

**Syllabus for the trade**

of

**RADIOLOGY TECHNICIAN**  
**(RADIO DIAGNOSIS & RADIOTHERAPY)**  
**(SEMESTER PATTERN)**

**Under**

**Craftsman Training Scheme (CTS)**

**Designed in**  
**2013**

By

Government of India CENTRAL STAFF TRAINING AND RESEARCH  
INSTITUTE Directorate General of Employment & Training Ministry of  
Labour & Employment EN-81, SECTOR-V, SALT LAKE CITY  
KOLKATA-700091

**List of members attended Trade Committee Meeting to finalize the draft syllabus held on 23.09.2004 for  
the trade of Radiology Technician ( Radio Diagnosis & Radiotherapy) under C.T.S.**

<b>Sl.No.</b>	<b>Name &amp; Designation</b>	<b>Office</b>	<b>Remarks</b>
1	Sri M.S. Lingaiah, Director	CSTARI, Salt Lake, Kolkata - 91	Chairman
2	Prof. S. K. Basu, Special Secretary Health and Family Welfare.	Govt. of West Bengal, Deptt. Of Health.	Member
3	Dr. Prabir Chowdhury, Radiation Oncologist.	Chittaranjan National Cancer Institute	Member
4	Dr. Soumitra Kr. Chowdhuri, Head,	Chittaranjan National Cancer Institute	Member
5	Dr. Suparna Majumdar, HOD/Deptt. Deptt. Of Radiology.	Chittaranjan National Cancer Institute	Member
6	Dr. P.K.Sarkar, Head, Health Physics Unit.	Variable Energy Cyclotron Centre.	Member
7	Prof. S. Pal, Professor, Biomedical Engg.	Jadavpur University, Kolkata-72	Member
8	Dr. Jyanta Kr. Paul, physicist cum RSO.	Nilratan Sarkar Medical College Hospital, Kolkata.	Member
9	Prof. Anjali Mukherjee, Sivatosh Mukherjee Science Centre	S .M. Sc., Kolkata - 25	Member
10	Sri Aminul Ahsan,	West Bengal Voluntary Health Association	Member
11	Sri Jnan Praakash Poddar	Indian Institute of Training & Dev. SRIJAN, Kolkata.	Member
12	Sri Moslem Tarafder	Indian Institute of Trg. & Dev.	Member
13	Sri R. Senthil Kumar, JDT	CSTARI, Salt Lake, Kolkata-91	Member
14	Sri M.M. Gera, DDT	CSTARI, Salt Lake, Kolkata-91	Member
15	Sri T. Mukhopadhyay, DDT.	CSTARI, Salt Lake, Kolkata-91	Member
16	Sri S.Kumar, DDT	CSTARI, Salt Lake, Kolkata-91	Member
17	Sri S.B.Sardar, T.O	CSTARI, Salt Lake, Kolkata-91	Member
18	Sri Surojit Pal	VECC, Kolkata	Special contributor

**List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6<sup>th</sup> to 10<sup>th</sup> May'2013 at CSTARI, Kolkata.**

Sl. No.	Name & Designation	Organisation	Remarks
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Mukherjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

## General Information

1. Name of the Trade : Radiology Technician  
(Radio Diagnosis & Radiotherapy)
2. N.C.O. Code No. : 2 Years (Four Semesters)
3. Duration : 4 KW : 75.04 Sq.mtr. :
4. Power norms : 10<sup>th</sup> Class Passed
5. Space norms
6. Entry Qualification
7. Unit Size (No. of Student) : 16
- 8a. Instructor's/Trainer's Qualification: Degree in Radiology Technician  
/Radiation therapy technician from recognized engineering  
College /university with one year experience in the relevant  
field
- OR
- Diploma in Radiology Technician from recognized board of  
technical education with two years experience in the relevant
- OR
- 10<sup>th</sup> Class Pass + NTC/NAC in the Trade of "Radiology  
Technician" With 3 years' post qualification experience in the  
relevant field.
- 8b. Desirable qualification : Preference will be given to a candidate with CIC (Craft  
Instructor Certificate)

Note: At least one Instructor must have Degree/Diploma in relevant field.

