

REGULATIONS & CURRICULUM OF GRADUATE PARAMEDICAL COURSE

BACHELOR OF SCIENCE IN RADIOTHERAPY TECHNOLOGY

2020



Sri Siddhartha Academy of Higher Education Deemed-to-be-University

**Established under Section 3 of the UGC Act, 1956
MHRD, GOI No. F.9-31/2006-U.3 (A) Dtd. 30th May 2008**

Agalakote, B.H. Road, Tumkur – 572107, Karnataka, India

SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(DEEMED TO BE UNIVERSITY)

Declared under Section 3 of the UGC Act, 1956, MHRD GOI No. F.9-31/2006-U.3 (A) Dated: 30/05/2008

Accredited 'A' Grade by NAAC

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No. SSAHE/ACA-S&C(AHSP)/20/2022

Date: 01/09/2022

NOTIFICATION

Sub: Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Radiotherapy Technology.

- Ref: 1). Proceedings of BOS Allied Health Sciences Programmes held on 06/04/2021
2). Proceedings of the Academic Council meeting held on 19/08/2021
3). Proceedings of the Board of Management held on 29/08/2022

In exercise of the powers vested under section 6 of 6.4 of MoA / Rules of SSAHE, the Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Radiotherapy Technology is notified herewith as per Annexure.

The above Regulations shall be applicable to the students admitted to the said course from the academic year 2020-21 onwards.

By Order,

REGISTRAR
REGISTRAR

Sri Siddhartha Academy of Higher Education
TUMKUR - 572 107, Karnataka.

To,
Dean / Principal, Sri Siddhartha Medical College & Hospital,

Copy to

- 1) Office of the Chancellor, SSAHE, for kind information,
- 2) PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE
- 3) The Director (AHSP), SSAHE
- 4) All Officers of the Academy Examination Branch / Academic Section
- 5) Guard File / Office copy.

5. Guard File / Office copy.

REVISED ORDINANCE GOVERNING REGULATIONS & CURRICULUM OF BACHELOR OF RADIOTHERAPY TECHNOLOGY - 2020

1. Eligibility for admission:

A candidate seeking admission to the BSc. RT shall have studied English as one of the principal subject during the tenure of the course and shall have passed:

1. Two year Pre-University examination or equivalent as recognized by Sri Siddhartha Academy of Higher Education with, Physics, Chemistry and Biology as subjects of study.

OR

2. Pre-Degree course from a recognized University considered as equivalent by SSAHE, (Two years after ten years of schooling) with Physics, Chemistry and Biology as subjects of study.

OR

3. Any equivalent examination recognized by the Sri Siddhartha Academy of Higher Education, Tumkur for the above purpose with Physics, Chemistry and Biology as subjects of study.

OR

4. The vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted is considered equivalent to plus TWO examinations of Government of Karnataka Pre University Course.

OR

5. Candidates with two years diploma from a recognized Government Board in RT shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates with 3 years diploma from a recognized Government Board in RT should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

Lateral entry to second year of B.Sc. RT for candidates who have passed diploma program from the Government Boards and recognized by SSAHE, fulfilling the conditions specified above under Sl. No. 5 and these students are eligible to take admission on lateral entry system only in the same subject studied at diploma level for the academic year

Note:

- a. The candidate shall have passed individually in each of the subjects.
- b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

2. Duration of the course:

Duration shall be for a period of four years including one year of Internship.

3. Medium of instruction:

The medium of instruction and examination shall be in English.

4. Scheme of examination:

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

5. Attendance:

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university in each of the subjects prescribed for that year separately in theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A candidate lacking in prescribed percentage of attendance in any subjects either in theory or practical in the first appearance will not be eligible to appear for the University Examination in that subject

6. Internal Assessment(IA):

1st Year B.Sc. RT

Theory - 20marks

Practicals - 10 marks*. [Lab work- 06 marks and Record-04 marks]

2nd & 3rd year B.Sc. RT

Theory – 20 Marks

Practicals – 20 Marks

There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests. The marks of the internal assessment must be displayed on the notice board of the respective colleges within a fortnight from the date test is held. If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

* There shall be no University Practical Examination in First year.

7. Subject and hours of teaching for Theory and Practical

The number of hours of teaching theory and practical, subject wise in first year, second year and third year are shown in Table-I, Table-II and Table-III

Main and Subsidiary subjects are common in first year for all the courses in Allied Health Science.

The number of hours for teaching theory and practical for main subjects in first, Second and Third year are shown in Table-I, II and III.

Table - I Distribution of Teaching Hours in First Year Subjects Main subjects

Sl. no	Subject	Theory No. Of Hours	Practical No. Of Hours	Total No. Of Hours
1	Human Anatomy	70	20	90
2	Physiology	70	20	90
3	Biochemistry I	70	20	90
4	Pathology I (Clinical Pathology, Haematology & Blood Banking)	70	20	90
5	Microbiology	70	20	90
	Total	350	100	450

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturday's students shall work in hospitals in the respective speciality or department chosen by them

Subsidiary Subjects

English 25Hours
 Kannada 25Hours
 Health-Care 40Hours

Clinical/Lab posting – 470 hours (Friday 9am – 1pm and 2pm - 4-30 pm Saturday 9am - 1pm)

Table – II: Distribution of Teaching Hours in Second Year Subjects

Main subjects

Sl. No	Subjects	Theory No. of Hours	Practical No. of Hours	Total No. of Hours
1	RADIOTHERAPY- PART-I A Fundamental physics:	100	-	100
2	RADIOTHERAPY- PART- I B	100	-	100
3	PRACTICE OF RADIATION THERAPY TECHNIQUES		300	300
	Total	200	300	500

Subsidiary Subjects:

Sociology - 20 Hours
 Constitution of India – 10 Hours
 Environmental Science &
 Health- 10 Hours

Table - III Distribution of Teaching Hours in Third Year Subjects

Main subjects

Sl. No	Subjects	Theory No. of Hours	Practical No. of Hours	Total No. of Hours
1	RADIOTHERAPY- PART-II A Radiation physics	150	-	150
2	RADIOTHERAPY- PART-II B	150		150
3.	RADIOTHERAPY-II		300	300
	Total	300	300	600

Subsidiary Subjects:

Ethics, Database Management – 50 Hours

Research & Biostatistics - 20 Hours

Computer application - 10 Hours

9. Schedule of Examination:

The university shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

10. Scheme of Examination:

There shall be three examinations, one each at the end of I, II and III year. The examination for both main and subsidiary subjects for all courses in Allied Health Sciences shall be common in the first year. Distribution of Subjects and marks for First Year, second year & Third year University theory and practical Examinations are shown in the Table – IV, V & VI.

First year Examination:

The University examination for 1st year shall consist of only theory examination and there shall be no University Practical Examination.

Second- & Third-year examination:

The University examination for 2nd and 3rd year shall consist of Written Examination & Practical.

Written Examinations consists of

- 05 papers in the 1ST year
- 03 papers in the 2ndYear
- 03 papers in the 3rdYear

Practical examination:

- There shall be no practical examination in the first year.
- There shall be one practical examination, at the end 2ndYear.
- There shall be one practical examination at the end of the 3rdyear.

