SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507

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

1st BOARD OF STUDIES MEETING

B.Sc. Radiotherapy Technology Course

19.02.2020

TIRUMALA TIRUPATI DEVASTHANAMS

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES, TIRUPATI

B.Sc. Radiotherapy Technology Course

1st BOARD OF STUDIES MEETING

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07.	Dr. B.V. Subramanian Assoc. Professor& HOD, Dept. of Radiotherapy, SVIMS, Tirupati.	-	Secretary, Internal Expert

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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 31stDecember 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: Theduration of the course is 4 years, divided into 8 semesters. The 1st& 2nd semesters shall be common for all the specializations. The 3rd, 4th, 5th& 6th semesters involve theory, practice and handling of equipment in the respective speciality. During 7th& 8th semesters, the candidate will undergo internship in the speciality.

5) Syllabus : The syllabus is common during 1st and 2nd 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 3rd to 8th

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 1st 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 Sankranthi 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.

1. 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	-	-	-	-	-		-	-	-
	Total	**360**	**140**								

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%	-	-
	Total	**400**	**200**								

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.N0	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.N0	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 +Practal)
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

Sl.N0	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

Sl.N0	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 3rd Semester to 6th 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 theFaculty 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	-	-	-
	Total		**50**	**850**			

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.	**100**	**-**	IE	50	-	50%
2.	Internship & Project work		-	800	-	-	50	50%
	Total		**100**	**800**				

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, 1st 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, lymphatoid 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
TOTAL		**80**	**40**

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	
Total	**80**	**40**	**15**		**135**

No. of teaching hours :

	Theory	Practicals
1st 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 1st 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	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
TOTAL MARKS			**50**

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, giganitism, 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, surfactantsOxygen 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 :

		Theory	Practicals
1st 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 1st 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	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 visualacuity, 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+, Acids, Bases, Buffers :**
   Equilibrium constant, dissociation of water, H+ concentration, pH, acids-strong and weak, bases, titration behavior, Henderson-Hesselbach 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 supplimentation, 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 :

		Theory	Practicals
1st semester	-	80	40

Suggested Books :

1. Biochemistry by U. Sathyanrayana
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 1st 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	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 :

	Theory	Practicals
1st semester -	80	40

Examination pattern – Internal Exam
(At the end of 2nd semester)

S.No	Paper	Theory				
		Theory	Min. Pass	Int. Assmt. (IA)	Min. pass	Aggregate
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:

		Theory	Practicals
1st 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 1st 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
2nd 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 2nd 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 :

		Theory	Practicals
2nd semester	-	80	40

Suggested Books :

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

Examination pattern – University Exam
(At the end of 2nd 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
Total Hours		**80**

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
1st semester	-	80	40

Suggested Books :

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

Examination pattern – University Exam
(At the end of 2nd 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 HIMS
6. Telemedicine

III. Basics of computer networks :

1. Internet
    a) Define the Internet
    b) How the Internet woks
    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 2nd 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	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, polimyclitis.
    c. Disease control programmes : Tuberculosis, Malaria, Filaria, S.T.D, Goitre, Cholera and other diarrhoeal diseases and National Programme for preventation 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
1st semester	-	30	20

Suggested Books :

1. Park's text book of Preventive and social Medicine – 23rd 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 2nd 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 :

		Theory
1st semester	-	50
2nd 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 Grammer - 40 Marks

Examination pattern – University Exam

(At the end of 2nd 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, Intravasularbrachy 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 – Carousal - 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. Tumrs – 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, hypo pharynx, 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, uretur and penis
   h) CNS
   i) Retinoblastoma, wilms tumor and rhabdomyo sarcoma

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 - parametersofisodose 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 ultra – sound 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 –2nd 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, 2nd 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 myloma

• 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. Teletherapyand Brachytherapy Equipments:

1. Time, Distance and shielding measurement of HVT & TVT
2. Familiarization of radiation survey meters and their functional performace 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 treatmentonTeletherapy 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. Intracavitaryapplication 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 maintainingRecords /Log Bookby 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	-	-	-
	Total		**50**	**850**			

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%
	Total		**100**	**800**				

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 & Endo tracheal intubation
5. Advanced airway management skill (Use of bogie stellate, supraglottic devices)
6. Basic settings of a ventilator
7. Basic modes of ventilator
8. General case 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:

