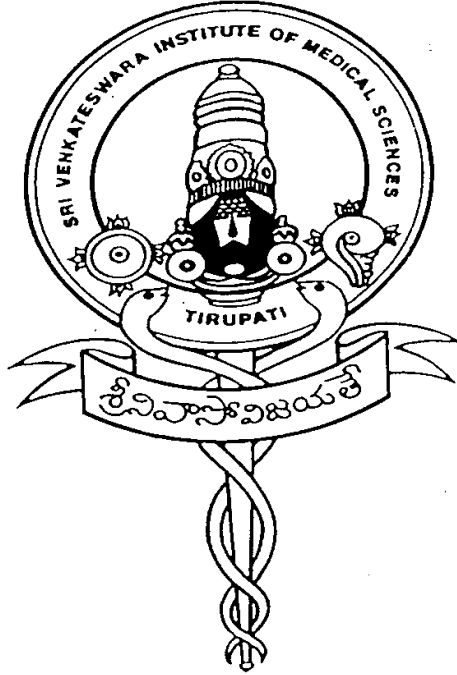


**SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES  
TIRUPATI – 517 507**

(A University established by an act of Andhra Pradesh State Legislature)



**1<sup>st</sup> BOARD OF STUDIES MEETING  
B.Sc. Radiotherapy Technology Course  
19.02.2020**

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**TIRUMALA TIRUPATI DEVASTHANAMS**

**SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES, TIRUPATI**

**B.Sc. Radiotherapy Technology Course**

**1<sup>st</sup> BOARD OF STUDIES MEETING**

**List of Members**

- |     |                                                                                                             |   |                            |
|-----|-------------------------------------------------------------------------------------------------------------|---|----------------------------|
| 01. | Dr. M.Hanumantha Rao<br>Dean,<br>SVIMS, Tirupati.                                                           | - | Chairman                   |
| 02. | Dr.K.V. SreedharBabu<br>Registrar,<br>SVIMS, Tirupati.                                                      | - | Member                     |
| 03. | Dr. Umamaheswara Rao<br>Controller of Examinations,<br>SVIMS, Tirupati.                                     | - | Member                     |
| 04. | Dr.N. Vijaya prabhu<br>Assoc. Prof. (Medical Physics)<br>Dept. of Radiation Oncology<br>JIPMER, Puducherry. | - | Member, External Expert    |
| 05. | Dr. K. Bhaskar Reddy<br>Prof. & HOD, Forensic Medicine<br>Principal i/c. AHS<br>SVIMS, Tirupati.            | - | Member                     |
| 06. | Mrs. M. Sangeetha<br>Lecturer in Radiological Physics,<br>SVIMS, Tirupati.                                  | - | Member, Internal Expert    |
| 07. | Dr. B.V. Subramanian<br>Assoc. Professor & HOD,<br>Dept. of Radiotherapy,<br>SVIMS, Tirupati.               | - | Secretary, Internal Expert |

# INDEX

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# **1. General Regulations**

These regulations may be called as, "The regulations for B.Sc. paramedical courses of Sri Venkateswara Institute of Medical Sciences, Tirupati".

## **Introduction:**

The department of Radiation Oncology was started in the year 2008. Subsequent to that in the academic year of 2010 -2011, Diploma in Radiotherapy Technology course was started with the intake of 4 students. The objective of the course is to train the students to handle the daily treatment of patients, who are undergoing Radiotherapy for the treatment of cancer. MD Radiotherapy course is also run by the department since 2012. The department is equipped with two Linear Accelerators, a CT simulator and an HDR Brachytherapy Unit. One of the recently installed Linear accelerator is fully equipped to perform State of the art techniques like IMRT, VMAT and SRS. B.Sc. Radiotherapy Technology course is started with the intent of lifting up the standard of education and thus provide the students with better knowledge and to keep open the possibilities of higher education in the same stream.

### **1) Eligibility for admission:**

Minimum education: 10+2 class passed with Science subjects (Physics, Chemistry, Biology)/ (Physics, Chemistry, Mathematics) & English Core/English Elective from recognized board under AISSCE/CBSE/ICSE/SSCE/HSCE/NIOS or other equivalent Board.

**2) Age limit for admission:** A candidate should have completed the age of 17 years at the time of admission or would complete the age on or before 31<sup>st</sup> December of the year of admission.

**3) Method of selection:** Admissions are made based on the marks secured in the qualifying examination. However, the order of preference to be followed in deciding the merit of the candidate, in case of a tie is given below:

Order of preference:

- i. Passing the qualifying examination in a single attempt
- ii. Total marks secured
- iii. Group total secured
- iv. Elder in person based on the date of birth

Note: The percentage of marks shall be calculated up to three decimal places

**4) Course structure:** The duration of the course is 4 years, divided into 8 semesters. The 1<sup>st</sup> & 2<sup>nd</sup> semesters shall be common for all the specializations. The 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> & 6<sup>th</sup> semesters involve theory, practice and handling of equipment in the respective speciality. During 7<sup>th</sup> & 8<sup>th</sup> semesters, the candidate will undergo internship in the speciality.

**5) Syllabus :** The syllabus is common during 1<sup>st</sup> and 2<sup>nd</sup> semesters for all B.Sc. Paramedical Courses. The subjects include Anatomy, Physiology, Microbiology, Pathology, Biochemistry, Pharmacology, Community Medicine, English, Principles of Nursing, Basic in Medical Physics & Electronics, Computer related to medical care. The syllabus for the specialties during 3<sup>rd</sup> to 8<sup>th</sup>

Semesters will be discussed and approved by the Board of Studies (specialty wise) meetings by the dept. concerned.

**6) Commencement of the programme :** The course will ordinarily commence from 1<sup>st</sup> August of the each academic year.

**7) Medium of Instruction :** English.

**8) Practical Book :** Each candidate has to maintain a practical book of cases attended and clinical hours posted in various sub specialties.

**9) Uniform :** As prescribed by the University from time to time.

**10) Attendance: 80%** of attendance in each subject is essential for all the courses. The condonation of attendance is allowed between 70 - 80% if the student is fall short of minimum requirement subject to production of medical certificate and payment of condonation fee.

**11) Holidays & Vacation:** The students are granted 01 week holidays each during Dasara and Sankranti and 15 days summer vacation shall be granted in the month of May, apart from public holidays declared by the University.

**12) Ban on ragging in the campus:** Ragging, use of drugs, drug trafficking, eve teasing etc. are strictly forbidden in the university campus and persons found indulging in such activities will be subjected to strict disciplinary action as per the law. Indulging in any criminal activity within or outside the university and any physical violence against fellow students and fellow residents will not be tolerated and will attract stern disciplinary action including rustication.

As per the orders of the Hon'ble Supreme Court of India if any incident of ragging comes to the notice of the authority of the university, the student concerned will be given liberty to explain and if his/her explanation is not satisfactory, the authority would expel him/her from the university besides making entry in his/her certificates to that effect. Apart from the above, the students are liable for a fine up to Rs.50,000/-, rigorous imprisonment up to three years (by court of law), and other punishments as per the Act.No.26 of 1997, dated 21-08-1997 of State of Andhra Pradesh.

**13) Examinations:** The examinations will be conducted in English medium at the end of each semester both in theory and practical. The semester examinations will be held during January / February and July/ August in each academic year.

**14) Appearance for the Examination:**

- i) A candidate shall register for all the subjects of a year when he / she appear for the examinations of that year for the first time.
- ii) A candidate shall not be admitted to the practical examinations for the first time unless he / she produce the class record book duly certified by the respective Head of the Department (if applicable).
- iii) The marks awarded to the record during the first appearance will be valid for the subsequent examinations in case of failed candidates.

**15) Re-totaling of answer scripts:**

There is no provision for revaluation of answer books in the University. However, as per the rules of the University the students can ask for re-totalling on payment of prescribed fees. The faculty members who are posted for the job will take up the correction of the errors in the re-totalling and correction of un-valued questions. Modification of the results, if any, will be declared as per the rules of the University.

**16) Minimum for a Pass:** The eligibility for minimum pass for all the subjects will be:

- i) 40% in internal assessment.
- ii) 40% in each theory paper.
- iii) 50% Aggregate in (i) & (ii)
- iv) 50% in each practical / viva voce.

**17) Detention:** There is no detention system as is not being followed for the rest of the courses. Accordingly, the student is allowed to appear for the University examination each semester subject to fulfilling the attendance requirement. However the final results will be kept under "Withheld" until he / she passes all the previous papers.

**18) Classification of results:** The committee agreed for the following:

Distinction: 75% and above of the total marks

First Class: 65<75% of the total marks

Second Class : 50<65% of the total marks

Pass class: If the student does not pass all the subjects within the duration of the course, the class will not be awarded and the final results will be declared as "Pass". Those who have break in the middle of the course due to detention system or due to attendance shortage, then it will be taken into consideration as not completed within the duration of the course and the final results will be declared as "Pass".

**19)** The rules for grace marks will be followed as per the existing rules of the University applicable for both Internal & University Examinations.

## Teaching hours for Theory & Practical

### I Semester:

S. No	Subject	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+Practical)
1	Anatomy	80	40	UE	80	40%	20	40%	50%	50	50%
2	Physiology	80	40	UE	80	40%	20	40%	50%	50	50%
3	Biochemistry	80	40	UE	80	40%	20	40%	50%	50	50%
4	Principles of Nursing	30	20	IE	40	40%	10	40%	50%	-	-
5	Basics in Medical Physics & Electronics	40	-	IE	40	40%	10	40%	50%	-	-
	English	50	-	-	-	-	-	-	-	-	-
	<b>Total</b>	<b>360</b>	<b>140</b>								

**Total hours : 500**

### II Semester:

S. No	Subject	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+Practical)
6	Microbiology	80	40	UE	80	40%	20	40%	50%	50	50%
7	Pathology	80	40	UE	80	40%	20	40%	50%	50	50%
8	Pharmacology	80	40	UE	80	40%	20	40%	50%	50	50%
9	Computers related to medical care	30	40	IE	40	40%	10	40%	50%	-	-
10	Community Medicine	80	40	IE	80	40%	20	40%	50%	-	-
11	English	50	-	UE	80	40%	20	40%	50%	-	-
	<b>Total</b>	<b>400</b>	<b>200</b>								

**Total hours: 600**

**\*Practical including Oral, Spotters & Record**

**Note :** 1. As per the Minutes of the meeting, held on 24/10/2016, it is agreed to transfer the Community Medicine subject from I to II semester and Principles of Nursing from II to I Semester w.e.f. 2017-18 admitted batch onwards.

2. The Teaching hours & Exam pattern from III –VI semesters (for paper no's 13-24) are furnished separately under each speciality.

### Speciality Papers: B.SC. RADIOTHERAPY TECHNOLOGY

#### Semester III

Sl.NO	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/IE	Theory	Practical	Min. for pass
01.	Radiation Physics- 1	80	120	IE	80	20	50%
02.	Medical Imaging Physics-1	80	120	IE	80	20	50%
03.	Patient care in Radiotherapy	80	120	IE	80	20	50%

#### Semester IV

Sl.NO	Paper	Hours of Teaching		Examination							
		Theory	Practical	UE/I E	Theory Marks	Min. Pass	IA	Min Pass	Aggregate (UE+IA)	Practical Marks	Min. for pass (Theory +Practical)
01.	Radiation Physics-2	80	120	UE	80	40%	20	40%	50%	50	50%
02.	Radiotherapy Equipments and Quality Assurance	80	120	UE	80	40%	20	40%	50%	50	50%
03.	Tumor Pathology and Oncology	80	120	UE	80	40%	20	40%	50%	50	50%



## Semester V

SI.NO	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/IE	Theory	Practical	Min. for pass
01.	Radiation Therapy Planning Concepts	80	120	80	40%	20	50%
02.	Medical Imaging Physics2	80	120	80	40%	20	50%
03.	Radiobiology	80	120	80	40%	20	50%

## Semester VI

SI.NO	Paper	Hours of Teaching		Examination							
		Theory	Practical	UE/IE	Theory Marks	Min. Pass	IA	Min Pass	Aggregate (UE+IA)	Practical Marks	Min. for pass (Theory +Practical)
01.	Radiation Protection and Safety	80	120	UE	80	40%	20	40%	50%	50	50%
02.	Advanced Radiotherapy Techniques	80	120	UE	80	40%	20	40%	50%	50	50%
03.	Principles and Practice of Radiotherapy	80	120	UE	80	40%	20	40%	50%	50	50%

Model Paper for all 3<sup>rd</sup> Semester to 6<sup>th</sup> Semester  
Time : 3 hours Max. Marks :80

1. Three essays out of four - 3x10 =30
2. Ten short notes out of twelve - 10x5 =50

## Internship

### VII Semester:

There shall be internship during the VII & VIII semester including clinical & hospital work, maintenance of log book etc.