Syllabus for the  
TRADE OF "RADIOLOGY TECHNICIAN"(RADIO DIAGNOSIS & RADIO THERAPY) UNDER  
CRAFTSMAN TRAINING SCHEME (CTS)

Duration: Six Months

First Semester

(Semester Code no. RAT - 01)

WEEK NO.	PRACTICAL	THEORY	ENGG. DRAWING.	WORKSHOP CAL.& Sc.
1-4	Hazards & observing safety measures associated with Radioactivity & X-rays Plateau determination using. Surveymeter - with source. Survey at different distances.	Radiotherapy, Radio activity, Radio active materials, Radioisotopes, Characteristics of $\alpha$ , $\beta$ , and $\gamma$ rays - Physical properties, X-rays, physical Properties	Basic concept of Engineering Drawing, 1 <sup>st</sup> & 3 <sup>rd</sup> angle projection.	<b>Physics:</b> General properties of Matter, Surface tension, Viscosity, Bernoulli's Theorem Heat (thermometry and calorimetric), Acoustics, Geometrical and physical optics (Interference, Diffraction, Polarization.
5-8	Study of X-ray m/c, circuits, controlling of different parameters	Diagnostic H.T. Circuits, high tension generators, Half wave & Full wave rectifiers, Three phase circuits, Constant voltage regulator H.T. switches, , Measuring Instruments, Voltmeters, Milliamp meter	Types of lines and its applications, line practice. Lettering practice.	-do-
9-12	Study of MAS meter, Interlock Mechanism	Focal spot, inherent filtration, tube holders, MAS meter, compensator, exposure timer, Interlock and safety devices. Grid, Ratio in relation to KV. Reciprocating and oscillating. Potter bucky diaphragms, stationary grids.	Reading of different types of scales and its applications.	<b>Atomic Physics</b> Semi conductors, types, diodes, biasing of diodes. Zener diode and its applications. Photo-electricity. Introduction to X-Ray. Introduction to Radio activity.
13-15	-do-	Control of scattered radiation, beam modification devices.	Free hand sketches of different types of tools used related to the trade. Study of the drawing related to various bones of human.	-do-

			Free hand sketches of bones, spinal cord and joints.	<b>Electromagnetism</b> Units used in Electrostatics. Magnetism and current electricity Elementary principles of magnetism as an electrical effect, magnetization of materials by electric current, the right hand rule, solenoids, electromagnets. Force on conductor in magnetic field, the motor principle, the left hand rule. . Instruments:-Ammeter, voltmeter, electromagnetic induction. Principles, mutual and self induction. Wave form, peak and mean values, frequency, power and power factor. Conduction of electricity through gases, effect of varying pressure, cathode rays, X-rays
16-24	A.V.Demo.	i) Flow of electricity through gases, effect of varying pressure, cathode rays and x-rays. ii) Definition of radiation and its types. Electromagnetic radiation, Radiation as a wave motion, wave length, frequency magnitude, velocity and their relations, Electromagnetic spectrum, common properties of electromagnetic radiation. iii) Sources of radiation- Natural and artificial. iv) Radioactivity- atomic	-do-	<b>Physics of Radiation</b> Definition of radiation and its types. Electromagnetic (EM) radiation. Radiation as a wave motion. Wave length, frequency, amplitude, velocity and their relation. Concept of Quanta. Energy of radiation. . Electro magnetic spectrum, common properties of radiation

Radioactive decay, Half life, Decay constant, Mean life and their relation. Specific activity, Alpha and Beta particles, Gamma radiation and their properties. Properties of Radium, Production of Radioisotopes, Natural & Artificial radioactivity, Radioactive equilibrium, Units of activity- curie and Bequerel. Specific gamma ray constant.

v) Fusion & Fission..

vi) X-rays: Principles of production of X-ray, Intensity, continuous and characteristic spectrum. Basic circuit of X-ray tube. Construction of modern X-ray tubes, filaments, anode, cathode, methods of cooling anode, Inherent filtration, added filtration and their effect on quality of spectrum. Rectification. CT Scan, MRI Scan, USG etc. (Principles only).

Demo on X-ray m/c, portable unit

Study of different parts of x-ray m/c.

Demo on C.T.Scan, MRI, USG m/c

Study of radiation protection.

