SARDAR PATEL UNIVERSITY

Rules/Regulations & Syllabus

[Including all revisions/amendments till June, 2013]

For the course of

B.Sc.- Medical Technology
[Radiotherapy Technology]

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SARDAR PATEL UNIVERSITY

F.Y.B.Sc.- Medical Technology
[Radiotherapy Technology]
Proposed Revision in the Curriculum

Sr. No.	Subject	Course No.	Teaching Hours
Main Subjects			
1	Human Anatomy	BMT-101	60
	Practical – Anatomy	BMT-101(P)	30
2	Human Physiology	BMT-102	60
	Practical – Physiology	BMT-102(P)	30
3	Pathology	BMT-103	60
	Practical-Pathology	BMT-103(P)	30
4	Microbiology	BMT-104	60
	Practical- Microbiology	BMT-104(P)	30
5	Biochemistry	BMT-105	60
	Practical- Biochemistry	BMT-105(P)	30
		Main Subjects- Teaching hours	450
Subsidiary subjects			
6	English	E-101	60
	Practical-English	E-102(P)	30
7	Health-Care	BMT-S-101	30
		Subsidiary subjects- Teaching hours	120
		Teaching hours-Theory/Practicals	570
		Hospital Posting	360
		Total Teaching hours	930

SARDAR PATEL UNIVERSITY

B.Sc.- Medical Technology
(First Year)

Table 1. Subjects, Credits and Scheme of Examination

Sr. No.	Subject	Course No.	No. Credits per week	Duration of Uni. Exam	External Marks	Internal Marks	Total	Grand Total
1	Human Anatomy	BMT-101	2	3	80	20	100	100
	Practical – Anatomy	BMT-101(P)	1	-	-	-	-	
2	Human Physiology	BMT-102	2	3	80	20	100	100
	Practical – Physiology	BMT-102(P)	1	-	-	-	-	
3	Pathology	BMT-103	2	3	80	20	100	100
	Practical-Pathology	BMT-103(P)	1	-	-	-	-	
4	Microbiology	BMT-104	2	3	80	20	100	100
	Practical- Microbiology	BMT-104(P)	1	-	-	-	-	
5	Biochemistry	BMT-105	2	3	80	20	100	100
	Practical- Biochemistry	BMT-105(P)	1	-	-	-	-	
6	English	E-101	2	3	80	20	100	100
	Practical-English	E-102(P)	1	-	-	-	-	
7	Health-Care	BMT-S-101	1	2	40	10	50	50
							Total	650

Rules & Regulations for the course of F.Y.B.Sc.- Medical Technology

B.Sc.- Medical Technology (First Year)

With the increasing use of advanced diagnostic and therapeutic technologies in medicine; there has been a challenging career for well-trained Medical technologists in different specialties of **Medical Technology**.

Proposed course of First Year of **B.Sc. – Medical Technology** offers a sound foundation to pursue further, in second and third year of B.Sc. MT, any of the several specialties of Medical; Technology; some of them have been mentioned hereunder:

a. Clinical Laboratory Technology
b. Operation Theatre & Anaesthesia Technology
c. Respiratory Care Technology
d. Imaging Technology
e. Cardiac Care Technology
f. Perfusion Technology
g. Neuro Science Technology
h. Renal Dialysis Technology
i. Radiotherapy Technology

R. BMT. 1: Eligibility for the admission:

Candidates who have passed 10+2 examination conducted by any recognized School Certification Board or Equivalent Examination; with principal subjects Physics, Chemistry, Biology/Maths and English (A or B or AB group student).

R. BMT. 2: Duration of the course:

Duration shall be for a period of **three years** for the course of B.Sc.- Medical Technology in *Clinical Laboratory Technology*.

All other courses will be of **four years** duration; having a compulsory stipendiary Internship during the fourth year.

R. BMT. 3: Medium of instruction:

The medium of instruction and examination shall be in English.

R. BMT. 4: Attendance

Candidate shall be required to attend at least 75% of the Lectures and Practical separately in each year.

R. BMT. 5: **Subjects, Credits and Scheme of examination**

Main and Subsidiary subjects are common in first year for all the courses of Medical Technology. The subject-wise details of examination for the first year have been given in Table 1.

There shall be three examinations one each at the end of 1st, 2nd and 3rd year.

There shall be no University Practical Exam in the First Year.

It is however necessary that candidates score at least 35% internal marks in all main as well as subsidiary subjects - theory and practical - to become eligible to appear in the University examination.

R. BMT. 6: Eligible candidate desirous for appearing in the University examination of any/all theory papers must forward his/her application in the prescribed form from the respective college to the University on or before the date prescribed for the purpose under the relevant ordinance.

R. BMT.7: **Standard of passing**:

The standard of passing the F.Y.B.Sc. degree examination will be as under:

(a) To pass the B.Sc. Degree examination, a candidate must obtain at least 3**5% marks** (aggregate of external and internal) in each of the main and subsidiary subjects **separately.**

(b) Award of class will be as per the other degree examinations of faculty of Medicine, S.P. University.

R. BMT. 8: **Promotion and A.T.K.T.**

a. Candidates, who have passed separately in theory and practical of all subject heads (course) in F.Y.B.Sc. and S.Y.B.Sc. Shall be promoted to S.Y.B.Sc. And T.Y.B.Sc. Respectively.

b. Candidates, who fail in **any three** of the subject heads (courses) in F.Y.B.Sc. Or S.Y.B.Sc. Shall be granted A.T.K.T. And shall be allowed to attend S.Y.B.Sc. Or T.Y.B.Sc.; as the case may be. Candidate can re-appear in the following subject-heads in the subsequent exam.

c. Candidate would however not be allowed for the promotion from S.Y.B.Sc. to T.Y.B.Sc. unless and untill s/he passes all subjects of F.Y.B.Sc.

Course code: BMT 101

HUMAN ANATOMY

Theory classes: 60 hours
Practical classes : 30 hours

Unit 1. Introduction: human body as a whole
Theory:

- Definition of anatomy and its divisions
- Terms of location, positions and planes
- Cell and its organelles
- Epithelium-definition, classification, describe with examples, function
- Glands- classification, describe serous & mucous glands with examples
- Basic tissues – classification with examples

Practical:

- Histology of types of epithelium
- Histology of serous, mucous & mixed salivary gland

Unit 2. Locomotion and support
Theory:

- Cartilage – types with example & histology
- Bone – Classification, names of bone cells, parts of long bone, microscopy of compact bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- Joints – Classification of joints with examples, synovial joint (in detail for radiology)
- Muscular system: Classification of muscular tissue & histology
- Names of muscles of the body

Practical:

- Histology of the 3 types of cartilage
- Demo of all bones showing parts, radiographs of normal bones & joints
- Histology of compact bone (TS & LS)
- Demonstration of muscles of the body (as functional groups)
- Histology of skeletal (TS & LS), smooth & cardiac muscle

Unit 3. Cardiovascular system
Theory:

- Heart-size, location, chambers, exterior & interior
- Blood supply of heart
- Systemic & pulmonary circulation
- Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Peripheral pulse
- Inferior venacava, portal vein, portosystemic anastomosis
- Great saphenous vein
- Dural venous sinuses
- Lymphatic system- cisterna chyli & thoracic duct
- Histology of lymphatic tissues
- Names of regional lymphatics, axillary and inguinal lymph nodes in brief

Practical:

- Demonstration of heart and vessels in the body
- Histology of large artery, medium sized artery & vein, large vein
- Microscopic appearance of large artery, medium sized artery & vein, large vein
- pericardium
- Histology of lymph node, spleen, tonsil & thymus
- Normal chest radiograph showing heart shadows
- Normal angiograms