Paper No.	Paper	Taught by the Faculty of	Hours of Teaching		Examination		
			Hours of Teaching	Hours of clinical / Practicals	UE/ IE	Theory Max. Marks	Mim. for Pass
1.	Basic Life support & Trauma life support	Anesthesia & Emergency Medicine	20	10	IE	50	50%
2.	Cardiac life support	Cardiology	15	10	IE	50	50%
3.	Medical Ethics	Forensic Medicine	15	10	IE	50	50%
4.	Internship	In the Speciality Dept.	-	820	-	-	-
	<b>Total</b>		<b>50</b>	<b>850</b>			

**Total Hours: 900**

### VIII Semester:

Paper No.	Paper	Taught by the faculty of	Hours of Teaching		Examination			
			Hours of Teaching	Hours of clinical / practicals	UE/ IE	Theory Max. Marks	Viva - Voce Max. Marks	Mim. for Pass
1.	Fundamental in Research	In the Speciality Dept.	<b>100</b>	-	IE	50	-	50%
2.	Internship & Project work		-	800	-	-	50	50%
	<b>Total</b>		<b>100</b>	<b>800</b>				

**Total hours : 900**

#### Procedure of conduct of Internal Examination (IE)

- The question paper will be set by the concerned internal HoD and will send the same to the Controller of Examinations one month before the declaration of preparation holidays.
- The Controller of Examinations will conduct the examination and send the answer papers to the concerned HoD.
- The HoD or any internal faculty as recommended by the HoD shall evaluate the answer paper and send the marks statement and answer papers to the Controller of Examinations.
- The tabulation and declaration of results lies with the Controller of Examination.
- All the IE marks shall also be included in the overall total marks for declaration of division in the exam.

# SYLLABUS - I & II Semesters

## SEMESTER - I

### Subject 1 : Anatomy

#### Unit I - Human Body as a whole

##### Learning objectives :

10 hrs

1. Define anatomy.
2. List the sub-divisions of anatomy.
3. Describe the Anatomical terms of location and position of various parts and organs in the human body
4. Fundamental planes of the body.
5. Enumerate the levels of organization of human body.
6. Structure of cell
7. Basic Tissues of the body - classification and preparation of tissue for observation under microscope – describe properties of various basic tissues of the body with examples – Epithelial tissue, connective tissue, muscular tissue, nervous tissue.
8. Microscope- Parts of microscope and functions

**Practical:** Illustrations of histological slides of basic tissues

6 hrs

#### Unit II - Locomotor System

##### Learning objectives:

##### Skeletal system:

12 hrs

1. Classify different types of bones.
2. Describe different parts of bone.
3. Understand blood supply of a long bone.
4. Identify major bones of the body and their parts
5. Classify different joints with examples.
6. Describe general features of a synovial joint.
7. Classification of different types of synovial joints with type of movements and examples.
8. Classify different types of muscles.

##### Region-wise anatomy of muscles and joints

9. List the names of muscles as functional groups.
10. Describe important muscles in the body.- Trapezius, Deltoid, Pectoralis major, Gluteus maximus, Hamstring muscles, Soleus, sternocleidomastoid, oblique muscles of abdomen, muscles of tongue, scapular muscles

## **Regional anatomy:**

### **11. Describe the following :**

Axilla, cubital fossa, popliteal fossa, Triangles of neck, Flexor and Extensor Retinaculum, Palmar and Plantar Apo neurosis

## **Arthrology:**

12. Describe Type, Sub type, Articular surface, Ligaments, Relations, Blood supply, Nerve supply, Movements and Clinical Anatomy of Shoulder joint, Elbow Joint, Wrist joint, 1<sup>st</sup>carpo-metacarpal joint, Hip Joint, Knee Joint, Ankle Joint

**Practicals:** Illustrations- major bones, important muscles, joints

**8 hrs**

## **Unit III - Nervous System**

### **Learning objectives:**

**12 hrs**

Describe the

1. Parts of nervous system.
2. Structure of nervous tissue.
3. Spinal cord - coverings, extent, general features, sub-divisions, structural organization of grey matter and white matter. Blood supply. Formation of tracts –Posterior column pathway, pyramidal tract and their clinical importance. Injuries to spinal cord.
4. Brain stem – components, Blood supply, important functional components and effect of their injury
5. Cerebellum – location, parts, functional subdivisions, connexions, blood supply and functional importance
6. Cerebrum – surfaces, poles, lobes, blood supply, sulci, gyri and important functional areas and their clinical importance. Thalamus, hypothalamus, basal ganglia, corpus striatum, hippocampus and amygdala – their location and function.
7. Cranial nerves – names, location of nucleus and the functional components
8. Spinal nerves – Course of a typical spinal nerve. Formation of plexuses – brachial, lumbar – important nerves of upper limb, lower limb.

**Practicals:** Illustrations– Brain, spinal cord and their sections

**6 hrs**

## **Unit IV - Circulatory System**

### **Learning objectives:**

**10 hrs**

Describe the

1. General plan of circulatory system.
2. Pulmonary, portal and systemic circulations.
3. Structure of cardiac muscle, blood vessels.
4. Thoracic cavity – Bony cage, muscles – intercostal muscles, diaphragm
5. Mediastinum – sub-divisions, contents
6. Heart - coverings, external features, chambers, blood supply, nerve supply.
7. Major arteries of upper limb, lower limb, head and neck, abdomen and pelvis.
8. Important veins – superior and inferior vena cava, portal vein, veins of upper limb and lower limb - varicose veins and their importance
9. Lymphatic system – components, Describe in brief anatomy and microscopic structure of lymphoid organs – lymphnode, tonsil, thymus, spleen, thoracic duct.

**Practicals:** Illustrations -thoracic cavity, mediastinum, heart, major vessels, lymphoid organs

**04 hrs**

## Unit V - Respiratory System

### Learning objectives:

10 hrs

Describe the

1. Parts of respiratory system.
2. Nasal cavity, paranasal air sinuses, nasal septum, lateral wall of nose.
3. Pharynx – extent, sub-divisions, muscles
4. Larynx – cartilages, muscles, parts, nerve supply
5. Trachea and bronchial tree – extent, measurements, histological structure of trachea – subdivisions of bronchial tree – broncho-pulmonary segments and their clinical importance
6. Pleura – types, reflections, recesses
7. Lung – location, relations, lobes, fissures, surfaces.

**Practicals:** Illustrations – Cut section of head & neck, trachea, lungs

4 hrs

## Unit VI - Digestive System

### Learning objectives:

16 hrs

Describe the

1. Abdomen – quadrants, musculature of wall, Formation inguinal canal, rectus sheath and their importance
2. Components of digestive system.
3. Mouth - Tongue, palate – Structure of tongue
4. Salivary glands – parotid, sub-mandibular – Brief anatomy and structure
5. Stomach – position, parts, blood supply, nerve supply, lymphatic drainage, relations, structure
6. Small intestine – sub-divisions, microscopic structure
7. Large intestine in general - sub-divisions, microscopic structure. Specific -caecum and appendix
8. Accessory organs of digestive system –Liver, pancreas, extra hepatic biliary apparatus - Gross features, relations, blood supply, microscopic structure.

**Practicals:** Illustrations – Demonstration of Rectus sheath, inguinal canal, various organs of digestive system

8 hrs

## Unit VII - Excretory and Reproductive Systems

### Learning objectives:

6 hrs

Describe the

1. Excretory system – parts
2. Kidney – Gross anatomy and microscopic structure.
3. Ureter, urinary bladder and urethra – gross anatomy in brief.
4. Male reproductive system – parts – external genitalia – Testis and duct system in detail. Microscopic structure of testis.
5. Female reproductive system - parts – external genitalia – Ovaries and duct system in detail. Microscopic structure of Ovary and uterus.
6. Accessory organs of reproduction – prostate gland, mammary gland- gross anatomy and their structure

**Practicals:** Illustrations – urinary system, reproductive system of male and female

2 hrs

## Unit VIII - Endocrine System

### Learning objectives:

4 hrs

Describe the

1. List the endocrine glands and their location
2. Thyroid and parathyroid glands – location, relations, blood supply, functions, clinical importance – Microscopic structure
3. Pituitary gland – location, parts, relations, blood supply, functions, clinical importance- Microscopic structure
4. Supra renal gland - location, parts, relations, blood supply, functions, clinical importance - Microscopic structure.

**Practicals:** Illustrations – Demonstration of Thyroid, Pituitary, supra renal glands and their histological appearance –

2 hrs

### Histology Slides:

#### General Slides:

1. Hyaline cartilage.
2. Fibro cartilage.
3. Elastic cartilage.
4. T.S & L.S. Bone
5. Blood vessels – Large artery, vein
6. Tonsils
7. Spleen
8. Thymus
9. Lymph node
10. Epithelial tissue
11. Skeletal and Cardiac Muscle
12. Types of neurons , peripheral nerve

#### Systemic Slides:

1. G.I.T – Tongue, Oesophagus, Stomach-fundus and pylorus, Duodenum, appendix, liver, gall bladder.
2. Respiratory system – Lung, Trachea
3. Kidney
4. Reproductive System : Uterus, Ovary, Testis
5. Nervous system – Spinal cord
6. Endocrines – Pituitary, Thyroid, Adrenal, Pancreas

### Syllabus for Anatomy subject:

S.No	Topics Proposed	Theory (Hrs.)+Lecture demonstration (80 hrs)	Practicals (Hrs.)
1	Human body as whole	10	06
2	Locomotor system and supports	12	08
3	Anatomy of Nervous system	12	06
4	Anatomy of Circulatory system	10	04
5	Anatomy of Respiratory system	10	04
6	Anatomy of Digestive system	16	08
7	Anatomy of Excretory system and Reproductive system	06	02
8	Anatomy of Endocrine system	04	02
<b>TOTAL</b>		<b>80</b>	<b>40</b>

**Distribution of total hours :**

Hours	Theory	Practical's	Exams		TOTAL
			Theory	Practical's	
Hours per week	4	2	3 exams x3 hours	3 exams x 2 hours	
Hours per month	16	8			
Hours per year (10 months)	80	40	9	6	
<b>Total</b>	<b>80</b>	<b>40</b>	<b>15</b>		<b>135</b>

**No. of teaching hours :**

	Theory	Practicals
1 <sup>st</sup> semester -	80	40

**Books Recommended :**

1. B.D. Chaurasia – General Anatomy
2. P R Ranganath, SuruchiSinghal, Leelavathy N, Vani Vijay Rao, Roopa R - Basics in Human Anatomy For BSc paramedical Courses, Jaypee publishers.