TABLE-III

Distribution of Subjects and marks for First Year University Theory Examination

A	Main Subjects*	Written Paper		I A Theory	Total
		Duration	Marks	Marks	Marks
1	Basic Anatomy (Including Histology)	3 Hours	80	20	100
2	Physiology	3 Hours	80	20	100
3	Biochemistry	3 Hours	80	20	100
4	Pathology	3 Hours	80	20	100
5	Microbiology	3 Hours	80	20	100
Subsidiary Subject**					
1	English	3 Hours	80	20	100
2	Kannada	3 Hours	80	20	100
3	Health Care	3 Hours	80	20	100

Note: I A = Internal Assessment

*Main Subjects shall have University Examination. There shall be no University Practical Examination.

**Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

Distribution of Subjects and marks for 2ND Year University Theory Examination

A	Main Subjects*	Written Paper			Practical			Total Marks
		Duration	Marks	I A Theory Marks	Practicals	Viva Voce	I A practical Marks	
1	Radiotherapy- part- 1 A	3 Hours	80	20	-	-	-	100
2	Radiotherapy-part- I B	3 Hours	80	20	-	-	-	100
3	Radiation therapy practical part -1				40	40	20	100
Subsidiary Subject**								
1	Sociology	3 Hours	80				20	100
2	Constitution of India	3 Hours	80				20	100
3	Environmental Science &Health	3 Hours	80				20	100

Note: I A = Internal Assessment

*Main Subjects shall have University Examination. There will be University Practical Examination.

**Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

Distribution of Subjects and marks for 3RD Year University Theory Examination

A	Main Subjects*	Written Paper			Practical			Total Marks
		Duration	Marks	I A Theory Marks	Practicals	Viva Voce	I A practical Marks	
1	Radiotherapy- part- 2 A	3 Hours	80	20	-	-	-	100
2	Radiotherapy-part- 2 B	3 Hours	80	20	-	-	-	100
3	Radiation therapy practical part 2				140	40	20	200
Subsidiary Subject**								
1	Ethics, Database Management	3 Hours	80				20	100
2	Research & Biostatistics	3 Hours	80				20	100
3	Computer application	3 Hours	80				20	100

Note: I A = Internal Assessment

*Main Subjects shall have University Examination. There will be University Practical Examination.

**Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

11. Pass criteria

11.1. First year examination

a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures, 50% of marks in University Theory exam and internal assessment added together.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the Commencement of the University examination.

11.2. Second- and Third-year Examination

a. Main Subjects: A candidate is declared to have passed the examination in a subject if he/she secures 50% of the marks in Theory and 50% in practical separately. For a pass in theory, a candidate has to secure a minimum of 40% marks in the University conducted written examination, and 50% in aggregate in the University conducted written examination and internal assessment added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the university conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

12. Carry over benefit

12.1 First year examination:

A candidate who fails in any two of the five main subjects of first year shall be permitted to carry over those subjects to second year. However, he/ she must pass the carry over subjects before appearing for second year examination.

12.2. Second year examination:

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third-year examination.

13. Declaration of Class

a. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.

b. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.

c. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 60% of grand total marks prescribed will be declared to have passed the examination in Second Class.

d. A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by

him/her in the Examination.

The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank. [Please note, fraction of marks should not be rounded off clauses (a), (b) and(c)]

14. Eligibility for the award of Degree:

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams the candidate is then eligible for the award of degree

15. Distribution of Type of Questions and Marks

SUBJECTS HAVING MAXIMUM MARKS= 80 (for First year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	1	10
Short Essay	5	5
Short Notes Type	5	3
Short Answer Type	10	2
MCQ's	10	1

- | | |
|---|------------------|
| 1. Long essay- 1 Questions (answer any one) | 1x10= 10 marks |
| 2. Short essay- 7 Questions (answer any five) | 05x5= 25 marks |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks |
| 4. Short answer- 12 Questions (answer any ten) | 10x2= 20 marks |
| 5. MCQ's – 10 Questions | 10x1= 10 marks |
| | Total= 80 |

SUBJECTS HAVING MAXIMUM MARKS= 80 (for Second and Third Year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	1	10
Short Essay	5	5
Short Notes Type	5	3
Short Answer Type	10	2
MCQ's	10	1

- | | |
|---|------------------|
| 1. Long essay- 1 Questions (answer any one) | 1x10= 10 marks |
| 2. Short essay- 7 Questions (answer any five) | 05x5= 25 marks |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks |
| 4. Short answer- 12 Questions (answer any ten) | 10x2= 20 marks |
| 5. MCQ's – 10 Questions | 10x1= 10 marks |
| | Total= 80 |

SUBJECTS HAVING MAXIMUM MARKS= 80 (for Subsidiary subjects)		
Type of Questions	No. of Questions	Marks for Each Questions
Essay Type	3 (2 x 10)	10
Short Essay Type	8 (6 x 5)	05
Short Answer Type	12 (10 x 3)	03

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STUDENT LEARNING OUTCOMES ALLIED HEALTH SCIENCES PROGRAMMES

- Employ critical thinking and innovation to analyze challenges, concepts, research, and clinical outcomes and apply them to professional practice.
- Analyze, interpret, integrate and evaluate information with the ability to communicate findings in a written or oral format.
- Demonstrate a broad-based and integrative understanding of basic biological, physical, chemical, and/or psychological concepts that prepare them for careers in health science.
- Approach patient care from a cultural humility perspective that respects varied backgrounds including but not limited to: cultural, social, religious, racial, gender, and ethnic diversity of the patient and family regarding disease and their health.
- Integrate concepts from various scientific fields to meet the requirements for entry-level healthcare administrative positions or admission to professional programs in allied health fields (e.g. athletic training, physical therapy, occupational therapy, physician assistant, chiropractic, etc)

INTENDED LEARNING OUTCOMES- COMMON FOR ALL SPECIALITY

COURSE TITLE	OUTCOMES	ASSESSMENT METHODS V-Verbal W-Written P-Practical
Anatomy	<ol style="list-style-type: none"> 1. Define basic technical terminology and language associated with anatomy 2. Identify the structures of human body 3. Describe the anatomy of human body 4. Describe the structure and features of the organ systems of the human body 5. Identify the anatomical structure in the dissected specimen 	W,P,V Internal [20]+ university [80] Total marks=100
Physiology	<ol style="list-style-type: none"> 1. Describe the functional anatomy and histology of various organ systems 2. Describe the basic physiological principles involved in the normal functioning of the human body 3. Apply the physiological principles in comprehending the pathophysiology of disease and its management 	W,P,V Internal [20]+ university [80] Total marks=100
Biochemistry	<ol style="list-style-type: none"> 1. Describe chemistry & metabolism of macromolecules, vitamins and minerals 2. Correlate biochemical mechanisms to diseases 3. Discuss the importance of biochemical parameters in clinical decision making 	W,P,V Internal [20]+ university [80] Total marks=100 Practical
Microbiology	<ol style="list-style-type: none"> 1. Classify microorganisms, discuss the morphological and growth characteristics and its association with causation of disease 2. Demonstrate and interpret basic laboratory techniques used in the detection of micro organisms 3. Explain principles of antimicrobial therapy and Immunization 4. Demonstrate basic infection control practices 	W,P,V Internal [20]+ university [80] Total marks=100
Pathology	<ol style="list-style-type: none"> 1. Identify and Describe the causative agent in various disease 2. Comprehend the major signs and symptoms of the various diseases 3. Describe the pathophysiology of various disease related to anesthetic care Apply pathophysiology 4. knowledge in anesthetic care 5. To Analyze the patient pre-operative fit for undergoing procedure 	W,P,V Internal [20]+ university [80] Total marks=100

