REGULATIONS AND CURRICULA
FOR
BACHELOR OF SCIENCE IN RADIOTHERAPY TECHNOLOGY (B.Sc. RTT)

2007

RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES, KARNATAKA,
JAYANAGAR, 4TH `T` BLOCK, BANGALORE – 560041
KARNATAKA STATE,
INDIA.

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Rajiv Gandhi University Of Health Sciences, Karnataka, Bangalore

The Emblem

The Emblem Of The Rajiv Gandhi University Of Health Sciences Is A Symbolic Expression Of The Confluence Of Both Eastern And Western Health Sciences. A Central Wand With Entwined Snakes Symbolises Greek And Roman Gods Of Health Called Hermis And Mercury Is Adapted As Symbol Of Modern Medical Science. The Pot Above Depicts Amrutha Kalasham Of Dhanvanthri The Father Of All Health Sciences. The Wings Above It Depicts Human Soul Called Hamsa (Swan) In Indian Philosophy. The Rising Sun At The Top Symbolises Knowledge And Enlightenment. The Two Twigs Of Leaves In Western Philosophy Symbolises Olive Branches, Which Is An Expression Of Peace, Love And Harmony. In Hindu Philosophy It Depicts The Vanaspathi (Also Called As Oushadi) Held In The Hands Of Dhanvanthri, Which Are The Source Of All Medicines. The Lamp At The Bottom Depicts Human Energy (Kundalini). The Script "Devahitham Yadayahu" Inside The Lamp Is Taken From Upanishath Shanthi Manthram (Bhadram Karnebhi Shrunuyanadev…), Which Says "**May We Live The Full Span Of Our Lives Allotted By God In Perfect Health**" Which Is The Motto Of The Rajiv Gandhi University Of Health Sciences.

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Vision Statement

The Rajiv Gandhi University Of Health Sciences, Karnataka, Aims At Bringing About A Confluence Of Both Eastern And Western Health Sciences To Enable The Humankind "Live The Full Span Of Our Lives Allotted By God In Perfect Health"

It Would Strive For Achievement Of Academic Excellence By Educating And Training Health Professionals Who

Shall Recognize Health Needs Of Community, Carry Out Professional Obligations Ethically And Equitably And In Keeping With National Health Policy,

It Would Promote Development Of Scientific Temper And Health Sciences Research.

It Would Encourage Inculcation Of Social Accountability Amongst Students, Teachers And Institutions.

It Would Support Quality Assurance For All Its Educational Programmes.

Motto

Right For Rightful Health Sciences Education

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Notification

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Schedule annexed to University Notification No; UA/AUTH/I year AHS/126/2007-08 dated 29/06/07.

SECTION I

REVISED ORDINANCE GOVERNING
REGULATIONS & CURRICULUM FOR BACHELOR OF SCIENCE DEGREE COURSES
IN
ALLIED HEALTH SCIENCE FOR FIRST YEAR

BSc. Radiotherapy Technology

1. Title of the Courses offered in Allied Health Sciences:

1. Bachelor of Science in Medical Laboratory Technology [B.Sc. (M.L.T)]
2. Bachelor of Science in Operation Theatre Technology [BSc .O.T. Technology]
3. Bachelor of Science in Cardiac Care Technology [B.Sc Cardiac Care Technology]
4 .Bachelor of Science in Perfusion Technology [BSc. Perfusion Technology]
5. Bachelor of Science in Neuro Science Technology [BSc. Neuro Science Technology]
6. Bachelor of Science in .Renal Dialysis Technology [BSc. Renal Dialysis Technology]
7. Bachelor of Science in Respiratory Care Technology [BSc. Respiratory Care Technology]
8 Bachelor of Science in Anaesthesia Technology [BSc. Anaesthesia Technology]
9. . Bachelor of Science in Imaging Technology [BSc. Imaging Technology]
10. Bachelor of Science in Radiotherapy Technology [BSc. Radiotherapy Technology]

2. Eligibility for admission:

A candidate seeking admission to the Bachelor of Science Degree Courses in the Allied Health Sciences course from Sl.No. 1 to 10 shall have studied English as one of the principal subject during the tenure of the course and for those seeking admission to the Bachelor of Science Degree Courses in the Allied Health Sciences courses from Sl.No. 1 to 8 mentioned above except for B.Sc. Imaging Technology and B.Sc. Radiotherapy Technology shall have passed:

.

1. Two year Pre-University examination or equivalent as recognized by Rajiv Gandhi University of Health Sciences with, Physics, Chemistry and Biology as principle subjects of study.

OR

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

OR

3. Any equivalent examination recognized by the Rajiv Gandhi University of Health Sciences, Bangalore for the above purpose with Physics, Chemistry and Biology as principal subjects of study.

OR

4. The vocational higher secondary education course conducted by Vocational Higher

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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 a subject for which the candidate desires to enroll, in the respective Allied Health Sciences course mentioned in Sl. No. 1 to 10 shall have passed plus 12 [10+2] with Physics, Chemistry and Biology, as principal subjects or candidates with 3 years diploma from a recognized Government Board in a subject for which the candidate desires to enroll, in the respective Allied Health Sciences course mentioned in Sl. No. 1 to 10 should have studied Physics, Biology and Chemistry as principal subjects during the tenure of the course.

6.Lateral entry to second year for allied health science courses for candidates who have passed diploma program from the Government Boards and recognized by RGUHS, 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 from the academic year 2008-09 vide RGUHS Notification no. AUTH/AHS/317/2008-09 dated 01.08.2008.

7. In case of admission to B.Sc. Imaging Technology or B.Sc. Radiotherapy Technology the candidate should have passed Pre-University or equivalent examination with Physics, Chemistry, Biology and Mathematics, as principal subjects of study.

Note:

a. The candidate shall have passed individually in each of the principal subjects.

b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

5. Scheme of examination:

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

6. 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 .

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7. Internal Assessment (IA):

Theory - 20 marks.

Practical - 10 marks*. [Lab work- 06 marks and Record-04 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 with in 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.**

8. Subject and hours of teaching for Theory and Practicals

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

S L 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	70	20	90
4	Pathology (Clinical Pathology, Hematology & 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 Saturdays students shall work in hospitals in the respective specialty or department chosen by them.

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Subsidiary Subjects

English	25 Hours
Kannada	25 Hours
Health-Care	40 Hours

Hospital posting – **Fri day** 9am – 1pm and 2pm - 4-30 pm
Saturday 9am - 1pm

Departmental/ Hospital Posting: 450 Hours.

. Subject and hours of teaching for Theory and Practicals for 2nd and 3rd year

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

TABLE-II:

DISTRIBUTION OF SUBJECTS AND NUMBER OF HOURS OF TEACHING IN SECOND YEAR

SL. NO.	SUBJECT	THEORY NO. OF HOURS	PRACTICAL NO. OF HOURS	TOTAL
1	**RADIOTHERAPY-PART- I A** FUNDAMENTALS OF PHYSICS	140	140	280
2.	**RADIOTHERAPY-PART- I B** A. RADIATION BIOLOGY B. APPLIED ANATOMY & PATHOLOGY C.PRINCIPLES OF RADIOTHERAPY	200	600 (HOSPITAL POSTINGS)	800
	TOTAL	340	740	1080

Subsidiary Subjects:

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

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TABLE-III:

DISTRIBUTION OF SUBJECTS AND NUMBER OF HOURS OF TEACHING IN THIRD YEAR

SL. NO.	SUBJECT	THEORY NO. OF HOURS	PRACTICAL NO. OF HOURS	TOTAL
1.	**RADIOTHERAPY-PART-II A** RADIATION PHYSICS	160	160	320
2.	**RADIOTHERAPY-PART-II B** PRINCIPLES AND PRACTICE OF RADIOTHERAPY	160	600 (HOSPITAL POSTINGS)	760
	Total	320	760	1080

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 1st, 2nd and 3rd year University examinations are shown in the Table – IV, V and 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

02 papers in the 2nd Year
02 papers in the 3rd Year.

Practical examination:

One combined practical examination, at the end 2nd Year and one combined practical examination at the end of the 3rd year.

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TABLE-IV

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	3hours	80	20	100
5	Microbiology	3 hours	80	20	100
B	Subsidiary Subject**				Total
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.

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TABLE - V. Distribution of Subjects and marks for Second Year Examination.

		Theory				Practicals			
Paper	Subjects	Theory	Viva voce	I.A.	Sub Total	Practicals	I.A.	Sub Total	Grand Total
I	**RADIOTHERAPY-PART-I A** FUNDAMENTALS OF PHYSICS	60	20	20	100	80	20	100	300
II	**RADIOTHERAPY-PART-I B** **Sec A :** RADIATION BIOLOGY, APPLIED ANATOMY & PATHOLOGY	30	10	10	100				
	Sec B : PRINCIPLES OF RADIOTHERAPY	30	10	10					

Distribution of Subsidiary **Subjects and marks for Second Year Examination**

B	Subsidiary Subject**	Duration	Marks	I .A Theory Marks	Total Marks
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

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

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TABLE – VI
Distribution of Subjects and marks for Third Year Examination.

		Theory				Practicals			
Paper	Subjects	Theory	Viva voce	I.A.	Sub Total	Practicals	I.A.	Sub Total	Grand Total
I	**RADIOTHERAPY-PART-II A** Radiation Physics	60	20	20	100	80	20	100	300
II	**RADIOTHERAPY-PART-II B** - Principles and Practice of Radiotherapy **Sec A :** Diagnostic work up treatment principles and RT- techniques. **Sec B :** Psychosocial management, Health & safety, Qualitative & Quantitative methods of research, Medical Legal & Ethical aspects and recent advances.	30 30	10 10	10 10	100				

Distribution of Subsidiary **Subjects and marks for Third Year Examination**

B	**Subsidiary Subject****	**Duration**	**Marks**	**I .A Theory Marks**	**Total Marks**
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

** 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.

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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 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, internal assessment and Viva-Voce 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.

Practicals for second and third year : If a candidate passes in practical examination in second or third year but fails in one or more theory papers such candidates are exempted from reappearing for practical but they have to appear in the subsequent examination for the theory paper in which she/he has failed OR vice versa.

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 shall appear for all the subjects of that particular year in the University examinations to avail this benefit. A candidate who fails in any two of the five main subjects and English in the first year shall be permitted to carry over these 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 subject of the second year to the third year but shall pass this subject before appearing for the third year examination.

A candidate is permitted to join third year provided he/she has appeared for all the subjects of second year and availed the carry over benefit for one subject in the second year.

13. Declaration Of Class

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.

a. 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.

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b. 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.

c. 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.

d. 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 award of degree.

15. Distribution of Type of Questions and Marks for Various Subjects

THEORY

SUBJECTS HAVING MAXIMUM MARKS = 100		
TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS FOR EACH QUESTION
ESSAY TYPE	3 (2 x 10)	10
SHORT ESSAY TYPE	12 (10 × 5)	5
SHORT ANSWER TYPE	12 (10 × 3)	3

SUBJECTS HAVING MAXIMUM MARKS = 80		
TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS FOR EACH QUESTION
ESSAY TYPE	3 (2 x 10)	10
SHORT ESSAY TYPE	8 (6 × 5)	5
SHORT ANSWER TYPE	12(10 × 3)	3

SUBJECTS HAVING MAXIMUM MARKS = 60		
TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS FOR EACH QUESTION
ESSAY TYPE	3 (2 x 10)	10
SHORT ESSAY TYPE	7(5×5)	5
SHORT ANSWER TYPE	7(5×3)	3

SUBJECTS HAVING MAXIMUM MARKS = 50		
TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS FOR EACH QUESTION
ESSAY TYPE	3 (2 x 10)	10
SHORT ESSAY TYPE	5(3×5)	5
SHORT ANSWER TYPE	7(5×3)	3

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SECTION II

Goals and General objectives of the Education program

GENERAL OBJECTIVES

1. Practice the specialty concerned ethically and in step with the principles of primary health care.
2. Demonstrate sufficient understanding of the basic sciences relevant to the concerned specialty.
3. Observe and discuss measures for the Radiation Safety and Protection in radiotherapy.
4. Demonstrate empathy and humane approach towards patients and their families and exhibit interpersonal behavior in accordance with the societal norms and expectations.
5. Develop skills as a self-directed learner, recognize continuing educational needs; select and use appropriate learning resources.

ROLE OF THE RTT (The identification of the roles expected of an RTT).
In broad terms these roles are:

Treatment preparation

a) Awareness of diagnostic modalities relevant to oncology
b) Planning/Dosimetry
c) Localization/Simulation
d) Hand and computer planning
   Single field (skin, metastases)
   Parallel opposed (palliative and radical intent)
e) Mould room techniques and practice
f) Treatment calculations
g) Quality control and Quality Assurance

Treatment equipment

Knowledge of the characteristics of the equipment and the appropriate selection of equipment for common malignancies.

a) Superficial
b) Orthovoltage
c) Cobalt-60
d) Linear accelerator
e) Brachytherapy (LDR and HDR)
f) 3DCRT/SRS/SRT/IMRT

Treatment set-up and delivery

a) Single field (skin, metastases)
b) Parallel opposed (palliative and radical intent)
c) Multiple planned fields
d) Simple 2 field plan
e) Box (Ca Cx)
f) 3-field with wedge (Bladder)

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g) Complex planned treatment
h) 3-D
i) Mixed modality (head and neck, breast)
j) Detecting abnormal equipment displays that may indicate a malfunction.
k) Intervening in case of an accident or emergency.

Patient care

a) Before radiation therapy
b) Awareness of patient management before attending for radiation oncology
c) During radiation therapy
d) Treatment preparation
e) Monitoring the patient during treatment
f) Detecting and communicating to the physician any unusual patient reactions
g) After radiation therapy
h) Awareness of patient management after completion of treatment (follow-up)

In summary

The RTT will need:

- Ability and skills to work in a team
- Technological aptitude
- Academic knowledge
- Technical skills, knowledge and ability
- Knowledge of radiation protection
- Professionalism
- Communication skills
- Computer skills
- Problem solving ability
- Continued professional development (CPD)

STATEMENT OF THE COMPETENCIES

Keeping in view the general objectives of the training, each discipline shall aim at development of specific competencies, which shall be defined and spelt out in clear terms. Each department shall produce a statement and bring it to the notice of the trainees in the beginning of the program so that he or she can direct the efforts towards the attainment of these competencies.

COMPONENTS OF THE CURRICULUM

The major components of the curriculum shall be:

- Theoretical knowledge
- Practical/clinical skills
- Practical Training / Quality Assurance.
- Radiation Safety and Protection
- Attitudes, including communication.
- Training in research methodology.

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B.Sc. RADIOTHERAPY TECHNOLOGISTS (RTT)

INTRODUCTION

Radiotherapy involves the use of ionizing radiation to treat disease and is one of the major modalities used in the management of cancer. The emphasis is on teamwork and therapeutic radiographers work closely with doctors, medical physicists and nurses to provide the optimum care for patients.

Modern radiotherapy utilizes highly sophisticated technology and the Radiotherapy Technologist [RTT] need to have an interest in and understanding of the technical aspects of treatment planning and delivery combined with good communication and caring skills. Other important qualities are the ability to work accurately and efficiently, often under pressure, and a concern to continuously improve and develop the service offered to the cancer patients.

The expected outcome is an improvement in the professional standard of technical, clinical and psychological care given to the patient to whom a course of radiation is administered. The program is to ensure that the level of expertise necessary for the profession is achieved to facilitate an overall progression towards the desired goals.

GOALS:

The Radiotherapy Technology Course is a three year integrated program consisting of alternating blocks of academic learning and Practical training in order to integrate theory with practice. At the end of training program the candidates should have acquired sufficient knowledge, Expertise & Understanding of the functioning of human body, the disease process, Basic & Radiation Therapy Physics, Radiobiology, Basic concepts in Oncology, knowledge of various malignant diseases & its management particularly with Radiotherapy. The technologist should be capable of using wide range of Radiation Therapy Equipment's (Teletherapy, Brachytherapy, Dosimetry, Treatment simulation, Treatment planning) including Mould room and Radiation protection.

OBJECTIVES:

The following objectives are laid out to achieve the goals of the course. These objectives are to be achieved by the time the candidate completes the course.

Knowledge:

- To acquire basic knowledge of Human Anatomy, Physiology, Surface marking,
- Cancer aetiology, Pathology, Natural history, Lymphatics
- To understand the Basics of Oncology
- Multimodality management i.e., Radiation Therapy, Surgery, Chemotherapy,
- Common malignancies in the country and their management,
- Basic concepts in Radiation Oncology, Radiation therapy Physics & radiation Biology

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- Radiotherapy & Treatment using Teletherapy & Brachytherapy Machines,
- TPS, Mould Room & Simulation
- Structure, Functioning, Maintenance, Quality assurance,
- Update oneself by self-study and by attending courses, Workshops, Conferences and Seminars relevant to the specialty.
- Teach and guide his team, colleagues and other students.
- Undertake audit, use information technology tools to carryout both clinical related and technology related work relevant to Radiotherapy treatment execution.

Skills:

- Handling of various Radiotherapy and X-ray equipment's,
- Handling of patients:
- Acquire skills relevant to Treatment Planning & Simulation, Mould Room techniques and its practical applications,
- Radiotherapy safety and protection, Quality assurance checks,
- Develop communications skills for better patient care and inter personal relationships.

Human Values, Ethics and Communication Abilities:

- Adopt ethical principles in all aspects of his/her patient care.
- Professional honesty and integrity are to be fostered.
- Care is to be delivered irrespective of the social status, caste, creed or religion of the patient.
- Apply high moral and ethical standards while carrying out their duties.
- Be humble and accept the limitations in his knowledge and skill and to ask for help from the Radiation Oncologists, Radiation Physicists, or from colleagues when needed.
- Respect patient's rights and privileges.

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SECTION III

Course Description

RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES, KARNATAKA, BANGALORE.