**Examination pattern – University Exam****(At the end of 1<sup>st</sup> semester )**

S.No	Paper	Theory					Practical incl. oral, spotters & record	Min. for pass (Theory+ Practical)
		Theor y	Min. pass	Int. Assmt. (IA)	Min. pass	Aggregate		
1	Anatomy	80	40%	20	40%	50%	50	50%

**a. Theory: Question paper pattern**

Type of Questions	No of questions	Marks allotted for each question	Total marks
Essays	2 out of 4	10	20
Short answers	6 out of 6	05	30
Brief answers	10 out of 10	03	30
Total	18	--	80

**b. Practical examination:**

Proposed pattern			
Region	No of slides/ no of spotters	Marks allotted	Total marks
Histology	04	02	08
Abdomen, Thorax and Pelvis	08	02	16
Head and neck	01	02	02
Brain	01	02	02
Upper limb bones	02	02	04
Lower limb bones	02	02	04
Head, neck and Thorax bones	02	02	04
Record + IA Practical			10
<b>TOTAL MARKS</b>			<b>50</b>

## **Subject 2 : Physiology**

### **1. General Physiology**

Concept of homeostasis , Cell structure and functions, Transport across membranes

### **2. Blood and Body Fluids**

Body fluid volumes, compartments, and composition, Blood composition and functions  
Plasma proteins, Erythrocytes – morphology and functions, Platelets-morphology and functions, Blood groups.

### **3. Nerve & Muscle**

Nerve structure, classification of nerve fibres, Mechanism of impulse formation and conduction. Muscles-classification, structure, neuro muscular junction, muscle contraction – mechanism, types

### **4. Digestive System**

Salivary glands: Nerve supply, functions of saliva  
Parts of stomach:Structure of stomach and gastric glands, nerve supply, composition & functions of gastric juice  
Pancreatic juice – composition, functions and regulation  
Bile – composition, functions of bile and bile salts  
Succusentericus and small intestinal movements  
Deglutition, vomiting, functions of large intestine  
Gastric movements and emptying

### **5. Skin**

Structure of sweat glands; temperature regulation

### **6. Excretory System**

Structure of nephron and its blood supply  
Formation of urine-filtration  
Formation of urine-reabsorption and secretion  
Micturition & bladder abnormalities  
Daily output of urine, water regulation, diuresis  
Diuretics, diabetes insipidus and diabetes mellitus

### **7. Endocrine System**

Posterior pituitary hormones and their actions, Hypothalamohypophyseal inter relationship, Diabetes Insipidus  
Anterior pituitary hormones and their functions  
Dwarfism, gigantism, acromegaly  
Thyroid hormones, biosynthesis and functions  
Cretinism, Myxoedema, Goiter and Grave's disease  
Parathyroid hormones, functions, tetany  
Insulin, glucagons, actions and diabetes mellitus  
Adrenal medullary hormones and their actions  
Adrenal cortex hormones and their functions

### **8. Reproductive System**

Male reproductive organs-spermatogenesis and testosterone actions  
Female reproductive organs-menstrual cycle, ovarian, uterine  
Cervical, vaginal and breast changes, hormonal control  
Contraceptive methods of couple (rhythm method)  
Male and female contraceptive methods



## **9. Respiratory System**

Structure of upper and lower respiratory tract. Muscles of respiration and mechanism of respiration

Lung volumes and capacities – definitions, normal values intra pulmonary and intra pleural pressures, surfactants Oxygen transport, Carbon-di-oxide transport

Nervous and chemical regulation of respiration

Hypoxia, cyanosis and artificial respiration.

## **10. Cardiovascular System**

Structure and specialized conducting system of the heart, properties of cardiac muscle, innervation of heart and its action

Cardiac cycle

ECG, heart sounds

Blood pressure – Definition, measurement, factors maintaining B.P.

Regulation of B.P.

Cardiac output-Definition, factors regulating cardiac output and measurement of cardiac output

Effect of exercise on CVS & respiration

## **11. Nervous System**

Structure of neurons

Properties of neurons (excitation and conduction)

Synapses and synaptic transmission, reflexes and properties of reflexes

Sensory endings and sensory mechanisms

Spinal cord-pathways in the spinal cord

Brain stem, thalamus, basal ganglia, cerebellum, cortex and reticular formation.

Cerebrospinal fluid

Control of posture and control of voluntary motor activity

Autonomic nervous system

## **12 Special Senses**

1. Vision

2. Audition, olfaction, gustation and vestibular apparatus

### **Practicals / Demonstration :**

1. Determination of RBC and WBC count.
2. Differential leucocyte count.
3. Determination of Hb, PCV & ESR.
4. Determination of blood groups, bleeding and clotting times.
5. Properties of skeletal muscle contraction-Study of charts, amphibian experiments such as simple muscle curve, wave summations, Tetanus and fatigue.
6. Examination of radial pulse, apex beat, and heart sounds.
7. Examination of blood pressure and effects of exercise on blood pressure.
8. Properties of cardiac muscle-Study of charts and amphibian experiments such as normal cardiogram, properties of cardiac muscle, effects of vagus and effect of drugs.
9. Effects of exercise on pulmonary ventilation.
10. Examination of sensory and motor system.
11. Examination of superficial and deep reflexes.
12. Tests of vision (Acuity and colour perception) and hearing (rhines test and webers test)
13. Determination of lung volumes.

A practical record book of these experiments must be maintained by the student.

**No. of teaching hours :**

	<b>Theory</b>	<b>Practicals</b>
1 <sup>st</sup> semester -	80	40

**Suggested Books :**

1. Basics of Medical Physiology By Dr. D.Venkatesh
2. Text book of Human Physiology Dr. D. Venkatesh

**Examination Pattern – University Exam  
(At the end of 1<sup>st</sup> semester)**

S.No	Paper	Theory					Practical incl. oral, spotters & record	Min. for pass (Theory+ Practical)
		Theor y	Min. pass	Int. Assmt. (IA)	Min. pass	Aggregate		
1	Physiology	80	40%	20	40%	50%	50	50%

**Practicals :**

**Spotters-10**

Skeletal m. contraction, Cardiac muscle

**Record – 10**

**Major -20**

RBC count, WBC count, Diff. count

**Minor -10**

HG% PCV ESR, Blood Group radial pulse B.P sensor motor system reflexes visual acuity, lung volume.

**MODEL PAPER –I**

**Time: 3 hours**

**Max. Marks: 80**

- |      |                                     |             |
|------|-------------------------------------|-------------|
| i.   | Two essays out of four              | - 2x10 = 20 |
| ii.  | Six short notes out of six          | - 6x5 = 30  |
| iii. | Ten – very brief answers out of ten | - 10x3 = 30 |

**Subject 3 : Biochemistry**

**1. H<sup>+</sup>, Acids, Bases, Buffers :**

Equilibrium constant, dissociation of water, H<sup>+</sup> concentration, pH, acids-strong and weak, bases, titration behavior, Henderson-Hasselbach equation, buffers, pH measurement, physiological buffers.

**2. Membrane and Cell:**

Organelles, functions, membrane structure, transport across membranes, ionophores, membrane proteins, transporters.

**3. Chemistry of Carbohydrates:**

Classification, important monosaccharides, stereoisomerism, anomerism. Reaction with acids, amines, oxidizing agents, reducing agents. Osazones, Disaccharides, polysaccharides.

**4. Chemistry of lipids:**

Definition, classification, nature of fatty acids, triacyl glycerol, saponification and iodine number, rancidity, antioxidants, complex lipids, steroids.energitics, Lipolysis.

**5. Chemistry of amino acids, peptides, proteins:**

Structure of 20 amino acids, grouping isomerism, charge properties, ninhydrin reaction, peptide bond, examples of peptides, Proteins –classification, Structure-primary, secondary, tertiary and quaternary forms, denaturation.

**6. Chemistry of Nucleic Acids including protein synthesis :**

History, bases, nucleosides, nucleotides.DNA and gene.Types of RNAs, Nucleotides coenzymes.

**7. Haemoglobin :**

Structure and functions of haemoglobin, Hb derivatives, degradation of Hb, Jaundice, Haemoglobinopathies

**8. Enzymes:**

History, catalyst, classification, efficiency, specificity, basic account of mechanism of action.Factors affecting enzyme activity.Units of measurement, Inhibitors – competitive, non-competitive, examples. Coenzymes, proenzymes, isoenzymes, Clinical enzymology, normal values.

**9. Vitamins:**

History, Vitamins A, D, E and K.B-complex vitamins – thiamine, riboflavin, niacin, pyridoxine, folic acid, pantothenic acid, biotin, B-12, Vitamin C.Brief account of chemistry, source, requirements, deficiency diseases, biochemical functions, Hypervitaminosis.

**10. Mineral metabolism:**

Bulk and trace elements. Sodium, potassium, Calcium, Phosphorous, Iron.Brief account of iodine, magnesium, copper, zinc, fluoride, manganese, selenium and molybdenum.

**11. Energy Metabolism:**

Calorimetry, basal metabolism, specific dynamic action, energy requirements under different conditions.Hormonal influence.

**12. Nutrition:**

Distribution of energy in dietary factors, Nitrogen balance, Protein quality, Kwashiorkar and Marasmus. Protein supplementation, Recommended dietary allowance and diet planning.

**13. Immunology:**

BASICS : Innate & acquired immunity, humoral & cell mediated immunity, antigen & antibodies

**Practicals:**

1. Reactions of monosaccharides.
2. Reactions of disaccharides.
3. Reactions of polysaccharides.
4. Identification of unknown carbohydrate.
5. Colour reactions of proteins and amino acids.
6. Precipitation reactions of proteins.
7. Identification of unknown proteins.
8. Preparation of patients for general laboratory investigations
9. Specimen collection & processing - anticoagulants & urine preservatives
10. Preanalytical variations: variations related to sample collection, post collection variation

**No. of teaching hours :**

	<b>Theory</b>	<b>Practicals</b>
1 <sup>st</sup> semester -	80	40

**Suggested Books :**

1. Biochemistry by U. Sathyanarayana
2. Text book of Biochemistry for Medical students by D.M.Vasudevan
3. Text book of Biochemistry for Medical students by Dr. MD. Rafi

**Examination pattern – University Exam  
(At the end of 1<sup>st</sup> semester)**

S.No	Paper	Theory					Practical incl. oral, spotters & record	Min. for pass (Theory+ Practical)
		Theor y	Min. pass	Int. Assmt. (IA)	Min. pass	Aggrega te		
1	Biochemistry	80	40%	20	40%	50%	50	50%

**Practicals:**

1. Qualitative Experiment - Identification of unknown carbohydrate solution - 15 M
2. Qualitative Experiment - Identification of unknown Protein solution - 15 M
3. Spotters - 5 M
4. Viva - 10 M
5. Records - 5 M

**MODEL PAPER –I****Time: 3 hours****Max. Marks: 80**

- |                                          |             |
|------------------------------------------|-------------|
| i. Two essays out of four                | - 2x10 =20  |
| ii. Six short notes out of six           | - 6x5 = 30  |
| iii. Ten – very brief answers out of ten | - 10x3 = 30 |

**Subject 4 : Principles of Nursing****Unit I : Nursing & Nursing process:**

Definition, concept of Nursing, History of Nursing, Nursing process, Problems solving approach, Assessment, Diagnosis, planning, Implementation and Evaluation.

**Unit II : First aid and Nursing Emergencies:**

Definition, basic principles, scope and rules.

Wounds, hemorrhages, shock, fracture, dislocation and muscle injuries, respiratory emergencies, resuscitation, unconsciousness, Miscellaneous conditions, burns, scalds, foreign bodies in the skin, eyes, ear, nose, throat and stomach.

Frost bite, effects of heart cramps, bites and stings.

Poisoning.

Transporting injured persons.

**Unit III : Personal Hygiene and Health**

Care of skin, mouth, eyes, nails, hair.

Menstrual hygiene, clothing, mental health, common health problems of poor personal hygiene.

