.The Endocrine system.	
	8.The Nervous system.	

Details of Curriculum for First Year
Diploma in Radiotherapy Technology (DRTT)

PAPER 2nd Theory	Topics	Hours.
1.Principles of Radiation Therapy, Radiation Units and Measurements.	**Section A:-**	
	1.SI Units, Force, mass, momentum, work, energy, power, density, pressure, heat, sound, wave and oscillations. Atomic structure: Atom, nucleus, nuclear energy levels, particle radiations, electromagnetic radiations, Radiation Units: Activity, Becquerel (Bq), exposure, roentgen, absorbed dose, rad, Gray, dose-equivalent, rem, Sievert, KERMA. Relation between absorbed dose, exposure and KERMA. **Interaction of Radiation with Matter** Photoelectric effect, Compton Effect, Pair production, Ionisation of matter, Energy absorbed from X-rays, X-rays Scattering, X-rays transmission through the medium, linear and mass attenuation coefficient, HVT and TVT, Interaction of charged particle and neutrons with matterCalculation of absorbed dose from exposure, Absorbed dose to air, Absorbed dose to any medium, Exposure from radioactive sources, exposure rate constant. HVL and attenuations	
	2.Dose distribution and scattering in medium: Properties of phantom materials and various types of phantoms, depth dose distribution, dose build-up, percentage depth dose and its influencing factors. Back scatter factor, tissue-air-ratio and influencing factors. Relation between TAR and PDD. Scatter-air-ratio. Dose calculation of irregular fields using Clarkson's method	
	3.Dosimetric calculations: Dose calculation parameters, collimator scatter factor (Sc), phantom scatter factor (Sp), Tissue phantom ratio (TPR), tissue maximum ratio (TMR), and their influencing factors. Relationship between TMR and PDD. Scatter maximum ratio (SMR). Dose calculations for linear accelerator and Co-60 unit using Sc, Sp factors for SSD and SAD methods, irregular fields, asymmetric fields etc.	

Details of Curriculum for First Year
Diploma in Radiotherapy Technology (DRTT)

PAPER 2nd Theory	Topics	Hours.
1.Principles of Radiation Therapy, Radiation Units and Measurements.	**4.**Isodose distribution of phantom beam: Isodose charts, measurement of isodose curves, parameters of isodose curves: beam quality, source size, SSD and SDD – penumbra effect, collimation and flattening filter, field size, Wedge filters: wedge angle, wedge transmission factor, wedge systems, effect of beam quality, design of wedge filters, Bolus, tissue compensators, shielding blocks.	
	5.Basics of Electron beam therapy Principles of Calibration of Cobalt Unit, mHDR and Linac	
	Section B:-	
	1.Basics of radiography of Chest & Thorax Bones, Abdomen, Upper limb, Lower limb:,Vertebral Column, Hips & Pelvis:- Ward mobile radiography,Basics of mammography, Bone Densitometer, CT scan and MRI Dark Room Procedures : manual and auto processors. • Dark Room: Layout and planning. • Type of entry, door design. Dark room illuminations - white light and safe lighting	
	2.Basics of nuclear medicine : Fundamentals of Nuclear medicine, Isotones used and their characteristics. Thyroid Uptake counter, gamma camera, SPECT-CT and PET CT, Radionuclide therapy	

Details of Curriculum for First Year
Diploma in Radiotherapy Technology (DRTT)

PAPER 2nd Theory	Topics	Hours.
1.Principles of Radiation Therapy, Radiation Units and Measurements.	**Section C:-**	
	1.Principles and working of x-ray tube. Measuring instruments voltage or KV meters. Measurement of tube current Principles of thermionic emission and rectification in x-ray technology. High voltage circuits in x-ray Units. Electrical hazards and safety. Tube rating in imaging and therapy x-ray tube and thermal safety. Intensity of radiation and its variation with distance,KV,MA. Introduction to electro-magnetic spectrum, definition of wave length and its quantum relationship with peak kilovoltage. Physical principles of radiation. Radioactivity and ionizing radiations used in treatment of malignancy, sources and techniques. Tissue tolerance, tumour lethal dose, therapeutic ratio and radiosensitivity. Units of exposure and radiation, prescription of radiation treatment. Definitions and basics of teletherapy techniques. Orthovoltage and megavoltage machines. Teletherapy machines – cobalt and linear accelerator. Basic principles and clinical applications of beam direction and modification devices. Clinical application of mould room techniques	
	2.**Brachytherapy:** Definition and basic principles. Radium and its substitutes used. Surface Moulds. Interstitial implantation. Intracavitary and intraluminal brachytherapy.	