Familiarization with code of practice and nuclear structures, Atomic number, Isotopes, Mass number, Atomic mass, Binding energy, Energy level, Nuclear binding energy, Nuclear Stability, NP- ratios,

vii) Interaction of X Rays and Gamma rays with matter, Ionisation & excitation, Attenuation and absorption coefficient, Modes of interaction. Energy absorption from X-rays, Half value Layer

	<p>Study of Dosimeters. TLD badges, Survey meter, Gamma zone monitor &amp; calculation of barrier thickness</p>	<p>Roentgen and Rad. Simple principles of decimeters, fluorescent effect, photographic effect. viii) Radiation protection: Code of practice for the protection of persons against ionizing radiation, protective materials, Lead, lead equivalent, Building materials, personnel monitoring, international recommendations against hazards in ionizing radiation (Internal &amp; External.), Units of Dose limit, ALARA principle, operational dose limits for radiation worker &amp; public. ix) Calculations of barrier thickness. Film badges and TLD badges, Survey meter, Gamma zone monitor. Pocket dosimeters.(Basic principle)</p>		
25	<b>(i) Project Work(ii) Industrial Visit (Optional)</b>			
26	<b>Examination</b>			



Syllabus for the  
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Second Semester

(Semester Code no. RAT - 02)

WEEK NO.	PRACTICAL	THEORY	ENGG. DRAWING.	WORKSHOP CAL.& Sc.
1-5	Demonstration	<p><b>ANATOMY The Cell-</b> Types, structure, function reproduction , structure of general tissues.</p> <p><b>General Anatomical terms-</b> Regions of the body. Bones and joints. Skull, spine, pelvis , bones of upper and lower extremities. Structure of a typical joint and general description of main joints, movements in joints and their limitations, group movement of joints.</p> <p><b>Thorax and abdomen:</b> Structure of thoracic cage; abdominal cavity. Diaphragm and mediastinum. Heart - structure and function of heart. Names of main arteries and function of heart. Names of main arteries and veins.</p> <p><b>Brain:</b> Main subdivisions and lobes, ventricles , spinal cord.</p> <p><b>Respiratory system:</b> Sinuses, trachea, tonsils</p>	Free hand sketches of bones, spinal cord, joints.	<p><b>Sources of radiation -Natural and Artificial</b> Radioactivity - Atomic and Nuclear structures. Rutherford, Bohr model. Atomic Number. Mass Number. Atomic Mass. Binding energy. Energy level. Nuclear binding energy. NP ratio. Definition of radioactivity. Natural radioactivity. Radioactive decay. Half- life, decay constant. Mean line and their relation. Specific activity.</p> <p>Radiation from radioactive elements. Alpha and beta particles. Gamma radiation and their properties. Radioactive series. Properties of Radium and its daughter products. Radioactive equilibrium,. Units of activity. The Curie and Becquerel. Specific Gamma Ray constant.</p>

Duration: Six Months

larynx , lungs, bronchi,  
pleura

**Reproductive system:**

(a) Female genital tract  
fallopian tubes, ovaries,  
uterus , vagina (b) Male  
genital tract:- Testis,  
epididymis , prostate.

**Alimentary system :**

Mouth, tongue, salivary  
glands, esophagus, pharynx,  
stomach, small and large  
intestine, liver and biliary  
tract spleen, Pancreas ,  
mesentery, omentum, Gall  
Bladder

**Urinary tract:**

Kidney, ureters, bladder,  
urethra

**Special sense organs** (Broad  
outlines only)-Structure and  
function of eye, structure  
and function of ear.

**Lymphatic system and  
reticulo- endothelial  
system**

Position of main lymphatic  
structures, tonsils, spleen  
and Liver, Bone marrow.  
Functions of Red and white  
corpuscles of Blood.

**Ductless glands :**

(Broad principles only):  
Macroscopic anatomy  
and function of Pituitary,  
Thyroid , Pancreas,  
gonads etc.

6-15 Demo & Practice on x-rays Magnification practice on radiography & image intensifier units, Portable units, Image intensifier, Tele-radiography, Spot film devices, stereoscopy.

b) **Radiographic Technique**

i) Contrast media: Barium preparation, iodine preparation, Air-oxygen.

ii) Skeletal system: Upper limb, lower limb, shoulder girdle and thorax, vertebral column, pelvic girdle. Hip region, Teeth jaw.

iii) Respiratory system: Upper respiratory passage, lungs, Pleura, diaphragm, mediastinum, bronchography, artificial pneumothorax

iv) Gynecology: Radiation protection, pregnancy, hysterosalpingography, placentography

v) CNS: Routine and special projections of skull, ventriculography, cerebral angiographies, myelography.

vi) G.I. System:- Barium suspension, Barium swallow, Barium meal and follow through Barium enema

Practice on IVP, IVU, Peroperative Cholangiogram, ERCP, Ba-Meal, Ba-follow through, Ba-swallow, Ba-Enema etc.