Syllabus For First Year Degree Courses In Allied Health Science

ANATOMY

No. of theory classes: 70 hours

No. of practical classes: 20 hours

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

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 all muscles of the body

Histology of skeletal (TS & LS), smooth & cardiac muscle

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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

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

5. Respiratory system

Parts of RS, nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments

Histology of trachea, lung and pleura

Names of paranasal air sinuses

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Practical: Demonstration of parts of respiratory system.

Normal radiographs of chest

Histology of lung and trachea

6. Peritoneum

Theory: Description in brief

Practical: Demonstration of reflections

7. Urinary system

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

8. 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 glad – 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

9. 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

10. Nervous system

Theory:

Neuron

Classification of NS

Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross &

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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

1. 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

2. Embryology

Theory:

Spermatogenesis & oogenesis

Ovulation, fertilization

Fetal circulation

Placenta

Internal Assessment

Theory - Average of two exams conducted. 20

Practicals: Record & Lab work* 10

* There shall be no University Practical Examination and internal assessment marks secured in Practicals need not be sent to the University.

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Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Anatomy shall be as given under.

Type of Questions	No. of Questions	Marks	Sub-total
Long Essay (LE)	3 (To attempt 2)	2 x 10	20
Short Essay (SE)	8 (To attempt 6)	6 x 5	30
Short Answer (SA)	12 (To Attempt 10)	10 x 3	30
Total Marks			80

NO PRACTICAL EXAMINATION

REFERENCE BOOKS

Anatomy

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

2. Chaursia –A Text book of Anatomy
   T.S. Ranganathan – A text book of Human Anatomy

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

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PHYSIOLOGY

Theory 70 hours

Practical 20hours

Introduction – composition and function of blood

Red blood cells – Erythropoiesis , stages of differentiation function , count physiological Variation.

Haemoglobin –structure , functions , concentration physiological variation

Methods of Estimation of Hb

White blood cells – Production , function, life span, count, differential count

Platelets – Origin, normal count, morphology functions.

Plasma Proteins – Production, concentration , types, albumin, globulin, Fibrinogen, Prothrombin functions.

Haemostasis & Blood coagulation

Haemostasis – Definition, normal haemostasis, clotting factors, mechanism of clotting, disorders of clotting factors.

Blood Bank

Blood groups – ABO system, Rh system

Blood grouping & typing

Crossmatching

Rh system – Rh factor, Rh in compatibility.

Blood transfusion – Indication, universal donor and recipient concept.

Selection criteria of a blood donor. transfusion reactions Anticoagulants – Classification, examplesand uses

Anaemias : Classification – morphological and etilogical. effects of anemia on body

Blood indices – Colour index , MCH, MCV, MCHC

Erythrocyte sedementation Rate (ESR) and Paced cell volume

Normal values, Definition . determination, Blood Volume -Normal value ,determination of blood volume and regulation of blood volume Body fluid – pH, normal value, regulation and variation

Lymph – lymphoid tissue formation, circulation, composition and function of lymph

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Cardiovascular system

Heart – Physiological Anatomy, Nerve supply

Properties of Cardiac muscle,

Cardiac cycle-systole,diastole. Intraventricular pressure curves.

Cardiac Output – only definition

Heart sounds Normal heart sounds Areas of auscultation.

Blood Pressure – Definition, normal value, clinical measurement of blood pressure.

Physiological variations, regulation of heart rate, cardiac shock, hypotension, hypertension.

Pulse – Jugalar, radial pulse, Triple response

Heart sounds – Normal heart sounds, cause characteristics and signification. Heart rate Electrocardiogram (ECG) –significance.

Digestive System - Physiological anatomy of Gastro intestinal tract, Functions of digestive system

Salivary glands Stucture and functions. Deglutination –stages and regulation

Stomach – structure and fuctions

Gastric secretion – Composition function regulation of gastric juice secretion

Pancrease – structure, function, composition, regulation of pancreatic juice

Liver – functions of liver

Bile secretion, composition, function regulation of bile secretion .Bilirubin metabolism types of bilirubin, Vandernberg reaction, Jaundice- types, significance.

Gall bladder – functions

Intestine – small intestine and large intestine Small intestine –Functions- Digestive, absorption ,movements.

Large intestine – Functions, Digestion and absorption of Carbohydrates,Proteins, Fats,Lipids.Defecation

Respiratory system

Functions of Respiratory system, Physiological Anatomy of Respiratory system, Respiratory tract, Respiratory Muscles, Respiratory organ-lungs, Alveoli, Respiratory membrane, stages of respiration.

Mechanism of normal and rigorous respiration. Forces opposing and favouring expansion of the lungs. Intra pulmonary pleural pressure, surface tension, recoil tendency of the wall. H

Transportation of Respiratory gases :

Transportation of Oxygen : Direction, pressure gradient, Forms of transportation, Oxygenation of Hb. Quantity of Oxygen transported.

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Lung volumes and capacities

Regulation of respiration what? Why? How? Mechanisms of Regulation, nervous and chemical regulation. Respiratory centre. Hearing Brier, Reflexes.

Applied Physiology and Respiration : Hypoxia, Cyanosis, Asphyxia, Dyspnea, Dysbarism, Artificial Respiration, Apnoea.

Endocrine System - Definition Classification of Endocrine glands & their Harmones Properties of Harmones .

Thyroid gland hormone – Physiological, Anatomy, Hormone scerated, Physiological function, regulation of secretion. Disorders – hypo and hyper secretion of hormone Adrenal gland, Adrenal cortex physiologic anatomy of adrenal gland, Adrenal cortex, cortical hormones – functions and regulation Adrenal medulla – Hormones , regulation and secretion. Functions of Adrenaline and nor adrenaline.

Pituitary hormones – Anterior and posterior pituitary hormones, secretion ,function

Pancreas – Hormones of pancreas

Insulin – secretion, regulation ,function and action

Diabetes mellitus – Regulation of blood glucose level

Parathyroid gland – function, action ,regulation of secretion of parathyroid hormone. Calcitonin – function and action

Special senses

Vision – structure of eye. Function of different parts.

Structure of retina

Hearing structure and function of can mechanism of hearing

Taste – Taste buds functions . Smell physiology, Receptors.

Nervous system

Functions of Nervous system, Neurone structure, classification and properties. Neuroglia, nerve fiber, classification ,conduction of impulses continuous and saltatory. Velocity of impulse transmission and factors affecting. Synapse – structure, types, properties. Receptors – Definition, classification ,properties. Reflex action – unconditioned properties of reflex action. Babinski's sign. Spinal cord nerve tracts. Ascending tracts, Descending tracts –

pyramidal tracts – Extrapyramidal tracts. Functions of Medulla, pons, Hypothalamic disorders. Cerebral cortex lobes and functions, Sensory cortex, Motor cortex,Cerebellum functions of Cerebellum.Basal ganglion-funtions. EEG.

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Cerebro Spinal Fluid(CSF) : formation, circulation, properties, composition and functions lumbar puncture.

Autonomic Nervous System : Sympathetic and parasympathetic distribution and functions and comparison of functions.

Excretory System

Excretory organs

Kidneys: Functions of kidneys structural and functional unit nepron, vasarecta, cortical and juxtamedullary nephrons – Comparision, Juxta Glomerular Apparatus –Structure and function. Renal circulation peculiarities.

Mechanism of Urine formation : Ultrafiltration criteria for filtration GFR, Plasma fraction, EFP, factors effecting EFR. Determination of GFR selective reabsorption – sites of reabsorption ,substance reabsorbed, mechanisms of reabsorption Glucose, urea.

H + Cl aminoacids etc. TMG, Tubular lead, Renal threshold % of reabsorption of different substances, selective e secretion.

Properties and composition of normal urine, urine output. Abnormal constituents in urine , Mechanism of urine concentration.

Counter – Current Mechanisms : Micturition, Innervation of Bladder, Cysteurethrogram.

Diuretics : Water, Diuretics, osmotic diuretics, Artificial kidney Renal function tests – plasma clearance Actions of ADH, Aldosterone and PTH on kidneys. Renal function tests

Reproductive system

Function of Reproductive system, Puberty, male reproductive system. Functions of testes, spermatogenesis site, stages, factors influencing semen. Endocrine functions of testes Androgens – Testosterone structure and functions. Female reproducive syustem. Ovulation, menstrual cycle. Physiological changes during pregnancy, pregnancy test. Lactation : Composition of milk factors controlling lactation.

Muscle nerve physiology

Classification of muscle, structure of skeletal muscle, Sarcomere contractile proteins, Neuromuscular junction. Transmission across, Neuromuscular junction. Excitation contraction coupling. Mechanism of muscle contraction muscle tone, fatigue Rigour mortis

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.

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Practicals

Haemoglobinometry

White Blood Cell count

Red Blood Cell count

Determination of Blood Groups

Leishman's staining and Differential WBC count

Determination of packed cell Volume

Erythrocyte sedimentation rate [ESR]

Calculation of Blood indices

Determination of Clotting Time, Bleeding Time

Blood pressure Recording

Auscultation for Heart Sounds

Artificial Respiration

Determination of vital capacity

Internal Assessment

Theory - Average of two exams conducted. 20

Practicals: Record & Lab work* 10

* There shall be no University Practical Examination and internal assessment marks secured in Practicals need not be sent to the University.

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Physiology shall be as given under.

Type of Questions	No. of Questions	Marks	Sub-total
Long Essay (LE)	3(To attempt 2)	2 x 10	20
Short Essay (SE)	8 (To attempt 6)	6 x 5	30
Short Answer (SA)	12 (To Attempt 10)	10 x 3	30
Total Marks			80

NO PRACTICAL EXAMINATION

REFERENCE BOOKS

Physiology

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

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BIOCHEMISTRY

No. Theory classes : 70hours

No. of practical classes : 20 hours

Theory:

1. **Specimen collection** : Pre-analytical variables
   Collection of blood
   Collection of CSF & other fluids
   Urine collection
   Use of preservatives
   Anticoagulants

2. **Introduction to Laboratory apparatus**

Pipettes- different types (Graduated, volumetric, Pasteur, Automatic etc.,)

Calibration of glass pipettes

Burettes, Beakers, Petri dishes, depression plates.

Flasks - different types)Volumetric, round bottmed, Erlemeyer conical etc.,)

Funnels – different types (Conical, Buchner etx.,)

Bottles – Reagent bottles – graduated and common, Wash bottles – different type Specimen bottles etc.,

Measuring cylinders, Porcelain dish

Tubes – Test tubes, centrifuge tubes, test tube draining rack

Tripod stand, Wire gauze, Bunsen burner.

Cuvettes, significance of cuvettes in colorimeter, cuvettes for visible and UV range, cuvette holders

Racks – Bottle, Test tube, Pipette

Dessicator, Stop watch, rimers, scissors

Dispensers – reagent and sample

Any other apparatus which is important and may have been missed should also be covered

Maintenance of lab glass ware and apparatus:

Glass and plastic ware in Laboratory

*use of glass: significance of boro silicate glass ; care and cleaning of glass ware, different cleaning solutions of glass

* care and cleaning of plastic ware, different cleaning solutions .

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3. **Instruments** (Theory and demonstration) Diagrams to be drawn

1. Water bath: Use, care and maintenance

   Oven & Incubators : Use, care and maintenance.

   Water Distilation plant and water deionisers. Use, care and maintenance

   Refrigerators, cold box, deep freezers – Use, care and maintanance

   Reflux condenser : Use, care and maintenance

2. Centrifuges (Theory and demonstration) Diagrams to be drawn

   Definition, Principle, svedberg unit, centrifugal force, centrifugal field rpm, ref.Conversion of G to rpm and vice versa.

   Different types of centrifuges

   Use care and maintenance of a centrifuge

3. Laboratory balances [Theory & Practicals) Diagrams to be drawn

   - Manual balances: Single pan, double pan, trip balance
   - Direct read out electrical balances.

   Use care and maintenance. Guideline to be followed and precautions to be taken while weighing. Weighing different types of chemicals, liquids. Hygroscopic compounds etc.

4. Colorimeter and spectrophotometer (Theory and Practicals) Diagrams to be drawn

   Principle, Parts Diagram.

   Use, care and maintenance.

5. pH meter (Theory & practicals) Diagrams to be drawn

   principle, parts, Types of electrods, salt bridge solution.

   Use, care and maintenance of Ph meter and electrodes

   Guidelines to be followed and precautions to be taken while using pH meter

4. Safety of measurements

5. Conventional and SI units

6. Atomic structure

1. Dalton's theory, Properties f electrons, protons, neutrons, and nucleus, Rutherford's model of atomic structure, Bohr's model of atomic structure, orbit and orbital, Quantum numbers, Heisenberg's uncertainly principle.
2. Electronic configuration – Aufbau principle, Pauli's exclusion principle, etc.,m
3. Valency and bonds – different types of strong and weak bonds in detail with examples

6.1 Theory & Practicals for all the following under this section

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6.1.1 Molecular weight, equivalent weight of elements and compounds, normality molarity

Preparation of molar solutions (mole/litre solution) eg: 1 M Nacl, 0.15 M NaCL

1 M NaOH, 0.1 M HCl, 0.1 M H 2S04 etc.

preparation of normal solutions. eg., IN Na2CO3, O IN Oxalic acid, 0.1 N HCl, 0.1N H2504, 0.66 N H2S04 etc.,

6.1.2. Percent solutions. Preparation of different solutions – v/v w/v (solids, liquids and acids) Conversion of a percent solution into a molar solution

6.1.3.Dilutions

Diluting solutions: eg. Preparation of 0.1 N NaCl from 1 N NaCl from 2 NHCl etc., Preparing working standard from stock standard, Body fluid dilutions, Reagent dilution techniques, calculating the dilution of a solution, body fluid reagent etc.,

6.1.4. Saturated and supersaturated solutions. Standard solutions. Technique for preparation of standard solutions eg: Glucose, urea, etc., Significance of volumetric flask in preparaing standard solutions. Volumetric flasks of different sizes, Preparation of standard solutions of deliquesent compounds (CaCl2, potassium carbonate, sodium hydroxide etc.,)

Preparation of standards using conventional and Sl units

6.1.5. Acids, bases, salts and indicators.

Acids and Bases: Definition, physical and chemical properties with examples.

Arrehenius concept of acids and bases, Lowery – Bronsted theory of acids and bases classification of acids and bases. Different between bases and alkali, acidity and basicity, monoprotonic and polyprotonic acids and bases

Concepts of acid base reaction, hydrogen ion concentration, Ionisation of water, buffer, Ph value of a solution, preparation of buffer solutions using Ph meter.

Salts: Definition, classification, water of crystallization – definition and different types, deliquescent and hygroscopic salts

Acid- base indicators: (Theory and Practicals)

Theory – Definition, concept, mechanism of dissociation of an indicator, colour change of an indicator in acidic and basic conditions, use if standard buffer solution and indicators for Ph determinations, preparation and its application, list of commonly used indicators and their Ph range, suitable pH indicators used in different titrations, universal indicators

Practicals – Titration of a simple acid and a base (Preparation of standard solution of oxalic acid and using this solution finding out the normality of a sodium hydroxide solution . Acid to be titrated using

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this base) Calculation of normality of an acid or a base after titration, measurement of hydrogen ion concentration

Quality control : Accuracy
Precision
Specificity
Sensitivity
Limits of error allowable in laboratory
Percentage error

Normal values and Interpretations

Special Investigations : Serum Electrophoresis
Immunoglobulins
Drugs : Digitoxin, Theophyllines

3. Regulation of Acid Base status:

Henderson Hasselback Equations
Buffers of the fluid
pH Regulation
Disturbance in acid Base Balance
Anion Gap
Metabolic acidosis
Metabolic acidosis
Metabolic alkalosis
Respiratory acidosis
Respiratory alkalosis

4. Basic Principles and estimation of Blood Gases and pH
5. Basic principles and estimation of Electrolytes

Water Balance
Sodium regulation
Bicarbonate buffers

6. Nutrition, Nutritional support with special emphasis on parental nutrition.

Calorific Value
Nitrogen Balance
Respiratory Quotient
Basal metabolic rate
Dietary Fibers
Nutritional importance of lipids, carbohydrates and proteins
Vitamins

PRACTICALS

1. Analysis of Normal Urine
Composition of urine
Procedure for routine screening
Urinary screening for inborn errors of metabolism
Common renal disease
Urinary calculus

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2. Urine examination for detection of abnormal constituents

3. Interpretation and Diagnosis through charts
   a. Liver Function tests
   b. Lipid Profile
   c. Renal Function test
   d. Cardiac markers
   e. Blood gas and Electrolytes

4. Estimation of Blood sugar, Blood Urea and electrolytes

5. Demonstration of Strips

7. Demonstration of Glucometer

Internal Assessment
Theory - Average of two exams conducted. 20
Practicals: Record & Lab work* 10
* There shall be no University Practical Examination and internal assessment marks secured in Practicals need not be sent to the University.

Scheme of Examination

Theory

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Biochemistry shall be as given under.

Type of Questions	No. of Questions	Marks	Sub-total
Long Essay (LE)	3(To attempt 2)	2 x 10	20
Short Essay (SE)	8 (To attempt 6)	6 x 5	30
Short Answer (SA)	12 (To Attempt 10)	10 x 3	30
		Total Marks	80

NO PRACTICAL EXAMINATION

REFERENCE BOOKS

Biochemistry

1. Varley – Clinical chemistry
2. TEITZ – Clinical chemistry
3. Kaplan – Clinical chemistry
4. Ramakrishna(S) Prasanna(KG), Rajna ® Text book of Medical Biochemistry Latest Ed Orient longman Bombay –1980
5. Vasudevan (DM) Sreekumari(S) Text book of Biochemistry for Medical students ,Latest Ed
6. DAS(Debajyothi) Biochemistry Latest ED Academic, Publishers, Culcutta – 1992

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Syllabus for first year Allied Health science courses RGUHS

PATHOLOGY

Histo Pathology ,Clinical Pathology, Haematology and Blood Banking

Theory – 70 hours

Practical – 20 hours

HistoPathology - Theory

- 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.
- Bio-Medical waste management
- Section Cutting
- Tissue processing for routine paraffin sections
- Decalcification of Tissues.
- Staining of tissues - H& E Staining
- Bio-Medical waste management

Clinical Pathology – Theory

- 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 body fluids.
- Examination of cerebro spinal fluid (CSF)
- Sputum Examination.
- Examination of feces

Haematology – Theory

- 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.