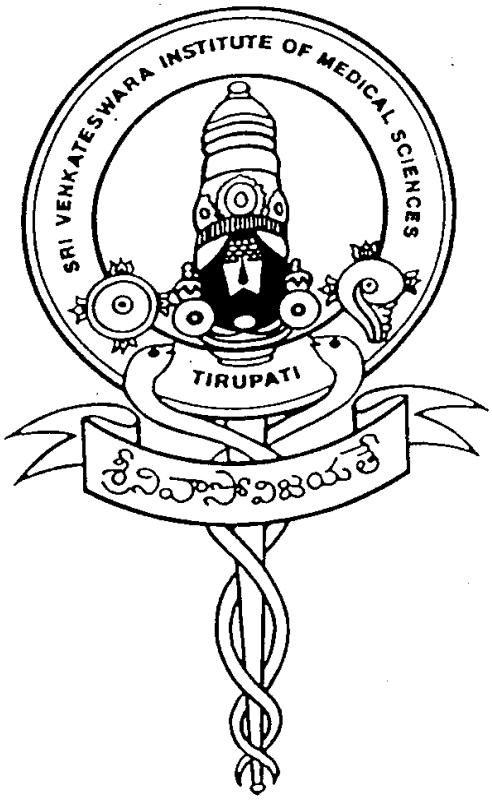
- Introduction to Biostatistics and Research Methods by Sunder Rao PSS Y Richard J . PHI publishers 2012.
- Biostatistics: A Foundation for Analysis of Health Sciences by Danial WW. John Wiley Publishers.
- Primer of Biostatistics by Galantz SA. McGraw Hill Press, 2011
- Essentials of Medical Statistics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

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

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)



REGULATIONS & SYLLABUS
2016-17

B. Sc Allied Health Sciences
(All Specialties)

TIRUMALA TIRUPATI DEVASTHANAMS

INDEX

1. GENERAL REGULATIONS

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

Historical Background:

The Paramedical courses were started in 1996-97 as PG Diploma with 2 year duration for Science Graduates. Subsequently, from 2009-10 onwards in place of PG Diploma, B.Sc Degree courses with 3 year duration were started in the all the specialities except Dialysis technology, Nuclear medicine technology and ECG & CVT technology with the course duration of 4 years (including 1 year internship).

W.e.f 2015-16 academic year onwards the duration of all the courses were increased to 4 years including 1 year internship. The course structure is re-designed from annual to semester pattern with 4 year duration having 8 semesters as per the revised UGC regulations. All the Paramedical courses are recognized by the A.P. Paramedical Board, Govt. of A.P.

1) Notification:

Notification shall be issued by the SVIMS University inviting applications from the eligible candidates who satisfy the Local or Non-local status in Andhra Pradesh / Telangana (Residence requirement) as laid down in Andhra Pradesh Education Institutions (Regulations of Admissions) Order, 1974 applicable to Non-statewide Universities and Educational Institutions. The admissions are subject to the procedure laid down in the G.O. Ms.No. 26, Dt: 22.03.2016 of HM & FW (E1), Dept. Govt. of A.P.

2) Programmes offered:

S.No	Name of the course	Eligibility	No. of seats	Duration
1	B.Sc Anaesthesia Technology (AT)	Inter Bi.PC or equivalent	12	**4 years**
2	B.Sc Medical Lab Technology (MLT)	-do-	20	
3	B.Sc Neurophysiology T echnology (EEG & ENMG)	-do-	2	
4	B.Sc Radiography & Imaging Technology (RIT)	-do-	9	
5	B.Sc Cardiac Pulmonary Perfusion Technology (CPPT)	-do-	2	
6	B.Sc ECG and Cardiovascular Technology (ECG & CVT)	-do-	6	
7	B.Sc Dialysis Technology (DT)	-do-	6	
8	B.Sc Emergency Medical Services Technology (EMST)	-do-	4	
9	B.Sc Nuclear Medicine Technology (NMT)	Inter MPC/ Bi.PC or equivalent	2	

3) Eligibility for admission:

i) The minimum age for admission shall be 17 years on 31st December of the year in which admission is sought.

ii) Minimum education:
10+2 class passed with Science subjects (Physics, Chemistry, Biology) & English Core/English Elective with aggregate of 45% marks from recognized board under AISSCE/CBSE/ICSE/SSCE/HSCE/NIOS or other equivalent Board. In case of SC/ST & Backward classes candidates, it shall be, not less than 40% of marks.

iii) Inter with optional subjects of MPC are also eligible for B.Sc (NMT) & DRT courses.

iv) The students who have passed intermediate vocational bridge course with Biology & Physical Sciences are also eligible for courses S.No. 1 to 8 subject to merit in the Bridge course in Physical & Biological sciences.

v) The following qualifications are also considered equivalent to be eligible for admission to the courses as mentioned against them even without qualifying bridge course :

a. Intermediate vocational (M.L.T.) - B.Sc (MLT)
b. Intermediate Vocational (Radiography) - B.Sc (RIT)

vi) Any other qualification awarded by the board of intermediate education equivalent to the specialization offered by the university at intermediate level are also eligible.