Practice on Barium swallow

**RADIO DIAGNOSTICS**

a) **Special equipments: Topography-**

Magnification technique, Mobile

-do-

**Fission, Fusion, Artificial radioactivity**

X-Ray - Principles of production of X-rays, Intensity, continuous and characteristic spectrum. Basic Circuit of X-ray tube. Construction of modern X-ray tubes, Filament, Anode, Cathode, Methods of cooling anode, Inherent filtration and their effect on quality of spectrum, Rectification. Semi conductors-Diode, Transistors.

		vii) Bleary system: Cholecystography, oral and I.V. cholangiography- direct and indirect	
		ix) Salivary glands: Calligraphy	Metabolism of Carbohydrate, Proteins, Lipids, Amino acids , Hemins, Purines, Pyrimidies and Nucleic Acids.
	Practice on mammography.	x) Orthography, Lymphangiography, operation theatre technique and ward radiography. Magnification, High and low K.V. technique and mammography .	Nature, properties, Kinetics and mechanism of action of energy and co-enzymes, Biological oxidation and bio-energetic.
16-24	Practice on Photography &Dark room technique	<b><u>Radiographic Photographic and Dark room technique</u></b> Types of emulsion-Characteristic and control, screen and non screen films , dental films, x-ray paper under and over exposure, speed contrast.	Free hand drawing of skeleton of human body Drawing of major muscles , nerve supplies & blood supply & action
		<b><u>Intensifying screens:</u></b> Fluorescence, application of fluorescence in Radiography, type of intensifying screens, intensifying factors, cleaning and general care of screens - after glow.	Basic Ideas of Chemical Reactions
		<b><u>X-ray cassettes:</u></b> Testing and providing good screen contact, general care.	<b><u>Physical Chemistry</u></b> Solutions, osmotic pressure, lowering of
	Practice on Rectify & Maintaining of X-ray cassettes	<b><u>X-ray developers:</u></b> <b><u>Characteristics, Detail</u></b>	
	viii) Liver and spleen: Splemoportal renography		<b><u>Bio chemistry:</u></b> Chemistry of water, Mineral, Vitamins, Protein, Carbohydrate, Lipids, Nucleic acids, Enzymes, Blood, Extra cellular fluids.

	and constituent of developer, standardization by time and temperature, exhaustion of developer.	storage of dry chemicals, storage of solution.
	Replenishes Powder and liquid solution, radium and high contrast developer, ultra-rapid development methods. Automatic processing.	<u>Processing apparatus:</u> Processing units, hangers, care of hangers, refrigeration and use of ice. vapour pressure. Electrochemistry, Ionic Equilibrium, Acids & Base pit and indicators. Surface chemistry, colloid chemistry, Structure of Matter, Radioactivity.
Practice on X-ray fixing	<u>X-ray fixers and fixing:</u> Fixing agents, acid and preservative in fixer, inclusion of hardener, time of fixation, silver recovery.	Bio-chemistry
Practice on washing & Drying and contrast freedom from Chemical fog and staining, function	Washing and drying:-Object, methods employed, method of drying films. <u>Processing:</u> Preparation of solution, suitable water supply, nature of mixing vessels, order of mixing solutions, filtrations, making of stock solutions,	Bio-chemistry