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Blood Bank
Introduction
Blood grouping and Rh Types
Cross matching

PRACTICALS

- 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]

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Internal Assessment

Theory - Average of two exams conducted. 20
Practical: Record & Lab work* 10

* There shall be no University Practical Examination and internal assessment marks secured in Practical need not be sent to the University.

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Pathology shall be as given under.

Type of Questions	No. of Questions	Marks	Sub-total
Long Essay (LE)	3(To attempt 2)	2 x 10	20
Short Essay (SE)	8 (To attempt 6)	6 x 5	30
Short Answer (SA)	12 (To Attempt 10)	10 x 3	30
Total Marks			80

NO PRACTICAL EXAMINATION

REFERENCE BOOKS

Pathology –

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss – cytology
4. Winifred greg – Diagnostic cytopathology
5. Orell – Cyto Pathology
6. Todd & Sanford Clinical Diagnosis by laboratory method
7. Dacie & Lewis – Practical Haematology
8. Ramanic Sood, Laboratory Technology (Methods and interpretation) 4th Ed. J.P. Bros, New Delhi –1996)
9. Satish Gupta Short text book of Medical Laboratory for technician J.P. Bros, New Delhi – 1998
10. Sachdev K.N. Clinical Pathology and Bacteriology 8th Ed, J.P. Bros, New Delhi-1991.
11. Krishna - Text book of Pathology, Orient Longman PVT Ltd.

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Syllabus for BSc. Allied Health Science Courses - RGHUS
Microbiology

Objective : - This course introduces the principles of Microbiology with emphasis on applied aspects of Microbiology of infectious diseases particularly in the following areas

1. Principles & practice of sterilization methods.
2. Collection and despatch of specimens for routine microbiological investigations.
3. Interpretation of commonly done bacteriological and serological investigations.
4. Control of Hospital infections
5. Biomedical waste management
6. Immunization schedule

Theory - 70 hours

1. **Morphology** 4 hours
   Classification of microorgaisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria.
2. **Growth and nutrition** 4 hours
   Nutrition, growth and multiplications of bacteria, use of culture media in diagnostic bacteriology.
3. **Sterilisation and Disinfection** 4 hours
   Principles and use of equipments of sterlization namely Hot Air oven, Autoclave and serum inspissrator. Pasteurization, Anti septic and disinfectants.
   Antimicrobial sensitivity test
4. **Immunology** 6 hours
   Immunity Vaccines, Types of Vaccine and immunization schedule
   Principles and interpretation of commonly done serological tests namely Widal, VDRL, ASLO, CRP, RF & ELISA. Rapid tests for HIV and HbsAg(Technical details to be avoided)
5. **Systematic Bacteriology** 20 hours
   Morphology, cultivation, diseases caused ,laboratory diagnosis including specimen collection of the following bacteria(the classification, antigenic structure and pathogenicity are not to be taught)
   Staphyloccci, Streptococci, Pneumococci, Gonococci, Menigococci, C diphtheriae, Mycobacteria, Clostridia, Bacillus, Shigella, Salmonella, Esch coli, Klebsiella, Proteus,vibrio cholerae, Pseudomonas & Spirochetes
6. **Parasitology** 10 hours
   Morphology, life cycle, laboratory diagnosis of following parasites
   E. histolytica, Plasmodium, Tape worms, Intestinal nematodes

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7. **Mycology** 4 hours
   Morphology, diseases caused and lab diagnosis of following fungi.
   Candida, Cryptococcus, Dermatophytes ,opportunistic fungi.
8. **Virology** 10 hours
   General properties of viruses, diseases caused, lab diagnosis and prevention of following viruses, Herpes, Hepatitis, HIV, Rabies and Poliomyelitis.
9. **Hospital infection** Causative agents, transmission methods, investigation, prevention and control Hospital infection. 4 hours

10. **Principles and practice Biomedical waste management** 4 hours

Practical 20 hours

1. Compound Microscope.
2. Demonstration and sterlization of equipments – Hot Air oven, Autoclave, Bacterial filters.
3. Demonstration of commonly used culture media, 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
4. Antibiotic susceptibility test
5. Demonstration of common serological tests – Widal, VRDL, ELISA.
6. Grams stain
7. Acid Fast staining
8. Stool exam for Helminthic ova
9. Visit to hospital for demonstration of Biomedical waste mangement.
10. Anaerobic culture methods.

Internal Assessment

Theory - Average of two exams conducted. 20
Practicals: Record & Lab work* 10
* There shall be no University Practical Examination and internal assessment marks secured in Practicals need not be sent to the University.

Scheme of Examination

Theory

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Microbiology shall be as given under.

Type of Questions	No. of Questions	Marks	Sub-total
Long Essay (LE)	3(To attempt 2)	2 x 10	20
Short Essay (SE)	8 (To attempt 6)	6 x 5	30
Short Answer (SA)	12 (To Attempt 10)	10 x 3	30
Total Marks			80

NO PRACTICAL EXAMINATION

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REFERENCE BOOKS

Microbiology

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. Emmons – Medical mycology
6. Basic laboratory methods in Parasitology, 1st Ed, J P Bros, New Delhi – 199
7. Basic laboratory procedures in clinical bacteriology, 1st Ed, J P Brothers, New Delhi
8. Medical Parasitology – Ajit Damle

SUBSIDIARY SUBJECTS
SOCIOLOGY

Teaching Hours : 20

COURSE DESCRIPTION

This course will introduce student to the basic sociology concepts, principles and social process, social institutions [in relation to the individual, family and community and the various social factors affecting the family in rural and urban communities in India will be studied.

Introduction :

1. Meaning – Definition and scope of sociology
2. Its relation to Anthropology, Psychology, Social Psychology
3. Methods of Sociological investigations – Case study, social survey, questionnaire, interview and opinion poll methods.
4. Importance of its study with special reference to health care professionals

Social Factors in Health and Disease:

1. Meaning of social factors
2. Role of social factors in health and disease

Socialization :

1. Meaning and nature of socialization
2. Primary, Secondary and Anticipatory socialization
3. Agencies of socialization

Social Groups:

1. Concepts of social groups, influence of formal and informal groups on health and sickness. The role of primary groups and secondary groups in the hospital and rehabilitation setup.

Family :

1. The family, meaning and definitions
2. Functions of types of family
3. Changing family patterns
4. Influence of family on individual's health, family and nutrition, the effects of sickness in the family and psychosomatic disease and their importance to physiotherapy

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Community :

1. Rural community: Meaning and features – Health hazards to rural communities, health hazards to tribal community.
2. Urban community – Meaning and features – Health hazards of urbanities

Culture and Health :

1. Concept of Health
2. Concept of culture
3. Culture and Health
4. Culture and Health Disorders

Social Change :

1. Meaning of social changes
2. Factors of social changes
3. Human adaptation and social change
4. Social change and stress
5. Social change and deviance
6. Social change and health programme
7. The role of social planning in the improvement of health and rehabilitation

Social Problems of disabled :

Consequences of the following social problems in relation to sickness and disability remedies to prevent these problems

1. Population explosion
2. Poverty and unemployment
3. Beggary
4. Juvenile delinquency
5. Prostitution
6. Alcoholism
7. Problems of women in employment

Social Security :

Social Security and social legislation in relation to the disabled

Social Work :

1. Meaning of Social Work
2. The role of a Medical Social Worker

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.

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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 summarising
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

Deleted: ¶

UNIT - VI : VERBAL COMMUNICATION :
Discussions and summarization, Debates, Oral reports, use in teaching

Scheme of Examination

Written (Theory): Maximum Marks: –80 marks.
No Practical or Viva voce examination

- This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

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 D Wainwright
6. Writers Basic Bookself Series, Writers Digest series
7. Interviewing by Joan Clayton Platkon
8. Penguin Book of Interviews.

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BIO STATISTICS

Time Allotted: 20 Hours

Course Description:

Introduction to basic statistical concepts: methods of statistical analysis; and interpretation of data

Behavioural Objectives:

Understands statistical terms.
Possesses knowledge and skill in the use of basic statistical and research methodology.

Unit – I : **Introduction**

Meaning, definition, characteristics of statistics.
Importance of the study of statistics.
Branches of statistics.
Statistics and health science including nursing.
Parameters and estimates.
Descriptive and inferential statistics.
Variables and their types.
Measurement scales

Unit – II : **Tabulation of Data**

Raw data, the array, frequency distribution.
Basic principles of graphical representation.
Types of diagrams - histograms, frequency polygons, smooth frequency polygon, commulative frequency curve, ogive.
Normal probability curve.

Unit - III : **Measure of Central Tendency**

Need for measures of central tendency
Definition and calculaton of mean - ungrouped and grouped
Meaning, interpretation and calculation of median ungrouped and grouped.
Meaning and calculation of mode.
Comparison of the mean, and mode.
Guidelines for the use of various measures of central tendency.

Unit - IV : **Measure of Variability**

Need for measure of dispression.
The range, the average deviation.
The variance and standard deviation.
Calculation of variance and standard deviation ungrouped and grouped.
Properties and uses of variance and SO

Unit -V : **Probability and Standard Distributions.**

Meaning of probability of standard distribution.
The Binominal distribution.

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The normal distribution.
Divergence from normality - skewness, kurtosis.

Unit - VI : **Samling Techniques**
Need for sampling - Criteria for good samples.
Application of sampling in Community.
Procedures of sampling and sampling designs errors.
Sampling variation and tests of significance.

Unit - VII : **Health Indicator**
Importance of health Indicator.
Indicators of population, morbidity, mortality, health services.
Calculation of rates and rations of health.

Recommended Books.

1. B.K. Mahajan & M. Gupta (1995) Text Book of Preventive & Social Medicine, 2002, 17th Edition Jaypee Brothers.

B.Sc. Allied health Sciences – I year

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, sterlization and disinfection.
- Surgical Dressing: Observation of dressing procedures

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

INDIAN CONSTITUTION

Prescribed for the First Year students of all degree classes

Unit-I: Meaning of the team 'Constitution' making of the Indian Constitution 1946-1940.

Unit-II: The democratic institutions created by the constitution Bicameral system of Legislature at the Centre and in the States.

Unit-III: Fundamental Rights and Duties their content and significance.

Unit – IV: Directive Principles of States Policies the need to balance Fundamental Rights with Directive Principles.

Unit – V: Special Rights created in the Constitution for: Dalits, Backwards, Women and Children and the Religious and Linguistic Minorities.

Unit-VI: Doctrine of Separation of Powers legislative, Executive and Judicial and their functioning in India.

Unit – VII: The Election Commission and State Public Service commissions.

Unit – VIII: Method of amending the Constitution.

Unit – IX: Enforcing rights through Writs:

Unit – X: Constitution and Sustainable Development in India.
Unit - XI : Consumer protection act and other acts pertaining to Medical Profession.

Books: 1. J.C. Johari: The Constitution of India- A Politico-Legal Study-Sterling Publication, Pvt. Ltd. New Delhi.
2. J.N . Pandey: Constitution Law of India, Allahbad, Central Law Agency, 1998.
3. Granville Austin: The Indian Constitution – Corner Stone of a Nation-Oxford, New Delhi, 2000.

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ENVIRONMENT SCIENCE AND HEALTH

Introduction to Environment and Health

Sources, health hazards and control of environmental pollution

Water

The concept of safe and wholesome water.

The requirements of sanitary sources of water.

Understanding the methods of purification of water on small scale and large scale.

Various biological standards, including WHO guidelines for third world countries.

Concept and methods for assessing quality of water.

Domestic refuse, sullage, human excreta and sewage their effects on environment and health, methods and issues related to their disposal.

Awareness of standards of housing and the effect of poor housing on health.

Role of arthropods in the causation of diseases, mode of transmission of arthropods borne diseases, methods of control

Recommended Books.

1.Text Book of Environmental Studies for under gradute courses By Erach Bharucha Reprinted in 2006, Orient Longman Private Limited /Universities Press India Pvt. Ltd.
2. Questions and Answers in Environmental Science – Basu Orient Longman Pvt. Ltd.

BASICS IN COMPUTER APPLICATIONS

The course enables the students to understand the fundamentals of computer and its applications.

1. Introduction to Data processing :

Features of computers, Advantages of using computers. Getting data into / out of computers. Role of computers. What is Data processing? Application areas of computers involved in Data processing. Common activities in processing. Types of Data processing, Characteristics of information. What are Hardware and Software?

2. Hardware Concepts :

Architecture of computers, Classification of computers, Concept of damage. Types of storage devices. Characteristics of disks, tapes, Terminals, Printers, Network. Applications of networking concept of PC System care, Floppy care, Data care.

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Concept of Software.

Classification of software : System software. Application of software. Operating system. Computer system. Computer virus. Precautions against viruses. Dealing with viruses. Computers in medical electronics

Basic Anatomy of Computers

Principles of programming

Computer application - principles in scientific research ; work processing, medicine, libraries, museum , education, information system.

Data processing

Computers in physical therapy - principles in EMG, Exercise testing equipment, Laser.

Scheme of Examination for *MEDICAL ELECTRONICS including COMPUTER APPLICATIONS*

One Written (Theory) paper: Maximum Marks: –80 marks.

No Practical or Viva voce examination.

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RADIOTHERAPY- PART-I A

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 focal spot.
- 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, Atomic number (Z), Mass number (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, 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.

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- 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 (self-rectifying 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 X-ray 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), 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. 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.

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Scheme of Examination

Theory

There shall be one theory paper of three hours duration carrying 60 marks. Distribution of type of questions and marks for **Radiotherapy Part I A** shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS FOR EACH QUESTION	Sub-total
ESSAY TYPE	3 questions to attempt 2 (10 marks each)	10	20
SHORT ESSAY TYPE	7questions to attempt 5 (5 marks each)	5	25
SHORT ANSWER TYPE	7questions to attempt 5 (5 marks each)	3	15
			60

SECOND YEAR B.Sc. RADIOTHERAPY TECHNOLOGY

2.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 Carcinogenisis, Hereditary Effects,
- Effects on Embryo and Foetus, Catractogenisis
- 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
- Carcinogensis
- Characteristic of neoplasia (Natural History)
- Histological classification of neoplasia
- Spread of neoplasia
- Staging and grading systems

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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
- Prostate cancer
- Bladder cancer
- Seminoma
- Pediatric Tumours and others

SECTION-B

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,
- 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

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Scheme of Examination *Theory*

There shall be one theory paper with two sections of three hours duration carrying **60** marks. Distribution of type of questions and marks for **Radiotherapy Part I B(Sec A & B)** shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS FOR EACH QUESTION	Sub-total
ESSAY TYPE	Section A -2 questions to attempt 1 Section B – 2 questions to attempt 1	10	20
SHORT ESSAY TYPE	6 questions to attempt 4 Section A – 3 questions to attempt 2 Section B – 3 questions to attempt 2	5	20
SHORT ANSWER TYPE	12 questions to attempt 10 Section A – 6 questions to attempt 5 Section B – 6 questions to attempt 5	2	20
			60

PRACTICALS :

RADIOTHERAPY –I .

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 / Aquaplast immobilization cast and others
      iv. Shield (use of Styrofoam 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 to tumor and Normal tissues
   c. Calculations of Teletherapy & Brachytherapy treatment time.
   d. 3D Planning (optional)
   e. Use of Computers and TPS
   f.

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3. Simulation equipment parts, operation, principles: **(E)** Simulation of: -
    i. AP/PA portals for pelvis in cancer cervix with SSD Techniques.
    ii. Simulation of four 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 80 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 -------- 10 Marks
5. Quality Assurance in Radiotherapy------- 10 Marks

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B.Sc Radiotherapy Technology

1.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, 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.

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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; thermo luminescent, 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.

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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

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
- 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.

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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

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- 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 preperation
- Beam shaping devices (block, compensators etc.) and their preperation
- Bolus material and their preparation
- 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

Scheme of Examination *Theory*

There shall be one theory paper of three hours duration carrying **60** marks. Distribution of type of questions and marks for **Radiotherapy Part II A** shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS FOR EACH QUESTION	Sub-total
ESSAY TYPE	3 questions to attempt 2 (10 marks each)	10	20
SHORT ESSAY TYPE	7questions to attempt 5 (5 marks each)	5	25
SHORT ANSWER TYPE	7questions to attempt 5 (5 marks each)	3	15
			60

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2.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 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

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Sec 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

6. RECENT ADVANCES IN RADIOTHERAPY.

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)**

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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

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SCHEME OF EXAMINATION
University Examination

Scheme of Examination *Theory*
There shall be one theory paper with two sections of three hours duration carrying **60** marks. Distribution of type of questions and marks for **Radiotherapy Part II B (Sec A & B)** shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS FOR EACH QUESTION	Sub-total
ESSAY TYPE	Section A -2 questions to attempt 1 Section B – 2 questions to attempt 1	10	20
SHORT ESSAY TYPE	6 questions to attempt 4 Section A – 3 questions to attempt 2 Section B – 3 questions to attempt 2	5	20
SHORT ANSWER TYPE	12 questions to attempt 10 Section A – 6 questions to attempt 5 Section B – 6 questions to attempt 5	2	20
			60

PRACTICALS SCHEME OF EXAMINATION 80 Marks
(One Common Practical)

1.Cobalt-machine---------- **20 Marks**
2.LinearAccelerator--------- 20 **Marks**
3.SimulationandTreatmentTechniques------- 20 Marks
4.Spotters 20 Marks
a) I/capplicationcancercervix---
b)I/LRadiotherapyapplication-------.
c) Advanced Training

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SECTION-IV

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 and 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 observe or participate as appropriate.