**Unit IV :Comfort, Rest and Sleep****Unit V :Hospital Housekeeping****Unit VI :Health Education**

Introduction to principles and methods of health education. Use of audio visual aids, mass education, role of nurse in health education.

**Clinical Practicals :**

1. First Aid, CPR, Bandaging types.
2. Practice of various comfort devices, various positions in nursing foundation lab.
3. Health talk, preparation of 3-5 types of A.V. Aids,
4. Ward visit to monitor BMW management.

**No. of teaching hours :**

	<b>Theory</b>	<b>Practicals</b>
1 <sup>st</sup> semester -	80	40

**Examination pattern – Internal Exam  
(At the end of 2<sup>nd</sup> semester )**

<b>S.No</b>	<b>Paper</b>	<b>Theory</b>				
		<b>Theory</b>	<b>Min. Pass</b>	<b>Int. Assmt. (IA)</b>	<b>Min. pass</b>	<b>Aggregate</b>
1	Principals of Nursing	40	40%	10	40%	50%

**MODEL PAPER –I**

**Time: 2 hours****Max. Marks: 40**

- |      |                                                 |             |
|------|-------------------------------------------------|-------------|
| i.   | One essay out of two                            | - 1x10 = 10 |
| ii.  | Three short notes out of three                  | - 3x5 = 15  |
| iii. | Five questions – very brief answers out of five | - 5x3 = 15  |

## **Subject 5 :Basics in Medical Physics & Electronics**

### **UNIT – I : Optics, Laser**

**10 hrs**

Introduction to Lasers-Characteristics of Laser-Spontaneous and Stimulated emissions-Population inversion- Laser action-Types of laser systems: Ruby laser, Semiconductor laser- Lasers in Medical Application: Ophthalmology, Gastroenterology, Dermatology, and Urology.

Optical fibers-Basic Principles and construction- acceptance cone- numerical aperture- Types of optical fibers-Losses in Optical fibers-Light Wave propagation in optical fibers-Applications in Medicine.

### **UNIT – II :Ultrasonics, X-Rays and Nuclear Physics**

**10 hrs**

Ultrasonic waves - Generation of ultrasonic waves by Piezo-electric method - Properties of Ultrasonic waves- detection of Ultrasonics, Modes of transmission of ultrasound - Diagnostic applications- Risks and side effects.

X-rays: Production of X-rays –Properties of X-rays-Applications of X-rays- X-ray image formation - X-ray interactions with Patients.

Radioactivity: Nature of Nuclear radiations- Properties of Alpha, Beta and Gamma rays, Natural and artificial radioactivity, Half-life period- Nuclear Fission and Fusion- Nuclear reactions. Medical applications of radio isotopes.

### **UNIT – III : Electricity & Electromagnetism**

**10 hrs**

Electric charge- Conductors and insulators- Coulomb`s law- Electric field-Electric lines of force-properties of lines of force- Electric field strength-Capacity- Units of capacity- Potential energy of a charged conductor-Principle of a condenser- Capacity of a parallel plate condenser-Electric current and its units- Potential difference-Electromotive Force- Ohm`s law – Electric Power and Electric Energy-Kirchhoff`s Law.

Magnetic Field and Magnetic Induction-Magnetic Flux-Direction of Magnetic Field and Current - Ampere's Law-Application of Ampere's Law. Electromagnetic induction, laws of mutual induction and self induction.

### **UNIT – IV : Electronics**

**10 hrs**

Introduction to Semiconductors- Extrinsic and Intrinsic Semiconductors- Formation of p-n Junction, p-n Junction diode-Half wave and Full wave rectifiers using diodes, Efficiency: Bipolar Junction Transistor-Forward and reverse bias characteristics, Amplifiers; Types of Amplifiers- Characteristics of CE and CC Amplifiers and frequency response.

**No. of teaching hours:**

	<b>Theory</b>	<b>Practicals</b>
1 <sup>st</sup> semester -	40	-

**Suggested Books :**

1. Engineering Physics by R.K.Gaur and S.L.Gupta
2. Unified Physics by S.L.Gupta and Sanjeev Gupta
3. Text Book Of Physics by Resnik and Holiday
4. Basic Radiation Physics by K.Thayalam
5. Principles of Electronics by V.K.Mehta

**Examination pattern – Internal Exam  
(At the end of 1<sup>st</sup>semester )**

S.No	Paper	Theory				
		Theory	Min. pass	Int. Assmt. (IA)	Min. pass	Aggregate
1	Basics in medical Physics & Electronics	40	40%	10	40%	50%

**MODEL PAPER –I**

**Time: 2 hours**

**Max. Marks: 40**

- |                                                      |             |
|------------------------------------------------------|-------------|
| i. One essay out of two                              | - 1x10 = 10 |
| ii. Three short notes out of three                   | - 3x5 = 15  |
| iii. Five questions – very brief answers out of Five | - 5x3 = 15  |

## SEMESTER – II

### Subject 6 : Microbiology

- Unit - I : Introduction and History of microbiology
- Unit -II : Classification, shape and arrangements of micro organisms, special characteristics, spores, capsules, enzymes, motility and reproduction
- Unit - III : Disinfection and antiseptics
- Unit- IV : Sterilization and asepsis
- Unit -V : Anti bacterial agents:  
Fundamental aspects and susceptibility tests
- Unit- V : Infection:  
Sources of infection, portals of entry and spread of infection
- Unit -VII : Non specific immunity  
Immunity – natural and acquired; Immunisation schedule
- Unit -VIII : Allergy and Hyper sensitivity
- Unit- IX : Outline of common pathogenic bacteria, diseases produced by them, treatment and Prevention.  
Respiratory tract infections, meningitis, enteric infections, anaerobic infections, urinary tract infections, leprosy, TB and miscellaneous infections, wound infections, sexually transmitted infections, hospital acquired infections
- Unit -X : Pathogenic Yeasts and Fungi
- Unit -XI : Virology  
Viral infections with special mention of hepatitis, poliomyelitis, HIV and rabies, FLU (Influenza) , Dengue, Chikungunya.
- Unit -XII : Basic Parasitology (Introduction)

#### No. of teaching hours :

	Theory	Practicals
2 <sup>nd</sup> semester -	80	40

#### Suggested Books :

1. AnanthanarayanaPaniker Text book of Microbiology
2. SC Parija, Text book of parasitology
3. Monika Chesbrow District laboratory practice in Tropical countries II volume
4. Baveja Medical Paracytology

#### Examination pattern – University Exam (At the end of 2<sup>nd</sup>semester )

S. No	Paper	Theory					Practical incl. oral, spotters & record	Min. for pass (Theory+ Practical)
		Theory	Min. pass	Int. Assmt. (IA)	Min. pass	Aggregate		
1	Microbiology	80	40%	20	40%	50%	50	50%



**Practical examination pattern:**

- |                          |        |
|--------------------------|--------|
| 1. Practicals            | -20 M  |
| a) Bacteriology          | -10 M  |
| b) Immunology & Virology | -10 M  |
| 2. Spotters              | – 10 M |
| 3. Viva voce             | – 10 M |
| 4. Record book           | – 10 M |

**MODEL PAPER –I****Time: 3 hours****Max. Marks: 80**

- |      |                                     |             |
|------|-------------------------------------|-------------|
| i.   | Two essays out of four              | - 2x10 = 20 |
| ii.  | Six short notes out of six          | - 6x5 = 30  |
| iii. | Ten – very brief answers out of ten | - 10x3 =30  |

**Subject 7 : Pathology**

- Unit -I : Introduction  
Concept of diseases, classification of lesions
- Unit -II : Bacterial, viral and parasitic infections – A general outline
- Unit -III : Inflammation and repair
- Unit- IV : Degeneration, necrosis and gangrene
- Unit -V : Haemorrhage, shock, embolism and thrombosis.
- Unit -VI : Tuberculosis
- Unit -VII : Leprosy and Typhoid.
- Unit -VIII : Deficiency diseases
- Unit -IX : Tumors – Terminologies, Nomenclature. Differences between benign and malignant tumors
- Unit -X : Tumors – Etiology, pathogenesis and spread of tumors.
- Unit- XI : Anaemias
- Unit -XII : Coronary Heart Disease (Ischaemic Heart Disease) to include atherosclerosis
- Unit -XIII : Congenital and Valvular Heart Diseases
- Unit -XIV : Bone and Joints – Autoimmune diseases, septic arthritis, osteomyelitis.
- Unit -XV : Rheumatoid Arthritis
- Unit- XVI : Diseases of the Kidney
- Unit- XVII : Diseases of other parts of the Urinary System
- Unit- XVIII : Central Nervous System. CNS infections and Neurologic disorder
- Unit -XIX : Diseases of muscle including poliomyelitis, myopathies
- Unit -XX : Diseases of Esophagus, Stomach and Intestine
- Unit -XXI : Diseases of Liver and Pancreas.

**No. of teaching hours :**

	<b>Theory</b>	<b>Practicals</b>
2 <sup>nd</sup> semester -	80	40

**Suggested Books :**

1. Text book of pathology by Harsh Mohan
2. Practical Haematology by DACIE & LEWIS
3. Haematology practice by Dr. Tejendra Singh
4. Histopathology Techniques by Bancraft.
5. Clinical Diagnosis and laboratory methods by Todd & Sanford

**Examination pattern – University Exam  
(At the end of 2<sup>nd</sup> semester )**

S. No	Paper	Theory					Practical incl. oral, spotters & record	Min. for pass (Theory + Practical)
		Theory	Min. Pass	Int. Assmt . (IA)	Min. pass	Aggregate		
1	Pathology	80	40%	20	40%	50%	50	50%

**MODEL PAPER –I****Time: 3 hours****Max. Marks: 80**

- |      |                                     |             |
|------|-------------------------------------|-------------|
| i.   | Two essays out of four              | - 2x10 = 20 |
| ii.  | Six short notes out of six          | - 6x5 = 30  |
| iii. | Ten – very brief answers out of ten | - 10x3 = 30 |

**Subject 8: Pharmacology****Theory - Contents**

S.No	Topic	No. of Hours
1	General Pharmacology	8
2	Autonomic Nervous System	7
3	Central Nervous system	8
4	Cardiovascular System	8
5	Biogenic. amines & Autocoids	3
6	Respiratory System	2
7	Blood & Blood forming agents	4
8	Kidney - Diuretics	2
9	Gastro Intestinal System	3
10	Chemotherapy	20
11	Endocrinology	5
12	Miscellaneous drugs	8
13	Metallic poisoning	2
<b>Total Hours</b>		<b>80</b>

### Practicals

S.No	Topic	No. of Hours
1	Instruments & Drugs dosage forms	10
2	Spotters	10
3	Charts	10
4	Student - discussion	6
5	Record work & Model exams	4
Total Hours		40

**No. of teaching hours :**

	Theory	Practicals
1 <sup>st</sup> semester	80	40

### **Suggested Books :**

1. Essence of Pharmacology by K.D. Tripathi
2. Pharmacology and Pharmacotherapeutics by Sethoskar
3. Text book of Pharmacology for Allied Sciences – PadmajaUdaykumar

### **Examination pattern – University Exam (At the end of 2<sup>nd</sup> semester )**

S.No	Paper	Theory					Practical incl. oral, spotters & record	Min. for pass (Theory+ Practical)
		Theory	Min. pass	Int. Asst. (IA)	Min. pass	Aggregate		
1	Pharmacology	80	40%	20	40%	50%	50	50%

### **Practicals: Max Marks – 50**

Spotter	- 10 M
Record	- 10 M
Instruments	- 10 M
Viva	- 20 M

### **MODEL PAPER –I**

**Time: 3 hours**

**Max. Marks: 80**

- |      |                                     |              |
|------|-------------------------------------|--------------|
| i.   | Two essays out of four              | - 2 x10 = 20 |
| ii.  | Six short notes out of six          | - 6 x 5 = 30 |
| iii. | Ten – very brief answers out of ten | -10 x 3 = 30 |