Unit 4. Gastro-intestinal system

Theory:

- Parts of GIT, Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring)
- Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas
- Radiographs of abdomen

Unit 5. Respiratory system

Theory:

- Parts of RS, nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments
- Histology of trachea, lung and pleura
- Names of paranasal air sinuses

Practical:

- Demonstration of parts of respiratory system.
- Normal radiographs of chest
- Histology of lung and trachea

Unit 6. Urinary system

Theory:

- Kidney, ureter, urinary bladder, male and female urethra
- Histology of kidney, ureter and urinary bladder

Practical:

- Demonstration of parts of urinary system
- Histology of kidney, ureter, urinary bladder
- Radiographs of abdomen-IVP, retrograde cystogram

Unit 7. Reproductive system

Theory:

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross &
- histology)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology)
- Mammary gland – gross

Practical:

- Demonstration of section of male and female pelves with organs *in situ*
- Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary
- Radiographs of pelvis – hysterosalpingogram

Unit 8. Endocrine glands

Theory:

- Names of all endocrine glands in detail on pituitary gland, thyroid gland, parathyroid gland, suprarenal glad – (gross & histology)

Practical:

- Demonstration of the glands
- Histology of pituitary, thyroid, parathyroid, suprarenal glands

Unit 9. Nervous system
Theory:

- Neuron
- Classification of NS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (Gross Anatomy)
- Histology of Cerebrum, cerebellum and spinal cord
- Meninges, Ventricles & cerebrospinal fluid
- Blood supply of brain (In Brief)
- Cranial nerves (Only Names)

Practical:

- Histology of peripheral nerve & optic nerve
- Demonstration of all plexuses and nerves in the body
- Demonstration of all part of brain
- Histology of cerebrum, cerebellum, spinal cord

Unit 10.Sensory organs:
Theory:

- Skin: Skin-histology
- Appendages of skin
- Eye: Parts of eye & lacrimal apparatus
- Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents

Practical:

- Histology of thin and thick skin
- Demonstration and histology of eyeball
- Histology of cornea & retina

Unit 11.Embryology:
Theory:

- Spermatogenesis & oogenesis
- Ovulation, fertilization
- Fetal circulation
- Placenta

There shall be no University Practical Examination.

REFERENCE BOOKS

1 William Davis (P) understanding Human
Anatomy and Physiology MC Graw Hill

2. Human Anatomy for Nursing & Allied Sciences - 1st edition
Dr. M.K.Anand, Dr. Meena Verma, The Arora Medical Publishers Pvt.Ltd

3. Fattana, Human anatomy
(Description and applied)
Saunder's & C P Prism Publishers, Bangalore – 1991

4. ESTER . M. Grishcimer,
Physiology & Anatomy with Practical
Considerations, J.P. Lippin Cott. Philadelphia

Course code: BMT 102
HUMAN PHYSIOLOGY

Theory classes: 60 hours
Practical classes : 30 hours

Theory:

Unit 1. Blood and Muscle Physiology:

- Compositin & Fucnction of Blood
- Erythropoesis and Leucopoesis
- Hemostasis
- Action potential and mechanism of Muscle contraction
- Neuromuscular junction

Unit 2. Digeestive System and Excretary System

- Movement and Alimentary tract
- Deglutition and Mechanism of Vomiting
- Digestive juices
- Micturition
- Mechanism of Urine formation
- Regulation of scid-base balance

Unit 3. Cardiovascular and Respiratory Sustem

- Heart rate and sound
- Blood pressure
- Cardiac cycle and output
- Mechanism of breathing
- Oxygen and Carbon dioxide Transport
- Pulmonary volume and capacity

Unit 4. Endocrinology and Reproductive System

1. Spermatogenesis and Menstrual cycle
2. Puberty
3. Pregnancy and Lactation
4. Hormones of Pituitary, Thyroid & Parathyroid Glands
5. Hormones of Adrenal Gland and Pancreas

Unit 5. Nervous System and Special Senses

- Neuron and Neuroglia
- Properties of nerve fibre
- Reflex mechanism and Receptors
- Mechanism of vision and hearing
- Taste and smell

Practical:

- Estimation of Haemoglobin
- Bleeding time
- Clotting time
- Blood Grouping
- Erythrocyte Sedimentation rate
- Packed Cell Volume
- Arterial Blood Pressure
- Pulse
- Heart rate
- Breathing rate

There shall be no University Practical Examination.

REFERENCE BOOKS

1. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism publishers
2. Ganong (William F) Review of Medical Physiology. Latest Ed . Appleton
3. Jain AK, Concise Physiology,Latest Ed.

Course code: BMT 103
PATHOLOGY

Theory classes: 60 hours
Practical classes : 30 hours

Theory

Unit 1. Histo Pathology

- Introduction to Histo Pathology
- Receiving of Specimen in the laboratory
- Grossing Techniques
- Mounting Techniques – various Mountants
- Maintenance of records and filing of the slides.
- Use & care of Microscope
- Various Fixatives, Mode of action, Preparation and Indication.
- Section Cutting
- Tissue processing for routine paraffin sections
- Decalcification of Tissues.
- Staining of tissues - H& E Staining
- Bio-Medical waste management

Unit 2. Clinical Pathology

- Introduction to Clinical Pathology
- Collection, Transport, Preservation, and Processing of various clinical Specimens
- Urine Examination – Collection and Preservation of urine.
- Physical, chemical, Microscopic Examination
- Examination of CSF and other body fluids.
- Sputum Examination.
- Examination of feces

Unit 4. Haematology

- Introduction to Haematology
- Normal constituents of Blood, their structure and function.
- Collection of Blood samples
- Various Anticoagulants used in Haematology
- Various instruments and glassware used in Haematology, Preparation and use of glassware
- Laboratory safety guidelines
- SI units and conventional units in Hospital Laboratory
- Hb, PCV
- ESR
- Normal Haemostasis
- Bleeding Time, Clotting Time, Prothrombin Time, Activated Partial Thromboplastin Time.

Unit 5. Blood Bank

- Introduction
- Blood grouping and Rh Types
- Cross matching

Practical:

- Urine Examination.
- Physical
- Chemical
- Microscopic
- Blood Grouping Rh typing.
- Hb Estimation,Packed Cell Volume[PCV], Erythrocyte Sedimentation rate{ESR]
- Bleeding Time, Clotting Time.
- Histopathlogy – Section cutting and H &E Staining.[For BSc MLT only]

There shall be no University Practical Examination.

REFERENCE BOOKS

1. Silvertone : Introduction to Medical Lab. Technology
2. Bancroft : Theory and Practical of Histology techniques
3. Textbook of Clinical Blood Banking Science by Zmijewski.
4. Manual for Clinical Pathology by Sabitry Sanyal
5. Practical Pathology by Dr.P.Chakraborty & Gargi Chakraborty
6. Haematology for students and practitioners by Ramnik Sood
7. Histological techniques by K.Laxminarayan
8. Practical Pathology by Dr.K.Uma Chaturvedi & Tejsindersingh

Course code: BMT 104
MICROBIOLOGY

Theory classes: 60 hours
Practical classes : 30 hours

Theory

Unit 1. Morphology

- Classification of microorgaisms,
- Size, shape and structure of bacteria.
- Use of microscope in the study of bacteria.