General procedures to be observed when patients attend for appointment:

- Lifting and moving techniques
- Administration of bedpans, 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.
- Stoma 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

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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:

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

Equipment's and integration:

(i) Begin to become competent in the manipulation of the radiotherapy equipment.
(ii) Be able to communicate effectively with patients.
(iii) 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 the set up of multi field 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 dark room practice) and correctly unloading and reloading cassettes.

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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) Set up a patient on their first visit.

TO ACHIEVE FINAL COMPETENCY SUBSTANTIAL TIME WILL BE SPENT:

(i) Setting up multi field techniques under supervision.

(ii) Participating in the quality control procedures in the department in accordance with the protocols.

(iii) Simulating and localizing a 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 Project work, 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 checklists provided (Assessment forms).

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The learning out comes to be assessed should included: (1) 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) Periodic tests:
   The departments may conduct three tests (Internal Assessment), two of them be annual tests, one at the end of first year and the other in the second year. The third test may be held three months before the final examination. The tests may include written papers, practical with viva voce.

2) 6) Work diary / Log Personal Attitudes.
   The essential items are:
   - Caring attitudes
   - Initiative
   - Organizational ability
   - Potential to cope with stressful situations and undertake responsibility
   - Trust worthiness and 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.

3) Acquisition of knowledge:
   The methods used comprise of 'Log Book' 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 log book 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.

4) Technical skills
   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 performance is assessed by the guide by direct observation. Particulars are recorded by the student in the log book.

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5) Teaching Skills:

Book:

Every candidate shall maintain a work diary and record his/her participation in the training programs conducted by the department 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.

6) Records:

Records, log books, 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 through out the said course shall be made by the HOD.

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

RECOMMENDED BOOKS

BASIC BOOKS:

01. Principles of Anatomy and Physiology, 10th Edition . Tortura Grabowski. Whiley International Press.
02. Anatomy and Physiology in Health and illness.9th edition. Kathleen J.W.Wilson and Anne Waugh. Churchill Livingstone.
03. Anatomy and Physiology for Nurses, T.W.A. Glenister, William Heilemann Medical Books LTD., London
04. Textbook of Radiotherapy, Radiation Physics , Therapy and Oncology. 6th Edition. C.K. Bomford. Churchill Livingstone.
05. Anatomy and Physiology in Health and Illness, Anne Waugh, Allison Grant, Illustrations by Graeme Chambers.
06. Ross and Wilson, Anatomy and Physiology in health and illness, Kathleen J.W. Wilson, 8th Edition, Churchill and Living stone.
07. Walter and Millers, Text Book of Radiotherapy, Radiation Therapy Physics, Therapy and Oncology. C.K. Bomford, 6th Edition, Churchill Living Stone.
08. A Nurses Guide to Cancer Care, Brenda M. Nevidjon, Lippincott.
09. Radiotherapy: Principles and Practice, A Manual for quality in Treatment delivery, Sue E. Griffith, Churchill Living stone.
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 ant other editions, Published by the American Cancer Society.

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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: John Wright & 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 William Hendee Mosby
4. The Physics of Radiation Therapy, Second Edition, Fiaz M. Khan, Ph.D. Williams & Wilkins.
5. Clinical Oncology, Geoffrey R. Weiss, Associate Professor of Medicine, The University of Texas Health Science Center at San Antonio.
6. Cancer Facts, A concise Oncology Text, James F. Bishop, Harwood Academic Publishers,
7. Review of Medical Physiology, 20th edition, William F. Ganong, LANGE
8. A Colour Atlas of Human Anatomy, Wolfe Medical Publications

9. Medical Physics Handbook 6, Fundamentals of Radiation Dosimetry, J R Greening, Adam Hilger ltd, Bristol.
10. Principles and Practice of Radiation Oncology, Carlos A Perez,
11. Principles and Practice of Radiation Therapy, G.K.Rath & B.K.Mohanthi.ILBS
12. Principles of Radiological Physics. 3rd edition. Donald T. Graham. Churchill Livingstone.
13. Radiation Oncology: Rational technique and results. 8th edition. James D & K.Khan Ang.
14. Clinical Oncology for Medical Students and Physicians. Philip Rubin. American Cancer Society.

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SECTION-V

Monitoring Learning Progress

LOG BOOK

ASSESSMENT FORMS

- Template

Centres may develop their own criteria based on local practice.

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PRACTICAL ASSESSMENT

(To be completed by the Clinical Assessor/Supervisor within two days of discussion with the student)

Date ……

EMERGENCY PROCEDURES	**YES**	**NO**	**Not applicable**
Student indicated the position of the emergency on/off switches for electrical and radiation safety			
Student indicated the location of the oxygen, resuscitation and fire fighting equipment			
Familiarity with the treatment documents of the Quality Assurance programme			

TREATMENT PREPARATION	**YES**	**NO**	**Not applicable**
Student correctly interprets the treatment prescription			
Student correctly prepares the treatment room			
Student correctly prepares the equipment			
Student correctly identifies the patient			
Student assesses the patient's condition and responds appropriately			
Correctly identifies the treatment site			

TECHNIQUE	**FIELD 1**		**FIELD 2**		**Not applicable**
	YES	**NO**	**YES**	**NO**	
Student correctly positions patient on the treatment couch					
Student correctly set the FSD					
Student demonstrates accurate beam alignment					
Student correctly sets the interlocks					
Student monitors the patient throughout the treatment procedure					
Student cleans the room and prepares for the next patient					

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CARE OF THE PATIENT	YES	NO	Not applicable
1. Student gave adequate explanation of procedure to the patient			
2. Student assisted the patient as required			
3. Student was considerate to the patient			
4. Student demonstrated suitable aftercare to the patient			
5. Student paid attention to the specific hygiene practices and universal precautions relevant to the patient			

UNACCEPTABLE PERFORMANCE / FAILURE

1. Failure to identify the location of the various items of emergency equipment.
2. Failure to check the identity of the patient and / or the site of treatment.
3. Failure to assess pre-treatment condition and to act appropriately (the assessor intervenes if he/she considers the patient unfit for treatment).
4. Preparing to give an incorrect treatment.

Please outline any special problems which arose during the assessment procedure which may have influenced the result.

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Assessor's/Supervisor's signature ……

I have seen and discussed this assessment with the Assessor / Supervisor

Student's signature ……

Date ……

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Multi field treatment with / without shielding

Name ……

Student ID ……

Stage in training ……

Clinical Department ……

Date ……

Clinical Assessor ……

Treatment related information

Diagnosis ……

Site for treatment ……

Technique ……

Treatment unit including the type and energy of radiation ……

……

Fields to be treated for the purpose of assessment ……

……

Date patient consent was obtained ……

Student's signature

……

I agree that the above information is correct.

Clinical Assessor / Supervisor's signature ……

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PRACTICAL ASSESSMENT

(To be completed by the Clinical Assessor/ Supervisor within two days of the pre-evaluation discussion with the student).

Date ……

PREPARATION (Student accurately / correctly)	**YES**	**NO**	**Not applicable**
Indicates position of emergency on/off switches for electrical and radiation safety			
Indicated location of oxygen, resuscitation and fire-fighting equipment			
Notes any pre-treatment requirement Full bladder Blood count Routine clinic visit Dietician appointment To be seen on setup Port film Other (please indicate)			
Interprets treatment prescription			
Prepares the treatment room			
Prepares the equipment Treatment table Pillows / headrest / immobilization device Bolus Shielding devices			
Identifies the patient			
Evaluates patient condition and informs the radiographer of any problems			

TECHNIQUE (Student demonstrates accuracy in)	**YES**	**NO**	**Not applicable**
Positioning of patient			
Use of immobilization devices			
Setting FSD / SSSD / SAD			
Use of beam directional devices			
Use of beam definition devices			
Use of bolus			
Use of beam attenuation			
Beam alignment			
Student correctly sets interlocks			
Other (please indicate)			

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PRE-SETUP ASSESSMENT

To take place between the clinical assessor and the student at a designated time prior to the formal practical assessment.

Date ……

	YES	NO
Student has reviewed all the relevant information for this patient.		

STUDENT WAS ABLE TO GIVE INFORMATION ON	YES	NO	Not applicable
DISEASE Diagnosis Extent of disease Common routes of spread			
TREATMENT VOLUME Areas included Anatomical field limits Critical structures and their radiation tolerance dose(s)			
BEAM MODIFICATION Used Reasons for			
TREATMENT PRESCRIPTION Total dose Daily fractionation Any modification for this treatment and the reasons for			
P'ATIENT Treatment intent Position Probable side effects Appropriate advice Any other relevant information to this individual patient Any anticipated problems			
OTHER Please indicate			

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DOSE DELIVERY (Student correctly)	YES	NO	Not applicable
Double checks dose prescription			
Indicates monitor units / time to be set			
Observes control panel throughout the treatment procedure			
Observes patient throughout the treatment procedure			
Cleans the treatment room			

PATIENT CARE Student:	YES	NO	Not applicable
Asked patient re overall well-being			
Responded adequately to problems reported by the patient			
Responded adequately to questions asked by the patient			
Reported any problems / queries to the radiographer			
Gave an adequate explanation of the treatment procedure			
Gave appropriate level of assistance to the patient in the treatment room			
Was considerate to the needs of the patient			
Paid attention to the specific hygiene practices relevant to the patient			
Demonstrated suitable aftercare			

PROFESSIONALISM	YES	NO	Not applicable
Asked questions of the radiographers appropriate to this patient and technique			
Demonstrated initiative			
Worked well as a member of the team			

Comments……

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UNACCEPTABLE PERFORMANCE / FAILURE

1. Failure to identify the location of the various items of emergency equipment.
2. Failure to check the identity of the patient.
3. Failure to assess pre-treatment condition and to act appropriately (the assessor intervenes if he/she considers the patient unfit for treatment).
4. Preparing to give an incorrect treatment.

Please outline any special problems which arose during the assessment procedure which may have influenced the result.

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Assessor's/Supervisor's signature ……

I have seen and discussed this assessment with the Assessor / Supervisor

Student's signature ……

Date ……

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Assessment of Clinical Placement

Name .....

Unit .....

Phase in programme .....

Grade awarded for professional development .....

Grade awarded for assessment .....

Course Director's/Clinical Coordinator's signature .....

Student's signature .....

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Assessment of Patient Management

At a level appropriate to his/her stage in training the student should demonstrate an ability to:		
	MAXIMUM MARKS	**MARKS AWARDED**
Interpret information from treatment sheet and patients notes	**10**	
Carry out appropriate preparation of treatment room and equipment	**10**	
Discuss the merits or otherwise of the treatment plan for individual patients	**10**	
Recognise signs of reactions to treatment	**10**	
Reassure and support patient throughout the treatment procedure	**10**	
Communicate effectively with patients, relatives and other professionals	**10**	
Appropriately record details of treatment and other relevant information	**10**	
TOTAL MARKS	**70**	

Comments of clinical supervisor:

Comments of student:

Clinical Supervisor's signature .....

Student's signature .....

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Assessment of Professional Development

Score on a scale of 1 to 5. (1 unsatisfactory and 5 excellent)					
	1	**2**	**3**	**4**	**5**
Professional appearance					
Reliability					
Initiative, including willingness to learn enquire/ research while on placement					
General handling and positioning of patients					
Professional manner					
Ability to work independently and as part of a team					
Attention to safety aspects					

Comments of clinical supervisor:

Comments of student:

Clinical Supervisor's signature .....

Student's signature .....

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PATIENT MANAGEMENT

Interprets information
Correct identification / need for blood counts / clinic visit, etc.

Implements preparation
Field size / accessory equipment, etc.

Merits of treatment plan
Aim of treatment / reasons for modifications / lead, etc.

Reactions
Aware of normal and reports abnormal to radiographer

Reassurance and support of patient
Appropriate comments and information

Communication
Clear / appropriate / all patients / staff / others

Records
Accuracy / relevance / date / respect for confidentiality

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PROFESSIONAL DEVELOPMENT

Professional Appearance
Uniform / overall neatness, etc.

Reliability
Attendance / punctuality / accurate reporting / carrying out tasks

Initiative
Ability / willingness to take action. Asking questions / seeking help

General handling skills
Positioning of patient / accurate setting up, care with lead blocks, etc.

Professional manner
Courtesy / participation in discussion / empathy / common sense

Independence / teamwork
Relevant to stage in training / less dependent on instructions

Safety
Includes radiation awareness, fire prevention, prevention of cross infection, etc.

Comments
Comments should be included to explain the scores / marks from each section and to help guide students on how to improve in these areas and are invaluable to school staff in co-ordinating assessments and placements

Student comments will provide feedback to clinical staff and to school staff on the placement in general.

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Assessment of Technical Competence

At a level appropriate to his/her stage in training the student should demonstrate an ability to:		
	MAXIMUM MARKS	**MARKS AWARDED**
Identify the functions on the pedestal/handset	**10**	
Safely operate the pedestal/handset	**10**	
Identify the functions on a control panel and indicate their purpose	**10**	
Correctly and safely under supervision set the control panels	**10**	
Safely use the accessory equipment in the correct context	**10**	
Correctly and safely use the immobilization equipment	**10**	
Identify and locate the radiation protection features in the treatment areas	**10**	
Set up a single field under supervision	**10**	
Set up a parallel opposed treatment under supervision	**10**	
Assist in the set up of a multi field treatment	**10**	
Identify the cassettes and films used in the simulator	**10**	
Identify the cassettes and films used in the treatment unit	**10**	
Demonstrate the correct procedure for developing films	**10**	
Demonstrate the correct procedure for unloading and reloading cassettes	**10**	
TOTAL MARKS	**140**	

Comments of clinical supervisor:

Comments of student:

Clinical Supervisor's signature ....

Student's signature ....

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Assessment of Technical Competence

At a level appropriate to his/her stage in training the student should demonstrate an ability to:		
	MAXIMUM MARKS	**MARKS AWARDED**
Set up multi field treatments under supervision	**10**	
Participate in the quality control programme	**10**	
Simulate and localise a target volume	**10**	
Describe the purpose of health and safety regulations	**10**	
Describe the purpose of ionising radiation regulations	**10**	
Discuss the local roles in the departments	**10**	
Complete a basic treatment plan	**10**	
Set up a patient on their first visit	**10**	
TOTAL MARKS	**80**	

Comments of clinical supervisor:

Comments of student:

Clinical Supervisor's signature .....

Student's signature .....

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Assessment of Basic Clinical Competence and Technical Skill

Please comment on and score out of 10 each of the following:

Student accuracy and safety in	Mark awarded
Setting up patients	
Using accessory equipment	
Using unit controls	
Setting time, dose, etc.	
Setting interlocks	
Additional (please name)	

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TECHNICAL SKILLS	extremely helpful				unhelpful
Patient setup	5	4	3	2	1
Using accessory equipment	5	4	3	2	1
Using unit controls	5	4	3	2	1
Setting time, dose etc	5	4	3	2	1
Other (please name)	5	4	3	2	1

MANAGEMENT SKILLS					
Understanding of the appointment system	5	4	3	2	1
Recording data - treatment sheets etc	5	4	3	2	1
Checking against treatment plans	5	4	3	2	1
Other (please name)	5	4	3	2	1

PSYCHO-SOCIAL SKILLS	extremely helpful				unhelpful
Interactions with patients with respect to					
Side effects	5	4	3	2	1
Other aspects of treatment	5	4	3	2	1
Anxiety etc	5	4	3	2	1
Social problems	5	4	3	2	1
Other (please name)	5	4	3	2	1

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Level of Competency Assessment

TECHNICAL ABILITY

TASK	GRADE			
	I	II	III	FAIL
Patient positioning				
Use of immobilization devices				
Setting FSD				
Use of beam directional devices				
Use of beam definition devices				
Addition of beam modification				
Beam alignment				
TOTAL				

Comments .....
.....
.....

PATIENT CARE

TASK	GRADE			
	I	II	III	FAIL
Good use of questioning				
Approachable				
Considerate				
Demonstrated observational skills				
Gave adequate explanation of Procedure				
Advised re side effects and Management				
TOTAL				

Comments .....
.....
.....

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TEAM SKILLS

TASK	GRADE			
	I	II	III	FAIL
Adaptable				
Accepts responsibility				
Demonstrates initiative				
Discusses clinical issues				
Considerate to needs of other Team members				
Versatile				
TOTAL				

Comments

.....

.....

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KNOWLEDGE AND UNDERSTANDING

Assessment of knowledge on specific techniques taught in the academic programme and consolidated during clinical placement.

SITE	GRADE			
	I	II	III	FAIL
Breast				
Lung				
Prostate				
Colon				
Cervix / Uterus				
Oesophagus				
Bone metastases				
TOTAL				

Comments .....

.....

.....

.....

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I.6. Cumulative Total

	GRADE			
	I	II	III	FAIL
TECHNICAL ABILITY TOTAL				
KNOWLEDGE AND UNDERSTANDING TOTAL				
PATIENT CARE TOTAL				
TEAM SKILLS TOTAL				
FINAL TOTAL				

Comments

.....

.....

.....

FINAL GRADE AWARDED .....

Signed .....

Date .....

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ACADEMIC ACTIVITIES ATTENDED

Name: Admission Year:

College:

Date	Type of activity specify Lectures, Seminar, literature review, Presentation, Practicals etc	Particulars

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PRACTICAL PROCEDURES PERFORMED

Name: Admission Year:

College:

Date	Name	ID No	Procedure	Category O,A,PA,PI*

***Key: O -- observed**
A -- Assisted a more senior RTT
PA -- Performed procedure under the direct supervision of a senior RTT
PI -- performed independently.