## **Subject 9 : Computers Related to Medical Care**

### **I. Computer Applications & Technologies in Health care**

- Logical organization of computer, advantages of computer and types of computers
- Computer peripherals
  1. Identify peripherals and operating requirements of each.
  2. Explain purpose of input devices (e.g., keyboard, mouse, scanners, barcode readers, credit/debit/smart cards)
  3. Describe operation of output devices(e.g., Voice, speaker output devices, printers, plotters, printer sharing units, SCSI interface, video display)
  4. Describe operation of multimedia (video, audio sound)
- Memory and Storage devices
  1. Data representation
  2. computer storage capacity
  3. Computer memory & types
  4. Data storage devices
  5. Back-up and archival disciplines
- Software
  1. Software types and functions
  2. Application software and system software
  3. Software copyright laws
- Connecting and configuring peripheral devices
  1. Ports and Slots
  2. Connecting and configuring I/O devices – barcode reader, keyboard, printers, scanners, etc.,
  3. Operating Systems
    - a) Identifying operating systems and their attributes(i.e., DOS, Unix, Macintosh, Windows, Linux)
    - b) Identify the advantages and disadvantages of the computer to individuals and business.
  4. Basic computer literacy and Computer file manipulation
    - a) Create directories / folders and sub-directories
    - b) Copy, rename, move and delete files
    - c) Copy a disk, Format disks
    - d) Manipulate files (copy, rename, delete)
    - e) Create data directory and subdirectories/ folders and place files in subdirectories/ folder.
    - f) Make backup disks/ files of a data directory or subdirectory/ folder and delete data from backup disks/files

### **II. Role of Medical records in Health care management**

1. Computers for Medical records
  2. Developments of computerized medical record information processing system(EMR's)
  3. Computer stored (Vs) Manual hand written record, Advantages of EMR (Vs) Manual
  4. Computer assisted diagnosis & its results
  5. Basic ICD-10 coding – Medical names – closure and classification
- Hospital Information Management system (HIMS) & its Modules.
    1. Maintaining applications & Database
    2. Statistical Analysis in LIS (laboratory Information system)
    3. Medical Image Processing
      - i. Dicom viewer
      - ii. PACS (Picture Archival system)

4. Testing and reporting
5. Medical informatics prominence in HIMMS
6. Telemedicine

### **III. Basics of computer networks :**

1. Internet
  - a) Define the Internet
  - b) How the Internet works
  - c) Internet capabilities and Limitations
  - d) Navigate the World Wide Web
  - e) Identify services and tools offered on the Internet
  - f) Use services and tools offered on the Internet
  - g) Web Browsers and its features
  - h) Safety
2. Email
  - a) Define electronic mail
  - b) Compose electronic messages
  - c) Send electronic messages using appropriate format
  - d) Transmit document using electronic mail system
3. Search Engines –

### **IV. MS Office 2010**

- a. MS Word
  - b. MS Excel
  - c. MS Powerpoint
  - d. MS Access
- Theoretical concepts of MS Office practical.

### **Practicals :**

- I. Microsoft word 2010
  1. Introduction
    - a) Introduction to MS-word
    - b) Menus
    - c) Shortcuts
    - d) Document types
  2. Working with documents
    - a) Saving
    - b) Formatting
    - c) Converting files to different formats
    - d) Importing, Exporting, Margins, Header & Footer
    - e) Editing – Deleting, Cut, Paste, Copy, Replace search, etc
    - f) Creating graphs, borders & shading, tables
    - g) Printing, etc
- II. Microsoft Excel 2010
  1. Introduction
    - a) Introduction to MS-Excel
    - b) Opening spread sheet
    - c) Shortcuts
  2. Working with Spreadsheets
    - a) Opening a file, saving, using Menus
    - b) Setting margins, entering data
    - c) Rows, columns & cells
    - d) Formatting cells

- e) Mathematical operations
- f) Sorting, filtering, consolidation
- g) Using / creating graphs, labeling & formatting graphs

### III. Microsoft PowerPoint 2010

1. Introduction
  - a) Introduction to PPT
  - b) Creating, saving & opening a presentation
  - c) Working with templates
  - d) Setting backgrounds, presentation layouts
  - e) Insert pictures, clip arts & graphs
  - f) Inserting audio & video
  - g) Animations
  - h) Colors, gradient fill, drawing pictures, insert objects & printing

### IV. Microsoft PowerPoint 2010

1. Introduction
  - a) Introduction to Database
  - b) Creating, saving & opening a database
  - c) Creating tables and queries
  - d) Creating forms and reports

No. of teaching hours :

		Theory	Practicals
1st semester	-	30	40

### Suggested Books :

1. Foundation of computer science by Ashok Arora ,Lakshmi Publications
2. PC Hardware by Balvirsingh
3. MS OFFICE 2010
4. Electronic medical records for clinicians and administrators by Jerome h.carter

### Examination Pattern – Internal Exam (At the end of 2<sup>nd</sup> semester)

S. No	Paper	Theory					Practical incl. oral, spotters & record	Min. for pass (Theory+ Practical )
		Theor y	Min. pass	Int. Assmt (IA)	Min. pass	Aggregat e		
1	Computers related to medical care	40	40%	10	40%	50%	-	-

### MODEL PAPER –I

**Time: 2 hours**

**Max. Marks: 40**

- |                                                      |            |
|------------------------------------------------------|------------|
| i. One essay out of two                              | -1x10 = 10 |
| ii. Three short notes out of three                   | - 3x5 = 15 |
| iii. Five questions – very brief answers out of five | - 5x3 =15  |

## **Subject 10 : Community Medicine**

### **1. Concepts in Community Medicine**

- a. Determinants and Dimensions of Health.
- b. Natural History of Disease
- c. Multi – factorial causation of disease
- d. Host, agent, environment relationship
- e. Primary, secondary and tertiary levels of prevention with examples related to few diseases of national importance.

### **2. Model of transmission of disease**

- a. Air – borne, vector and vehicle transmission
- b. Methods of control with examples for control of each mode.

### **3. Disinfection**

Common infections, Disinfection, Disinfestations and Sterilization at the health centre level.

### **4. Hospital Waste Management**

Disposal of wastes in Hospital and Primary Health Centre

### **5. Health services**

Brief description of organization of health services at the centre and state levels.

### **6. Primary Health Care**

- a. Definition, components and principles of primary health care.
- b. Millennium Development Goals.

### **7. Primary Health Centre**

The functions, staffing pattern and the role of paramedicals in primary Health Centre.

### **8. Nutritional Health:**

Vitamins and Minerals protein Energy malnutrition obesity & Nutritional Assessment.

### **9. Epidemiology of Communicable and Non communicable disease polio, measles, Tuberculosis, Leprosy cholera, Tetanus, Vector bone diseases, Obesity, CAD, DM, HTN, Cancers & Accidents.**

### **10. National Programmes of Health and disease eradication / control**

#### **a. Health Programmes:**

- i. Family Welfare Programme
- ii. National Programme for water supply and sanitation.
- iii. Nutritional Programmes.
- iv. Immunization and universal immunization programme.
- b. Disease Eradication programme: Leprosy & Guinea worm, polio, myelitis.
- c. Disease control programmes : Tuberculosis, Malaria, Filaria, S.T.D, Goitre, Cholera and other diarrhoeal diseases and National Programme for prevention of blindness including trachoma, vector bone disease.

### **11. Demography & Population control**

- a. The factors influencing population growth, death rate, birth rate Age pyramid and methods of contraception.
- b. Sources of Health information – Census, SRS

### **12. Environmental sanitation**

- a. Water borne diseases, Methods of water purification and disinfection, collection of water samples, their transport and bacteriological analysis.
- b. Methods of excreta disposal and solid waste disposal.

## Teaching Learning Activities :

The course content in Community Medicine will be covered by:

1. Interactive Lectures
2. Group Discussions
3. Practical
4. Demonstrations
5. Field Visits
6. Seminars
7. Assignments

## No. of teaching hours :

	Theory	Practicals
1 <sup>st</sup> semester -	30	20

## Suggested Books :

1. Park's text book of Preventive and social Medicine – 23<sup>rd</sup> Edition (2015)
2. Community Medicine with recent advances by A.H. Surya Kantha
3. Short text book of preventive and social medicine by G.N. Prabhakar
4. Text book of community medicine – By Sunderlal.

## Examination pattern – Internal Exam (At the end of 2<sup>nd</sup> semester )

S.No	Paper	Theory				
		Theory	Min. pass	Int. Assmt. (IA)	Min. pass	Aggregate
1	Community Medicine	80	40%	20	40%	50%

## MODEL PAPER –I

**Time: 3 hours**

**Max. Marks: 80**

- |      |                                     |             |
|------|-------------------------------------|-------------|
| i.   | Two essays out of four              | - 2x10 = 20 |
| ii.  | Six short notes out of six          | - 6x5 = 30  |
| iii. | Ten – very brief answers out of ten | - 10x3 = 30 |



## Subject 11 : English

### **Objective:**

English language plays a Predominant role in all aspects at Modernman's life. So the syllabus has been proposed for acceptance which is designed in a precise manner to enhance the L.S.R.W skills of the students.

### **UNIT – I : Prose**

1. Secret of work – Swami Vivekananda
2. Man in black – Oliver Gold Smith
3. Playing the English gentle man – M.K. Gandhi

### **UNIT-II : Poetry**

1. Ecology – A.K. Ramanujan
2. Gods – Walt Whit Man
3. La Belle Dame Sans Merci – John Keats

### **UNIT-III : Short Story**

1. The Boy who Broke the bank – Ruskin Bond
2. Lottery Ticket – Antonchekov
3. The Death Trap – Saki (H.H.Munro)  
(One act play)

### **UNIT-IV : Language activity**

1. Syllable division
2. Precis – Writing
3. Common errors
4. Comprehension
5. Letter writing
6. Expansion of proverbs
7. Resume writing
8. One word substitutes

### **UNIT : V Grammar**

- |                                         |         |
|-----------------------------------------|---------|
| 1. Divided the word into syllables      | – 5x1-5 |
| 2. Presey writing (one out of two)      | – 1x5-5 |
| 3. Correction of sentence               | – 5x1-5 |
| 4. Comprehension passage                | – 5x1-5 |
| 5. Match the one word substitute        | – 5x1-5 |
| 6. Letter writing                       | – 1x5-5 |
| 7. Expansion of proverbs one out of two | – 1x5-5 |
| 8. Resume writing                       | – 1x5-5 |

### **No. of teaching hours :**

		<b>Theory</b>
1 <sup>st</sup> semester	-	50
2 <sup>nd</sup> semester	-	50

### **Suggested Books :**

"Paths to skills in English" published by Orient Blackswan PVT LTD by Sundaravalli, AS.  
Kamalakaretal

## MODEL PAPER

**Max Marks : 80**

- i) Three short answers out of four in prose – 3x5 = 15
- ii) Two short answers out of three in poetry – 2x5 = 10
- iii) Three short answers out of four in non detailed – 3x5 = 15
- iv) English Grammar - 40 Marks

### Examination pattern – University Exam

(At the end of 2<sup>nd</sup> semester )

S.No	Paper	Theory				
		Theory	Min. pass	Int. Assmt. (IA)	Min. pass	Aggregate
1	English	80	40%	20	40%	50%

**Internal assessment**

**20 Marks**

# SYLLABUS FOR B.Sc. RADIOTHERAPY TECHNOLOGY

## III SEMESTER

### 1. Radiation Physics- I

#### Properties of Radiation:

Atomic structure - atomic number and mass number - electron orbits and energy levels -isotopes and isobars.

Radiation – dual nature – classifications of radiations – ionizing and non-ionizing – directly & indirectly ionizing – exponential law of attenuation – attenuation coefficients (Mass, electronic and atomic) - HVL & TVL and relation between them.