Unit 2. Sterilisation and Disinfection

- Principles and use of equipments of sterlization namely Hot Air oven, Autoclave and serum inspissrator. Pasteurization,
- Anti septic and disinfectants

Unit 3. Growth and nutrition

- Nutrition, growth and multiplications of bacteria,
- Use of culture media in diagnostic bacteriology.
- Antimicrobial sensitivity test

Unit 4. Immunology

- Infection & Immunity
- Antigen, Immunoglobuline (in brief)
- Principles and interpretation of commonly done serological tests namely Widal, VDRL, ASO, CRP, RF & ELISA. Rapid tests for HIV and HBsAg (Technical details to be avoided)
- Types of Vaccine and immunization schedule

Unit 5. Systematic Bacteriology

- Morphology, cultivation, diseases caused, laboratory diagnosis including specimen collection of the following bacteria
  (the classification, antigenic structure and pathogenicity to be avoided)
    - *Staphyloccci, Streptococci, Pneumococci,*
    - *Gonococci, Menigococci,*
    - *C. diphtheriae, Clostridia, Bacillus,*
    - *Shigella, Salmonella, Esch coli,*
    - *Klebsiella, Proteus, Pseudomonas*
    - *Mycobacteria*
    - *Vibrio cholerae, &*
    - *Spirochetes-Treponema pallidum & Leptospira*

Unit 6. Parasitology

- Morphology, life cycle, laboratory diagnosis of following parasites
    - Protozoa - *E. histolytica, Plasmodium,*
    - Tape worms –*Taenia*
    - Intestinal nematodes – Round worm, Hookworm,

Unit 7. Mycology

- Morphology, diseases caused and lab diagnosis of following fungi.
    - Candida, Cryptococcus,
    - Dermatophytes ,
    - opportunistic fungi.

Unit 8. Virology

- General properties of viruses, diseases caused, lab diagnosis and prevention of following viruses,
    - Herpes,
    - Hepatitis,
    - HIV
    - Rabies and
    - Poliomyelitis.

Unit 9. Hospital infection

- Causative agents, transmission methods,
- Prevention and control Hospital infection.

Unit 10. Principles and practice Biomedical waste management

Practical

- Compound Microscope.
- Grams stain
- Acid Fast staining
- Demonstration and sterlization of equipments – Hot Air oven, Autoclave, Bacterial filters.
- Demonstration of commonly used culture media, culture methods
    - Nutrient broth, Nutrient agar, Blood agar, Chacolate agar, Mac conkey medium, LJ media, Robertson Cooked meat media, Potassium tellurite media with growth, Mac with LF & NLF, NA with staph
- Demonstration of commonly used Biochemical Reactions for identification of bacteria
    - Coagulase test
    - Catalase test
    - IMViC
    - TSI
    - Urease, Oxidase
- Antibiotic susceptibility test
- Anaerobic culture methods.
- Demonstration of common serological tests – Widal, VRDL, ELISA.
- Stool exam for Helminthic ova
- Visit to hospital for demonstration of Biomedical waste management.

There shall be no University Practical Examination.

REFERENCE BOOKS

1. Anathanarayana & Panikar Medical Microbioloty
2. Roberty Cruckshank – Medical Microbiology – The Practice of Medical Mircrobiology
3. Chatterjee – Parasitology – Interpretation to Clinical medicine.
4. Rippon – Medical Mycology
5. Monica Cheesebrough,

Course code: BMT 105

BIOCHEMISTRY

Theory classes: 60 hours
Practical classes : 30 hours

Theory

Unit.1 Introduction, specimen collection and Handling

- Introduction to Bio-chemistry including code of ethics for Medical Lab technicians and Medical Lab Organization.
- Reception, Registration and Bio-chemical parameters investigated.
- Types of vials used in blood /specimen collection
- Anticoagulants
- Preservatives
- Blood collection
- Precautions
- Safety, first aid, Biological and chemical hazards
- Processing of samples
- Preservation
- Disposal of samples
- Introduction to laboratory apparatus :
  - Pipettes - different types (Graduated, volumetric, Pasteur, Automatic etc.,), Calibration of glass pipettes
  - Burettes, Beakers,Flasks,Funnels, Cuvettes,

Unit 2. Units of measurements and Basics of Instrumentation

- Conventional and SI units
  - Molecular weight, equivalent weight of elements and compounds, normality, molarity,
  - Preparation of molar solutions,normal solutions,Percent solutions

I. Colorimetry : Photoelectric methods, instrumentation, principles and laws involved, Operation, maintenance, applications.
II. Spectrophotometry : Principle ,types and applications.
III. Weighing : Different types of balances used, care and maintenance.
IV. pH meter-Principle, Use, care and maintenance of pH meter and electrodes

- Basic lab operations like -Separation of Solids from liquids,
  a) Centrifugation : Principle, Different types of Centrifuges, care and maintenance, applications
  b) Filtration using funnel

Unit.3 Carbohydrates :
Definition, biological importance, classification, qualitative tests, Metabolism(brief), Blood glucose.

Unit.4 Lipids :
Definition, biological importance, classification, Acid value, Iodine value, saponification value, Metabolism(brief).

Unit.5 Aminoacids and Proteins :
Definition, biological importance, classification, qualitative tests.

Unit.6 Vitamins and Minerals :
Vitamins : Classification of Vitamins, Sources, Daily requirements, Deficiency diseases. (In Brief)
Minerals (Iron, calcium, Iodine): Sources, Daily requirements, Deficiency diseases .

Unit.7 Enzymes
Nature, Classification and Clinical enzymes.

Unit.8 Nucleic acids- Chemistry and functional aspects
Purine bases, Pyrimidine bases, nucleosides, Nucleotides, DNA & RNA, Their functions
Brief outline of Replication, Transcription, translation.

Unit.9

- PH, buffers, acid-base balance, disorders.
- Digestion and absorption of Biomolecules
- Water, Chemicals and related substances
  - Purity of chemicals
  - Corrosives

Practical:

- Reception and registration
- Collection of Capillary blood
- Collection of Venous blood
- Separation of Serum from clotted blood
- Separation of plasma from blood
- Lab glass ware
  a) Identification
  b) Handling
  c) Care and Maintenance
  d) Uses
- Lab instruments
  a) Centrifuges
  b) Balances
  c) Photo Electric colorimeter
  d) Spectrophotometer
- Preparation of
  a) Percentage solutions
  b) Normal solutions
  c) Molar solutions
- Qualitative identification of tests of sugars
- Qualitative identification of tests of proteins
- Qualitative identification of tests for amino acids
- Estimation of Blood glucose
- Estimation of Blood urea
- Normal and pathological urine.

There shall be no University Practical Examination.

REFERENCE BOOKS

1. TEITZ – Clinical chemistry
2. Vasudevan (DM) Sreekumari(S) Text book of Biochemistry for Medical students ,Latest Ed
3. Varley – Clinical chemistry
4. Kaplan – Clinical chemistry

Course code: BMT-S-101
HEALTH CARE

Theory classes: 30 hours

Unit 1. Introduction to Health

- Definition of Health
- Determinants of Health
- Health Indicators of India
- Health Team

Unit 2. Health Policy and Programmes

- Concept.
- National Health Policy
- National Health Programmes (Briefly Objectives and scope)
- Population of India and Family welfare programme in India

Unit 3. Introduction to Nursing

- What is Nursing ? Nursing principles.
- Inter-Personnel relationships.
- **Bandaging :** Basic turns; Bandaging extremities; Triangular Bandages and their application.
- Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.
- **Lifting And Transporting Patients**: Lifting patients up in the bed. Transferring from bed to wheel chair. Transferring from bed to stretcher.