MODEL OVERALL ASSESSMENT SHEET

Name of the college : Academic year:

Sl.	Faculty Member & Others	Name of the student and mean score									
		A.	B.	C.	D.	E.	F.	G.	H.	I.	J
1											
2											
3											
4											
5											
TOTAL SCORE											

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Rajiv Gandhi University of Health Sciences,
Karnataka, Bangalore

The Emblem

The Emblem of the Rajiv Gandhi University of Health Sciences is a symbolic expression of the confluence of both Eastern and Western Health Sciences. A central wand with entwined snakes symbolises Greek and Roman Gods of Health called Hermis and Mercury is adapted as symbol of modern medical science. The pot above depicts Amrutha Kalasham of Dhanvanthri the father of all Health Sciences. The wings above it depicts Human Soul called Hamsa (Swan) in Indian philosophy. The rising Sun at the top symbolises knowledge and enlightenment. The two twigs of leaves in western philosophy symbolises Olive branches, which is an expression of Peace, Love and Harmony. In Hindu Philosophy it depicts the Vanaspathi (also called as Oushadi) held in the hands of Dhanvanthri, which are the source of all Medicines. The lamp at the bottom depicts human energy (kundalini). The script "Devahitham Yadayahu" inside the lamp is taken from Upanishath Shanthi Manthram (Bhadram Karnebhi Shrunuyanadev…), which says "May we live the full span of our lives allotted by God in perfect health" which is the motto of the Rajiv Gandhi University of Health Sciences.

RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES

Revised Ordinance Governing
Regulations and Curriculum for Bachelor of Science in

RADIOTHERAPY TECHNOLOGY (B.Sc. RTT)
2007

RAJIV GANDHI UNIVERSITY OF
HEALTH SCIENCES KARNATAKA

4th 'T' Block, Jayanagar, Bangalore 560041

Revised Ordinance Governing
Regulations and Curriculum for Bachelor of Science in

Radiotherapy Technology (B.Sc. RTT)
2007

Schedule annexed to University Notification
No; UA/AUTH/I year AHS/126/2007-08 dated 29/06/07.

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Rajiv Gandhi University of Health Sciences, Karnataka
ರಾಜೀವ್ ಗಾಂಧಿ ಆರೋಗ್ಯ ವಿಜ್ಞಾನಗಳ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಕರ್ನಾಟಕ

Ref.: UA/AUTH/1 YEAR A.H.S/126/2007/08 Date : 29-06-2007

NOTIFICATION

Sub : Revised Ordinance Governing Regulations and common curriculum for first year Bachelor of Science Degree courses in Allied Health Sciences.

Ref. 1. Proceeding of Academic Council Meeting dated 06/05/2007.
2. Minutes of the Syndicate meeting held on 16/05/2007.

In exercise of the powers conferred under section 35(1) of the RGUHS Act 1994, the Syndicate in its meeting held on 16/05/2007 decided to implement the Revised Ordinance Governing Regulation and common curriculum for first year Bachelor Science Degree Courses in Allied Health Sciences as shown in Annexure herewith.

The above Ordinance comes into effect from the academic year 2007-08 and onwards.

By order,

sd/-

REGISTRAR

To
The Principals of Allied Health Science Colleges affiliated to RGUHS.

Copy to :

1. The Secretary to his excellency the Governor of Karnataka, Raj Bhavan, Bangalore - 560001
2. Secretary to Government, Health & Family Welfare Department, (Medical Education), Vikasa Soudha, Bangalore - 560001.
3. PA to Vice - Chancellor / PA to Registrar (Eva.) / PA to Finance Officer.
4. Home page of RGUHS Website.
5. All Officers of the RGUHS
6. Guard File / Office Copy.

Rajiv Gandhi University of Health Sciences

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Rajiv Gandhi University of Health Sciences, Karnataka
ರಾಜೀವ್ ಗಾಂಧಿ ಆರೋಗ್ಯ ವಿಜ್ಞಾನಗಳ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಕರ್ನಾಟಕ

Ref.: AUTH/BOS-AS/344/2008/09 Date : 04-08-2008

NOTIFICATION

Sub : Revised Ordinance Governing Regulations and Course contents for 2nd & 3rd year Bachelor Courses in Allied Health Science, Subjects.

Ref. 1. Minutes of meeting of Syndicate held on 30/07/2008.
2. Recommendations of BOS Allied Health Sciences dated 19/07/2008.

In exercise of the powers conferred under section 35(2) of the RGUHS Act 1994, the Syndicate in its meeting held on 30/07/2008 is notify the Revised Ordinance Governing Regulation and Course contents for 2nd & 3rd year Bachelor Courses in Allied Health Science Subjects as shown in the annexure appended herewith. The above Ordinance shall come into force with effect from the academic year 2008-09 and onwards.

It is also notified that students can change the course in Allied Health Science subjects from one to another subject to the availability of clear vacancy and with the prior approval of the university.

By order,

sd/-

REGISTRAR

Copy to :

1. The Secretary to his excellency the Governor's Secretariat Raj Bhavan, Bangalore - 560001
2. Secretary to Government, Health & Family Welfare Department, (Medical Education), Vikasa Soudha, Bangalore - 560001.
3. The Director, Department of Medical Education, Anand Rao Circle, Bangalore.
4. PA to Vice - Chancellor / Registrar / Registrar (Eva.) / Finance Officer.
5. Director, Curriculum Development Cell.
6. Public Information officer.
7. The home Page of RGUHS Website.
8. Guard File / Office Copy.

Rajiv Gandhi University of Health Sciences

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SECTION I

REGULATIONS GOVERNING
B.Sc. RADIOTHERAPY TECHNOLOGY

1. Title of the Courses offered in Allied Health Sciences:

1.	Bachelor of Science in Medical Laboratory Technology	[B.Sc. (M.L.T)]
2.	Bachelor of Science in Operation Theatre Technology	[B.Sc .O.T. Technology]
3.	Bachelor of Science in Cardiac Care Technology	[B.Sc Cardiac Care Technology]
4.	Bachelor of Science in Perfusion Technology	[B.Sc. Perfusion Technology]
5.	Bachelor of Science in Neuro Science Technology	[B.Sc. Neuro Science Technology]
6.	Bachelor of Science in .Renal Dialysis Technology	[B.Sc. Renal Dialysis Technology]
7.	Bachelor of Science in Respiratory Care Technology	[B.Sc. Respiratory Care Technology]
8.	Bachelor of Science in Anaesthesia Technology	[B.Sc. Anaesthesia Technology]
9.	Bachelor of Science in Imaging Technology	[B.Sc. Imaging Technology]
10.	Bachelor of Science in Radiotherapy Technology	[B.Sc. Radiotherapy Technology]

2. Eligibility for admission:

A candidate seeking admission to the Bachelor of Science Degree Courses in the Allied Health Sciences course from Sl.No. 1 to 10 shall have studied English as one of the principal subject during the tenure of the course and for those seeking admission to the Bachelor of Science Degree Courses in the Allied Health Sciences courses from Sl.No. 1 to 8 mentioned above except for B.Sc. Imaging Technology and B.Sc. Radiotherapy Technology shall have passed:

.

1. Two year Pre-University examination or equivalent as recognized by Rajiv Gandhi University of Health Sciences with, Physics, Chemistry and Biology as principle subjects of study.
   OR
2. Pre-Degree course from a recognized University considered as equivalent by RGUHS, (Two years after ten years of schooling) with Physics, Chemistry and Biology as principal subjects of study.
   OR
3. Any equivalent examination recognized by the Rajiv Gandhi University of Health Sciences, Bangalore for the above purpose with Physics, Chemistry and Biology as principal 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 a subject for which the candidate desires to enroll, in the respective Allied Health Sciences course mentioned in Sl. No. 1 to 10 shall have passed plus 12 [10+2] with Physics, Chemistry and Biology, as principal subjects or candidates with 3 years diploma from a recognized Government Board in a subject for which the candidate desires to enroll, in the respective Allied Health Sciences course mentioned in Sl. No. 1 to 10 should have studied Physics, Biology and Chemistry as principal subjects during the tenure of the course.

6. Lateral entry to second year for allied health science courses for candidates who have passed diploma program from the Government Boards and recognized by RGUHS, 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 from the academic year 2008-09 vide RGUHS Notification no. AUTH/AHS/317/2008-09 dated 01.08.2008.

7. In case of admission to B.Sc. Imaging Technology or B.Sc. Radiotherapy Technology the candidate should have passed Pre-University or equivalent examination with Physics, Chemistry, Biology and Mathematics, as principal subjects of study.

Note:

a. The candidate shall have passed individually in each of the principal subjects.

b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

3. Duration Of The Course:

Duration Shall Be For A Period Of Three And Half Years Including Six Months Of Internship.

4. Medium Of Instruction:

The Medium Of Instruction And Examination Shall Be In English.

5. Subject and Hours of Teaching:

For theory and practicals for 1st, 2nd and 3rd year.

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 year are shown in table-I

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	70	20	90
4.	Pathology-[Clinical pathology, Hematology & 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 Saturdays students shall work in hospitals in the respective specialty or department chosen by them.

Subsidiary Subjects

English 25 Hours
Kannada 25 Hours
Health-Care 40 Hours
Hospital posting - Fri day 9am - 1pm and 2pm - 4-30 pm
Saturday 9am - 1pm
Departmental/ Hospital Posting: 450 Hours.

Subject and hours of teaching for Theory and Practicals for 2nd and 3rd year

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

TABLE-II:
DISTRIBUTION OF SUBJECTS AND NUMBER OF HOURS OF TEACHING IN SECOND YEAR

Sl. No.	Subject	Theory No. of Hours	Practical No. of Hours	Total
1.	Physics of Radiology, Radiation Physics & Medical Physics	100	No Practical	100
1.	Radiographic Techniques I*	100	540 (Hospital Postings)	640
1.	Radiographic Photography and Image Processing	100	240	340

*Exam For This Subject Will Be Held In III Year.

Subsidiary Subjects :

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

TABLE-III:
DISTRIBUTION OF SUBJECTS AND NUMBER OF HOURS OF TEACHING IN THIRD YEAR

Sl. No.	Subject	Theory No. of Hours	Practical No. of Hours	Total
1.	Diagnostic Imaging Techniques	200	340	540
1.	Radiographic Techniques II	100	440	540

Subsidiary Subjects

Biostatistics	20 Hours
Computer Application	10 Hours

6. 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 . Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in theory and practical to become eligible to appear for the university examination in that subject in the supplementary or subsequent examination. however, this is not applicable in case of carryover subjects.

7. Internal Assessment (IA):

First, Second And Third Year
Theory - 20 Marks.
Practical - 20 Marks. [Lab Work- 15 Marks And Record-5 Marks]

There shall be a minimum of three periodical tests preferably one in each term in theory and practical of each subject in an academic year. the average marks of the best of the two tests will be calculated and reduced to 20 in theory and 15 in practicals. 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 with in 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

8. 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.

A candidate has to register for all the subjects of a year when he/she appears for the examination of that year for the first time.

9. 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 1st, 2nd and 3rd year university examinations are shown in the Table - IV, V And VI.

The University Examination shall consist of:
Written Examination
Practical
The University Examination for 1st Year shall consist of only Theory Examination In 5 papers and there shall be no University practical examination.

Number Of Theory Papers For Written Examinations In 2nd & 3rd Year Consists of
2 Papers In The 2nd Year
2 Papers In The 3rd Year.

Practical Examination:

One Practical Examination At The End 2nd Year And One Practical Examination At The End Of The 3rd Year.

TABLE-IV
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	3hours	80	20	100
	Subsidiary Subject**				Total
1.	English	3 hours	80	20	100
2.	Kannada	3 hours	80	20	100
3.	Health Care	3 hours	80	20	100

Note: *IA = Internal Assessment

Main Subjects Shall Have University Examination.
There Shall Be No University Practicals Examination.

** Subsidiary Subjects : Examination For Subsidiary Subjects Shall Be Conducted By Respective Colleges.

TABLE - V. Distribution of Subjects And Marks For Second Year Examination.

		Theory				Practicals			
Paper	Subjects	Theory	Viva voca	I.A	Sub Total	Practicals	I.A	Sub Total	Grand Total
i	Sec A:- Physics of Radiology. Sec B:- Radiation Physics & Medical Physics								
	Radiographic Photography and Image Processing								

Distribution of Subsidiary Subjects and marks for Second Year Examination

B	Subsidiary Subject**	Duration	Marks	I .A Theory Marks	Total Marks
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

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

TABLE - VI
Distribution of Subjects and marks for Third Year Examination.

		Theory				Practicals			
Paper	Subjects	Theory	Viva voca	I.A	Sub Total	Practicals	I.A	Sub Total	Grand Total
i	Radiotherapy-Part-I A Radiation Physics	60	20	20	100	80	20	100	300
ii	Radiotherapy-part-I B Principles and Practice of Radiotherapy Sec A : Diagnostic work up treatment principles and RT-techniques. Sec B : Psychosocial management, Health & safety, Qualitative & Quantitative methods of research, Medical Legal & Ethical aspects and recent advances.	30 30	10 10	10 10	100	}			

Distribution of Subsidiary Subjects and marks for Third Year Examination

B	Subsidiary Subject**	Duration	Marks	I .A Theory Marks	Total Marks
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

**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 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, internal assessment and Viva-Voce 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.

Practicals for second and third year : If a candidate passes in practical examination in second or third year but fails in one or more theory papers such candidates are exempted from reappearing for practical but they have to appear in the subsequent examination for the theory paper in which she/he has failed OR vice versa.

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 shall appear for all the subjects of that particular year in the University examinations to avail this benefit. A candidate who fails in any two of the five main subjects and English in the first year shall be permitted to carry over these 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 subject of the second year to the third year but shall pass this subject before appearing for the third year examination.

A candidate is permitted to join third year provided he/she has appeared for all the subjects of second year and availed the carry over benefit for one subject in the second year.

13. Declaration Of Class

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.

a. 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.

b. 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.

c. 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.

d. 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 award of degree.

THEORY

SUBJECTS HAVING MAXIMUM MARKS = 100

Type of Questions	No of Questions	Marks For Each Questions
ESSAY TYPE	3 (2x10)	10
SHORT ESSAY TYPE	12 (10x5)	05
SHORT ANSWER TYPE	12 (10x3)	03

SUBJECTS HAVING MAXIMUM MARKS = 80

Type of Questions	No of Questions	Marks For Each Questions
ESSAY TYPE	3 (2x10)	10
SHORT ESSAY TYPE	8 (6x5)	05
SHORT ANSWER TYPE	12 (10x3)	03

SUBJECTS HAVING MAXIMUM MARKS = 80

Type of Questions	No of Questions	Marks For Each Questions
ESSAY TYPE	3 (2x10)	10
SHORT ESSAY TYPE	7 (5x5)	05
SHORT ANSWER TYPE	7 (5x3)	03

SUBJECTS HAVING MAXIMUM MARKS = 50

Type of Questions	No of Questions	Marks For Each Questions
ESSAY TYPE	3 (2x10)	10
SHORT ESSAY TYPE	5 (3x5)	05
SHORT ANSWER TYPE	7 (5x3)	03

SECTION *II*

GOALS AND GENERAL OBJECTIVES OF THE EDUCATION PROGRAM

GENERAL OBJECTIVES

1. Practice the specialty concerned ethically and in step with the principles of primary health care.
2. Demonstrate sufficient understanding of the basic sciences relevant to the concerned specialty.
3. Observe and discuss measures for the Radiation Safety and Protection in radiotherapy.
4. Demonstrate empathy and humane approach towards patients and their families and exhibit interpersonal behavior in accordance with the societal norms and expectations.
5. Develop skills as a self-directed learner, recognize continuing educational needs; select and use appropriate learning resources.

ROLE OF THE RTT (The identification of the roles expected of an RTT).
In broad terms these roles are:

Treatment preparation

a. Awareness of diagnostic modalities relevant to oncology
b. Planning/Dosimetry
c. Localization/Simulation
d. Hand and computer planning
   Single field (skin, metastasis)
   Parallel opposed (palliative and radical intent)
e. Mould room techniques and practice
f. Treatment calculations
g. Quality control and Quality Assurance

Treatment equipment
Knowledge of the characteristics of the equipment and the appropriate selection of equipment for common malignancies.
a. Superficial
b. Orthovoltage
c. Cobalt-60
d. Linear accelerator
e. Brachytherapy (LDR and HDR)
f. 3DCRT/SRS/SRT/IMRT

Treatment set-up and delivery

a. Single field (skin, metastasis)
b. Parallel opposed (palliative and radical intent)
c. Multiple planned fields
d. Simple 2 field plan
e. Box (Ca Cx)
f. 3-field with wedge (Bladder)
g. Complex planned treatment
h. 3-D
i. Mixed modality (head and neck, breast)
j. Detecting abnormal equipment displays that may indicate a malfunction.
k. Intervening in case of an accident or emergency.

Patient care

a. Before radiation therapy
b. Awareness of patient management before attending radiation
c. During radiation therapy
d. Treatment preparation
e. Monitoring the patient during treatment
f. Detecting and communicating to the physician any unusual patient reactions
g. After radiation therapy
h. Awareness of patient management after completion of treatment (follow-up)

In summary
The RTT will need:

- Ability and skills to work in a team
- Technological aptitude
- Academic knowledge
- Technical skills, knowledge and ability
- Knowledge of radiation protection
- Professionalism
- Communication skills
- Computer skills
- Problem solving ability
- Continued Professional Development (CPD)

STATEMENT OF THE COMPETENCIES

Keeping in view the general objectives of the training, each discipline shall aim at development of specific competencies, which shall be defined and spelt out in clear terms. Each department shall produce a statement and bring it to the notice of the trainees in the beginning of the program so that he or she can direct the efforts towards the attainment of these competencies.

COMPONENTS OF THE CURRICULUM

The major components of the curriculum shall be:

- Theoretical knowledge
- Practical/clinical skills
- Practical Training / Quality Assurance.
- Radiation Safety and Protection
- Attitudes, including communication.
- Training in research methodology.