25  
26

**(ii) Project Work(ii) Industrial Visit (Optional)**  
**Examination**

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**Third Semester**

**(Semester Code no. RAT - 03)**

WEEK NO.	PRACTICAL	THEORY	ENGG. DRAWING.	WORKSHOP CAL.& Sc.
1-8	Exposure on operation Theater ( along with Doctor & Surgeon).	<b>Operation Theatre processing:</b> Dish Units Chemical and processing faults: Chemical reduction. Chemistry and characteristics of Fasher's reducer, local and general applications.	Drawing of different joints of human organ. Different drawing of bones, nerve roots & muscle attachment. Sketches of excretory system.	Electronics -Semiconductors -Diode, Rectifier, transistors, Analog & Digital circuits Amplifier Environments Management -Basic concepts.
9-13	Demonstration on x-ray dark room setting	<b>X-ray dark room:</b> Size, light proof entrance, hatches, construction of walls for protection against chemicals and radiation, ceiling, colour schemes, water proofing of floors, loading bench design, disposition of processing and accessory equipment for efficient working , arrangement of drying cabinets in darkroom or in adjacent rooms, dark-room illumination and testing for safety, ventilation.	Sketches of heart Sketches of Neurons and nerves	Mathematics -. Basic algebra, trigonometry, mensuration.
14-18	Demonstration	<b>Radiographic image:</b> Radiographic factors affecting image contrast and sharpness, variation in exposure time in accordance with quality of radiation fillers, distance, intensifying screens, grids, film speed, developer and development.	Sketches of digestive system	Introduction of computer. Operating system and practice on word processing software.
19-21	Demonstration	<b>Attenuation of Radiograph:</b> Identification of films, aspect for direct and	Sketches of respiratory system	-do-

Duration: Six Months

		stereo viewing, mounting dental films.		
22-24	Demonstration	<b>Accessories:</b> Viewing boxes, spot light, illuminators, projectors and viewing screens for miniature and cine radiography, magnifiers, film identification, lead letters and numbers, actinic markers embossing machine, film trimmers, corner cutters, dental mounts and cutter, filling units.	-do-	-do-
25	<b>(iii) Project Work(ii) Industrial Visit (Optional)</b>			
26	<b>Examination</b>			

Syllabus for the  
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**Fourth Semester**

**(Semester Code no. RAT - 04)**

WEEK NO.	PRACTICAL	THEORY	ENGG. DRAWING.	WORKSHOP CAL.& Sc.
1-2	Practice on maintenance of charts ,radiographic calibration.	<b>Care and maintenance of equipment</b> General principles and routine use of charts supplied by manufacturer, Radiographic calibration procedure, Tube rating chart.	Free hand drawing of skeleton of human body.	<b>Bio chemistry:</b> Chemistry of water, Mineral, Vitamins, Protein, Carbohydrate, Lipids, Nucleic acids, Enzymes, Blood, Extra cellular fluids.
3-4	Practice on First Aid in case of shock etc.	<b>First Aid: -</b> Shock, convulsion, asphyxia, artificial respiration , Administration of Oxygen, Burns Electric shock & burns, wound, hemorrhage, pressure points , Tourniquet. Injuries to bone joints and muscles. Dressing or bandages, Plaster of Paris technique, splints, Drug reaction, Poisons.	Drawing of human body & different organs.	-do-
5-8	Demonstration & practice on CT SCAN	<b>CT Scan -</b> Principles, Scan parameters, Image reconstruction Image display, Image quality, computer system CT guided biopsy , contrast media etc.	Drawing of major muscles , nerve supplies & blood supply & action. Drawing of different joints of human organ.	Metabolism of Carbohydrate, Proteins, Lipids, Amino acids , Hemins, Purimes, Pyrimidies and Nucleic Acids.
9-11	Demonstration & practice on MRI	<b>MRI Scan-</b> Basic Physics, Imaging process, dynamic MR, MR angiography etc. safety	-do-	Nature, properties, Kinetics and mechanism of action of energy and co-enzymes, Biological oxidation and bio-energetic.
12-15	Demonstration & practice on USG	<b>Ultra-sonography -</b> Physics, Techniques,	Sketches of heart Sketches of	Basic Ideas of Chemical Reactions.

Duration: Six Months



		Application , Safety.	Neurons and nerves.	
16-23	Basic familiarization (along with Doctor) Demonstration Patient treatment Telecobalt unit & Linear Accelerator using different treatment techniques like SSD, SAD, Wedge, rotation compensator.	<b>RADIOTHERAPY :-</b> i) Elementary Pathology-Health and disease. Degeneration, repair of wounds, inflammation, infection, immunity. ii) Tumors - Definitions, Classifications, causes, spread, General effects. iii) Methods of diagnosis (Elementary principles)-Clinical, Radiographic, histological and biochemical methods. iv) Treatments - Radical and Palliative, treatment. General principles of medical , surgical, radio therapeutic methods including anti-cancer drugs, hormones. v) Biological effects of radiation: Physical and chemical effects of radiation, General effects on cells and tissues. Recovery, sensitivity. Special effects on skin, mucous membrane, bone, lymph nodes, bone marrow, blood, eyes, goudas, spinal cord, lung. Effects of acute and chronic exposures. Whole body effects, radiation syndrome-Lethal dose. vi) Factors modifying radiation effect- Dose, type of radiation, area, volume, total time and fractionation of	Different drawing of bones, nerve roots & muscle attachment.	i) Calculations of percentages, proportion, Inverse-square law. ii) Geometry of triangles. Logarithmic and Exponential functions. Linear and semi log plotting. iii) Elementary principles of - Magnetism as an electrical effect, magnetization of materials by electric current, the right hand rule, electromagnets. Force on conduction in magnetic field, Left hand rule. Voltmeter, Electromagnetic induction, wave form, peak and mean values, frequency, power and power factor