LEARNING OUTCOMES OF RADIOTHERAPY TECHNOLOGY

COURSE TITLE		OUTCOMES	ASSESSMENT METHODS V-Verbal,W-Written,P-Practical
RADIOTHERAPY- PART-I A Fundamental physics:		<ol style="list-style-type: none"> To have knowledge about Fundamentals of physics Electromagnetic Radiation, Atomic Structure and Radioactivity: To know X-rays (Basics of Radiation Physics): 	Internal [20] University [80] Total marks=100
RADIOTHERAPYPART- I B		<ol style="list-style-type: none"> Radiation and its importance Cell Survival curves Oxygen Effect and reoxygenation Radiation Protection 	Internal [20] University [80] Total marks=100
RADIATION THERAPY TECHNIQUES PRACTICAL –Part 1		<ol style="list-style-type: none"> RADIATION BIOLOGY Tumours, Definition, formation of tumours, characteristics of benign and malignant tumours,spread of tumours. Types of benign tumours, Types of malignant tumours 	Internal [20] P40 + v40[80] Total marks=100
RADIOTHERAPYPART-II A Radiation physics		<ol style="list-style-type: none"> Principles of Radiation detection and measurement: Biological Effects of Radiation: Philosophy of radiation protection-historical development 	Internal [20] University [80] Total marks=100
RADIOTHERAPYPART-II B		<ol style="list-style-type: none"> Radiotherapeutic Management of the following Cancer & occasional Benign Diseases Clinical applications of techniques of Radiotherapy: 	Internal [20] University [80] Total marks=100
RADIOTHERAPY	Elective :1 Radiotherapy -I	<ol style="list-style-type: none"> Procedures for adaptation and rehabilitation of the person with cancer-Body Mechanics, 	Internal [20] P=140 V=40 Total P+V=200
	Elective :2 Radiotherapy-II	<ol style="list-style-type: none"> Moving &Transferring Patients with Spinal cord injury, Fractured Extremity, Agitated & Confused patients 	

I YEAR B.Sc. RT

ANATOMY

Theory: 70hrs

Practicals: 20hrs

Chapter 1: Introduction:

Theory:

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

★ **Practical:**

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

Chapter 2: Connective tissue:

Theory:

- ★ Cartilage – types with example & histology theory
- ★ 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
- ★ Histology of compact bone (TS & LS)
- ★ Histology of skeletal (TS & LS) & cardiac muscle
- ★ Demo of all bones showing parts, radiographs of normal bones & joints
- ★ Demonstration of important muscles of the body

Chapter 3: Cardiovascular system:

Theory:

- Heart-size, location, chambers, exterior & interior, pericardium
- 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
- Inferior vena cava, 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 & vein, medium sized artery & vein
- Histology of lymph node, spleen, tonsil & thymus
- Radiology: Normal chest radiograph showing heart shadows

Chapter 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, spleen, peritoneum & reflections

Practical:

- Demonstration of parts of GIT
- Radiographs of abdomen

Chapter 5: Respiratory system

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

Practical:

- Demonstration of parts of respiratory system.
- Normal radiographs of chest, X-ray paranasal sinuses
- Histology of lung and trachea

Chapter 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, retrogradecystogram

Chapter 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 pelvis with organs insitu
- Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary
- Radiographs of pelvis -hysterosalpingogram

Chapter 8: Endocrine glands

Theory:

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

Practical:

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

Chapter 9: Nervous system Theory:

- Neuron & Classification of CNS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology) Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei
- Blood supply of brain
- Cranial nerves
- Sympathetic trunk & names of parasympathetic ganglia

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

Chapter 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 eye ball
- Histology of cornea & retina

Chapter 11: Embryology:

Theory:

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

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practical's need not be sent to the university.

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand Total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	--	20	100	*			100

REFERENCE BOOKS:

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaurasia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied)- Saunder's & C P Prism Publishers, Bangalore
5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippincott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt.Ltd.

PHYSIOLOGY

Theory 70 hours

Practical 20 hours

1. General Physiology

Introduction to cell physiology, transport across cell membrane Homeostasis, Body Fluid compartment & measurement.

2. Blood

Introduction- composition and function of blood Plasma. proteins, types and functions

Red blood cells - erythropoiesis, stages of differentiation, factors affecting it, function, normal count, physiological variation.

Hemoglobin- function, concentration, types & methods of Hb estimation, fate of hemoglobin Jaundice-types Anaemia,-types

ESR, PCV, osmotic fragility & blood indices

WBC- morphology, production, functions, normal count, differential count, variation, variation Immunity (in brief)

Platelets- origin, morphology, normal count, function-Platelet plug, bleeding disorder

Haemostasis - definition, normal haemostasis, clotting factors, mechanism of clotting, anticoagulants disorders of clotting factors.
Blood group-ABO & Rh system, Rh incompatibility blood typing ,cross matching, hazards of mismatched blood transfusion
RES, spleen and lymph.

3. Nerve-Muscle

Neuron structure, types, neuroglia-types, nerve fibre classification, properties of nerve fibres, RMP,action potential, wallerian degeneration
NMJ, blockers, Myasthenia gravis
Classification of muscle, structure of skeletal muscle, sarcomere, contractile proteins Excitation contraction coupling, mechanism of muscle contraction, types of contraction Motor unit, fatigue, rigor mortis Smooth muscle.

4. Respiratorysystem

Physiological anatomy of respiratory system, muscles of respiration, respiratory & non respiratory functions of lungs, dead space
Mechanics of breathing, intrapulmonary & pleural pressures Compliance, Surfactant, Hyaline membrane disease
Lung volumes and capacities
Respiratory membrane, transport of O₂ & CO₂
Chemical regulation of respiration, Neural regulation of respiration Hypoxia, Acclamatization, Dysbarism. Artificial respiration
Definition-Periodic breathing, dyspnoea, apnoea, asphyxia,, cyanosis.

5. Cardiovascularsystem

Introduction to CVS & general principles of circulation Properties of Cardiac muscle
Cardiac cycle, heart sounds, Pulse Cardiac output, factors and measurement Heart rate
BP-factors, measurement, Short term regulation Intermediate and long term regulation of BP
ECG uses and significance, .normal waveform, heart block Coronary circulation, Cutaneous circulation-Triple response Shock
Effects of exercise on CVS and Respiratory system.

6. Renal system, Skin and body temperature

Kidneys- functions, structure of nephron, type, juxtaglomerular apparatus-structure And function, non- excretory functions of kidney
Glomerular filtration rate (GFR)- Definition ,normal value, factors affecting GFR
Tubular reabsorption - sites, substance reabsorbed, mechanisms of reabsorption
Tubular secretion- sites, substance secreted, mechanisms of reabsorption
Counter current mechanism of concentration of urine Obligatory and Facultative reabsorption of water Micturition reflex, Diuretics

Artificial kidney, renal function tests-clearance tests

Skin -structure and function, body temperature measurement, physiological variation,

Regulation of body Temperature by physical chemical and nervous mechanisms-

Role of Hypothalamus Hypothermia and fever.

7. Digestive system

Physiological anatomy, Enteric nervous system & functions of GIT Saliva-composition, regulation, disorder.

Deglutition- stages & disorders

Stomach-functions, composition and regulation of gastric juice Gastric motility, MMC, vomiting reflex.

Pancreas- function, composition and regulation of pancreatic juice

Liver & gall bladder-functions, bile- composition, secretion and regulation Small

intestine- Succus entericus-composition, functions & movements Large intestine-functions, movements and defecation reflex

Digestion & absorption of Carbohydrates, fats and proteins.