B.Sc. RADIOTHERAPY TECHNOLOGISTS (RTT)

INTRODUCTION

Radiotherapy involves the use of ionizing radiation to treat disease and is one of the major modalities used in the management of cancer. The emphasis is on teamwork and therapeutic radiographers work closely with doctors, medical physicists and nurses to provide the optimum care for patients.

Modern radiotherapy utilizes highly sophisticated technology and the Radiotherapy Technologist [RTT] need to have an interest in and understanding of the technical aspects of treatment planning and delivery combined with good communication and caring skills. Other important qualities are the ability to work accurately and efficiently, often under pressure, and a concern to continuously improve and develop the service offered to the cancer patients.

The expected outcome is an improvement in the professional standard of technical, clinical and psychological care given to the patient to whom a course of radiation is administered. The program is to ensure that the level of expertise necessary for the profession is achieved to facilitate an overall progression towards the desired goals.

GOALS:

The Radiotherapy Technology Course is a three year integrated program consisting of alternating blocks of academic learning and practical training in order to integrate theory with practice. At the end of training program the candidates should have acquired sufficient knowledge, expertise & understanding of the functioning of human body, the disease process, Basic & Radiation Therapy Physics, Radiobiology, Basic concepts in Oncology, knowledge of various malignant diseases & its management particularly with Radiotherapy. The technologist should be capable of using wide range of Radiation Therapy Equipment's (Teletherapy, Brachytherapy, Dosimetry, Treatment simulation, Treatment planning) including Mould room and Radiation protection.

OBJECTIVES:

The following objectives are laid out to achieve the goals of the course. These objectives are to be achieved by the time the candidate completes the course.

Knowledge:

- To acquire basic knowledge of Human Anatomy, Physiology, Surface marking,
- Cancer aetiology, Pathology, Natural history, Lymphatics
- To understand the Basics of Oncology
- Multimodality management i.e., Radiation Therapy, Surgery, Chemotherapy,
- Common malignancies in the country and their management,
- Basic concepts in Radiation Oncology, Radiation therapy Physics & radiation Biology
- Radiotherapy & Treatment using Teletherapy & Brachytherapy Machines,
- TPS, Mould Room & Simulation
- Structure, Functioning, Maintenance, Quality assurance,
- Update oneself by self-study and by attending courses, Workshops, Conferences and Seminars relevant to the specialty.
- Teach and guide his team, colleagues and other students.
- Undertake audit, use information technology tools to carryout both clinical related and technology related work relevant to Radiotherapy treatment execution.

Skills :

- Handling of various Radiotherapy and X-ray equipment's,
- Handling of patients:
- Acquire skills relevant to Treatment Planning & Simulation, Mould Room techniques and its practical applications,
- Radiotherapy safety and protection, Quality assurance checks,
- Develop communications skills for better patient care and inter personal relationships.

Human Values, Ethics and Communication Abilities:

- Adopt ethical principles in all aspects of his/her patient care.
- Professional honesty and integrity are to be fostered.
- Care is to be delivered irrespective of the social status, caste, creed or religion of the patient.
- Apply high moral and ethical standards while carrying out their duties.
- Be humble and accept the limitations in his knowledge and skill and to ask for help from the Radiation Oncologists, Radiation Physicists, or from colleagues when needed.
- Respect patient's rights and privileges.

COURSE DESCRIPTION

ANATOMY

No. of theory classes: 70 hours
No. of practical classes: 20 hours

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

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 all muscles of the body
Histology of skeletal (TS & LS), smooth & cardiac muscle

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

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

5. Respiratory system

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

6. Peritoneum

Theory: Description in brief
Practical: Demonstration of reflections

7. Urinary system

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

8. 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 glad - 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

9. 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

10. Nervous system
Theory:

Neuron
Classification of NS
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

1. 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

2. Embryology
Theory:

Spermatogenesis & oogenesis
Ovulation, fertilization
Fetal circulation
Placenta
Internal Assessment
Theory - Average of two exams conducted. 20
Practicals: Record & Lab work* 10

* There shall be no University Practical Examination and internal assessment marks secured in Practicals need not be sent to the University.

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Anatomy shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
LONG ESSAY (LE)	3 (To attempt 2)	2 x 10	20
SHORT ESSAY (SE)	8 (To attempt 6)	6 x 5	30
SHORT ANSWER (SA)	12 (To attempt 10)	10 x 3	30
TOTAL MARKS			80

NO PRACTICAL EXAMINATION
REFERENCE BOOKS

Anatomy

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

2. Chaursia -A Text book of Anatomy
T.S. Ranganathan - A text book of Human Anatomy

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

PHYSIOLOGY

Theory 70 hours
Practical 20hours
Introduction - composition and function of blood
Red blood cells - Erythropoiesis , stages of differentiation function , count physiological Variation.
Haemoglobin -structure , functions , concentration physiological variation Methods of Estimation of Hb White blood cells - Production , function, life span, count, differential count Platelets - Origin, normal count, morphology functions.
Plasma Proteins - Production, concentration , types, albumin, globulin, Fibrinogen, Prothrombin functions.
Haemostasis & Blood coagulation
Haemostasis - Definition, normal haemostasis, clotting factors, mechanism of clotting, disorders of clotting factors.

Blood Bank

Blood groups - ABO system, Rh system
Blood grouping & typing
Crossmatching
Rh system - Rh factor, Rh in compatibility.
Blood transfusion - Indication, universal donor and recipient concept.
Selection criteria of a blood donor. transfusion reactions Anticoagulants - Classification, examplesand uses
Anaemias : Classification - morphological and etilogical. effects of anemia on body
Blood indices - Colour index , MCH, MCV, MCHC
Erythrocyte sedementation Rate (ESR) and Paced cell volume
Normal values, Definition . determination,
Blood Volume -Normal value ,determination of blood volume and regulation of blood volume Body fluid - pH, normal value, regulation and variation
Lymph - lymphoid tissue formation, circulation, composition and function of lymph

Cardiovascular system

Heart - Physiological Anatomy, Nerve supply
Properties of Cardiac muscle,
Cardiac cycle-systole,diastole. Intraventricular pressure curves.
Cardiac Output - only definition
Heart sounds Normal heart sounds Areas of auscultation.
Blood Pressure - Definition, normal value, clinical measurement of blood pressure.
Physiological variations, regulation of heart rate, cardiac shock, hypotension, hypertension.
Pulse - Jugalar, radial pulse, Triple response
Heart sounds - Normal heart sounds, cause characteristics and signification. Heart rate Electrocardiogram (ECG) -significance.

Digestive System

Physiological anatomy of Gastro intestinal tract, Functions of digestive system
Salivary glands Stucture and functions. Deglutination -stages and regulation
Stomach - structure and fuctions
Gastric secretion - Composition function regulation of gastric juice secretion
Pancrease - structure, function, composition, regulation of pancreatic juice
Liver - functions of liver
Bile secretion, composition, function regulation of bile secretion .Bilirubin metabolism types of bilirubin, Vandernberg reaction, Jaundice- types, significance.
Gall bladder - functions
Intestine - small intestine and large intestine
Small intestine -Functions- Digestive, absorption ,movements.
Large intestine - Functions, Digestion and absorption of Carbohydrates,Proteins, Fats,Lipids.Defecation

Respiratory system

Functions of Respiratory system, Physiological Anatomy of Respiratory system, Respiratory tract, Respiratory Muscles, Respiratory organ-lungs, Alveoli, Respiratory membrane, stages of respiration.

Mechanism of normal and rigorous respiration. Forces opposing and favouring expansion of the lungs. Intra pulmonary pleural pressure, surface tension, recoil tendency of the wall. H

Transportation of Respiratory gases :

Transportation of Oxygen : Direction, pressure gradient, Forms of transportation, Oxygenation of Hb. Quantity of Oxygen transported.

Lung volumes and capacities

Regulation of respiration what? Why? How? Mechanisms of Regulation, nervous and chemical regulation. Respiratory centre. Hearing Brier, Reflexes.

Applied Physiology and Respiration : Hypoxia, Cyanosis, Asphyxia, Dyspnea, Dysbarism, Artificial Respiration, Apnoea.

Endocrine System - Definition Classification of Endocrine glands & their Harmones Properties of Harmones .

Thyroid gland hormone - Physiological, Anatomy, Hormone scerated, Physiological function, regulation of secretion. Disorders - hypo and hyper secretion of hormone Adrenal gland, Adrenal cortex physiologic anatomy of adrenal gland, Adrenal cortex, cortical hormones - functions and regulation Adrenal medulla - Hormones , regulation and secretion. Functions of Adrenaline and nor adrenaline.

Pituitary hormones - Anterior and posterior pituitary hormones, secretion ,function Pancreas - Hormones of pancreas Insulin - secretion, regulation ,function and action Diabetes mellitus - Regulation of blood glucose level Parathyroid gland - function, action ,regulation of secretion of parathyroid hormone. Calcitonin - function and action

Special senses

Vision - structure of eye. Function of different parts.
Structure of retina
Hearing structure and function of can mechanism of hearing
Taste - Taste buds functions . Smell physiology, Receptors.

Nervous system

Functions of Nervous system, Neurone structure, classification and properties. Neuroglia, nerve fiber, classification ,conduction of impulses continuous and saltatory. Velocity of impulse transmission and factors affecting. Synapse - structure, types, properties. Receptors - Definition, classification ,properties. Reflex action - unconditioned properties of reflex action. Babinski's sign. Spinal cord nerve tracts. Ascending tracts, Descending tracts -

pyramidal tracts - Extrapyramidal tracts. Functions of Medulla, pons, Hypothalamic disorders. Cerebral cortex lobes and functions, Sensory cortex, Motor cortex,Cerebellum functions of Cerebellum.Basal ganglion-funtions. EEG.

Cerebro Spinal Fluid(CSF) : formation, circulation, properties, composition and functions lumbar puncture.

Autonomic Nervous System : Sympathetic and parasympathetic distribution and functions and comparison of functions.

Excretory System

Excretory organs
Kidneys: Functions of kidneys structural and functional unit nepron, vasarecta, cortical and juxtamedullary nephrons - Comparision, Juxta Glomerular Apparatus -Structure and function. Renal circulation peculiarities.

Mechanism of Urine formation : Ultrafiltration criteria for filtration GFR, Plasma fraction, EFP, factors effecting EFR. Determination of GFR selective reabsorption - sites of reabsorption ,substance reabsorbed, mechanisms of reabsorption Glucose, urea.

H + Cl aminoacids etc. TMG, Tubular lead, Renal threshold % of reabsorption of different substances, selective e secretion.

Properties and composition of normal urine, urine output. Abnormal constituents in urine , Mechanism of urine concentration.

Counter - Current Mechanisms : Micturition, Innervation of Bladder, Cysteurethrogram.

Diuretics : Water, Diuretics, osmotic diuretics, Artificial kidney Renal function tests - plasma clearance Actions of ADH, AIdosterone and PTH on kidneys. Renal function tests

Reproductive system

Function of Reproductive system, Puberty, male reproductive system. Functions of testes, spermatogenesis site, stages, factors influencing semen. Endocrine functions of testes Androgens - Testosterone structure and functions. Female reproducive syustem. Ovulation, menstrual cycle. Physiological changes during pregnancy, pregnancy test. Lactation : Composition of milk factors controlling lactation.

Muscle nerve physiology

Classification of muscle, structure of skeletal muscle, Sarcomere contractile proteins, Neuromuscular junction. Transmission across, Neuromuscular junction. Excitation contraction coupling. Mechanism of muscle contraction muscle tone, fatigue Rigour mortis

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.

Practicals

Haemoglobinometry
White Blood Cell count
Red Blood Cell count
Determination of Blood Groups
Leishman's staining and Differential WBC count
Determination of packed cell Volume
Erythrocyte sedimentation rate [ESR]
Calculation of Blood indices
Determination of Clotting Time, Bleeding Time
Blood pressure Recording
Auscultation for Heart Sounds
Artificial Respiration
Determination of vital capacity

Internal Assessment

Theory - Average of two exams conducted.	20
Practicals: Record & Lab work*	10

* There shall be no University Practical Examination and internal assessment marks secured in

Practicals need not be sent to the University.

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Physiology shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
LONG ESSAY (LE)	3 (To attempt 2)	2 x 10	20
SHORT ESSAY (SE)	8 (To attempt 6)	6 x 5	30
SHORT ANSWER (SA)	12 (To attempt 10)	10 x 3	30
TOTAL MARKS			80

NO PRACTICAL EXAMINATION
REFERENCE BOOKS

Physiology

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

No. Theory classes : 70hours
No. of practical classes : 20 hours

Theory:

1. Specimen collection : Pre-analytical variables
Collection of blood
Collection of CSF & other fluids
Urine collection
Use of preservatives
Anticoagulants

2. Introduction to Laboratory apparatus

Pipettes- different types (Graduated, volumetric, Pasteur, Automatic etc.,)
Calibration of glass pipettes
Burettes, Beakers, Petri dishes, depression plates.
Flasks - different types)Volumetric, round bottmed, Erlemeyer conical etc.,)
Funnels - different types (Conical, Buchner etx.,)
Bottles - Reagent bottles - graduated and common, Wash bottles - different type Specimen bottles etc.,
Measuring cylinders, Porcelain dish
Tubes - Test tubes, centrifuge tubes, test tube draining rack
Tripod stand, Wire gauze, Bunsen burner.
Cuvettes, significance of cuvettes in colorimeter, cuvettes for visible and UV range, cuvette holders Racks - Bottle, Test tube, Pipette
Dessicator, Stop watch, rimers, scissors
Dispensers - reagent and sample
Any other apparatus which is important and may have been missed should also be covered
Maintenance of lab glass ware and apparatus:
Glass and plastic ware in Laboratory
*use of glass: significance of boro silicate glass ; care and cleaning of glass ware, different cleaning solutions of glass
*care and cleaning of plastic ware, different cleaning solutions .

3. Instruments (Theory and demonstration) Diagrams to be drawn

1. Water bath: Use, care and maintenance
Oven & Incubators : Use, care and maintenance.
Water Distilation plant and water deionisers. Use, care and maintenance
Refrigerators, cold box, deep freezers - Use, care and maintanance
Reflux condenser : Use, care and maintenance

2. **Centrifuges** (Theory and demonstration) Diagrams to be drawn
   Definition, Principle, svedberg unit, centrifugal force, centrifugal field rpm, ref. Conversion of G to rpm and vice versa.
   Different types of centrifuges
   Use care and maintenance of a centrifuge

3. **Laboratory balances** [Theory & Practicals) Diagrams to be drawn
   - Manual balances: Single pan, double pan, trip balance
   - Direct read out electrical balances.

   Use care and maintenance. Guideline to be followed and precautions to be taken while weighing. Weighing different types of chemicals, liquids. Hygroscopic compounds etc.

4. **Colorimeter and spectrophotometer** (Theory and Practicals) Diagrams to be drawn
   Principle, Parts Diagram.
   Use, care and maintenance.

5. **pH meter** (Theory & practicals) Diagrams to be drawn
   principle, parts, Types of electrods, salt bridge solution.
   Use, care and maintenance of Ph meter and electrodes
   Guidelines to be followed and precautions to be taken while using pH meter

4. **Safety of measurements**

5. **Conventional and SI units**

6. **Atomic structure**

1. Dalton's theory, Properties f electrons, protons, neutrons, and nucleus, Rutherford's model of atomic structure, Bohr's model of atomic structure, orbit and orbital, Quantum numbers, Heisenberg's uncertainly principle.

2. Electronic configuration - Aufbau principle, Pauli's exclusion principle, etc.,m

3. Valency and bonds - different types of strong and weak bonds in detail with examples

6.1 Theory & Practicals for all the following under this section

6.1.1 Molecular weight, equivalent weight of elements and compounds, normality molarity **Preparation of molar solutions** (mole/litre solution) eg: 1 M Nacl, 0.15 M NaCL
1 M NaOH, 0.1 M HCl, 0.1 M H 2S04 etc.
preparation of normal solutions. eg., IN Na2CO3, O IN Oxalic acid, 0.1 N HCl, 0.1N H2504, 0.66 N H2S04 etc.,

6.1.2. Percent solutions. Preparation of different solutions - v/v w/v (solids, liquids and acids) Conversion of a percent solution into a molar solution

6.1.3. Dilutions

Diluting solutions: eg. Preparation of 0.1 N NaCl from 1 N NaCl from 2 NHCl etc., Preparing working standard from stock standard, Body fluid dilutions, Reagent dilution techniques, calculating the dilution of a solution, body fluid reagent etc.,

6.1.4. Saturated and supersaturated solutions. Standard solutions.

Technique for preparation of standard solutions eg: Glucose, urea, etc., Significance of volumetric flask in preparaing standard solutions. Volumetric flasks of different sizes, Preparation of standard solutions of deliquesent compounds (CaCl2, potassium carbonate, sodium hydroxide etc.,) Preparation of standards using conventional and SI units

6.1.5. Acids, bases, salts and indicators.

Acids and Bases: Definition, physical and chemical properties with examples.

Arrehenius concept of acids and bases, Lowery - Bronsted theory of acids and bases classification of acids and bases. Different between bases and alkali, acidity and basicity, monoprotonic and polyprotonic acids and bases Concepts of acid base reaction, hydrogen ion concentration, Ionisation of water, buffer, Ph value of a solution, preparation of buffer solutions using Ph meter.