Unit 4. Bed Side Management:

- Giving and taking Bed pan, Urinal :
- Observation of stools, urine.Observation of sputum,
- Understand use and care of catheters, enema giving.
- **Methods Of Giving Nourishment**: Feeding, Tube feeding, drips, transfusion
- Recording of body temperature, respiration and pulse,
- **Simple aseptic technique**: Sterlization and disinfection.
- Surgical Dressing: Observation of dressing procedures

Unit 5. First Aid :

- Syllabus as for Certificate Course of Red Cross Society

Course Code: E - 101

ENGLISH

Theory classes: 60 hours
Practical classes: 30 hours

There will be two papers in English at the FYBSc as per the revised syllabus E-101 (Theory) will be taught for two hours a week and E-102 (Practical) will also be taught for two hours a week/per Batch each form the academic year 2009-10

Language Skills like Reading and Writing will be covered in E-101 and Listening and Speaking will be covered in E-102 which will also have Lab Session of two hours per week.

Aim

These two course will aim at helping the course participants develop their communication skills in English by training them in handling all the four language skills effectively. The learners will be able to listen, speak, read and write in English adequately so that they could participate in various activities and perform satisfactory the different tasks listed below.

Overall Objectives

The objectives are to develop abilities

- To process information using a variety of media
- To use appropriate phrases for performing language functions
- To edit, select and present information in a format / perspective
- To listen and reduce information to a point form
- To read and to expand from points to paragraph
- To predict, comprehend, infer and synthesize information
- To question, probe and arrive at information through discussions, dialogues and interviews
- To answer questions, choose and provide data etc.

E-101 (Theory) : 2 Credits : 2 hours week

A. Reading

The objectives are to enable the students to

- Read for information news features, articles, newspaper and text
- Read intensively a collection of short stories given in a complied text (See for the text and the lessons selected from it below)

Book prescribed

- L.A.Hill (1970), **Contemporary Short Stories.** Chennai: Oxford University Press. The following stories have been selected for use on the course.

- The happy Prince
- A Horseman in the sky
- The Wolves of Cernogratz
- The half Mile
- The Mark of Vishnu
- The Halfyard Ham
- Locomation 38
- The Ghost Ship
- Uneasy Homecoming
- The Trust Property

B. Writing

The objectives are to enable the students to

- Form words properly using prefixes / suffixes (See list 4 in the Appendix)
- Use phrasal verbs (See list 3 in the Appendix)
- Use appropriate and related registers (See list 5 in the Appendix)
- Writing paragraphs, developing points / ideas
- Writing resume, job applications, letters of invitations (inviting / accepting/ declining), letters of complaint to civil authorities
- Answering questions based on the prescribed text: **Contemporary Short Stories**

Books Recommended

- Champa Tickoo and Jaya Sasikumar (2000). **Writing with a Purpose**, Chennai, OUP
- David Jolly (1988). **Writing Tasks**: An authentic task approach to individual writing needs.

E-102 (Practicals) : 2 hours week

C. Listening

The objectives are to enable the students to listen and understand

- Short lecture, descriptions, and narrations, rapid talks, passages read aloud and/or dictated and identify Language functions (See list 2 in the Appendix)
- Conversions based on familiar situations, and
- Note Making

Books Recommended

- Spoken English-D Sasikumar and PV Dhamija (with Audio Cassette) Tata Mcgraw Hill

D. Speaking

The objectives are to enable the students to

- Use greeting and formula in everyday conversations.
- Use various notions and function of everyday usage (See list 2 in the Appendix)
- Use grammatically correct and appropriately structures to organize thought (See list 1 Containing Syntactic items in the Appendix)
- Give short formal and informal talks, speeches

Books Recommended

- Grant Taylor. English Conversation Practice. New Delhi: Tata McGraw Hill
- R.P.Bhatnagar and R.T.Bell (1999) **Communication in English**, Hyderabad: Orient Longman

Testing: Division of Marks

E – 101 (Theory)

Q.1	Answer in Brief. (In not more than three sentences)	14 marks
Q.2	Short Notes (Any Two)	06 marks
Q.3	Multiple Choice	
	• Content based questions	05 marks
	• Expressions / Idioms / Difficult words	05 marks
	• Connectives	04 marks
	• Concord	04 marks
Q.4	**(A)** Comprehension (Unseen Passage) OR Paragraph Writing	08 marks
	(B) Letter Writing	08 marks
	• Formal Letters- Letters of complaint, Invitation- Extending/declining, Resume building/ Applications	
Q.5	**(A)** Phrasal Verbs	04 marks
	(B) Registers	02 marks

E – 102 (Practical)

• Listening	15 marks
• Dictation	05 marks
• Reading A loud	10 marks
• Viva + Journal	10 + 5 marks
• Note Making	10 marks
• Vocabulary	05 marks
	60 marks (60/2 = 30)

SARDAR PATEL UNIVERSITY

S.Y. B. Sc.- Medical Technology in Radiotherapy Technology

Curriculum

Sr. No.	Subject	Course No.	Teaching Hours
Major Subjects			
1	**FUNDAMENTAL PHYSICS**	BMT-RTT-201	60
2	**Radiation Biology**	BMT-RTT-202	60
3	**Principles of Radiotherapy**	BMT-RTT-203	60
4	**Practicals –Radiotherapy Technology**	BMT-RTT-204-(P)	90
		Major Subjects- Teaching hours	**270**
Subsidiary subjects			
5	Bio-ethics	BMT-S-201	20
6	Computer Organization & PC Software	BMT-S-202	25
7	Practical - Computer Organization & PC Software	BMT-S-203-(P)	25
		Subsidiary subjects- Teaching hours	**70**
		Teaching hours-Theory/Practicals	340
		Hospital Posting	540
		Total Teaching hours	**880**

S.Y.B.Sc.- Medical Technology
(in Radiotherapy Technology)

Table 1. Subjects, Credits and Scheme of Examination

Sr. No.	Subject	Course No.	No. Credits per week	Duration of Uni. Exam	External Marks	Internal Marks	Total	Grand Total
1	Fundamental of Physics	BMT-RTT-201	2	3	80	20	100	100
2	Radiation Physics	BMT-RTT-202	2	3	80	20	100	100
3	Principles of Radiotherapy	BMT-RTT-203	2	3	80	20	100	100
4	Practical – Radiotherapy Technology	BMT-RTT-204-(P)	2	1 day	80	20	100	100
5	Bioethics	BMT-S-201	1	2	40	10	50	50
	No practical Exam	-	-	-	-	-	-	
6	Computer Organization & PC Software	BMT-S-202	1	2	40	10	50	80
	Practical- Computer Organization & PC Software	BMT-S--203(P)	1	-	25	5	30	
							Total	**430**

Syllabus for Second year
B.Sc- Medical Technology in RadiotherapyTechnology

Course code: BMT-RTT- 201

FUNDAMENTAL PHYSICS :

Applied Mathematics:

1. Elementary use of algebraic symbols and signs, Fractions & Decimals.
2. Indices: Power of 10 simple equations, Logarithms.
3. Fundamentals of Trigonometry
4. Fundamentals of Geometry, Application of similar Triangles in finding focal spot.
5. Divergence from a point source.
6. Graphical representation of a data – linear & semi log plot,
7. Measurement of angles. Geometry of triangles,
8. Proportion, Inverse square law, Elementary explanation of exponential law.
9. Basic statistics : Distribution, differentiation, Integration, Vector Algebra.

Electromagnetic Radiation, Atomic Structure and Radioactivity:

1. Electromagnetic waves and their properties, Inverse square law
2. The quantum theory of Radiation (Planck's concept of quanta, Photon and its characteristic properties),
3. The electromagnetic spectrum, Fluorescence and Phosphorescence, Photoelectric emission, Photocell, Intensity and quality of electromagnetic radiation.
4. The structure of the Atom: Nucleus, Atomic number (Z), Mass number (A), Ionization & Excitation, Isotopes, And the Periodic Table.
5. Radioactivity, Properties of alpha, beta, gamma radiation, Radioactive transformation process (Radioactive displacement law), Radioactive decay (Radioactive disintegration law), decay constant, half-life, Units of Radioactivity
6. Radioactive nuclides in medicine
7. Radioactive disintegration process and radiation emission and daughter products.
8. Properties of radium and its daughter elements.
9. Radioactive equilibrium.
10. Production of artificial radioactive isotopes.
11. The principles of the nuclear reactor.
12. The curie and specific gamma ray emission.