Details of Curriculum for First Year
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PAPER 2nd Theory	Topics	Hours.
3.Hand hygiene & prevention of cross infection.	1. Hand hygiene & method of Hand washing.	15 Hrs
	2. Prevention of cross infection.	15 Hrs

PAPER 2nd Theory	Topics	Hours.
4.Basic life support (BLS) & Cardio-pulmonary resuscitation (CPR).	1. Code blue.	05 Hrs
	2. Details of basic life support (BLS) & Cardio-pulmonary resuscitation (CPR).	35 Hrs

Curriculum
for
Practical :- First Year
Diploma in Radiotherapy Technology (DRTT)

Practical	Topics

Details of Curriculum for Second Year
Diploma in Radiotherapy Technology (DRTT)

PAPER 1st Theory	Topics	Hours.
1.**Modern Imaging and Conventional & advanced Radiotherapy Planning Techniques.**	**Section A:-**	
	1.Physics of Diagnostic Radiology:- Familiarisation with various X-ray diagnostic tools, Radiological image formation, Use of contrast media, Films, Characteristic of X-ray films, Film Processing, Optical Density Measurements, Different types of Screens, Use of fluorescent screens in radiology, Effect of screen in reduction of patient dose, Various types of grids	
	2.Recent advances in imaging technology-: ultrasound, color Doppler, different types of transducers, applications & role in medicine & cross sectional anatomy.	
	3.CT scan, conventional, spiral (helical), Multislice-: Historical development, its principle and applications, various generations& definition of terms and cross sectional anatomy& use of diagnostic methods.	
	4.Magnetic Resonance Imaging (MRI)-: Principle, application, its advantage over computed tomography or ultrasonography. **Spectroscopy-:** Principle, application and uses.	
	5.Computerized Radiography-: Principle, application, advantage & technique.	
	6.Digital Radiography-: Principle, scanned projection radiography, digital subtraction angiography application, definition, advantages & techniques.	
	7.Picture Archiving Communication System (PACS)-: Basic knowledge of PACS, application, principle & image transmission.	
	8. **Mammography-:** Principle, application, advantage in soft tissue radiography, physics, filtration, QA & QC	

Details of Curriculum for Second Year
Diploma in Radiotherapy Technology (DRTT)

PAPER 1st Theory	Topics	Hours.
1.**Modern Imaging and Conventional & advanced Radiotherapy Planning Techniques.**	**Section A:-**	
	9.Positron Emission Tomography (PET) : Basic priciple, clinical application & advantages.	
	10.Different types of cameras e.g. laser, photography *etc*-: principle, processing & applications.	
	11.Radio isotopes-: Principles of Scanner, Rectilinear scanner, gamma camera.	
	12.QA in Diagnostic Radiology Verification of Optical and Radiation field congruence, Beam alignment, Focal spot size, Linearity of tube current mA and Timer, applied potential, HVT and total tube filter, Contact between film and intensifying screen, Contrast resolution, Grid alignment, Special techniques like mammography, CT and Digital Radiography.	
	Section B**:-**	
	1. Isodose curves, isodose charts,. Influency parameters of isodose curves: beam quality source size, SSD, SDD, penumbra, collimation & flattening filter, field size. Wedge filters: wedge angle, wedge factor, wedge systems, effect of beam quality, design of wedge filters. Combination of various radiation fields: Wedge field techniques. Definitions of following terms according to ICRU-50/62. Gross tumour volume (GTV), clinical target volume (CTV), planning target volume, irradiated volume cold and hot spots.	