8. Endocrine system

Classification of Endocrine glands & their hormones & properties-chemistry and receptor, feedback mechanisms of hormone regulation.

Anterior pituitary hormones- secretion, functions , disorders Posterior pituitary hormones- secretion , functions , disorders Thyroid hormones- secretion, functions, disorders

Parathyroid hormones- secretion, functions, disorders Calcium homeostasis & disorders

Pancreatic hormones, -Insulin and Glucagon- . secretion, functions, disorders

Adrenal cortex- Glucocorticoids & Mineralocorticoids, Androgen - secretion,

functions, disorders Adrenal medulla- secretion, functions, disorders Thymus &

Pineal gland.

9. Reproductive system

Introduction to reproductive system, sex differentiation & Puberty Male reproductive system, functions of testosterone & Spermatogenesis

Female reproductive system, functions of Estrogen, Progesterone, Oogenesis

Ovulation & Menstrual cycle

Physiological changes during pregnancy, pregnancy tests, parturition & lactation

Male & Female contraceptive methods.

10. Central nervous system

Introduction to CNS, Sensory receptors classification, properties Synapse-classification, properties

Sensory pathways: Anterior spino thalamic tract and Posterior column pathway

Lateral spino thalamic tract, Types of pain, Referred pain, Thalamus; nuclei and function

Classification of reflexes, Monosynaptic reflex- Stretch reflex , muscle spindle

,inverse stretch reflex. Polysynaptic reflex-Withdrawal reflex

Motor pathways : Pyramidal pathway and functions, UMNL, LMNL Cerebral cortex (Sensory and motor)-functions, Medulla and Pons-functions Cerebellum –functions, disorders

Basal ganglia-functions, disorders Hypothalamus and Limbic system-functions CSF, lumbar puncture

Sleep, EEG,

Autonomic Nervous System - Sympathetic and parasympathetic distribution and functions.

11. Special senses

Vision –Functional anatomy of eye, visual pathway, lesion Refractive errors, color vision

Audition – Physiological anatomy of ear, Mechanism of hearing, auditory pathway, deafness Olfaction –modalities, receptor, function, abnormalities

Gustation-modalities, receptor, function, taste pathway, abnormalities.

Practicals

Blood pressure Recording

Auscultation for Heart Sounds

Artificial Respiration

Determination of vital capacity

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practical need not be sent to the university.

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand Total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	--	20	100	*			100

REFERENCE BOOKS:

1. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers
2. Chatterjee (CC) Human Physiology Latest Ed. Vol. 1, Medical Allied Agency
3. Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book
4. Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton

BIOCHEMISTRY I

No. Theory classes: 70 hours

No. Practical classes: 20 hours

1. Carbohydrate Chemistry [3hours]

- Classification (Definition/ examples for each class)
- Monosaccharides (classification depending upon number of carbon atoms and functional group with examples)
- Disaccharides (Sucrose/ lactose/ maltose and their composition)
- Polysaccharides:
 - a) Homopolysaccharides (Structure of starch and glycogen)
 - b) Heteropolysaccharides (Functions).

2. Lipid Chemistry [3hours]
 - Definition of lipids
 - Functions of lipids in the body
 - Classification of lipids (subclasses with examples)
 - Definition and Classification of fatty acids
 - Essential fatty acids
 - Phospholipids and their importance

3. Amino-acid and Protein Chemistry [3hours]
 - General structure of D and L amino acids
 - Amino acids; Definition and Classification of amino acids with examples.
 - Peptides; definition & Biologically important peptides
 - Classification of Proteins based on composition, functions and shape(with examples)
 - Functions of amino acids and Proteins.

4. Nucleotide and Nucleic acid Chemistry [3hours]
 - Nucleosides & Nucleotides
 - Nucleic acid Definition &types
 - Composition & functions of DNA &RNA
 - Structure of DNA (Watson and Crickmodel)
 - Structure of tRNA, & functions of tRNA, rRNA,mRNA
 - Difference between DNA andRNA.

5. Enzymes [5hours]
 - Definition & Classification of Enzymes with example
 - Definitions of Active site, Cofactor (Coenzyme,Activator),
 - Proenzyme; Definition and examples (Pepsin &trypsin).

6. Digestion and Absorption [3Hours]
 - General characteristics of digestion and absorption,
 - Digestion and absorption of carbohydrates, proteins and lipids.

7. Carbohydrate Metabolism [5Hours]
 - Glycolysis ; Aerobic, Anaerobic, Definition , Site and subcellular site , Steps with all the enzymes and coenzymes at each step , mention the regulatory enzymes ,Energetics,
 - Citric acid cycle; Pyruvate dehydrogenase complex (reaction and coenzymes) , Site and subcellular site , Reactions with all the enzymes and coenzymes ,Regulatory enzymes ,Energetics
 - Significance of HMP Shunt pathway.
 - Hyperglycemic and hypoglycemic hormones
 - Blood Glucose Regulation.
 - Diabetes mellitus (definition, classification, signs and symptoms)
 - Glycogen metabolism and gluconeogenesis.

8. Lipid Metabolism [4Hours]

- Introduction to lipid metabolism ,Lipolysis
- Beta oxidation of fatty acids; Definition,Site and subcellular site, Activation of palmitic acid Transport of activated palmitic acid into mitochondria , Reactions, Energetics.
- Name the different ketone bodies. Note on ketosis.

9. Amino acid and Protein Metabolism [3Hours]

- Introduction, transamination, deamination, Fate of ammonia, transport of ammonia,
- Urea cycle.

10. Vitamins [5Hours]

- Definition and classification.
- RDA, sources, coenzyme forms, biochemical functions and disorders for the following water soluble vitamins: Thiamine, Niacin, Pyridoxine, Cobalamine ,Folic acid, Ascorbic acid
- RDA, sources, coenzyme forms, biochemical functions and deficiency Disorders for the following fat soluble vitamins; A and vitaminD.

11. Mineral Metabolism [3Hours]

- Name the macro/microminerals
- Iron: Sources,RDA, Functions and Disorders of deficiency and excess
- Calcium and phosphorus: Sources,RDA, functions, normal serum levels and hormones regulating their levels.

12. Nutrition [6hours]

- Balanced diet(Definition)
- Caloric value ; Definition , Caloric values of carbohydrates, proteins and fats
- Total daily caloric requirements of an adult male and female,
- RDA (Definition, standard values for nutrients)
- Basal metabolic rate(BMR) ; Definition , Magnitude of BMR in men and women, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients)
- Carbohydrates;. Daily dietary requirement. 2. Dietary fibers (Definition, functions, importance and their daily requirements)
- Proteins;. Daily requirement, Biological value. a. Definition b. Protein used as a standard for this, Protein sources with high and low biological value, Mutual supplementation of proteins(Definition, examples).
- Fats ; Daily requirement , Essential fatty acids (Definition, functions, daily requirement and deficiency manifestations) , Saturated and unsaturated Fatty acids(Definition, sources, examples).
- Malnutrition

13. Renal Function Tests [2hours]

- Name the different tests to assess the kidney functions
- Explain Creatinine clearance & Inulin clearance
- Urinary acidification test

14. Radioactive Isotopes [1hour]

- Definition, clinical applications
- Biological effects of radiations

15. Clinical Biochemistry [5 hours]

A. Definitions of acid, base, pH and pKa [1hour]

B. Buffers • Definition [2hours]

- Henderson Hasselbalch equation,
- Principal buffer systems in the ECF ICF and urine
- Bicarbonate and phosphate buffer systems (pKa value, normal ratio of base/acid in the plasma)
- Acidosis & Alkalosis (Definition, classification, causes and biochemical findings)

C. Normal serum levels and condition where they are altered [2hour]

- Glucose, Protein, urea, uric acid, and creatinine
- Bilirubin, cholesterol
- Serum Electrolytes

16. Fundamental Chemistry (1hour)

- Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

17. Solutions: Definition, use, classification where appropriate, preparation and storage (5hours)

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H₂SO₄, H₃PO₄, CH₃COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and super saturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal, Molar and percent solutions. Preparing working Standard from stock standard.
- Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors.