Fundamental of Electricity (Basic of Electronics):

- Electric charges and units of electric charge, Coulombs law, Electric induction, electric potential & potential difference, Capacitance and Capacitors, Resistance.
- Conductors, Insulators and Semiconductors, Electric current, Ohm's law & Kirchoff's law, circuit laws (Combination of Potential difference in series and parallel, meters, Electrical energy & Power, heating effect of a current.
- The magnetic effects of an electric current (Electromagnetism), electromagnetic induction, Mutual induction and Self-induction.
- Alternating current, The A.C. transformer theory, and construction, Types of transformers its practical aspects, Transformer losses and regulation and rating, Types of transformers used in X-ray equipment.
- Thermionic emission. The vacuum diode, Variation of anode current with anode voltage and filament temperature in the vacuum diode, the effect of gas in the diode, the thermionic gas diode. Meaning of rectification (full wave & half wave rectification).
- Principles of semiconductors, p-n junction diode, High voltage rectifier circuits (selfrectifying circuit, Half-wave pulsating voltage circuit, Full-wave pulsating voltage circuits, shock proofing. Advantages of semiconductor devices over thermionic devices

X-rays (Basics of Radiation Physics):

- Conductivity of electricity through gases at low pressure, Cathode rays – production and properties. Sources of electrons (Discharge through gases, Thermionic emission and photoelectric emission), Discovery of an electron, Concept of electron volt.
- Discovery of X-rays, Production & properties of X-rays. Bremstralung, Factors influencing the intensity and quality of X-rays, Construction and working of Modern Xray tube (fixed anode and rotatory anode tubes), The physics of X-spectra i.e., the spectrum of radiation from an X-ray tube (Continuous spectrum and line or characteristic spectrum), Factors upon which the X-ray emission depends, Soft and Hard X-rays, Distribution of X-rays in space, The diagnostic X-ray tubes (inserts and shields), filamentdesign, anode design (fixed and rotatory), methods of cooling, Basic X-ray Circuit.Linear accelerator – Transmission Type Target.
- Fine focus and large focus. Importance of Focal spot. Lione focus principle and shape of the anode surface, Anode heal effect.
- Basic interactions between X-rays and matter: Coherent scattering, Photoelectric effect,Compton scattering, Pair production and Photodisintegration, Attenuation and absorption,Reduction in intensity due to absorption and attenuation and the inverse square law(Exponential formula), Filtration, Attenuation coefficients and half value layer. Energy absorbed from X-rays, Factors affecting transmission of a homogenous beam through an object (geometry, thickness, wavelength of beam, composition of an object), Transmission of a heterogeneous X-rays beam,
- Transmission of X-rays through body tissues: Relative amount of scattered radiation in an X-ray beam during its passage through a patient. The practical aspects of X-ray absorption and transmission in body tissues. The physics of the radiograph. The basic of the X-ray measurements.

- The units of Exposure (Roentgen) and Absorbed dose (gray) and their simple principles of dosimeters. The fluorescent effect of X-rays. The photographic film as a dosimeter, X-ray quality specification and measurement, Kilo voltage peak, half value thickness. Routine methods of checking quality. Definition of KERMA.
- Dosimeteric quantities (mean energy imparted, the specific energy, exposure and exposure rate, absorbed dose and absorbed dose rate, concept of karma,
- Protection quantities (dose equivalent and effective dose equivalent) and Definition of Rem & Sievert. Linear Energy Transfer (LET) - Low & High LET Radiation.

Course code: BMT-RTT- 202

Radiation Physics

Radiation Biology:

- Physics and chemistry of Radiation absorption
  - Therapeutic ratio, Radiation biology continuum, Tissue Heterogenity
  - Interaction of Ionising radiation with biologic materials.
  - Biochemical repair of the DNA Damage : BER / NER / SSB / Mismatch repair
  - Cytogenetic effects of radition
  - Cell survival curves and cell survival theory
  - Cellular repair : Sublethal damage, Potentially lethal damage
  - Ionising radition and cell cycle
  - Densely Ionising radition : Linear energy transfer, Relative biologic effectiveness
  - Oxygen Effect
  - Radiosensitisers, Radioprotectors and bioreductive drugs
  - Growth kinetics of normal tissues and Tumors : Growth fraction, Volume doubling time, cell loss factor
  - Early and late effects of normal tissus
  - Time dose fractionation relationships: NSD Model, LQ model
  - Radiation protection

Applied Anatomy and pathology:

Tumours, Definition, formation of tumours, characteristics of benign and malignant tumours, spread of tumours. Types of benign tumours, Types of malignant tumours:

- Epidemiology
- Aetiology
- Carcinogensis
- Characteristic of neoplasia (Natural History)
- Histological classification of neoplasia
- Spread of neoplasia
- Staging and grading systems

Pathology of Common Malignant Disease of Individual sites (In brief):

- Skin cancer
- Head and neck tumours
- Brain tumours
- GI tract tumors (oesophagus, rectum, and anus)
- Lung cancer
- Lymphomas
- Breast cancer
- Gynecological cancers
- Genitourinary Cancers
- Pediatric Tumours and others

Course code: BMT-RTT- 203

Principles of Radiotherapy

Basics of Oncology : Multidisciplinary approach to the management of the Cancer Patient: - Radiation Therapy, Surgery and Chemotherapy.

- Development of neoplasia within the patient
- Clinical signs and symptoms of neoplasia,
- Physical effects of neoplasia on the body
- Staging of Cancer (TNM classification).
- External Beam Therapy & Brachytherapy: Rationale, Preparation of
- Patient, Techniques including 3D-CRT, IMRT, VMAT, 4-D Imaging, Stereotectic, radio-surgery
- Dose, Volume, Time, Fractionation, Simulation, Reduplication of
- Treatment, Results, Survival.
- Altered Fractionation Schedules
- Acute and Late Effects of Radiation Therapy
- Care & assistance during Sedation / Anesthesia
- Physical effects of radiotherapy, chemotherapy, surgery and other treatments, in combination and alone on the body.
- Prevention and treatment of the acute side effects of radiotherapy and associated treatments
- Complications associated with cancer and its treatment, Causes of death

SARDAR PATEL UNIVERSITY

S.Y.B.Sc. - Medical Technology

Bioethics

(Common to all specializations of Medical Technology)

Course Code: BMT-S-201

Goals

1. Provide a sense of responsibility and professionalism when interacting with patients, peers, fellow employees, and other health care providers.
2. Communicate effectively and professionally.
3. Instill the importance of honesty and professionalism in the workplace.

By the end of this module, the student should be able to:

1. Exhibit behavior consistent with the ethical practice of Medical Technologist.
2. Maintain confidentiality of all patients and test results.
3. Demonstrate an appreciation for the special knowledge and talent of other members of the health care team.
4. Explain the transmission of the AIDS/HIV and state how the virus affects the Immune system.