Treatment  
Compensator  
design.

treatment. Local factors  
in tissue and tumors -  
type, site, blood supply,  
oxygenation, infection,  
previous treatment.  
Constitutional factors -age,  
state of health.

vii) Clinical aspects of  
radiation reaction - care of  
patients undergoing  
radiotherapy(including use  
of blood counts) . Care of  
reactions. Consequence of  
technical errors.

viii) Absorption of X Rays  
and Gama Rays, Linear  
attenuation coefficient,  
Mass, Atomic absorption  
coefficient. Energy transfer  
and absorption co-efficient.

Preparation of  
thermoplastic  
mould.

ix) Measurement of X  
rays and Gamma rays-  
Ionizing process.  
Exposures. Absorbed  
dose- and its units - rad,  
Gy, principles of  
measurement- ionization,  
photographic,  
Scintillation ,  
thermo luminescent etc.  
Ionization chambers.  
Measuring instruments .  
Dosimeters. Quality of  
radiation, Half value layer  
etc.

x) Radiotherapy  
treatment machines:-

Telecobalt units , Linear  
accelerators, Brachy therapy  
units, Simulator,  
TPS etc.

xi) Radio therapeutic practices:

a) Teletherapy calculations: SSD and SAD techniques. Use of charts and graphs for free air dose rate, back scatter factors, percentage depth dose, tissue air ratio, equivalent squares, wedges and compensator.

b) Planning procedures: Construction of contour diagrams for plans. Tumor localization, field selection. Use of Isodose curves on body contours. Estimation of dose at different depth within the tissue using..... curves, tissue inhomogeneity correction, correction for curvature of body contour.

c) Treatment techniques-treatment techniques commonly used in lesions of skin, breast, pelvis, abdomen, thorax, spine, gland areas, limbs, larynx, ant rum, nasopharynx, testis, bladder, penish, tonsil, tongue etc. The use of single and multiple field arrangements, wedge filters, compensators, breast device, ROT, ARC, SKIP techniques etc.

d) Branchy therapy procedure: Definitions Types, intracavitary, Interstitial, Mould intraluminal. Different

		dosage systems. Sources used in Branchy therapy. Radiographic verifications. Superficial beta-ray applications. Mould room procedures, construction of moulds.		
24	<b>Visit to different Hospitals, Radiation Medicine Centre (RMC)</b>			
25	<b>Revision</b>			
26	<b>Examination</b>			

**\*\* All practical regarding the instruments and technique procedure (for both diagnostics and therapeutics) to be planned and carried out according to the facilities available in the Training Institute.**

**List of Tools & Equipments for the Trade of "RADIOLOGY TECHNICIAN"(RADIO  
DIAGNOSIS & RADIO THERAPY)  
For 16 trainees**

<b>Sl. No.</b>	<b>Name of the items</b>	<b>Qty.</b>
1	Model/ Diagram of i) Van de Graff Generator ii) Linear accelerator iii) Betatron iv) Cyclotron v) Geiger Muller Counter vi) Scintillation Counter vii) Safety precaution chart viii) Human Organs ix) Telecobalt Unit	1 no. 1 no. 1 no. 1 no. 1 no. 1 no. 1 no. 1 set 1 set
2	Pocket Dosimeter	16 nos.
3	TLD Badges	16 nos.
4	Continuation monitor	2 nos.
5	X-ray Unit 500 MA, 80 KVP	1 no.
6	Darkroom facility	1 no.
7	G.M B. V counting set up	1 no.
8	Gamma Survey meter (Range 0-20m R/hr or 0-100 mR/hr).	1 no.
9	Jacket and Shoes	16 nos.
10	Fire Extinguisher	1 no.
11	Lead Bricks	10 nos.

Social Studies - Syllabus is Already Approved and common for all trades.