ASSIGNMENT TOPICS

1. Units of measurement
2. Hazards - Physical, Chemical, Biological
3. Arterial blood gas analysis
4. Responsibilities of Health care personnel
5. Biomedical waste management

PRACTICAL DEMONSTRATION [20 hours]

- Color Reactions of Carbohydrates & amino acids.
- Precipitation Reactions of proteins
- Colorimetry
- Estimation of Blood glucose Folin Wu and enzymatic method
- Estimation of Urea by DAM method

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand Total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	--	20	100	*			100

Text Book References

- Biochemistry – 3rd revised edition by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry-6th Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2nd edition by Godkar and Godkar.
- Biochemistry-3rd edition by Pankaja Naik
- Medical Laboratory technology 6th edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students-3rd edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4th, 5th and 6th editions.

PATHOLOGY I

(Clinical Pathology, Hematology and Blood Banking)

Theory-70 hours

Practicals-20 hours

I. Clinical Pathology-Theory

- Introduction to clinical pathology
- Collection, transport, preservation and processing of various clinical specimens
- Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
- Examination of Body fluids
- Examination of Cerebrospinal fluid (CSF)
- Sputum examination
- Examination of feces

II. Hematology -Theory

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples

- Various anticoagulants used in Hematology
- Hemoglobin estimation, different methods and normal values
- Packed cell volume
- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

III. **Blood Bank-Theory**

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions

IV **General Pathology:**

1. **Cell injury:**

- a. Definition, causes.
- b. Cellular adaptations – Hypertrophy, hyperplasia, atrophy and metaplasia.
- c. Types of cell injury – Reversible and irreversible; morphology of reversible injury.
- d. Necrosis – Definition and patterns of tissue necrosis.
- e. Intracellular accumulations – Lipids, cholesterol, proteins, glycogen and pigments; examples.
- f. Pathologic calcification – Types and examples.

2. **Inflammation:**

- a. Definition and signs of inflammation.
- b. Types – Acute and chronic inflammation.
- c. Acute inflammation – Causes, morphological patterns and outcome.
- d. Chronic inflammation – Causes, morphology and examples.
- e. Regeneration and repair – Mechanism of cutaneous wound healing.
- f. Factors affecting wound healing.

3. **Hemodynamic disorders:**

- a. Edema – Definition, pathogenesis and types: Renal, cardiac, pulmonary and cerebral.
- b. Difference between transudate and exudate.
- c. Shock – Definition, types of shock with examples: Hypovolemic, cardiogenic and septic shock, stages of shock: Nonprogressive, progressive and irreversible.
- d. Thrombosis – Definition, mechanism of thrombus formation (Virchow's triad) and fate of thrombus.

- e. Embolism – Definition and types: Thromboembolism, fat, air and amniotic fluid embolism.
- f. Infarction – Definition and examples.

4. Immune system:

- a. Autoimmune diseases – General features, enumerate systemic and organ specific autoimmune diseases.
- b. Systemic lupus erythematosus – Manifestations and diagnosis.

5. Neoplasia:

- a. Definition and nomenclature of tumors.
- b. Differences between benign and malignant neoplasms.
- c. Enumerate modes of carcinogenesis: Genes, physical, chemical and microbial agents of carcinogenesis.
- d. Modes of spread of tumors.
- e. Clinical aspects of neoplasia.
- f. Grading and staging of cancers.
- g. Laboratory diagnosis of cancer.

Practicals

- 1. Urine analysis- Physical, Chemical, Microscopic
- 2. Blood grouping and Rh typing
- 3. Hb estimation , packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
- 4. Bleeding time and Clotting time
- 5. Histopathology - section cutting and H& E staining.

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand Total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	--	20	100	*			100

REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss-Cytology
4. Winifred Diagnostic cytopathology
5. Orell Cyto pathology
6. Todd and Sanford- clinical diagnosis by Laboratory Medicine
7. Dacie and Lewis- Practical Hematology
8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th edition JP BrosNewDelhi, 1996
9. Sathish Guptha , Short text book of Medical laboratory techniquesfor technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 thedi JP Bros,New Delhi,1996.

Microbiology I

Theory: 70Hours

Practicals: 20Hours

1. Introduction (6hrs)

History of Microbiology - Louis Pasteur, Antony Van Leeuwenhoek, Robert Koch, Edward Jenner, Alexander Fleming.

Use of microscope in the study of bacteria - Types of microscopes - compound microscope, phase contrast microscope, electron microscope, fluorescent microscope, dark ground microscope.

Morphology of bacterial cell

2. Growth and Nutrition (6hrs.)

Nutrition, growth and multiplication of bacteria, bacterial growth curve, culture media, culture methods, anaerobic culture methods.

3. Sterilization and disinfection (8hrs.)

Principles and use of equipments of sterilization, chemicals used in disinfection, testing of disinfectants.

4. Biomedical waste management principle and practice

5. Immunology (5hrs.)

Immunity - mechanism of immunity, classification, types

Vaccines

Immunization schedule

Definition of antigen, antibody, list of antigen antibody reaction (no need of detailed account of antigen antibody reactions)

Definition of hypersensitivity and classification (no need of detailed account of types of hypersensitivity)

6. Infection (5hrs.)

Definition, types and mode of transmission

Hospital acquired infection - causative agents, mode of transmission and prophylaxis.

Antimicrobial sensitivity testing

7. Systematic bacteriology (15hrs.)

Disease caused and laboratory diagnosis of medically important bacteria (Staphylococcus, coagulase negative Staphylococcus, MRSA, Streptococcus pyogenes, Pneumococcus, gonococcus, E.coli, diarrhoeagenic E.coli, Salmonella, Vibrio cholerae, ElTorvibrios, Halophilic vibrios, Shigella, Mycobacterium

tuberculosis, Mycobacterium leprae, Atypical Mycobacteria, Treponema pallidum, leptospira)
(no need of classification, antigenic structure, virulence mechanism)

]

8. Parasitology (10hrs.)

Introduction to Parasitology

List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma, B.coli, G.lambliia, T.solium, T.saginata)

Laboratory diagnosis of parasitic infection (No need of including life cycles)

9. Virology (10hrs.)

Introduction to virology

List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arbo viruses)

Cultivation of viruses and laboratory diagnosis of viral infections

10. Mycology (5hrs.)

Introduction to Mycology

Classification of medically important fungi - (based on morphology, spore production, disease production, taxonomy)

List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis, Mucor Mycosis)

Laboratory diagnosis of fungal infections.

Practicals (20 hrs.)

Compound microscope (Demonstration)

Demonstration of sterilization equipments

Demonstration of culture media and culture methods

Demonstration of antibiotic sensitivity testing

Demonstration of serological tests - Widal, VDRL, ASO, CRP, RA

Demonstration of gram stain and ZN staining

Demonstration of Helminthic ova

Grams stain, Acid fast staining

Stool exam for Helminthic ova

There shall be no university practical examination and Internal Assessment marks secured in practicals need not be sent to the university.