Methods of Presentation

Lecture, Discussion, Audio-Visual materials

Duration : 20 hours

COURSE CONTENT

1. Values of life (Philosophy)/in clinical practice & Definition of medical ethics. **1 hour**
2. History of Medical Ethics: **2 hour**
   - ◆ Indian perspectives : Charaka,Susruta
   - ◆ The Hippocratic Oath
   - ◆ Declaration of Helsinki
   - ◆ WHO Declaration of Geneva
   - ◆ International code of Medical Ethics
3. Ethical problems of life **2 hour**
   - Right to life, prenatal screening / sex selection
   - Abortion,feticide
   - Assisted reproductive technologies
   - Genetic testing
   - Genetic engineering, cloning
   - Care of terminally ill
   - Death and dying
   - Euthanasia

4. Family and society in medical ethics : **2 hour**
   - Children : Age to consent for treatment parent- Child – clinician conflict
   - Mental Disorders and disabilities
   - HIV / AIDs

5. Etiquette and mannerism **2 hour**
6. Good communication skill **2 hour**
   - Truthfulness, Building trust, Honesty with patients
   - Communication with colleagues, seniors and subordinates

7. Confidentiality **1 hour**
   - Malpractice, negligence
   - Medical ethics and law

8. Code of ethics: (Please refer Annexure for elaborations)
   - Duties to Patients **1 hour**
   - Duties to Colleagues and other Professionals: **1 hour**
   - Duties to Yourself: **1 hour**
   - Duties to Society: **1 hour**
   - Duties to your Profession: **1 hour**
   - Specific issues: **1 hour**

Internal Evaluation:
(Problem based questions, Short notes, MCQ, Viva) **2 hour**

EVALUATION : TOTAL: 50 marks

Internal evaluation: 10 marks
External Exam (One paper of 2 hours): 40 marks
- Problem oriented question
- Short notes
- Short answer questions

There will no Practical Exam for this course.

SUGGESTED BOOKS/LITERATURE:

1. MEDICAL ETHICS, by C.M.Francis, Jaypee Brothers
2. Current Problems in Medical ethics, by George V. Lobo, St. Paul's Society, Allahabad.
3. Ethics for Doctors, Nurses & Patients by H.P. Dunn, St. Pauls Bandar, Mumbai.

ANNEXURE

CODE OF ETHICS: Medical Technology

Code of Ethics, under different categories, has been elaborated hereunder as applied to the profession of Medical Technician/Technologist. It is however suggested that these elaborations are only indicative and not exclusive. There could be many more situations/ events, depending on the nature of work involved in different types of specialization of Medical Technology; which would also be deemed to be a part of the curriculum as and when identified.

1. Code of Ethics: Duties to Patients:
    - accountability for the quality and integrity of the services they provide.
    - respect patients' privacy and dignity
    - treat patients politely and with consideration
    - apply the principle of informed consent as an on-going process
    - recognize the rights of patients to maintain confidentiality of information in the course of professional duties, unless they agree to disclosure or the law demands
    - patients' permission before sharing information with their spouses, partners or relatives.
    - always seek to give priority to the service to be provided to patients solely on the basis of clinical need.

- Code of Ethics: Duties to Colleagues and other Professionals:
    - Should not make a patient doubt a colleagues' knowledge or skills by making comments about them that cannot be fully justified.
    - Work with and respect other health care professionals in pursuit of the best health care possible for all patients.
    - Should not discriminate against colleagues, including professionals applying for posts, because of views of their race, culture, ethnicity, social status, lifestyle, perceived economic worth, age, gender, disability, communicable disease status, sexual orientation, religious or spiritual beliefs, or any condition of vulnerability.
    - Refrain from speaking ill of colleagues or other health care professionals.
    - Actively strive to establish cooperative and respectful working relationships with other health care professionals with the primary objective of ensuring a high standard of care for the patients they serve.
    - Share their knowledge with colleagues and promote learning.

- Code of Ethics: Duties to Yourself :
    - Maintain and improve the standard of your performance by keeping your professional knowledge and skills up to date throughout your working life. In particular, regularly take part in educational activities that relate to medical laboratory science.
    - Acknowledge the limits of your professional knowledge and competence. Do not pretend to know everything.
    - Use equipment and laboratory ware correctly and with care.
    - Refrain from engaging in activities that may affect your health and lead to impairment.

- Aware laws and regulations governing medical laboratory technology and shall apply them in the practice of your profession.
- Not wasting reagents and other laboratory supplies unnecessarily.

Never taking anything from place of work that does not belong to you

- Code of Ethics: Duties to Society
    - Refrain from providing a service that is not needed, whether it provides financial gain or not.
    - Refrain from unnecessary wastage, and from participating in improper financial arrangements, especially those that escalate costs and disadvantage individuals or institutions unfairly.
    - Dedicate to serve the healthcare needs of the public

- Code of Ethics: Duties to your Profession
    - Uphold and maintain the dignity and respect of medical laboratory profession and strive to maintain a reputation of honesty, integrity and reliability.
    - Contribute to the advancement of the profession by improving the body of knowledge, adopting scientific advances that benefit the patient, maintaining high standards of practice and education, and seeking fair socioeconomic working conditions for members of the profession.

- Specific issues: Any other issues specific to a particular specialization of Medical Technology profession not categorized in any of the above.

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SARDAR PATEL UNIVERSITY

S.Y.B.Sc. - Medical Technology

Computer Organization and PC Software

(Common to all specializations of Medical Technology)

Course Code: BMT-S-202

Objective:

At the end of this course, a student would be able to :

- identify various components of computer hardware and
- use some software in order to manage data related to the profession.

Teaching hours: Theory: 25 hours
Practicals: 25 hours

Curriculum:

SECTION A

Unit 1. Computer Organization -I

Generations of a computer, types of a computer, some important terms: hardware, software, program, operating system, interpreter, compiler, assembler, high level languages, bits and bytes.

Introduction to number systems

Unit 2. Computer Organization -II

Processors, CPU organization, primary memory, memory addresses, secondary memory, memory hierarchies, magnetic disks, CDROMs, DVDs, input/output devices: keyboards, monitors, mice, printers, modems

The concept of character codes

SECTION B

Unit 1: PC Software- I

Introduction to spreadsheets, the concept of cells and cell addresses, formulas, some important functions, introduction to charts

Introduction, features and applications of a DBMS

Database objects

Tables – creation, modification, deletion

Working with data – insertion, modification, finding, sorting, grouping, viewing and sharing data

Unit 2. PC Software- II

Forms – creation of forms; modification, viewing and validating data using forms, subforms

Reports – creation, modification, opening, viewing

Creating mailing labels

REFERENCE BOOKS:

1. Tanenbaum A. S., Structured Computer Organization, 4th Edition, Prentice-Hall of India Pvt. Ltd., 2002.
2. Elmasri, Navathe, Somyajulu, Gupta, Fundamentals of Database Systems, Pearson Education, 2006.
3. Progue, Irwin, Roardon, Microsoft Office Access 2007 Bible, Wiley Publishing Inc., 2007.
4. Taxali R. K., P C Software for Windows 98 Made Simple, Tata McGraw-Hill, 2001.
5. Hall D. V., Microprocessors and Interfacing, McGraw-Hill Book Company, 1986.
6. Desai Bipin C., An introduction to Database Systems, 7th Edition, Pearson Education Asia, 2001.

SARDAR PATEL UNIVERSITY
T.Y. B. Sc.- Medical Technology
in
Radiotherapy Technology

Curriculum

Sr. No.	Subject	Course No.	Teaching Hours
Main Subjects			
1	RADIATION PHYSICS	BMT-RTT-301	60
2	External Beam Therapy	BMT-RTT-302	60
3	PRINCIPLES AND PRACTICE OF RADIOTHERAPY	BMT-RTT-303	60
4	Practical – Radiotherapy Technology	BMT-RTT-304-P	90
		Main Subjects- Teaching hours	270
		Hospital Posting	750
		Total Hours	1020

R. BMT.RTT.1: *Internship*

With reference of Rule No. R. BMT. 2 (First Year B.Sc. - Medical Technology); the course of B.Sc. - Medical Technology in *Radiotherapy Technology* shall be having a compulsory Internship during the fourth year.