Radioactivity – natural and artificial radioactivity - law of radioactive disintegration - half life and mean life - radioactive series - radioactive equilibrium - properties of alpha, beta, gamma radiation - uses of radioactive nuclides in medicine.

#### Interaction of ionizing radiation with matter:

Interaction of photons - Rayleigh scattering – Thomson scattering – Photoelectric absorption - Compton scattering – Pair production – Photonuclear reaction – importance of these interactions .

Interaction of charged particles - In-elastic collision with atomic electron and nucleus – elastic collision with atomic electron and nucleus - interaction of heavy charged particles – Bragg curve – LET

Properties of neutron – sources of neutron -Interaction of neutrons – reactions of slow and fast neutrons (absorption and scattering)

#### Radiation quantities and units:

Properties of Radiation field – concepts of point source – divergence and inverse square law - stochastic and non-stochastic quantities flux – fluence – planar fluence – process of energy transfer- concepts of secondary electrons – KERMA (collision and radiation kerma) – units – Gy - Exposure – Roentgen – Absorbed dose – Relation between kerma and exposure.

#### Reference Books

1. The Physics of Radiology Harold Elford Johns &Jonh Robert Cunningham.
2. The Physics of Radiation Therapy Faiz M. Khan.
3. Radiation Oncology physics A Handbook for Teachers and Students – E.B. Podgorsak.

## **2. Medical Imaging Physics- I**

### **Diagnostic X-ray tubes:**

X-rays – discovery and properties. Process of X-ray generation - types of X-rays - Bremsstrahlung and characteristic X-rays – intensity and quality of X-rays

Diagnostic X-ray tube and its components- tube current and tube voltage - line focus principle - stationary anode and rotating anode tubes – dual focus tube - grid controlled X-ray tubes – Metal/Ceramic X-ray tubes – tube ratings.

### **X-ray generators:**

Generation and distribution of electric power, Single and Polyphase supply, Fuses, Earthing. Construction, types, working principle and losses of transformers. Auto transformer: Construction, Working principle and Applications.

Filament and High Voltage circuits, Single phase generators. Self, Half wave and Full wave rectified, Three2d phase generators: 6 pulse – 6 rectifier, 6 pulse – 12 rectifier, 12 pulse – 12 rectifier circuits, Power Storage Generators, High Frequency Generators, Falling Load Generators, Exposure Switches and Timers.

### **Filters, Collimators& Grids:**

Filters and Filtration – Inherent and Added Filtration – Heavy metal filter- Effect of filtration on low and high energy beams. Collimators – Grids – grid characteristics – Types of grids- Evaluation of grid performance – stroboscopic effect.

### **X- ray Films& Cassettes:**

Film construction – image production – Development – Fixation and Hardening- processing – Properties of X-ray films – Density characteristic curves – film Gamma – speed or sensitivity – latitude. Contrast Screens: Intensifying and fluorescent screens – Actions- Intensifying factors – Screen thickness – materials used –

Image quality – Contrast and Resolution- Line Spread Function (LSF) – Modulation Transfer Function(MTF)

### **Reference Books**

1. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.
2. Chesney & Chesney's X-ray Equipments for Student Radiographers, 1987.
3. Chesney's Radiographic Imaging – 4th edition, Wiley-Blackwell, 1994
4. Radiologic Science for Technologists- 9th edition, Stewart Carlyle Bushong, Mosby Elsevier, 2008.
5. Principles of Imaging Science & Protection, Michael A. Thompson, W.B. Saunders Company, 1994.
6. Radiographic Imaging & Exposure, Terri L.Fauber, Mosby Elsevier, 2009.

### 3. Patient care in Radiotherapy

Patient vital signs - temperature, pulse, respiration and blood pressure - normal values and methods of taking and recording them. Development of communication skills with patient- general comfort and reassurance to the patient-patient education and explaining about the study-drugs used in the preparation of the patient. Handling of an unconscious patient-shifting of patients - hazards of lifting and maneuvering patients - rules for correct lifting- transfer from chair/wheel chair or trolley to couch and vice-versa - safety of patient and worker while lifting & shifting of patients- handling of geriatric, pediatric and trauma patients -handling female patients-pregnant women. Communicable diseases - hygiene in the department-cross infection and prevention-handling of infectious patients in the department -application of asepsis. Ethics of medical practice- Radiography professionalism-essential qualities of the radiographer-improving professional and personal qualities- Radiographer as a part of Hospital /Organization-responsibilities. Medico-legal considerations - radiographers clinical and ethical responsibilities-misconduct and malpractice.

General Principle of Hospital Practices Modern hospital treatment is based on team work; it is essential that the student should appreciate the technologists role and that the importance of co-operation with wards and other departments. The students should be attached to wards or the accident and emergency department for a definite training period, the length of time being suited to the individual hospital. 1. Hospital procedure: Hospital staffing and organization; records relating to patients and departmental statistics; professional attitude of the technologist to patients and other members of the staff; medico- legal aspects; accidents in the departments appointments organization; minimizing waiting time; out-patient and follow-up clinics; stock-taking and stock keeping.

Care of the patient : FIRST contact with patients in the department; management of chair and stretcher patients and aids for this, management of the unconscious patient; elementary hygiene; personal cleanliness; hygiene in relation to patients (for example clean linen and receptacles , nursing care; temperature pulse and respiration; essential care of the patient who has a tracheostomy; essential care of the patient who has a colostomy; bedpans and urinals; simple application of a sterile dressing.

First aid: Aims and objectives of first aid; wounds and bleeding, dressing and bandages; pressure and splints, supports etc. Shock; insensibility; asphyxia; convulsions; resuscitation, use of suction apparatus, drug reactions; prophylactic measures; administration of oxygen; electric shock; burns; scalds; hemorrhage; pressure points; compression band. Fractures; splints, bandaging; dressing, foreign bodies; poisons

Infection: Bacteria, their nature and appearance; spread of infections; auto-infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; asepsis and antisepsis.

Principles of asepsis: Sterilization - methods of sterilization; use of central sterile supply department; care of identification of instruments, surgical dressings in common use, including filamented swabs, elementary operating theatre procedure; setting of trays and trolleys in the radiotherapy department (for study by radiotherapy students only)

Departmental procedures: Department staffing and organization; records relating to patients and departmental statistics; professional attitudes of the technologist to patients and other members of the staff, medico-legal aspects accidents in the department; appointments; organization; minimizing waiting time; out-patient and follow-up clinics; stock taking and stock keeping.

Drugs in the department: Storage: classification; labelling and checking, regulations regarding dangerous and other drugs; units of measurement, special drugs, anti depressive, anti-hypertensive etc.

### **Reference Books**

1. Nursing foundation by Anuradha
2. Medical Surgical nursing by Javed Ansari and Lewis

## **IV SEMESTER**

### **4. Radiation Physics- II**

#### **Radiation measurement:**

Ionization of Gases -Fluorescence and Phosphorescence – Effect on Photographic Emulsion – Free air Ion chamber - Ionization chambers – Proportional counter - G.M. counters - Scintillation detectors – Semiconductor diode detectors – Neutron detectors - Pocket dosimeters - TL Dosimeters and their use in personnel monitoring badges – Advantages and disadvantages of various detectors - appropriateness of different types of detectors for different types of radiation measurement.

#### **Principle of Radiation Detectors:**

General properties of Radiation detectors – Zone monitor – Teletector – Contamination Monitor - Personnel monitoring devices – Film and TLD badges. In vivo – Direct patient dosimeter (DPD) - TLD, Diodes, MOSFET.

#### **Brachytherapy Physics:**

Historical background - radiation and dose units - properties of an ideal brachytherapy source, activity, specific activity, exposure, absorbed Dose, Mg-hr curie, Radium equivalent, Roentgen, Rad, Gray.

Source used in Brachy therapy: Ra-226, Cs- 137, Ir-192, Au-198, Co-60, I-125, Sr-90/Yt-90, Ru-106, Ta-182 and other new radio nuclides and their physical properties. Radium hazards-comparative advantages /disadvantages of these radio nuclides.

Pre-loaded, after loading (manual and remote) , Merits and Demerits - Interstitial , Intracavitary, Intraluminal, Intravascularbrachy therapy, Low, Medium , High and Pulsed dose rates. Description of HDR Remote loading Brachytherapy unit.

### **Reference Books**

1. The Physics of Radiology Harold Elford Johns &Jonh Robert Cunningham.
2. The Physics of Radiation Therapy Faiz M. Khan
3. Radiation Detection and measurement – Glenn F. Knoll.
4. Physical Aspects of Brachytherapy – T J Godden
5. Brachytherapy applications and Techniques – Phillip M. Devlin
6. Radiation Oncology physics A Handbook for Teachers and Students – E.B. Podgorsak.

## 5. Radiotherapy Equipments & Quality Assurance

### Historical Development

Kilo voltage Unit- Grenz Ray Therapy-contact therapy- superficial therapy- Deep therapy  
Megavoltage therapy- Vande Graff generator – Isotopic teletherapy machines - Linear accelerator-  
Betatron- microtron – Cyclotron- Heavy particle beams.

### Isotopic teletherapy machines

Radio Isotope units –physical components of cobalt 60 unit- source housing beam collimation and penumbra –cesium 137 units – Advantages and disadvantages - Shutter system – Primary and secondary collimator – trimmers - Penumbra – Optical distance indicator - source housing – control panel – T rod and its function - Beam Modifiers – wedges

### Linear accelerators:

Linear Accelerator – Electron gun – Wave guide – Magnetron – Klystron – Bending Magnet – Target materials – Beam flattening filters – Sealed Ion Chambers – Scattering foil – Carousel – Multi Leaf Collimator – wedges – dynamic wedge – enhanced dynamic wedge – motorized wedge – Accessory Tray – Couch – Optical system - Laser systems - Relative merits and demerits of Co60 and Linac units.

### Mould room equipments and simulators

Immobilization devices - Plaster of Paris mould (POP), Thermoplastic mould, Acrylic mould, Vacuum immobilization cushion- Blocks – custom blocks – electron cut- outs – hot wire cutter

Role of Simulators –Virtual simulator – CT simulator – Simulator CT – EPID - CBCT – KVCBCT – MVCBCT

### QA in Radiotherapy

Accessories and tools used for QA tests in Radiotherapy. Optical and radiation field congruence, Beam shaping blocks, beam shaping jaws, Delineator/Diaphragm movements, Isocentre alignment, Patient support system, Beam on and Off mechanisms, Technician's role in QA tests on Telecobalt/Linear Accelerator/Simulator/CT simulator machines.

### Reference Books

1. The Physics of Radiology Harold Elford Johns & Jonh Robert Cunningham.
2. The Physics of Radiation Therapy Faiz M. Khan
3. Radiation Oncology physics A Handbook for Teachers and Students – E.B. Podgorsak.

## **6. Tumor Pathology and Oncology**

1. Pathophysiology alteration in diseased state
2. Tumors – Malignant & Benign
3. Cancer – causes & Spread
4. Biopsy – Purpose & Methods
5. TNM staging
6. Different malignant tumors treated with Radiotherapy
  - a) Skin, lip, oral cavity and paranasal sinuses
  - b) Nasopharynx, oropharynx, hypopharynx, larynx and postcricoid
  - c) Thyroid and esophagus
  - d) Lungs, Pancreas and Breast
  - e) Cervix, uterus, vagina and vulva
  - f) Bladder, rectum and prostate
  - g) Kidney, ureter and penis
  - h) CNS
  - i) Retinoblastoma, Wilms tumor and rhabdomyosarcoma

### **Reference Books:**

1. Fletcher Diagnostic and Histopathology of tumors.
2. Introduction to Clinical Pathology – Harsh Mohan
3. Short text book of radiotherapy Walter and Miller:
4. Cancer explained; Sultan and Maurice
5. Radiation therapy in the management of cancers; Fletcher, Gilbert
6. Therapeutic radiology; Mos William



## **V SEMESTER**

### **7. Radiation Therapy Planning Concepts**

#### **Beam Therapy:**

Physics of Photons, electrons, protons and neutrons in Radiotherapy– Dosimetric Parameters - Percentage Depth Dose(PDD) - Tissue Air Ratio (TAR) - Off Axis Ratio (OAR) - Tissue Maximum Ratio (TMR) - Tissue Phantom Ratio (TPR) – Back Scatter Factor (BSF) – Scatter Air Ratio (SAR) – SSD and SAD techniques- Rotation Technique – Time and Dose calculations in SSD, SAD and Rotation Techniques.