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	10

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand Total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	--	20	100	*			100

Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- MedicalMycology
5. Emmons- MedicalMycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd.

SUBSIDIARY SUBJECTS

ENGLISH

COURSE OUTLINE

COURSE DESCRIPTION: This course is designed to help the student acquire a good command and comprehension of the English language through individual papers and conferences.

BEHAVIOURAL OBJECTIVES:

The student at the end of training is able to

1. Read and comprehend English language
2. Speak and write grammatically correct English
3. Appreciates the value of English literature in personal and professional life.

UNIT - I: INTRODUCTION:

Study Techniques

Organisation of effective note taking and logical processes of analysis and synthesis Use of the dictionary

Enlargement of vocabulary Effective diction

UNIT - II: APPLIED GRAMMAR:

Correct usage

The structure of sentences The structure of paragraphs Enlargements of Vocabulary

UNIT - III: WRITTEN COMPOSITION:

Precise writing and summarizing Writing of bibliography Enlargement of Vocabulary

UNIT - IV: READING AND COMPREHENSION:

Review of selected materials and express oneself in one's words. Enlargement of Vocabulary.

UNIT - V: THE STUDY OF THE VARIOUS FORMS OF COMPOSITION:

Paragraph, Essay, Letter, Summary, Practice in writing

UNIT - VI: VERBAL COMMUNICATION:

Discussions and summarization, Debates, Oral reports, use in teaching

REFERENCE

1. English Grammar Collins, Birmingham University, International Language Data Base, Rupa & Co.1993
2. Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
3. Letters for all Occasions. A S Myers. Pub - Harper Perennial
4. Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata Mcgraw Hill, New Delhi
5. Journalism Made Simple Dwainwright
6. Writers Basic Bookself Series, Writers Digest series
7. Interviewing by Joan Clayton Platkon
8. Penguin Book of Interviews.

HEALTH CARE

Teaching Hours: 40

Introduction to Health

Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept.

National Health Policy

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

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.

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
Care of Rubber Goods

Recording of body temperature, respiration and pulse, Simple aseptic technique, sterilization and disinfection. Surgical Dressing: Observation of dressing procedures

First Aid :

Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

Reference Books:

1. Preventive and Social Medicine by J. Park
2. Text Book of P & SM by Park and Park
3. Counseling & Communicate skills for medical and health, Bayne-Orient Longman Pvt. Ltd.

2nd Year - RADIOTHERAPY- PART-IA

FUNDAMENTAL PHYSICS:

Applied Mathematics:

- Elementary use of algebraic symbols and signs, Fractions & Decimals.
- Indices: Power of 10 simple equations, Logarithms.
- Fundamentals of Trigonometry
- Fundamentals of Geometry, Application of similar triangles in finding focalspot.
- Divergence from a point source.
- Graphical representation of a data - linear & semi log plot,
- Measurement of angles. Geometry of triangles,
- Proportion, Inverse square law, Elementary explanation of exponential law.

Electromagnetic Radiation, Atomic Structure and Radioactivity:

- Electromagnetic waves and their properties, Inverse square law
- The quantum theory of Radiation (Planck's concept of quanta, Photon and its characteristic properties),
- The electromagnetic spectrum, Fluorescence and Phosphorescence, Photoelectric emission, Photocell, Intensity and quality of electromagnetic radiation.
- The structure of the Atom :Nucleus ,Atomicnumber(Z), Massnumber(A) ,Ionization & Excitation , Isotopes, And the Periodic Table.
- 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
- Radioactive nuclides in medicine
- Radioactive disintegration process and radiation emission and daughter products.
- Properties of radium and its daughter elements.

- Radioactive equilibrium.
- Production of artificial radioactive isotopes.
- The principles of the nuclear reactor.
- 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 ,Electriccurrent ,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), electro magnetic induction, Mutual induction and Self-induction.
- Alternating current, TheA.C .transformer theory and construction, Types of transformers is 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, Highvoltage rectifier circuits(self-rectifying circuit, Half-wavepulsating 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. Bremstrahlung, Factors influencing the intensityandqualityofX-rays,ConstructionandworkingofModernX-raytube(fixedanodeand rotator 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), filament design , 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. Line focus principle and shape of the anode surface, Anode heel 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-ray sbeam,
- 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.
- Dosimetric 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.

2nd Year - RADIOTHERAPY-PART- I B

SECTION-A

A. RADIATION BIOLOGY

- The Physics and Chemistry of Radiation Absorption
- DNA strand breaks and chromosomal aberrations
- Cell Survival curves
- Dose response relationship for normal tissues
- Oxygen Effect and reoxygenation
- Linear Energy transfer and Relative Biologic Effectiveness
- Time, Dose and Fractionation in Radiotherapy
- New Radiation Modalities
- Acute Effects of Total Body Irradiation
- Radiation Carcinogenesis, Hereditary Effects,
- Effects on Embryo and Foetus, Cataractogenesis
- Radiation Protection
- The Cell cycle ,effects of radiation on the normal cell and abnormal cell.
- Radio sensitivity of normal and tumours cells,

B. APPLIED ANATOMY & 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
- Carcinogenesis
- 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,andanus)
- Lung cancer
- Lymphomas

- Breast cancer
- Gynecological cancers
 - Prostate cancer
 - Bladder cancer
- Seminoma
- Pediatric Tumours and others

SECTION-B

PRINCIPLES OF RADIOTHERAPY:

- Basics of Oncology: Multi disciplinary approach to them and 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,
- 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 radio therapy, 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

PRACTICALS :

There shall be a university practical examination in the subject for 100 marks.
The internal assessment is for 20 marks.

Pattern for Practical Examination:

Sl. No.	Particulars	Marks
1	Practical Exercise	40
2	Viva-Voce	40
Total		80

PRACTICE OF RADIATION THERAPY TECHNIQUES

Note: (E) Denotes Practical Prescribed in University Examinations.

1. Mould Room(E)

- a. Equipments
- b. Preparation of
 - i. Plaster of Paris cast
 - ii. Perspex cast
 - iii. Orifit/Aqua plast immobilization cast and others
 - iv. Shield(use of Styro foam Cutter)
 - v. Tissue Compensators
 - vi. Electron Lead Cutout
 - vii. Mouth Bite
 - viii. Computerized Tissue Compensator Preparation(optional)

2. Teletherapy & Brachytherapy Treatment planning: (E)

- a. Iso-dose plotting
- b. Studying of dose distribution of tumor and Normal tissues
- c. Calculations of Teletherapy & Brachytherapy treatment time.
- d. 3DPlanning(optional)
- e. Use of Computers and TPS

3. Simulation equipment parts,operation,principles: (E) Simulation of:-

- i. AP/PA portals for pelvis in cancer cervix with SSD Techniques.
- ii. Simulation of our fields of pelvis in cancer cervix with SAD Technique.
- iii. Simulation of oblique fields for cancer oesophogus with SAD Techniques.
- iv. Simulation of tangential field of a case of Ca. Breast
- v. Simulation of whole Brain Irradiation
- vi. Routine X-ray Chest, Abdomen ,Extremities & Patient Positioning and

decubitus.