(a) Internship shall be commenced only after the candidate is declared pass in all the subjects & practical of T.Y.B.Sc. and/or previous year's A.T.K.T., if any.

(b) **The Internship shall be commenced soon after the announcement of result of T.Y.B.Sc.- Medical Technology (*Radiotherapy Technology*) from a date as notified by the Principal of the affiliated Institute and would continue for continuous twelve months; with one leave per month permissible.**

(c) The degree of B.Sc. will be awarded by Sardar Patel University only on successful completion of Internship.

Subjects, code and Scheme of Examination

T.Y. B. Sc.- Medical Technology
in
Radiotherapy Technology

Sr. No.	Subject	Course code No	No. Credits per week	Duration of Uni. Exam	External Marks	Internal Marks	Total
1	Radiation Physics	BMT-RTT-301	2	3 hrs	80	20	100
2	External Beam Therapy	BMT-RTT-302	2	3 hrs	80	20	100
3	Principles and Practice of Radiotherapy	BMT-RTT-303	2	3 hrs	80	20	100
4	Practical Radiotherapy Technology	BMT-RTT-304-(P)	2	1 day	160	40	200
	Grand total				**400**	**100**	**500**

Syllabus for Third year
B.Sc- Medical Technology in Radiotherapy Technology

PAPER I : RADIATION PHYSICS

Course Code No. BMT-RTT-301

RADIATION PHYSICS

Principles of Radiation detection and measurement:

- Gas-filled detectors (ion chambers, proportional counters and Geiger Muller counters) scintillation detectors, thermo-luminescent dosimeters (TLD).
- Reasons for choice of airionization.
- Roentgen and Rad.
- Simple principles of dosimeters.
- Thimble chamber –electronic equilibrium and dose buildup.
- Secondary Dosimeter.
- Elementary principles of Scintillation detectors, Thermoluminisence dosimeters, Semi conductor devices.

Biological Effects of Radiation:

- Chemical effects of Radiation, radiolysis of water, production of free radicals, radical's reactions, G-valve.
- Effects - Stochastic and non-stochastic effects, chromosome aberrations and mutations.
- Radiation effects on whole body (early effects and late effects).
- Concept of doubling dose.

Radiation Protection:

- Philosophy of radiation protection – historical development, Maximum permissible exposure concept; Annual dose equivalent limits (ADEL) ALARA concept; international recommendations and current code of practice.
- Annual dose limits for public & Radiation workers. Protection of Public and Radiation workers.
- Protective materials: Concrete, lead, lead – impregnated substances, building materials, concept of barriers, lead equivalents and variations with quality.
- Teletherapy Bunker (Room) Design (Telecobalt, Linear Accelerator).
- Radiation protection features taking into account the work load, use factor, occupancy factor.
- Wall features with respect to primary beam and secondary radiation.
- Ceiling thickness depending on occupancy on the floor above Teletherapy room.
- Positioning of Air
- conditioning outlets.
- Design of Brachytherapy room: difference between public area and restricted areas.
- Radioactive source movement, control and maintenance of records. Protection instruments and personnel and area monitoring. (Survey meters, area monitors, pocket dosimeters and contamination monitors).

Production of X- and Gamma Ray Beams for Therapeutic purposes:

- Tubes and high-tension circuits for the production of X-ray from 5 to 500 curie Kv. Insulation and cooling problems in Radiotherapy tubes.
- Mains voltage compensation. Control of tube voltage.
- The control panel and control. The filament circuit.
- Timers safety devices and interlocks,
- Basic principles of mega voltage X-ray Machines.
- Distribution of Radiation around the target.
- Gamma ray beam unit.

Interaction of X and Gamma Rays with Matter:

- Photoelectric absorption; Compton scattering; pair production. Dependence on the nature and atomic number of the absorber and on the radiation energy.
- Range of secondary electron and its practical importance.
- Principles of filtration, protection and beam definition.
- Filters, beam – flattening devices, diaphragms and applicators.

Measurement of X and Gamma Rays:

- The roentgen and the rad,
- Quality. Half value thickness and its measurement,
- Methods of measurement; ionization; photographic; scintillation; calorimetric; thermoluminescent, their relative advantages.
- Ionization dosimeters; dose – rate, integrating and capacitor types.
- The Geiger – Muller counter.
- Scintillation counters and dosimeters.

Practical Dosage Measurements and Calculation:

- Initial calibration. Site of focal spot or source; alignment of applicator or diaphragm turntable and of the applicator of diaphragm.
- Variation of dose rate across the beam in air.
- Phantoms and phantom materials. Bolus materials.
- Air, surface and depth doses; factors affecting them.
- Calculation of treatment times.
- Isodose curves.
- The effect of focal spot or surface source site; penumbra.
- Energy absorption in the body tissues and its effects on depth dose.

Protection:

- Protective materials in common use,
- Room and machine radiation – protection in X- and Gamma – ray beam installations,
- Care and custody of small sealed radioactive sources (for example radium, caesium-137, Strontium 90).
- Precautions to be taken in the use of dispensing of radioactive solutions.
- Personnel-monitoring methods. Department survey. Film badges, capacitor chambers and survey meters. Geiger-Muller detector.
- Relevant protection recommendations and current code of practice

Technical aspects of X and Gamma Ray Therapy:

- ◆ Tumour location and verification, principles of simulators,
- ◆ Field combinations and treatment planning,
- ◆ Beam direction devices,
- ◆ Compensating filters (for example wedges)
- ◆ Physical principles of moving field and grid therapy,

- ◆ Special aspects of Radiotherapy using mega voltage radiations, including electron beam therapy.

Clinical Dosimetry for Photon and Electron Beams

- Dose distribution along beam axis
- Dose distribution off axis
- Variation of dose rate with distance and collimator settings
- Manual calculation of treatment times
- Beam modifiers (bolus, wedge, compensators)
- Computer dose calculations
- Definition of volumes and their significance
- Single, parallel and multi-field technique
- Effect of change of energy, beam direction, beam collimation, irradiation
- Geometry
- Calculated and applied doses and beams against professional knowledge

PAPER II: EXTERNAL BEAM THERAPY

Course Code No. BMT-RTT-302

Radiation equipment

- Principles and functioning of low energy x-rays
- Principles and functioning of Tele-cobalt machines
- Principles and functioning of linear accelerators

Dose delivery to the patient

- Immobilisation of patient
- Interpretation of the treatment prescription and plan
- Setting up of the prescribed beam parameters and check against reference marks
- Preparation, fixation and care of in vivo dosimeters (if available)
- Registration of the delivered beam parameters on a daily basis
- Documentation of portal verification and results of in vivo dosimetry
- Surveying the patient during the treatment procedure
-

Special techniques

- Total body irradiation
- Hemi-body irradiation
- Conformal Beam Radiation Therapy
- Intensity Modulated Radiation Therapy
- Stereo tactic radiotherapy
- Intra-operative radiotherapy
- Image guided radiotherapy
- Tomotherapy

Technical Aspects of the use of Radioactive Sources in the Body:

- Construction, measurement, testing and properties of small sealed radioactive sources,
- Dose calculations involving the inverse square law,
- Physical principles of moulds and implants,
- Superficial beta ray therapy. Measurement beta ray dose.
- Clinical beta-ray appliances.
- Physical principles of the clinical use of unsealed radioactive sources.