Isodose distributions – Isodose charts – measurement of isodose curves - parameters of isodose curves –Wedge filters –design - compensators

#### **Two Dimensional Planning :**

Single field - Parallel opposed - Multiple fields – integral dose – isocentric technique – stationary therapy – rotation therapy – wedged field techniques – open and wedged field combinations. Physics of Bolus, Phantom materials, compensators, wedges and custom blocks.

#### **Three Dimension (3D) planning:**

Conformal Therapy Basic calculations - Description of a treatment planning system (TPS) - 2D and 3D TPS - Beam data input, Patient data with CT/MRI/Ultrasound – ICRU volumes- GTV – CTV – PTV – ITV –OAR - PRV - Tumour dose prescription and specification - Mean, maximum, minimum, median and modal doses - Number of fractions - Treatment time – Monitor unit (Photon & Electron) Manual and computerized planning - Beams Eye view – DRR – color wash- Dose Volume histogram

Treatment verification – port films – EPID- CBCT – kVCBCT - MVCBCT

#### **Electron Beam Therapy:**

Characteristics of electrons beams - Surface dose, percentage depth dose, beam profiles, Isodose curves and charts, Flatness and symmetry. Beam collimation, variation of percentage depth dose and output with field size, and SSD, photon contamination. Energy spectrum-Energy and field size choice, air gaps, and obliquity, Tissue in homogeneity lung, bone, air filled cavities. Field junctions - External and internal shielding.

#### **Reference Books**

1. The Physics of Radiation Therapy Faiz M. Khan
2. Radiation Oncology physics A Handbook for Teachers and Students – E.B. Podgorsak.
3. Radiotherapy Treatment Planning – Richard F Mould
4. Practical Radiotherapy planning - Jane Dobbs, Ann Barrett, Daniel Ash
5. Radiation Therapy Planning – G.C. Bentel

## **8. Medical Imaging Physics - 2**

### **Ultrasonography**

Characteristics of ultrasound beam and propagation in human tissue. Basic principles of ultrasound imaging equipment – interaction of ultrasound energy and tissue – modes of ultrasound imaging – probes, transducers and Ultrasound beam shapes- B-Mode, real time, gray scale – Ultrasound imaging systems- Doppler Ultrasound – Care of instrument.

### **Computerised Tomography**

CT scanner – various generation of CT – Collimators, CT beam attenuation, linear attenuation coefficients, Hounsfield Unit, back-projection, filtered backprojection and Fourier transform. Computed tomography system components inherent in computer acquisition, processing and image display

### **Magnetic Resonance Imaging**

Basic properties of the hydrogen nucleus, precession in a magnetic field (classical picture); Larmor equation; energy levels in a magnetic field; size of bulk magnetisation; effects of RF ("B1") fields; Rotating frame, free precession and signals (FIDs), principle of slice selection; importance of RF pulse profile, Gradients and 1-D profiles - frequency encoding; mention of projectionreconstruction imaging (not in detail); introduction to sequence timing diagrams.

### **Special procedures**

Fluoroscopy – Tomography – Stereoscopy – Myelography – Mammography – Pelvimetry – xero radiography.

### **QA in Diagnostic Radiology**

Verification of optical and radiation field congruence, beam alignment, focal spot size, linearity of tube current mA and timer, applied potential, HVT and total tube filter, contact between film and intensifying screen, contrast resolution, grid alignment.

### **Reference Books**

1. The Essential Physics of Medical Imaging –2<sup>nd</sup> edition, Bushberg, 2001
2. Essentials of Ultrasound Physics, James A Zagzebski, Mosby, 1996.
3. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.
4. Euclid Seeram Computed Tomography – Physical principles, Clinical applications and Quality Control, 3rd edition, Saunders Elsevier, 2009.
5. MRI in Practice by Catherine Westbrook
6. MRI Physics for Radiologist by Alfred Horowitz
7. MRI made easy (for beginner) - Govind B. Chavhan

## **9. Radiobiology**

1. Cell Biology – Cell theory and structure – Cell division – Cell cycle – Molecular biology - Principles of Radiobiology - Radiation effect at cellular level - Radiation effect on human tissue - Radiation effect on organs.
2. Radiation effect on malignant cells and tissues - Fractionation and its effects - Concepts of tolerance doses Biological modifiers (includes chemotherapy agents commonly used) – Chromosomal aberration and its application for biological dosimetry – Somatic effects – Hereditary effect – Stochastic effect – Deterministic effect – Acute and Chronic exposure – LD50/60
3. Factors influencing tumour control – Relative Biological Effectiveness (RBE) & Oxygen Enhancement Ratio (OER)- Hypo and Hyper fractionation – CHART – Haemostatic Radiotherapy - Linear Energy Transfer (LET) - 4R's of Radiobiology – Basics of Cell survival curves – Established cell lines- Time Dose Fractionation (TDF) .
4. Overview of different radiobiological models – Ellis curves – Calculations based on TDF - Biological Effective Dose (BED) - Linear Quadratic model, Alpha Beta concepts - Tumour control probability (TCP) - Normal Tissue complication probability (NTCP)

### **TEXT BOOKS RECOMMENDED:**

Latest editions of the following books:

1. Radiobiology for the radiologist – Eric J Hall.
2. Radiobiology : A Handbook for Teachers and Students
3. Basic Clinical Radiology – G. G. Steel
4. Introduction to radiobiology - Uma Devi.

## **VI SEMESTER**

### **10. Radiation Protection and Safety**

#### **Units**

Roentgen, Rad, Gy, REM, Sievert – Quantities used in Radiological protection – Radiation weighing factors – equivalent dose – Tissue weighing factors – Effective dose. Radiation exposure control - Time, Distance and shielding - Concept of “As Low As Reasonable Achievable” (ALARA). Biological Effects of Radiation Exposure – somatic, genetic, acute chronic, stochastic and deterministic effects.

#### **Personnel and Area Monitoring:**

Need for personnel monitoring - film badge and TLD badge - Pocket dosimeter, Need for area monitoring, Gamma Zone Monitors, Survey meters. Pocket dosimeter-Radiation survey meter-wide range survey meter, zone monitor-contamination monitor, their principle, function and uses.

#### **Regulatory requirements**

National regulatory body, Responsibilities, Organization, Safety Standards, Codes and Guides, Responsibilities of licensees, registrants and employers and Enforcement of Regulatory requirements.

#### **Radiation hazard evaluation and control**

Philosophy of radiation protection, Effect of Time, Distance and Shielding, Weekly dose to the radiation worker and general public, good work practices in Diagnostic radiology and radiotherapy practices, Planning consideration for radiology and radiotherapy installation. Operational limits, Personnel monitoring.

#### **Radiation Emergency Preparedness**

Safety and security of radiation sources, case histories of emergency situations and preparedness, equipments and tools including role of Gamma zone monitor, Regulatory requirements and prevention of emergency, preventive maintenance and Safety culture, Role of technicians in handling radiation emergencies.

#### **REPORTS RECOMMENDED:**

Latest reports on:

1. AERB safety code.
2. Physics for Radiation Protection, 2<sup>nd</sup> Edition – James E.Martin
3. Safety code for Medical diagnostic x-ray.
4. Safety code for Radiation Therapy Sources, Equipment and Installations.

## **11.Recent Advances in Radiotherapy Techniques**

1. Special techniques in Radiotherapy - Intensity Modulated Radiotherapy techniques – using 3D compensators – static IMRT – dynamic IMRT – Volumetric Modulated Arc Therapy – micro MLC - Robotic Radiotherapy – Gamma knife – cyber knife - Tomotherapy
2. Stereotactic irradiation methods: Physics principles-Merits and demerits, stereo tactic Radio surgery (SRS) and stereo tactic Radiotherapy (SRT), whole body stereo tactic frame.
3. Telecobalt Rotation therapy – Arc therapy – Skip & Arc therapy - Mantle Fields – Inverted Y – Craniospinal fields – Haemostatic radiotherapy - TBI – TSET – IORT –Extracorporeal irradiation - Blood irradiation – Proton & Ion Therapy
4. Recent advances in Brachytherapy: Applicators – Templates - Intravascular brachytherapy – ophthalmic applicators – Permanent Implant – Temporary Implant – Beta applicators - Integrated brachytherapy unit.

### **TEXT BOOKS RECOMMENDED:**

Latest editions of the following books:

1. Treatment planning in radiation oncology Faiz M. Khan
2. Brachytherapy applications and Techniques – Philip M Devlin
3. Radiotherapy Treatment Planning – Richard F Mould
4. Practical Radiotherapy planning - Jane Dobbs, Ann Barrett, Daniel Ash
5. IMRT IGRT SBRT Advances in the Treatment planning and delivery of radiotherapy – John L. Meyer
6. Textbook of Radiotherapy- G.K.Rath
7. Principles and practice of Radiation Therapy - Washington Lever
8. Image Guided IMRT – T.Bortfield

## 12.Principles and Practice of Radiotherapy

### Introduction:

Cancer registry - epidemiology and prevention of cancer - methods of treatment of malignant disease - chemotherapy, hormone therapy, radiotherapy and surgery - relative value of each method for individual tumors or tumor sites.

Spread of cancer – local Spread, spread by lymph nodes, spread by bloodstream, cavity spread - staging of cancer

Choice of treatment: Anatomical site, relation to other tissue, extent of tumor and histology, place of previous treatment, place of radical and palliative therapy.

Choice of Radiotherapy: Tumor sensitivity, anatomical site, relation to other structure availability of equipment.