- vii. Barium Swallow Radiology Technique, Barium meal, Barium follow through
- viii. Intravenous pyelography
- ix. CT Simulation

4. Radiation Safety and Protection (E)

5. Quality Assurance in Radiotherapy (E)

PRACTICALS SCHEME OF EXAMINATION 100 Marks

(Common Practical)

1. Mould Room	-----	20 Marks
2. Teletherapy & Brachytherapy Treatment planning	-----	20 Marks
3. Simulation equipment parts, operation, principles	-----	20 Marks
4. Radiation Safety and Protection	-----	20 Marks
5. Quality Assurance in Radiotherapy	-----	20 Marks

3rd Year - RADIOTHERAPY- PART-II A

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 air-ionization. Roentgen and Rad. Simple principles of dosimeters. Thimble chamber-electronic equilibrium and dose buildup. Secondary Dosimeter. Elementary principles of Scintillation detectors, Thermo-luminescence dosimeters, Semiconductor devices.

Biological Effects of Radiation:

Chemical effects of Radiation, radiolysis of water, production of freed radicals, radical's reactions, G-value. Effects-Stochastic and non-stochastic effects, chromosome aberrations and mutations. Radiation effects on wholebody (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 workload, 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 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 therapy,
 - 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 source; alignment of applicator or 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 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, Strontium90).
 - 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 megavoltage radiations, including electron beam therapy.

Clinical Dosimetry for Photon and Electron Beams

- Dose distribution along beam axis
- Dose distribution of 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

EXTERNAL BEAM THERAPY

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
- Memi-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 output factor and its calibration
- Multi leaf collimator: 3D conformal/
- Stereotactic 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 moulds.
- Monitoring of the patient before, during and after treatment
- Accurate and complete recording of documentation of all the parameters relevant to the treatment
- After care 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 - hyperthermia, radio-sensitisers

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

- Immobilization Devices & techniques for patients and their preparation
- Beam shaping devices (block, compensators etc.) and their preparation
- Bolus material and their preparation
- Moulds for Brachytherapy

BASIC RADIOLOGIC IMAGING TECHNIQUES

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

3rd Year - RADIOTHERAPY- PART-II B

PRINCIPLES AND PRACTICE OF RADIO THERAPY

Sec A 1. Diagnostic Workup and Treatment Principles and Radiotherapy Techniques.

A Radiotherapeutic Management of the following Cancer & 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 radio therapy 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 isocenter verification

C. Clinical applications of Special teletherapy techniques.

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

Sec B

2. PSYCHOSOCIALMANAGEMENT

- 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,
- Counselling skills
- Role of effective communication
- Complementary therapies
- Stress and stress management
- Hospice and terminally ill

3. QUALITATIVEANDQUANTITATIVEMETHODSOFRESEARCH

- 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

6. RECENTADVANCESINRADIOTHERAPY.

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

PRACTICALS:

RADIOTHERAPY-II

Note: (E) Denotes Practical Prescribed in University Examinations.

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
Ability 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.

- 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/V 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. StereoTactic Radiotherapy/Surgery
- c. 3DCRT
- d. IMRT
- e. Portal Imaging Method
- f. HDR Brachytherapy

PRACTICALS SCHEME OF EXAMINATION 80Marks
(One Common Practical)

1. Cobalt-machine	-----	20 Marks
2. Linear Accelerator	-----	20 Marks
3. Simulation and Treatment Techniques	-----	20 Marks
4. Spotters		20 Marks
a. I/c application cancer cervix	-----	
b. I/L Radiotherapy application	-----	
c. Advanced Training		

CLINICAL TRAINING

Content and purpose

The clinical component has been designed to complement the academic program and runs throughout the course. The placements have to be designed so that the students will be able to observe the practical application of the academic course wherever possible. Content can be tailored to meet either National or Local needs as is deemed to be most appropriate.

1ST YEAR: INTRODUCTION TO THE HOSPITAL SETTING

The purpose of this phase is:

- i. For the students to become familiar with some of the practical applications of the academic course,
- ii. To introduce the wider hospital setting,
- iii. To help the students to identify the various disciplines within a hospital, their role & the importance of cooperation,
- iv. To introduce patients in a clinical setting and begin to acquire basic communication skills.

2ND YEAR: SKILLS NECESSARY TO WORK IN A HOSPITAL

To be completed very early in the training. The following procedures will be demonstrated to the students who will be expected to be serve or participate as appropriate.

General procedures to be observed when patients attend for appointment:

- Lifting and moving techniques
- Administration of bed pans, vomit bowls, etc.
- Care and management of drugs in the hospital setting

Correct procedures when dealing with patients with infectious diseases

- Universal precautions

Correct procedures when dealing with immuno-compromised patients:

- Hygiene practices,

- Simple dressings,
- Sterile procedures,
- Oxygen administration.

Care of patients with:

- Breathing difficulties,
- Terminal illness,
- Mental impairment,
- Physical disability.
- Special care of the geriatric and pediatric patient.
- Stomach care.
- Handling of patients with bone metastases.
- Care of the patient following an anaesthetic.
- Care of lines in the incubated patient.
- Communication skills with patients and relatives
- Terminally ill and Hospice

2ND & 3RD YEAR : SKILLS RELATED TO WORKING IN A RADIOTHERAPY DEPARTMENT

Introduction to the Radiotherapy Department. Time will be spent on each unit within the department. The purpose of this phase is to:-

In the Department:

- Familiarize the students with the different units within the department and the procedures carried out on each unit.
- Enable the student to recognize and relate to the basic terminology introduced in the academic program.
- Help to establish a sense of identity within the student group and to understand the role of the RTT in the management of cancer.
- Introduce the students to the staff of the department.
- Help the student to understand team roles.
- Familiarize the students with written QA programs within the department.

Equipment's and integration:

- Begin to become competent in the manipulation of the radiotherapy equipment.
- Be able to communicate effectively with patients.
- Begin to integrate into the department as part of the radiotherapy and

multidisciplinary teams.

- iv. Begin to empathize with patients and to appreciate their own feelings in the clinical situation.
- v. Being able to handle and achieve proficiency in Mould room techniques.

Safety & Precautions in Practice:

- i. Identifying the functions on the pedestal/handset and safely operating these on the treatment units.
- ii. Identifying the functions on a control panel, indicating their purpose and safely using these when appropriate.
 - iii. Safely using the accessory equipment in the correct context.
 - iv. Correctly and safely using equipment related to patient immobilization.
 - v. Identifying, locating, understanding and safely using the radiation protection features incorporated in the treatment areas, e.g. Door interlocks, visible and audible warning signs, primary and secondary barriers, etc.
 - vi. Setting up single and parallel opposed fields under supervision.
 - vii. Assisting in these type of multifield techniques.
 - viii. Identifying the cassettes and films commonly used for localization and verification on the simulator and treatment units.
 - ix. Demonstrating the correct procedure for developing films (daylight processing and darkroom practice) and correctly unloading and reloading cassettes.

TO ACHIEVE CLINICAL COMPETENCE

The purpose of this phase is for the students to:

- i. Demonstrate competence in the manipulation of radiotherapy equipment.
- ii. Demonstrate an ability to anticipate the physical and psychological needs of the cancer patient and respond to them.
- iii. Demonstrate the ability to communicate with ease with other staff involved in the multidisciplinary treatment of the cancer patient.
- iv. Increasingly participate as a team member in all aspects of the patient's management in radiotherapy in preparation to work as a qualified radiation therapist.
- v. Demonstrate competence in simulator procedures.
- vi. Acquire basic computer skills.
- vii. Participate in the development/ revision of formal written quality assurance procedures/ programme.
- viii. Setup a patient on their first visit.