Salts: Definition, classification, water of crystallization - definition and different types, deliquescent and hygroscopic salts

Acid- base indicators: (Theory and Practicals)

Theory - Definition, concept, mechanism of dissociation of an indicator, colour change of an indicator in acidic and basic conditions, use if standard buffer solution and indicators for Ph determinations, preparation and its application, list of commonly used indicators and their Ph range, suitable pH indicators used in different titrations, universal indicators

Practicals - Titration of a simple acid and a base (Preparation of standard solution of oxalic acid and using this solution finding out the normality of a sodium hydroxide solution . Acid to be titrated using this base) Calculation of normality of an acid or a base after titration, measurement of hydrogen ion concentration

Quality control : Accuracy
Precision
Specificity
Sensitivity
Limits of error allowable in laboratory
Percentage error
Normal values and Interpretations

Special Investigations : Serum Electrophoresis

Immunoglobulins
Drugs : Digitoxin, Theophyllines

3. Regulation of Acid Base status:

Henderson Hasselback Equations
Buffers of the fluid
pH Regulation
Disturbance in acid Base Balance
Anion Gap
Metabolic acidosis
Metabolic acidosis
Metabolic alkalosis
Respiratory acidosis
Respiratory alkalosis

4. Basic Principles and estimation of Blood Gases and pH

5. Basic principles and estimation of Electrolytes

Water Balance
Sodium regulation
Bicarbonate buffers

6. Nutrition, Nutritional support with special emphasis on parental nutrition.

Calorific Value
Nitrogen Balance
Respiratory Quotient
Basal metabolic rate
Dietary Fibers
Nutritional importance of lipids, carbohydrates and proteins
Vitamins

PRACTICALS

1. Analysis of Normal Urine
   Composition of urine
   Procedure for routine screening
   Urinary screening for inborn errors of metabolism
   Common renal disease
   Urinary calculus

2. Urine examination for detection of abnormal constituents

3. Interpretation and Diagnosis through charts
   a. Liver Function tests
   b. Lipid Profile
   c. Renal Function test

d. Cardiac markers
e. Blood gas and Electrolytes

4. Estimation of Blood sugar, Blood Urea and electrolytes

5. Demonstration of Strips

7. Demonstration of Glucometer

Internal Assessment

Theory - Average of two exams conducted. 20
Practicals: Record & Lab work* 10

* There shall be no University Practical Examination and internal assessment marks secured in Practicals need not be sent to the University.

Scheme of Examination

Theory

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Biochemistry shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
LONG ESSAY (LE)	3 (To attempt 2)	2 x 10	20
SHORT ESSAY (SE)	8 (To attempt 6)	6 x 5	30
SHORT ANSWER (SA)	12 (To attempt 10)	10 x 3	30
TOTAL MARKS			80

NO PRACTICAL EXAMINATION
REFERENCE BOOKS

Biochemistry

1. Varley - Clinical chemistry
2. TEITZ - Clinical chemistry
3. Kaplan - Clinical chemistry
4. Ramakrishna(S) Prasanna(KG), Rajna ® Text book of Medical Biochemistry Latest Ed Orient longman Bombay -1980
5. Vasudevan (DM) Sreekumari(S) Text book of Biochemistry for Medical students ,Latest Ed
6. DAS(Debajyothi) Biochemistry Latest ED Academic, Publishers, Culcutta - 1992

PATHOLOGY

Histo Pathology ,Clinical Pathology, Haematology and Blood Banking

Theory - 70 hours
Practical - 20 hours

HistoPathology - Theory

- 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.
- Bio-Medical waste management
- Section Cutting
- Tissue processing for routine paraffin sections
- Decalcification of Tissues.
- Staining of tissues - H& E Staining
- Bio-Medical waste management

Clinical Pathology - Theory

- 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 body fluids.
- Examination of cerebro spinal fluid (CSF)
- Sputum Examination.
- Examination of feces

Haematology - Theory

- 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.

Blood Bank
Introduction

Blood grouping and Rh Types

Cross matching

PRACTICALS

- 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]

Internal Assessment

Theory - Average of two exams conducted.	20
Practical: Record & Lab work*	10

* There shall be no University Practical Examination and internal assessment marks secured in Practical need not be sent to the University.

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Pathology shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
LONG ESSAY (LE)	3 (To attempt 2)	2 x 10	20
SHORT ESSAY (SE)	8 (To attempt 6)	6 x 5	30
SHORT ANSWER (SA)	12 (To attempt 10)	10 x 3	30
TOTAL MARKS			80

NO PRACTICAL EXAMINATION
REFERENCE BOOKS

Pathology

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss - cytology
4. Winifred greg - Diagnostic cytopathology
5. Orell - Cyto Pathology
6. Todd & Sanford Clinical Diagnosis by laboratory method
7. Dacie & Lewis - Practical Haematology
8. Ramanic Sood, Laboratory Technology (Methods and interpretation) 4th Ed. J.P. Bros, New Delhi - 1996)
9. Satish Gupta Short text book of Medical Laboratory for technician J.P. Bros, New Delhi - 1998
10. Sachdev K.N. Clinical Pathology and Bacteriology 8th Ed, J.P. Bros, New Delhi-1991.
11. Krishna - Text book of Pathology, Orient Longman PVT Ltd.

MICROBIOLOGY

Objective : This course introduces the principles of Microbiology with emphasis on applied aspects of Microbiology of infectious diseases particularly in the following areas

1. Principles & practice of sterilization methods.
2. Collection and despatch of specimens for routine microbiological investigations.
3. Interpretation of commonly done bacteriological and serological investigations.
4. Control of Hospital infections
5. Biomedical waste management
6. Immunization schedule

Theory - 70 hours

1. Morphology 4 hours
Classification of microorgaisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria.

2. Growth and nutrition 4 hours
Nutrition, growth and multiplications of bacteria, use of culture media in diagnostic bacteriology.

3. Sterilisation and Disinfection 4 hours
Principles and use of equipments of sterlization namely Hot Air oven, Autoclave and serum inspissrator. Pasteurization, Anti septic and disinfectants.
Antimicrobial sensitivity test

4. Immunology 6 hours
Immunity Vaccines, Types of Vaccine and immunization schedule
Principles and interpretation of commonly done serological tests namely Widal, VDRL, ASLO, CRP, RF & ELISA. Rapid tests for HIV and HbsAg(Technical details to be avoided)

5. Systematic Bacteriology 20 hours
Morphology, cultivation, diseases caused ,laboratory diagnosis including specimen collection of the following bacteria(the classification, antigenic structure and pathogenicity are not to be taught)
Staphyloccci, Streptococci, Pneumococci, Gonococci, Menigococci, C diphtheriae, Mycobacteria, Clostridia, Bacillus, Shigella, Salmonella, Esch coli, Klebsiella, Proteus,vibrio cholerae, Pseudomonas & Spirochetes

6. Parasitology 10 hours
Morphology, life cycle, laboratory diagnosis of following parasites
E. histolytica, Plasmodium, Tape worms, Intestinal nematodes

7. Mycology 4 hours
Morphology, diseases caused and lab diagnosis of following fungi.
Candida, Cryptococcus, Dermatophytes ,opportunistic fungi.

8. Virology 10 hours

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

9. Hospital infection Causative agents, transmission methods, investigation, prevention and control Hospital infection. 4 hours

10. Principles and practice Biomedical waste management 4 hours

Practical 20 hours

1. Compound Microscope.
2. Demonstration and sterlization of equipments - Hot Air oven, Autoclave, Bacterial filters.
3. Demonstration of commonly used culture media, 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
4. Antibiotic susceptibility test
5. Demonstration of common serological tests - Widal, VRDL, ELISA.
6. Grams stain
7. Acid Fast staining
8. Stool exam for Helminthic ova
9. Visit to hospital for demonstration of Biomedical waste mangement.
10. Anaerobic culture methods.

Internal Assessment

Theory - Average of two exams conducted.	20
Practicals: Record & Lab work*	10

* There shall be no University Practical Examination and internal assessment marks secured in Practicals need not be sent to the University.

Scheme of Examination

Theory

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of

questions and marks for Microbiology shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
LONG ESSAY (LE)	3 (To attempt 2)	2 x 10	20
SHORT ESSAY (SE)	8 (To attempt 6)	6 x 5	30
SHORT ANSWER (SA)	12 (To attempt 10)	10 x 3	30
TOTAL MARKS			80

NO PRACTICAL EXAMINATION
REFERENCE BOOKS

Microbiology

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. Emmons - Medical mycology
6. Basic laboratory methods in Parasitology, 1st Ed, J P Bros, New Delhi - 199
7. Basic laboratory procedures in clinical bacteriology, 1st Ed, J P Brothers, New Delhi
8. Medical Parasitology - Ajit Damle

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 summarising
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

Scheme of Examination

Written (Theory): Maximum Marks: -80 marks.

No Practical or Viva voce examination

- This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

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 D Wainwright

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, sterlization 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.

SECTION III

2nd Year - RADIOTHERAPY- PART-I A

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 focal spot.
- 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, Atomic number (Z), Mass number (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, 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 (self-rectifying 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 X-ray 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), 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. 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.

Scheme of Examination

Theory

There shall be one theory paper of three hours duration carrying 60 marks. Distribution of type of questions and marks for Radiotherapy Part I A shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
ESSAY TYPE	3 questions to attempt 2 (10 marks each)	10	20
SHORT ESSAY TYPE	7questions to attempt 5 (5 marks each)	5	25
SHORT ANSWER TYPE	7questions to attempt 5 (5 marks each)	3	15
TOTAL MARKS			60

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 Carcinogenisis, Hereditary Effects,
- Effects on Embryo and Foetus, Catractogenesis
- 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, and anus)
- Lung cancer
- Lymphomas
- Breast cancer
- Gynecological cancers
- Prostate cancer
- Bladder cancer

- Seminoma
- Pediatric Tumours and others

SECTION-B

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,
- 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

Scheme of Examination Theory

There shall be one theory paper with two sections of three hours duration carrying 60 marks. Distribution of type of questions and marks for Radiotherapy Part I B(Sec A & B) shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
ESSAY TYPE	Section A -2 questions to attempt 1 Section B - 2 questions to attempt 1 6 questions to attempt 4	10	20
SHORT ESSAY TYPE	Section A - 3 questions to attempt 2 Section B - 3 questions to attempt 2 12 questions to attempt 10	5	20
SHORT ANSWER TYPE	Section A - 6 questions to attempt 5 Section B - 6 questions to attempt 5	2	20
TOTAL MARKS			60

PRACTICALS :

RADIOTHERAPY - I .

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 / Aquaplast immobilization cast and others
iv. Shield (use of Styrofoam 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 to tumor and Normal tissues
c. Calculations of Teletherapy & Brachytherapy treatment time.
d. 3D Planning (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 four 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 80 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	----------	10 Marks
5. Quality Assurance in Radiotherapy	----------	10 Marks

SOCIOLOGY

Teaching Hours : 20

COURSE DESCRIPTION

This course will introduce student to the basic sociology concepts, principles and social process, social institutions [in relation to the individual, family and community and the various social factors affecting the family in rural and urban communities in India will be studied.

Introduction :

1. Meaning - Definition and scope of sociology
2. Its relation to Anthropology, Psychology, Social Psychology
3. Methods of Sociological investigations - Case study, social survey, questionnaire, interview and opinion poll methods.
4. Importance of its study with special reference to health care professionals

Social Factors in Health and Disease:

1. Meaning of social factors
2. Role of social factors in health and disease

Socialization :

1. Meaning and nature of socialization
2. Primary, Secondary and Anticipatory socialization
3. Agencies of socialization

Social Groups:

1. Concepts of social groups, influence of formal and informal groups on health and sickness. The role of primary groups and secondary groups in the hospital and rehabilitation setup.

Family :

1. The family, meaning and definitions
2. Functions of types of family
3. Changing family patterns
4. Influence of family on individual's health, family and nutrition, the effects of sickness in the family and psychosomatic disease and their importance to physiotherapy

Community :

1. Rural community: Meaning and features - Health hazards to rural communities, health hazards to tribal community.

2. Urban community - Meaning and features - Health hazards of urbanities

Culture and Health :

1. Concept of Health
2. Concept of culture
3. Culture and Health
4. Culture and Health Disorders

Social Change :

1. Meaning of social changes
2. Factors of social changes
3. Human adaptation and social change
4. Social change and stress
5. Social change and deviance
6. Social change and health programme
7. The role of social planning in the improvement of health and rehabilitation

Social Problems of disabled :
Consequences of the following social problems in relation to sickness and disability remedies to prevent these problems

1. Population explosion
2. Poverty and unemployment
3. Beggary
4. Juvenile delinquency
5. Prostitution
6. Alcoholism
7. Problems of women in employment

Social Security :

Social Security and social legislation in relation to the disabled

Social Work :

1. Meaning of Social Work
2. The role of a Medical Social Worker

INDIAN CONSTITUTION

Prescribed for the First Year students of all degree classes

Unit-I:
Meaning of the team 'Constitution' making of the Indian Constitution 1946-1940.
Unit-II:
The democratic institutions created by the constitution Bicameral system of Legislature at the Centre and in the States.

Unit-III:
Fundamental Rights and Duties their content and significance.

Unit - IV:
Directive Principles of States Policies the need to balance Fundamental Rights with Directive Principles.

Unit - V:
Special Rights created in the Constitution for: Dalits, Backwards, Women and Children and the Religious and Linguistic Minorities.

Unit-VI:
Doctrine of Separation of Powers legislative, Executive and Judicial and their functioning in India.

Unit - VII:
The Election Commission and State Public Service commissions.

Unit - VIII:
Method of amending the Constitution.
Unit - IX:
Enforcing rights through Writs:

Unit - X:
Constitution and Sustainable Development in India.

Unit - XI :
Consumer protection act and other acts pertaining to Medical Profession.

Books:

1. J.C. Johari: The Constitution of India- A Politico-Legal Study-Sterling Publication, Pvt. Ltd. New Delhi.

2. J.N . Pandey: Constitution Law of India, Allahbad, Central Law Agency, 1998.

3. Granville Austin: The Indian Constitution - Corner Stone of a Nation-Oxford, New Delhi, 2000.

ENVIRONMENT SCIENCE AND HEALTH

Introduction to Environment and Health

Sources, health hazards and control of environmental pollution

Water

The concept of safe and wholesome water.

The requirements of sanitary sources of water.

Understanding the methods of purification of water on small scale and large scale.

Various biological standards, including WHO guidelines for third world countries.

Concept and methods for assessing quality of water.

Domestic refuse, sullage, human excreta and sewage their effects on environment and health, methods and issues related to their disposal.

Awareness of standards of housing and the effect of poor housing on health.

Role of arthropods in the causation of diseases, mode of transmission of arthropods borne diseases, methods of control

Recommended Books.

1. Text Book of Environmental Studies for under gradute courses By Erach Bharucha Reprinted in 2006, Orient Longman Private Limited /Universities Press India Pvt. Ltd.

2. Questions and Answers in Environmental Science - Basu Orient Longman Pvt. Ltd.

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, 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; thermo luminescent, 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 end 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

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 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

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

Scheme of Examination Theory

There shall be one theory paper of three hours duration carrying 60 marks. Distribution of type of questions and marks for Radiotherapy Part II A shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
ESSAY TYPE	3 questions to attempt 2 (10 marks each)	10	20
SHORT ESSAY TYPE	7questions to attempt 5 (5 marks each)	5	25
SHORT ANSWER TYPE	7questions to attempt 5 (5 marks each)	3	15
TOTAL MARKS			60

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 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

Sec 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,
- Counselling 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

6. RECENT ADVANCES IN RADIOTHERAPY.

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

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.

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

SCHEME OF EXAMINATION

University Examination

Scheme of Examination Theory

There shall be one theory paper with two sections of three hours duration carrying 60 marks. Distribution of type of questions and marks for Radiotherapy Part II B (Sec A & B) shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
ESSAY TYPE	Section A -2 questions to attempt 1 Section B - 2 questions to attempt 1 6 questions to attempt 4	10	20
SHORT ESSAY TYPE	Section A - 3 questions to attempt 2 Section B - 3 questions to attempt 2 12 questions to attempt 10	5	20
SHORT ANSWER TYPE	Section A - 6 questions to attempt 5 Section B - 6 questions to attempt 5	2	20
TOTAL MARKS			60

PRACTICALS SCHEME OF EXAMINATION 80 Marks
(One Common Practical)

1. Cobalt-machine ---------- 20 Marks
2. LinearAccelerator ---------- 20 Marks
3. SimulationandTreatmentTechniques ---------- 20 Marks
4. Spotters 20 Marks
   a. I/capplicationcancercervix ----------
   b. I/LRadiotherapyapplication ----------
   c. Advanced Training

BIO STATISTICS

Time Allotted: 20 Hours

Course Description:

Introduction to basic statistical concepts: methods of statistical analysis; and interpretation of data

Behavioural Objectives:

Understands statistical terms.
Possesses knowledge and skill in the use of basic statistical and research methodology.

Unit - I : Introduction

Meaning, definition, characteristics of statistics.
Importance of the study of statistics.
Branches of statistics.
Statistics and health science including nursing.
Parameters and estimates.
Descriptive and inferential statistics.
Variables and their types.
Measurement scales

Unit - II: Tabulation of Data

Raw data, the array, frequency distribution.
Basic principles of graphical representation.
Types of diagrams - histograms, frequency polygons, smooth frequency polygon, commulative frequency curve, ogive.
Normal probability curve.

Unit - III : Measure of Central Tendency

Need for measures of central tendency
Definition and calculaton of mean - ungrouped and grouped
Meaning, interpretation and calculation of median ungrouped and grouped.
Meaning and calculation of mode.
Comparison of the mean, and mode.
Guidelines for the use of various measures of central tendency.

Unit - IV : Measure of Variability

Need for measure of dispression.
The range, the average deviation.
The variance and standard deviation.
Calculation of variance and standard deviation ungrouped and grouped.
Properties and uses of variance and SO

Unit -V : Probability and Standard Distributions.

Meaning of probability of standard distribution.
The Binominal distribution.
The normal distribution.
Divergence from normality - skewness, kurtosis.

Unit - VI : Samling Techniques

Need for sampling - Criteria for good samples.
Application of sampling in Community.
Procedures of sampling and sampling designs errors.
Sampling variation and tests of significance.