Concepts of combined modality treatment - Squeal associated with multimodality therapy and their management - Hypothermia - Immunotherapy

### Cancers of various sites:

- Skin cancers: squamous cell carcinoma, basal cell carcinoma, malignant melanoma, skin appendage tumors
- Head and neck tumors: oral cavity, nasal cavity and para nasal sinuses, nasopharynx ,oro pharynx, laryngo pharynx , larynx, salivary glands, ears
- Thoracic tumors : lung, esophagus, thymus
- Gastrointestinal tumors: stomach pancreas, liver, gall bladder, colon, rectum anal canal
- Urological tumors: kidney, ureter, urinary bladder, urethra
- Gynaecological cancer: uterus, ovary, cervix, vagina, vulva
- Male genital tumors : prostrate, testis, penis
- Breast Cancer
- Tumors of bone and soft tissue :osteo sarcoma, Ewing's tumor, fibro sarcoma,
- Lympho reticular tumors : Hodgkin's disease, non Hodgkin's lymphoma
- Hematological malignancies : Leukemia, multiple myeloma
- CNS tumors : gliomas, meningioma, medulloblastoma
- Cancer in children :retinoblastoma, Wilm's tumor, neuroblastoma, rhabdomyo sarcoma
- Endocrine tumors : thyroid, pituitary, adrenal
- Orbital and ocular tumors
- Metastasis of unknown primary site

### Reference Books:

1. Radiotherapy Treatment Planning – Richard F Mould
2. Practical Radiotherapy planning - Jane Dobbs, Ann Barrett, Daniel Ash
3. Radiation Therapy Planning – G.C. Bentel

## **Practical**

### **a. Teletherapy and Brachytherapy Equipments:**

1. Time, Distance and shielding measurement of HVT & TVT
2. Familiarization of radiation survey meters and their functional performance checks
3. Radiological protection survey of Radiotherapy, Simulator and CT simulator installation
4. QA on X-ray, Simulator and Radiotherapy equipments.
5. Procedure followed for calibration of measuring and monitoring instruments
6. Linac Machine: Various parts, its working, its Accessories, Beam Direction devices and control console.
7. Remote after loading machine: HDR: Parts, working, operation and precautions, advantages.
8. Various radioactive Sources for Implantation: Physical features, Advantages and disadvantages.
9. Mould Room Equipments
10. Preparation of immobilisation aids for various tumor sites.
11. Preparation of custom blocks
12. 3D CRT, SRS, SRT, IMRT, IGRT, VMAT techniques

### **b. Clinical Radiation Oncology**

1. Clinical features of a case of Ca. Oesophagus. Treatment options, simulation and treatment execution of Ca. Oesophagus.
2. Ca. Cervix Clinical features, Treatment options, simulation and treatment execution on Telecobalt /LINAC machines.
3. Ca. Breast clinical features, Treatment options, simulation and treatment on LINAC / tele cobalt unit.
4. Glottic cancer clinical features, Treatment options, simulation and treatment on Teletherapy machines.
5. Nasopharyngeal cancer clinical features, Treatment options, simulation and treatment on Teletherapy machines.
6. Retinoblastoma clinical features, Treatment options, simulation and treatment execution on LINAC/telecobalt unit.
7. Medulloblastoma clinical features, Treatment options, simulation and treatment on Teletherapy machines.
8. Ewings sarcoma clinical features, Treatment options, simulation and treatment using Teletherapy machines.
9. Bronchogenic cancer clinical features, treatment options, simulation and treatment on LINAC/telecobalt unit.
10. Intracavitary 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.
11. Simulation equipment parts, operation, principles.
12. Simulation of AP/PA portals for pelvis in cancer cervix with SSD Techniques.
13. Simulation of four fields of pelvis in cancer cervix with SAD Technique.
14. Simulation of oblique fields for cancer oesophagus with SAD Techniques.
15. Simulation of tangential field of a case of Ca. Breast postoperative.
16. Simulation of whole Brain Irradiation in case of ALL
17. Setup for total body and hemi body irradiation

## **INTERNSHIP**

### **Guidelines:**

1. The internship shall commence after the student has completed and passed all subjects upto VI semesters.
2. The internship is compulsory.
3. The duration of the internship shall be one year.
4. The degree of Bachelor in Allied Health Sciences shall be awarded after the satisfactory completion of the internship.

### **Evaluation of Internees:**

#### **Formative Evaluation:**

Day to day assessment of the internees during their internship postings should be done by the Head of the Department/Faculty assigned. The objective is that all the interns must acquire necessary minimum skills required for carrying out day to day professional work competently. This can be achieved by maintaining Records /Log Book by all internees. This will not only provide a demonstrable evidence of the processes of training but more importantly of the internee's own acquisition of competence as related to performance.

#### **Summative Evaluation:**

It shall be based on the observation of the Sr. Technical staff / Faculty of the department concerned and Record / Log book maintained by the interns.

Based on these two evaluations, the Head of the Department shall issue certificate of satisfactory completion of training, following which the university shall award the degree or declare him/her eligible for it.

To implement the project work uniformly for all the specialties in view of the curriculum and training to be acceptable internationally and the students to get opportunity for higher studies and employment.



## 5. Internship (VII & VIII Semesters)

### VII Semester :

There shall be internship during the VII & VIII semester including clinical & hospital work, maintenance of log book etc.

Paper No.	Paper	Taught by the Faculty of	Hours of Teaching		Examination		
			Hours of Teaching	Hours of clinical / practicals	UE/ IE	Theory Max. Marks	Mim. for Pass
01.	a) Basic Life support b) Trauma life support	Anesthesia Emergency Medicine	10 10	-	IE	50	50%
02.	Cardiac life support	Cardiology	15	-	IE	50	50%
03.	Medical Ethics	Forensic Medicine	15	-	IE	50	50%
	Internship	In the Specialty Dept.	-	850	-	-	-
	<b>Total</b>		<b>50</b>	<b>850</b>			

**Total Hours : 900**

### VIII Semester :

Paper No.	Paper	Taught by the faculty of	Hours of Teaching		Examination			
			Hours of Teaching	Hours of clinical / practicals	UE/ IE	Theory Max. Marks	Viva Max. Marks	Mim. for Pass
01.	Fundamentals in Research	In the Specialty Dept.	100	-	IE	50	-	50%
02.	Internship & Project work		-	800	-	-	50	50%
	<b>Total</b>		<b>100</b>	<b>800</b>				

**Total hours : 900**

## **VII SEMESTER**

### **1. BASIC LIFE SUPPORT & TRAUMA LIFE SUPPORT**

#### **a) Basic Life Support :**

**To be taught by the Dept. of Anesthesia**

**No. of Hrs : 10**

1. BLS
2. Airway Assessment
3. Airway Equipment
4. Technique of Mask Ventilation & Endotracheal intubation
5. Advanced airway management skill (Use of bougie, stylet, supraglottic devices)
6. Basic settings of a ventilator
7. Basic modes of ventilator
8. General care of patient on ventilator including endotracheal suctioning
9. Classification and management of shock
10. Central and peripheral venous access

#### **b) Trauma Life support :**

**To be taught by the Dept. of Emergency Medicine**

**No. of Hrs : 10**

1. TRIAGE
  - a. Primary Survey
  - b. Secondary Survey
2. Other thoracic injuries
3. Abdominal trauma – Blunt injuries
4. Abdominal trauma – Penetrating injuries
5. Spine and spinal cord trauma
6. Head trauma
7. Musculoskeletal trauma
8. Electrical injuries
9. Thermal burns
10. Trauma in pregnant women
11. Workshop cervical spine immobilization

## **2. CARDIAC LIFE SUPPORT**

**To be taught by the Dept. of Cardiology**

**No. of Hrs : 15**

1. The universal algorithm for adult ECC
2. Ventricular fibrillation / Pulseless ventricular tachycardia algorithm
3. Pulseless electrical activity (PEA) asystole algorithm
4. Bradycardia treatment algorithm
5. Tachycardia Treatment algorithm
6. Hypotension / Shock
7. Acute myocardial infarction
8. Paediatric Advanced life support
9. Defibrillation
10. Drug used in ACLS
11. Emergency Cardiac pacing
12. AED
13. Acute pulmonary embolism management
14. Heart failure Management
15. Fluid Management
16. Acid Base disorders, Electrolyte imbalance

## **3. MEDICAL ETHICS**

**To be taught by the Dept. of Forensic Medicine**

**No. of Hrs : 15**

1. Definition & key terms – ethics Vs law
2. Define Negligence, Malpractice & Liability
3. Influence of Ethics on general practice
4. Professional codes of Ethics
5. Describe primary & secondary ethical principles
6. Describe the Moral basis of Informed consent & advance directives
7. Euthanasia and physician – assisted suicide
8. Physicians, patients and other : Autonomy, Truth Telling & Confidentiality
9. Reproductive control : Assisted reproduction and Ethics
10. Workers compensation
11. Ethical issues in applied medicine
12. Fertility & Birth control
13. Genetic testing genetic screening.
14. Research Ethics

## VIII SEMESTER

### 1. Fundamentals and research methodology

Fourth Year – Semester - VIII					
Course Title	L	T	P	C	Total Hours
Basics of Research Methodology	2	-	-	2	30

#### Learning objectives:

- Basic concepts in research project, planning, execution, report submissions and research publications
- Integrate the concepts to real-time research situations/examples/case-studies

#### Learning outcome:

- To understand the importance of the methodological approach to research
- To acquire the required skills to needed for a research project
- To learn how to form a hypothesis and publish the research findings.

### SYLLABUS

#### UNIT I:

Introduction to the Process of Conducting Research: Introduction, Steps in the Process of Research, Identifying a hypothesis and/or research problem, specifying a purpose,

#### UNIT II:

Research Designs, Creating research questions, Review of literature, Ethics of research and informed consent, Research proposal writing & Components of Research paper.

#### UNIT III:

Introduction to Qualitative, Quantitative and Mixed methods Research: Essence of Qualitative Data, Sampling, Collection Techniques, Biography.

#### UNIT IV:

Essence of Quantitative Data, Collection and Analysis Techniques, Choosing a good instrument, Interval and Ratio Scales, Validity and Reliability, Essence of Mixed Methods, Advantages, Design Components, Explanatory Mixed Methods Frameworks.

#### UNIT V:

Epidemiological Methods: Measuring disease frequency, Descriptive and analytical studies-observational and experimental studies and Biases in Epidemiological Studies

Text Books :

- Research Methods: Methods and Techniques by Kothari CR. New Age International Publishers- 2004
- Research Methodology: A step by Step Guide to Beginners by Ranjit Kumar. SAGE Publishers-2014.
- Research Methods by Pannerselvam R. PHI Learning Pvt Ltd-2013
- Becoming Quantitative Researchers- An Introduction by Glesne C. Pearson Publishers- 2015
- Research Methods by Rajendra Kumar. APH Publishers-2008

## 2. Basics of Biostatistics

Fourth Year – Semester - VIII					
Course Title	L	T	P	C	Total Hours
Basics of Biostatistics	2	-	-	2	30

**Learning objectives:**

- Understand the relevance, basic concepts and use of statistics
- Apply the concepts to clinical data in statistics

**Learning outcome:**

- Understood concepts in statistics
- Be able to utilize the bio-mathematics and biostatistics tools for applications in human health data

## SYLLABUS

### UNIT I:

Introduction to Descriptive Statistics: Introduction, Summarizing and describing a collection of data, Univariate and bivariate analysis (frequencies and percentages), Mean, median, mode and standard deviation,

### UNIT II:

Percentages and Ratios, Histograms, Identifying randomness and uncertainty in data, Summarizing biological data, Identifying the dependent and independent variables, Scatter diagram, Correlation coefficient and its interpretation.

### UNIT III:

Introduction to Probability, distributions and sampling: Probability, addition and multiplicative theorems, problems, Probability distribution - Binomial, Poisson and Normal distributions, Applications to health sciences, Sampling methods Sample size and standard error

### UNIT IV:

Introduction to Inferential Statistics: Drawing inference from data, Estimation, Testing of hypothesis, Type I & type II errors, power and p-value, Modeling assumptions, Identifying Patterns, Simple Regression analysis, t-test, Analysis of Variance Chi-square, Non-parametric tests

### UNIT V:

Epidemiological Methods: Measuring disease frequency, Descriptive and analytical studies-observational and experimental studies and Biases in Epidemiological Studies.

### TEXT BOOKS:

- Introduction to Biostatistics and Research Methods by Sunder Rao PSS Y Richard J . PHI publishers 2012.
- Biostatistics: A Foundation for Analysis of Health Sciences by Danial WW. John Wiley Publishers.
- Primer of Biostatistics by Galantz SA. McGraw Hill Press, 2011
- Essentials of Medical Statistics by Kirkwood BR and Sterne JAC. Blackwell Publishers
- Fundamentals of Biostatistics by Rosner B & Rosner R. Cengage Learning Inc. 2010

### REFERENCE BOOKS:

- Biostatistics for Medical, Nursing and Pharmacy Students by Indrayan A and L. Satyanarayana, PHI publishers 2006 (e-book available)
- Statistics Made Simple – do it yourself on PC, by K.V.S.Sarma, PHI publishers 2010.

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**Note :** The Syllabus and other regulations for 1<sup>st</sup> , 2<sup>nd</sup> , 7<sup>th</sup> & 8<sup>th</sup> Semesters are on par with other B.Sc Paramedical courses.