TO ACHIEVE FINAL COMPETENCY SUBSTANTIAL TIME WILL BE SPENT:

- i. Setting up multifield techniques under supervision.
- ii. Participating in the quality control procedures in the department in accordance with the protocols.

- iii. Simulating and localizing at target volume.
- iv. Describing the purpose of health and safety and ionizing radiation regulations.
- v. Discussing the role of local rules and outline those in place in the different departments.

Graded Responsibility (structured Training Schedule)

1 Year: Theory classes, observation in treatment planning and treatment execution.

II year: Theory classes, Participation in OPD, Mould room techniques, Treatment planning, treatment, execution under the supervision of consultant, Senior RTT, Project Work.

III Year: Theory classes, Participation in OPD, Treatment planning and execution under supervision of Consultant & Senior RTT. Submission of Projectwork, Mould Room Techniques, Quality Assurance.

Rotation Posting

Students may be posted to other relevant departments or other centers with better and latest equipment's for a minimum period of 1 to 2 months, for completion of training in recent advances in the Specialty. The student on completion of the training shall submit a report duly signed by the concerned department to the HOD Radiotherapy/ Radiation Oncology.

MONITORING LEARNING PROGRESS

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps teachers to evaluate students but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching/learning activities. It may be structured and assessment be done using sample checklist provided (Assessment forms).

The learning outcomes to be assessed should include: (I) personal Attitudes

- ii. Acquisition of Knowledge (iii) Clinical and operative skills (iv) Teaching skills

Candidate should be encouraged to participate in teaching activities, seminars and literature reviews.

1. **Periodictests:**

2.

The departments may conduct periodic tests(InternalAssessment), The tests may include written papers, practical with viva voce.

3. **6) Workdiary/ Log Personal Attitudes. The essential items are:**

- Caring attitudes
- Initiative
- Organizational ability
- Potential to cope with stressful situations and undertake responsibility
- Trustworthinessand reliability
- To understand and communicate intelligibly with patients and other
- To behave in a manner which establishes professional relationships with patients and colleagues
- Ability to work in team
- A critical enquiring approach to the acquisition of knowledge

The methods used mainly consist of observation. It is appreciated that these items require a degree of subjective assessment by the guide, supervisors and peers.

4. **Acquisition of knowledge:**

The methods used comprise of' LogBook 'which records participation in various teaching/learning activities by the students. The number of activities attended and the number in which presentations are made are to be recorded. The logbook should periodically be validated by the supervisors, some of the activities are listed. The list is not complete .Institutions may include additional activities, if so,desired.

5. **Technicalskills**

Day to Day work: Skills on the Machines should be assessed periodically.The assessment should include the candidates' sincerity and punctuality ,analytical ability and communication skills.

Clinical and procedural skills: The candidate should be given graded responsibility to enable learning by apprenticeship .The perform an ceisassessed by the guide by direct observation. Particulars are recorded by the student in the log book.

6. Teaching

Skills:

Book:

Every candidate shall maintain a work diary and record his/her participation in the training

Programs conducted by the departments such as practical, literature reviews, seminars, etc. Special

mention may be made of the presentations by the candidate as well as details of Practical or laboratory procedures, if any conducted by the candidate.

7. Records:

Records, logbooks, Project Report and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University as indicated. The record books maintained by the student should be submitted to the Head of the department 6 months prior to completion of the course and the head of the department makes a certification of the of the academic progress an assessment of student performance throughout the said course shall be made by the HOD.

The logbook is a record of the important activities of the candidates during his training internal assessment should be based on the evaluation of the logbook collectively, logbooks are a tool for the evaluation of the training programme of the in situation by external agencies. The record includes academic activities as well as the presentations and procedures carried out by the candidate.

RECOMMENDED

BOOKS BASIC

BOOKS:

1. Principles of Anatomy and Physiology, 10th Edition. Tortura Grabowski. Wiley International Press.
2. Anatomy and Physiology in Health and illness. 9th edition. Kathleen J.W. Wilson and Anne Waugh. Churchill Livingstone.
3. Anatomy and Physiology for Nurses,

T.W.A. Glenister, William Heilemann Medical Books LTD., London

4. Textbook of Radiotherapy, Radiation Physics, Therapy and Oncology
.6thEdition.C.K.Bomford. Churchill Livingstone.
5. Anatomy and Physiology in Health and Illness,
Anne Waugh, Allison Grant, Illustrations by Graeme Chambers.
6. Rossand Wilson, Anatomy and Physiology in health and illness, Kathleen
J.W.Wilson, 8thEdition, Churchill and Livingstone.
7. Walterand Millers,TextBook of Radiotherapy, Radiation Therapy Physics, Therapy
and Oncology.
C.K. Bomford, 6th Edition, Churchill Living Stone.
8. A Nurses Guide to Cancer Care, Brenda M. Nevidjon ,Lippincott.
9. Radiotherapy :Principles and Practice, A Manual for quality in
Treatment delivery, Sue E.Griffith, Churchill Livingstone.
10. Principles and Practice of Radiation Therapy, Introduction to Radiation
Therapy. Charles M. Washington & Dennis T. Leaver, Mosby.
11. Clinical Oncology for Medical Students and Physicians,
Multidisciplinary Approach, Edition 1983 another editions,
Published by the American Cancer Society.
12. Basic Medical techniques and patient care for Radiologic
Technologists, Second Edition.
13. Principles of Imaging Science and Protection,
Michael A. Thompson, Janice D. Hall, Marian P. Hattaway, Steven B. Dowd,
14. Fundamental Physics of Radiology, W.J. Meredith ,J.B .Massey, Bristol:
JohnWright&Sons Ltd.,1977
15. Basic Clinical Radiobiology for Radiation Oncologist,
G. Gordon Steel, Edward Arnold, A Member of the Hodder Headline Group,
London Boston Melbourne Auckland.
16. Textbook of Radiobiology, Eric J Hall.

REFERENCE BOOKS:

1. B.D.Chaurasia, Human Anatomy, CBS Publishers
2. Radiographic Imaging, D.Noreen Chesney, Blackwell Scientific Publications, Oxford Scientific Publications, Oxford London Edinburgh, Boston Melbourne.
3. Radiation Therapy Physics
4. William Hendee
Mosby
5. The Physics of Radiation Therapy ,Second Edition, Fiaz M.Khan,Ph.D.
Williams & Wilkins.
6. Clinical Oncology,
Geoffrey R. Weiss, Associate Professor of Medicine, The University of Texas Health Science Center at San Antonio.
7. Cancer Facts ,A concise Oncology Text, James F.Bishop,
Harwood Academic Publishers,
8. Review of Medical Physiology, 20th edition, William F. Ganong, LANGE
9. A Colour Atlas of Human Anatomy, Wolfe Medical Publications
10. Medical Physics Handbook 6 ,Fundamentals of Radiation Dosimetry ,JR Greening, Adam Hilger Ltd, Bristol.
11. Principles and Practice of Radiation Oncology, Carlos A Perez,
12. Principles and Practice of Radiation Therapy, G.K. Rath & B.K .Mohanthi. ILBS
13. Principles of Radiological Physics .3rd edition. Donald T. Graham. Churchill Livingstone.

14. Radiation Oncology: Rational technique and results .8thedition .James D & K. KhanAng.
15. Clinical Oncology for Medical Students and Physicians. Philip Rubin. American Cancer Society.
16. Text of radiation physics; Author - khan; 5th edition, and Meredith and Massey