Details of Curriculum for Second Year
Diploma in Radiotherapy Technology (DRTT)

PAPER 1st Theory	Topics	Hours.
1.**Modern Imaging and Conventional & advanced Radiotherapy Planning Techniques.**	**Section B:-**	
	2.Acquisition of patient data: body contours, internal structures using radiographs, CT, MRI, US etc.; for 2-D & 3-D treatment planning. Treatment simulation using conventional simulator, Simulator CT, CT simulator and virtual simulator. Treatment verification using port films, electronic portal imaging devices. Corrections for surface irregularities; effective SSD method, TAR/TMR method, isodose shift method. Corrections for internal tissue in homogeneities: for beam attenuation and scattering using TAR method, power law TAR method, equivalent TAR method, isodose shift method, typical correction factor. Absorbed dose within inhomogeneity: bone, bone tissue interface, tissue surrounding bone, lung tissue, and air cavity. Tissue compensator, bolus, patient positioning	
	3.Shielding blocks: block thickness, block divergence. Field shaping : custom blocking, independent jaws, multileaf collimators, skin dose; electron contamination of photon beams, dose distribution in build-up region, skin sparing effect, effect of absorber skin distance effect of field size, electron filters, skin sparing at oblique incidence. Separation of adjacent fields; orthogonal field junction, cranio-spinal fields, guidelines for field matching	
	4.Parallel opposed, small beam directed therapy and wedge fields in head and neck cancers. Treatment techniques in the treatment of brain, pituitary, oral cavity, larynx, hypo/oropharynx, maxillary antrum, nasopharynx, thyroid, tonsil, lip etc.	
	5.Treatment techniques in Carcinoma breast, esophagus, bladder, Gynecological cancers.	

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PAPER 1st Theory	Topics	Hours.
1.**Modern Imaging and Conventional & advanced Radiotherapy Planning Techniques.**	**Section B:-**	
	6.Treatment techniques in medulloblastoma, Ca Lung, bone, lymphoma, with special emphasis on mantle field irradiation, Rx techniques in Ca. prostate, ophthalmic tumours. Hemi body, whole body, irradiation techniques using photons and electrons.	
	7.Basic terminology of brachytherapy, brachytherapy sources, properties of idea brachytherapy sources, construction of Ra-226, Cs-137 & Co-60 tubes and needles and Ir-192 wires. To decay processes of brachytherapy sources, calibration of brachytherapy (mg Ra), Air Kerma Strength, Reference-Air-Kerma, Radium mass equivalent (Ra mg Eq.), apparent Activity, milligram-hours, integrated reference Air-kerma total reference-air-kerma, Exposure rate calibration.ICRU-38/58. Techniques of brachytherapy – 1. Surface mould and interstitial implants.	
	8.Surface mould dosimetry system: construction and distribution rules of circular, square, rectangular, sandwich, concave and convex moulds. Use of surface moulds in the treatment of various anatomical sites. Interstitial implant dosimetry systems	
	Section C:-	
	1.Stockholm system: Source placement and dose prescription rules. Type of applicators and their packing.	
	2.Paris system: Source placement and dose prescription roles. Type of applicators and its packing.	
	3.Manchester system: Definition of points. A, B and MIR point P. Manchester applicators, radium loading as per Manchester and MIR criteria. Dose/dose-rate to points Z & B for different tandem and ovoid loadings. Tolerance doses of rectum and bladder. ICRU-38: Dose rate classifications, reference height, width & length. Reference volume. Reference points of rectum and bladder lymphatic trapezoid; pelvic wall points. Concept of 60 Gy.	

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PAPER 1st Theory	Topics	Hours.
1.**Modern Imaging and Conventional & advanced Radiotherapy Planning Techniques.**	**Section C:-**	
	4.Applicators of Ca Cx: Pre-loaded applicators (Stockholm, Paris etc.), Fletcher suit applicators. Henschke applicators, ring applicators, vaginal applicators. Different tools, catheters and other necessary items required for interstitial implant. Dose calculations for brachytherapy sources .	
	5.Exposure rate constant, exposure rate and effect of inverse square law, sievert integral to calculate	
	Section D:-	
	1.Special techniques in Radiotherapy such as SRS, SRT, IMRT, IGRT and Tomotherapy Gamma Knife, construction, design and working principles. QA procedures and different clinical applications of gamma knife. Dose prescription criteria in the treatment of gamma knife.	
	2.X-knife, modification of LINAC, necessary accessories required for X-knife, energy choice of x-ray photons in X-knife, QA procedures and application and techniques in the treatment using circular cones and their planning. Cyber Knife: Principles and applications.	
	3.Design and working of MLC and MMLC. QA procedures of MLC and MMLC. Conformal radiotherapy (CRT) and intensity modulated radiotherapy (IMRT). Use of MMLC in stereotactic radiotherapy and IMRT. Inverse planning system. Intra- operative Radiotherapy (IORT).	