Unit - VII : Health Indicator

Importance of health Indicator.
Indicators of population, morbidity, mortality, health services.
Calculation of rates and rations of health.

Recommended Books.

1. B.K. Mahajan & M. Gupta (1995) Text Book of Preventive & Social Medicine, 2002, 17th Edition Jaypee Brothers.

B.Sc. Allied health Sciences - I year

BASICS IN COMPUTER APPLICATIONS

The course enables the students to understand the fundamentals of computer and its applications.

1. Introduction to Data processing :

Features of computers, Advantages of using computers. Getting data into / out of computers. Role of computers. What is Data processing? Application areas of computers involved in Data processing. Common activities in processing. Types of Data processing, Characteristics of information. What are Hardware and Software?

2. Hardware Concepts :

Architecture of computers, Classification of computers, Concept of damage. Types of storage devices. Characteristics of disks, tapes, Terminals, Printers, Network. Applications of networking concept of PC System care, Floppy care, Data care.

Concept of Software.

Classification of software : System software. Application of software. Operating system.
Computer system. Computer virus. Precautions against viruses. Dealing with viruses.
Computers in medical electronics
Basic Anatomy of Computers

Principles of programming

Computer application - principles in scientific research ; work processing, medicine, libraries, museum , education, information system.

Data processing

Computers in physical therapy - principles in EMG, Exercise testing equipment, Laser.

Scheme of Examination for MEDICAL ELECTRONICS including COMPUTER APPLICATIONS

One Written (Theory) paper: Maximum Marks: -80 marks.
No Practical or Viva voce examination.

SECTION IV

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 observe or participate as appropriate.

General procedures to be observed when patients attend for appointment:

- Lifting and moving techniques
- Administration of bedpans, 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.
- Stoma 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:

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

Equipment's and integration:

i. Begin to become competent in the manipulation of the radiotherapy equipment.
ii. Be able to communicate effectively with patients.
iii. 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 the set up of multi field 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 dark room 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. Set up a patient on their first visit.

TO ACHIEVE FINAL COMPETENCY SUBSTANTIAL TIME WILL BE SPENT:

i. Setting up multi field techniques under supervision.
ii. Participating in the quality control procedures in the department in accordance with the protocols.
iii. Simulating and localizing a 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 Project work, 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 checklists provided (Assessment forms).

The learning out comes to be assessed should included: (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. Periodic tests:

The departments may conduct pariodir tests (Internal Assessment), The tests may include written papers, practical with viva voce.

2. 6) Work diary / Log Personal Attitudes.
The essential items are:

- Caring attitudes
- Initiative
- Organizational ability
- Potential to cope with stressful situations and undertake responsibility
- Trust worthiness and 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.

3. Acquisition of knowledge:

The methods used comprise of 'Log Book' 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 log book 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.

4. Technical skills

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 performance is assessed by the guide by direct observation. Particulars are recorded by the student in the log book.

5. Teaching Skills:

Book:
Every candidate shall maintain a work diary and record his/her participation in the training programs conducted by the department 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.

6. Records:

Records, log books, 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 through out the said course shall be made by the HOD.

The log book is a record of the important activities of the candidates during his training internal assessment should be based on the evaluation of the log book collectively, log books are a tool for the evaluation of the training programme of the institution 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. Whiley 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. 6th Edition. C.K. Bomford. Churchill Livingstone.

5. Anatomy and Physiology in Health and Illness,
Anne Waugh, Allison Grant, Illustrations by Graeme Chambers.

6. Ross and Wilson, Anatomy and Physiology in health and illness, Kathleen J.W. Wilson, 8th Edition, Churchill and Living stone.

7. Walter and Millers, Text Book 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 Living stone.

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 ant other 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: John Wright & 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
William Hendee
Mosby

4. The Physics of Radiation Therapy, Second Edition,
Fiaz M. Khan, Ph.D.
Williams & Wilkins.

5. Clinical Oncology,
Geoffrey R. Weiss, Associate Professor of Medicine, The University of Texas Health Science Center at San Antonio.

6. Cancer Facts, A concise Oncology Text,
James F. Bishop,
Harwood Academic Publishers,

7. Review of Medical Physiology, 20th edition, William F. Ganong, LANGE

8. A Colour Atlas of Human Anatomy,
Wolfe Medical Publications

9. Medical Physics Handbook 6, Fundamentals of Radiation Dosimetry, J R Greening, Adam Hilger ltd, Bristol.

10. Principles and Practice of Radiation Oncology, Carlos A Perez,

11. Principles and Practice of Radiation Therapy, G.K.Rath & B.K.Mohanthi.ILBS

12. Principles of Radiological Physics. 3rd edition. Donald T. Graham. Churchill Livingstone.

13. Radiation Oncology: Rational technique and results. 8th edition. James D & K.Khan Ang.

14. Clinical Oncology for Medical Students and Physicians. Philip Rubin. American Cancer Society.

SECTION V

MONITORING LEARNING PROGRESS

LOG BOOK

ASSESSMENT FORMS

- Template

Centres may develop their own criteria based on local practice.

PRACTICAL ASSESSMENT

(To be completed by the Clinical Assessor/Supervisor within two days of discussion with the student)

Date .....

EMERGENCY PROCEDURES	YES	NO	Not applicable
Student indicated the position of the emergency on/off switches for electrical and radiation safety			
Student indicated the location of the oxygen, resuscitation and fire fighting equipment			
Familiarity with the treatment documents of the Quality Assurance programme			

TREATMENT PREPARATION	YES	NO	Not applicable
Student correctly interprets the treatment prescription			
Student correctly prepares the treatment room			
Student correctly prepares the equipment			
Student corrctly identifies the patient			
Student assesses the patient's condition and responds appropriately			
Correctly identifies the treatement site			

TECHNIQUE	FIELD 1		FIELD 2		Not applicable
	YES	NO	YES	NO	
Student correctly positions patient on the treatment couch					
Student correctly set the FSD					
Student demonstrates accurate beam alignment					
Student correctly sets the interlocks					
Students monitors the patient throught the treatment procedure					
Student cleans the room and prepares for the next patient					

CARE OF THE PATIENT	YES	NO	Not applicable
1. Student gave adequate explanation of procedure to the patient			
2. Student assisted the patient as required			
3. Student was considerate to the patient			
4. Student demonstrated suitable aftercare to the patient			
5. Student paid attention to the specific hygiene practices and universal precautions relevant to the patient			

UNACCEPTABLE PERFORMANCE / FAILURE

1. Failure to identify the location of the various items of emergency equipment.

2. Failure to check the identity of the patient and / or the site of treatment.

3. Failure to assess pre-treatment condition and to act appropriately (the assessor intervenes if he/she considers the patient unfit for treatment).

4. Preparing to give an incorrect treatment.

Please outline any special problems which arose during the assessment procedure which may have influenced the result.

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Assessor's/Supervisor's Signature.....

I have seen and discussed this assessment with the Assessor / Supervisor

Student's Signature.....

Date.....

Multi field treatment with / without shielding

Name.....

Student ID.....

Stage in training .....

Clinical Department.....

Date.....

Clinical Assessor.....

Treatment related information

Diagnosis .....

Site for treatment .....

Technique .....

Treatment unit including the type and energy of radiation.....

.....

Fields to be treated for the purpose of assessment.....

.....

Date patient consent was obtained.....

Student's signature

.....

I agree that the above information is correct.

Clinical Assessor / Supervisor's signature.....

PRACTICAL ASSESSMENT

(To be completed by the Clinical Assessor/Supervisor within two days of the pre-evaluation discussion with the student)

Date .....

PREPARATION (Student accurately / correctly)	YES	NO	Not applicable
Indicate position of emergency on/off switches for electrical and radiation safety			
Indicated location of oxygen, resuscitation and fire-fighting equipment			
Notes any pre-treatment requirement Full bladder Blood count Routing clinic visit Dietician appointment To be seen on setup Port film Other (please indicate)			
Interprets treatment presceiption			
Prepares the treatment room			
Prepares the equipment Treatment table Pillows / headrest / immobilization device Bolus Shielding devices			
Identifies the patient			
Evaluates patient, condition and informs the radiographer of anyproblems			

TECHNIQUE (Student demonstrates accuracy in)	YES	NO	Not applicable
Positioning of patient			
Use of immobilization devices			
Setting FSD / SSSD / SAD			
Use of beam directional devices			
Use of beam definition devices			
Use of bolus			
Use of beam attenuation			
Beam alignment			
Student correctly sets interlocks			
Other (please indicate)			

PRACTICAL ASSESSMENT

To take place between the clinical assessor and the student at a designated time prior to the formal practical assessment.

Date .....

	YES	NO
Student has reviewed all the relevant information for this patient.		

STUDENT WAS ABLE TO GIVE INFORMATION ON	YES	NO	Not applicable
DISEASE Diagnosis Extent of disease Common routes of spread			
TREATMENT VOLUME Areas included Anatomical field limits Critical structures and their radiation tolerance dose (s)			
BEAM MODIFICATION Used Reasons for			
TREATMENT PRESCRIPTION Total dose Daily fractionation Any modification for this treatment and the reasons for			
PATIENT Treatment intent Position Probable side effects Appropriate advice Any other relevant information to this individual patient Any anticipated problems			
OTHER Please indicate			

DOSE DELIVERY (Student correctly)	YES	NO	Not applicable
Double checks dose prescription			
Indicates monitor units / time to be set			
Observes control panel throught the treatment procedure			
Observes patient throughout the treatment procedure			
Cleans the treatment room			

PATIENT CARE Student :	YES	NO	Not applicable
Asked patient re overall well-being			
Responded adequately to problems reported by the patient			
Responded adequately to questions asked by the patient			
Reported any problems / queries to the radiographer			
Gave an adequate explanation of the treatment procedure			
Gave appropriate level of assistance to the patient in the treatment room			
Was considerate to the needs of the patient			
Paid attention to the specific hygiene practices relevant to the patient			
Demonstrated suitable aftercare			

PROFESSIONALISM	YES	NO	Not applicable
Asked questions of the radiographers appropriate to this patient and technique			
Demonstrated initiative			
Worked well as a member of the team			

Commens .....

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UNACCEPTABLE PERFORMANCE / FAILURE

1. Failure to identify the location of the various items of emergency equipment.
2. Failure to check the identity of the patient and / or the site of treatment.
3. Failure to assess pre-treatment condition and to act appropriately (the assessor intervenes if he/she considers the patient unfit for treatment).
4. Preparing to give an incorrect treatment.

Please outline any special problems which arose during the assessment procedure which may have influenced the result.

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Assessor's/Supervisor's Signature.....

I have seen and discussed this assessment with the Assessor / Supervisor

Student's Signature

.....

Date.....

Assessment of Clinical Placement

Name .....

Unit .....

Phase in programme .....

Grade awarded for professional development .....

Grade awarded for assessment .....

Course Director's/Clinical Coordinator's signature.....

Student's signature

.....

Assessment of Patient Management

At a level appropriate to his/her stage in training the student should demonstrate an ability to:		
	Maximum Marks	Marks Awarded
Interpret information from treatment sheet and patients notes	10	
Carry out appropriate preparation of treatment room and equipment	10	
Discuss the merits or otherwise of the treatment plan for individual patients	10	
Recognise signs of reactions to treatment	10	
Reassure and support patient throughout the treatment procedure	10	
Communicate effectively with patients, relatives and other professionals	10	
Appropriately record details of treatment and other relevant information	10	
TOTAL MARKS	70	

Comments of clinical supervisor :

Comments of student:

Clinical Supervisor's signature.....

Student's signature .....

Assessment of Professional Development

Score on a scale of 1 to 5. (1 unsatisfactory and 5 excellent)					
	1	2	3	4	5
Professional appearance					
Reliability					
Initiative, including willingness to learn enquire/ research while on placement					
General handling and positioning of patients					
Professional manner					
Ability to work independently and as part of a team					
Attention to safety aspects					

Comments of clinical supervisor :

Comments of student:

Clinical Supervisor's signature.....

Student's signature .....

PATIENT MANAGEMENT

Interprets information

Correct identification / need for blood counts / clinic visit, etc.

Implements preparation

Field size / accessory equipment, etc.

Merits of treatment plan

Aim of treatment / reasons for modifications / lead, etc.

Reactions

Aware of normal and reports abnormal to radiographer

Reassurance and support of patient

Appropriate comments and information

Communication

Clear / appropriate / all patients / staff / others

Records

Accuracy / relevance / date / respect for confidentiality

PROFESSIONAL DEVELOPMENT

Professional Appearance
Uniform / overall neatness, etc.

Reliability
Attendance / punctuality / accurate reporting / carrying out tasks

Initiative
Ability / willingness to take action. Asking questions / seeking help

General handling skills
Positioning of patient / accurate setting up, care with lead blocks, etc.

Professional manner
Courtesy / participation in discussion / empathy / common sense

Independence / teamwork
Relevant to stage in training / less dependent on instructions

Safety
Includes radiation awareness, fire prevention, prevention of cross infection, etc.

Comments
Comments should be included to explain the scores / marks from each section and to help guide students on how to improve in these areas and are invaluable to school staff in co-ordinating assessments and placements.

Student comments will provide feedback to clinical staff and to school staff on the placement in general.

Assessment of Technical Competence

At a level appropriate to his/her stage in training the student should demonstrate an ability to:		
	MAXIMUM MARKS	MARKS AWARDED
Identify the functions on the pedestal/handset	10	
Safely operate the pedestal/handset	10	
Identify the functions on a control panel and indicate their purpose	10	
Correctly and safely under supervision set the control panels	10	
Safely use the accessory equipment in the correct context	10	
Correctly and safely use the immobilization equipment	10	
identify and locate the radiation protection features in the treatment areas	10	
Set up a single field under supervision	10	
Set up a parallel opposed treatment under supervision	10	
Assist in the set up of a multi field treatment	10	
Identify the cassettes and films used in the simulator	10	
Identify the cassettes and films used in the treatment unit	10	
Demonstrate the correct procedure for developing films	10	
Demonstrate the correct procedure for unloading and reloading cassettes	10	
TOTAL MARKS	140	

Comments of clinical supervisor :

Comments of student:

Clinical Supervisor's signature.....

Student's signature .....

Assessment of Technical Competence

At a level appropriate to his/her stage in training the student should demonstrate an ability to:		
	MAXIMUM MARKS	MARKS AWARDED
Set up multi field treatments under supervision	10	
Participate in the quality control programme	10	
Simulate and localise a target volume	10	
Describe the purpose of health and safety regulations	10	
Describe the purpose of ionising radiation regulations	10	
Discuss the local roles in the departments	10	
Complete a basic treatment plan	10	
Set up a patient on their first visit	10	
TOTAL MARKS	80	

Comments of clinical supervisor :

Comments of student:

Clinical Supervisor's signature.....

Student's signature .....

Assessment of Basic Clinical Competence and Technical Skill
Please comment on and score out of 10 each of the following:

Student accuracy and safety in	**Mark awarded**
Setting up patients	
Using accessory equipment	
Using unit controls	
Setting time, dose, etc.	
Setting interlocks	
Additional (please name)	

TECHNICAL SKILLS	**extremely helpful**				**unhelpful**
Patient setup	5	4	3	2	1
Using accessory equipment	5	4	3	2	1
Using unit controls	5	4	3	2	1
Setting time, dose etc	5	4	3	2	1
Other (please name)	5	4	3	2	1

MANAGEMENT SKILLS					
Understanding of the appointment system	5	4	3	2	1
Recording data - treatment sheets etc	5	4	3	2	1
Checking against treatment plans	5	4	3	2	1
Other (please name)	5	4	3	2	1

Level of Competency Assessment

TECHNICAL ABILITY

TASK	GRADE			
	I	II	III	FAIL
Patient positioning				
Use of immobilization devices				
Setting FSD				
Use of beam directional devices				
Use of beam definition devices				
Addition of beam modification				
Beam alignment				
TOTAL				

Comments .....

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PATIENT CARE

TASK	GRADE			
	I	II	III	FAIL
Good use of questioning				
Approachable				
Considerate				
Demonstrated observational skills				
Gave adequate explanation of Procedure				
Advised re side effects and Management				
TOTAL				

Comments .....

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TEAM SKILLS

TASK	GRADE			
	I	II	III	FAIL
Adaptable				
Accepts responsibility				
Demonstrates initiative				
Discusses clinical issues				
Considerate to needs of other Team members				
Versatile				
TOTAL				

Comments

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KNOWLEDGE AND UNDERSTANDING

Assessment of knowledge on specific techniques taught in the academic programme and consolidated during clinical placement.

SITE	GRADE			
	I	II	III	FAIL
Breast				
Lung				
Prostate				
Colon				
Cervix / Uterus				
Oesophagus				
Bone metastases				
TOTAL				

Comments .....

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1.6. Cumulative Total

	GRADE			
	I	II	III	FAIL
TECHNICAL ABILITY TOTAL				
KNOWLEDGE AND UNDERSTANDING TOTAL				
PATIENT CARE TOTAL				
TEAM SKILLS TOTAL				
FINAL TOTAL				

Comments

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FINAL GRADE AWARDED.....

Signed.....

Date .....

ACADEMIC ACTIVITIES ATTENDED

Name: Admission Year:

College:

Date	Type of activity specify Lectures, Seminar, literature review, Presentation, Practicals etc	Particulars

PRACTICAL PROCEDURES PERFORMED

Name: Admission Year:

College:

Date	Name	ID No	Procedure	Category O,A,PA,PI*

*Key: O -- observed
A -- Assisted a more senior RTT
PA -- Performed procedure under the direct supervision of a senior RTT
PI -- performed independently.

PRACTICAL PROCEDURES PERFORMED

Name of the college:

Academic Year:

Sl. No.	Faculty Member & Others	Name of the student and mean score									
		A	B	C	D	E	F	G	H	I	J
1.											
2.											
3.											
4.											
5.											
	Total Score										