Construction of Cobalt –60 Teletherapy Units:

- Types of source drawers (cylindrical/ Rotating Drum)
- Isocentric Setup and design of the Unit
- Collimation: Primary, secondary & tertiary
- Laser beam, Beam direction devices, back pointer, pin & arc principles.
- Beam modifying devices: Wedge Filters, Tissue compensators.
- Blocks, Breast cone.
- Radiation safety aspect
- Understanding why strength of Teletherapy source at a given distance, definition of RHM / RMM

Construction of Linear Accelerator

- Isocentric Setup and design of the Unit
- Collimation: Primary, secondary & tertiary, Symmetric/Asymmetric.
- RF production, Accelerator Tube, Bending Magnets
- Targets of X-ray and Electron beam production
- Radiation safety aspect: Ionization chamber, quality assurance checks.
- Definition of TMR, TPR with respect to high energy x-ray beams
- Concept of monitoring units instead of timer as in Telecobalt
- Measurement of out put factor and it calibration
- Multileaf collimator: 3D conformal /
- Sterotactic Radiation therapy & Surgery/IMRT.
- Portal imaging/IGRT.

BRACHYTHERAPY

- Knowledge of use of radionuclides and after loading equipment (low, medium, high and pulsed dose rate)
- Preparation of the source holders (applicators, catheters)
- Preparation of the patient including radiographs for dosimetry and preparation of the moulds
- Monitoring of the patient before, during and after treatment
- Accurate and complete recording of documentation of all the parameters relevant to the treatment
- Aftercare of the used radioactive sources with emphasis on safety
- Clinical Dosimetry for Brachytherapy

OTHER TREATMENT MODALITIES

- Gene therapy
- Photodynamic therapy
- Unsealed radioactive nuclides
- Radiation enhancers - hypothermia, radiosensitisers

LOCALISATION AND SIMULATION

- Principles and functioning of simulators
- Patient positioning, knowledge of fixation techniques
- Knowledge of simulation techniques for a broad range of indications and use of contrast media
- Contour taking techniques and reference marking
- Use of CT and MR images
- Data recording and transfer

QUALITY ASSURANCE - METHODS

- Equipment and auxiliary materials (to include care of)
- Treatment procedures - accuracy, reproducibility and verification
- Data handling
- Monitoring and evaluation of QA procedures
- Calibration of instruments
- Emergency procedures

MOULD ROOM TECHNIQUES

9. Immobilization Devices & techniques for patients and their preperation
10. Beam shaping devices (block, compensators etc.) and their preperation
11. Bolus material and their preparation
12. Moulds for Brachytherapy

BASIC RADIAOLOGIC IMAGING TECHNIQUES

- Radio logic Film – types, exposure, development
- Production of Radiographic Image using simulator, CT Scanner or conventional x-ray machines
- Improving Image Quality
- Fluoroscopy
- Dark Room Procedures

PAPER III: PRINCIPLES AND PRACTICE OF RADIO THERAPY

Course Code No. BMT-RTT-303

Section: A

Diagnostic Workup and Treatment principles and Radiotherapy Techniques.

A Radiotherapeutic Management of the following Cancer and occasional Benign Diseases

- Skin cancer
- Head and neck tumours
- Brain tumours
- GI tract tumors (oesophagus, rectum, anus)
- Lung cancer
- Lymphomas
- Breast cancer
- Gynecological cancers
- Prostate cancer
- Bladder cancer
- Seminoma
- Pediatric Malignancies

B. Clinical applications of techniques of Radiotherapy:
Teletherapy techniques

- use of conventional fields SSD, SAD , Rotation
- use of complex treatment plans – quality assurances, verification etc
- use of radiation sensitizers & radiation protectors and their importance with respect to timing of the radiotherapy exposure
- patient positioning, immobilization, daily reproduction errors and corrections

Combination of Teletherapy and Brachytherapy
Post & Pre operative Radiotherapy

Special Techniques : 3D Conformal RT, IMRT , SRS/SRT -

- Patient setup, Immobilization
- Simulation / CT Simulation and Verification with quality assurance checks
- Use of Immobilization devices & Frames – careful handling
- Daily reproduction and quality assurances
- Port filming and isocentre verification

C. Clinical applications of Special teletherapy techniques.

- Total body irradiation
- Hemi-body irradiation
- Conformal Beam Radiation Therapy
- Intensity Modulated Radiation Therapy
- Stereo tactic radiotherapy
- Intra-operative radiotherapy
- Image guided radiotherapy
- Tomotherapy

Section: B

2. PSYCHOSOCIAL MANAGEMENT

- Procedures for adaptation and rehabilitation of the person with cancer- Body Mechanics, Moving & Transferring Patients- Patients with Spinal cord injury, Fractured Extremity, Agitated & Confused patients
- Pediatric , Geriatric Patients.
- Patient with Ostomy, Gastric tube, Tracheotomy.
- Assisting with Drug and Contrast Administration,
- Counseling skills
- Role of effective communication
- Complementary therapies
- Stress and stress management
- Hospice and terminally ill

3. QUALITATIVE AND QUANTITATIVE METHODS OF RESEARCH

- Basic statistics, Interpretation of Research Publications
- Report writing

4. MEDICAL, LEGAL AND ETHICAL ASPECTS

- Getting the consent of the patient
- Confidentiality, Data handling and information control
- Non-discriminatory practice
- The professional role of the Radiotherapy technologists

5. HEALTH AND SAFETY

- Waste management and source Disposal
- Legislation: National and international
- Health and safety at work
- Emergency procedures
- Cardiopulmonary resuscitation procedures (CPR)
- Self Help Groups & NGO`s and other organizations funding agencies

RECENT ADVANCES IN RADIOTHERAPY.

- 3D CRT, IMRT, Particle Beam Therapy, IGRT, Radiation Sensitizer and Protectors, Cyber Knife, Tomotherapy, Gamma Knife

PRACTICAL: RADIOTHERAPY TECHNOLOGY

Course Code No. BMT-RTT-304 (P)

RADIOTHERAPY

1. Cobalt-60 machine: various parts, its working its Accessories, Beam Direction devices and control console. **(E)**
2. Linear Accelerator: Various parts, it's working its Accessories, Beam Direction devices and control console. **(E)**
3. Simulation and Treatment Techniques **(E)**

Execution of Treatment as Per Doctors Prescription in radiation therapy chart

Abilty to understand the, patients disease, patients general condition, shifting the patient into treatment room & couch, patient positioning, use of immobilization devices and preparation of the same, verification and quality assurances aling

a. Cancer Oesophogus
b. Cancer Cervix
c. Cancer Breast
d. Glottic cancer
e. Nasopharyngeal cancer
f. Brochogenic cancer
g. Whole Brain
h. Cranio-Spinal Axis Irradiation (optional)
i. Irregular Field (including Mantel Field)
j. Special Techniques (Rotation/ Arc etc.)
k. Newer Techniques (optional)

4.Brachytherapy:
l. Manual after loading applicators: Various types: I/c, I/Vaginal, I/L Principles, its care, sterilization, uses, safety measures.
m. (Optional) Remote After Loading machines, - LDR / HDR: Parts, working, operation and precautions.
n. Various after loading sources for Interstitial Implantation: Physical features.
o. Preparation of Radioactive Source for Brachytherapy

5. I/c application cancer cervix. Application, simulation study of dose distribution, preparation of sources, loading of sources and treatment and care and removal and storage of sources.**(E)**

6.I/L Radiotherapy application. Application, simulation, study of dose distribution,preparation of sources, loading of sources and treatment and care and removal and storage of sources.

7. Advanced Training
a. Dynamic Wedges
b. Stereo Tactic Radiotherapy / Surgery
c. 3D CRT
d. IMRT
e. Portal Imaging Method
f. HDR Brachytherapy