Details of Curriculum for Second Year
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PAPER 2nd Theory	Topics	Hours.
1. **Radiation Biology, Radiation Safety and Information Technology**	**1.Radiation protection quantities and units:** Exposure, dose equivalent (H). Committed dose equivalent (H_T), effective dose equivalent (H_E), Equivalent dose ((H_{TR}), effective dose (E). Sources of radiation exposure: Natural sources and human made sources. Standards and regulations, philosophies of exposure limit, occupational limits, non-occupational limits	
	2.**Biological effects of radiation**: Direct and indirect action of radiation, cell cycle effect, somatic and genetic effects. Effects on tissues and organs: Stochastic and non-stochastic (deterministic) effects, acute effects, late effects, effects of radiation on Embryo & fetus: lethal effects, organ malformation, growth impairment, mental retardation, cancer induction, genetic effects, Late (delayed) effects: cataract formation, organ function, cancer induction. Principles of basic radiobiology. Acute and chronic radiation effects. Cell survival curve. LET, RBE and OER. Time dose and fractionation. The Cell, Effect of ionising radiation on Cell, Chromosomal aberration and its application for the biological dosimetry, Somatic effects and hereditary effects, stochastic and deterministic effects, Acute exposure and Chronic exposure, LD50/60.	
	3.Personal dosimetry devices: Film badges, TLD badges, pocket ion chambers, electronic devices, Cr-39 foils, bubble, counting statistics, distributions, standard deviation. Standard error, confidence internal.	

Details of Curriculum for Second Year
Diploma in Radiotherapy Technology (DRTT)

PAPER 2nd Theory	Topics	Hours.
1. **Radiation Biology, Radiation Safety and Information Technology**	4.**Basics of Radiation protection principles and Practice**. Detection and measurement of Ionizing/radiation, Field survey instrument, GM survey instruments, personnel Monitoring devices film badge, TLD, pocket dosimeter, pulsed optically stimulated Luminescence dosimeter (POSL) *etc*. Radiation Protection Procedures for Patients and Personnel.	
.	5.**Radiation Hazard evaluation and control** Philosophy of radiation protection, Effect of Time, Distance and Shielding, Calculation of workload, Calculation of Weekly dose to the radiation worker and general public, good work practices in diagnostic radiology and/or radiotherapy practices (including teletherapy and Brachytherapy), Planning consideration for radiology and/or radiotherapy installation Including work load, use factor & occupancy factors, effect of different shielding material.	

Details of Curriculum for Second Year
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PAPER 2nd Theory	Topics	Hours.
1. **Radiation Biology, Radiation Safety and Information Technology**	**6.Regulatory requirements** National Regulatory Body, Responsibilities, organization, Safety Standards, Codes and Guides, Responsibilities of licensees, registrants and employers and Enforcement of Regulatory requirements Advisory Groups & Regulatory Agencies - ICRP, NCRP, UNSCEAR, AERB. Safety and security of radiation sources, case histories of emergency situations and preparedness, equipment and tools including role of Gamma Zone Monitor, Regulatory requirements and prevention of emergency, Preventive maintenance and Safety Culture, Role of technicians in handling radiation emergencies. Dose limits, ICRP recommendations ALARA principle. Protection of Personnel - Principles of personnel exposure reduction - Time, distance, shielding, protective barriers, protective devices. Protection of the patient Beam limitation, technique selection, general shielding, grids, image receptors, projection, repeat radiography etc. Radiation exposure and pregnancy - ALARA and Pregnancy, the pregnant radiation worker, patient and radiation exposure standards Regulatory aspect of Radiation safety and personnel monitoring	

Curriculum
for
Practical :- Second Year
Diploma in Radiotherapy Technology (DRTT)

	Topics
Practical	

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