4) Method of Selection :

Admissions are made based on the common merit list prepared basing on marks secured in the qualifying examination in the subjects of Physics, Chemistry, Biology & English with less No. of attempts. In case of a tie, the order of preference to be followed in deciding the merit of the candidate, shall be :

i. Optional subjects (Group) marks secured in Physics, Chemistry & Biology
ii. Elder person based on the date of birth

Note: *1. The percentage of marks shall be calculated up to three decimal places*

2. The marks secured in the bridge course shall be considered for deciding merit, in case the candidate is opting for the course other than the specialty studied.

5) Course structure: The duration of the course is 4 years, divided into 8 semesters. The I & II semesters shall be common for all the specializations. The III, IV, V & VI semesters involves theory, practice and handling of equipment in the respective speciality. During VII & VIII semesters, the candidate will undergo internship in the speciality along with teaching & practice of certain common subjects.

6) Syllabus: The syllabus is common during I and II 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 III to VIII semesters will be discussed and approved by the Board of Studies (specialty wise) meetings by the dept. concerned.

7) Commencement of the Programme: The course will ordinarily commence from 1st August of the each academic year.

8) Medium of Instruction: English.

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

10) Uniform : All the students have to wear the uniform prescribed by the University. They should also wear white shoes.

11) Attendance : A candidate must have minimum of 80% attendance (irrespective of the kind of absence) in theory and practical in each subject for appearing for examination. A candidate must have 100% attendance in each of the practical areas before award of degree.

Participation in NCC, NSS, Sports and Games, educational tours, professional meetings and conferences or other Co-curricular activities representing the institution / university will not count as absence, provided the student is permitted by the University through proper channel. The shortage of attendance, if any, upto 10% shall only be condoned.

12) Internship : For B.Sc AHS : After successful completion of three years of course, student have to undergo internship training for a period of one year.

13) Holidays & Vacation : During I - VI semesters, 01 week holidays each during Dasara and Sankranthi and 15 days summer vacation shall be granted in the month of May, apart from public holidays declared by the University.

During internship (VII & VIII semesters), 15 days of leave, 15 days of summer vacation and institute declared holidays are permitted.

14) 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.

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

- ***These regulations and syllabus were come into force w.e.f. the admissions of 2015-16 batch onwards***

2. Teaching Hours & Examination Pattern (Common for all Courses)

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	80	40%	20	40%	50%	-	-
5	Basics in Medical Physics & Electronics	40	-	IE	40	40%	00	40%	50%	-	-
	English	50	-	-	-	-	-		-	-	-
	Total	**360**	**140**								

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	40	40%	10	40%	50%	-	-
11	English	50	-	UE	80	40%	20	40%	50%	-	-
	Total	**400**	**200**								

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.

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
24	Basic Life support & Trauma life support	Anesthesia & Emergency Medicine	20	10	IE	50	50%
25	Cardiac life support	Cardiology	15	10	IE	50	50%
26	Medical Ethics	Forensic Medicine	15	10	IE	50	50%
27	Internship	In the Speciality Dept.	-	820	-	-	-
	Total		**50**	**850**			

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	Practical Max. Marks	Mim. for Pass
28	Fundamentals in Research	In the Speciality Dept.	**100**	**-**	IE	50	-	50%
29	Internship & Project work		-	800	-	-	50	50%
	Total		**100**	**800**				

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

COMMON FOR ALL SPECIALITIES

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

Practicals : 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, 1st 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, lymphatoid organs **4 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
TOTAL		**80**	**40**

a. 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	
Total	**80**	**40**	**15**		**135**

No. of teaching hours :

		Theory	Practicals
1st 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 1st 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	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
TOTAL MARKS			**50**

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
Succus entericus 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, Hypothalamo hypophyseal inter relationship, Diabetes Insipidus
Anterior pituitary hormones and their functions
Dwarfism, giganitism, 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, surfactantsOxygen 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 :

		Theory	Practicals
1st 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 1st 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	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 visualacuity, 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+, Acids, Bases, Buffers :**
   Equilibrium constant, dissociation of water, H+ concentration, pH, acids-strong and weak, bases, titration behavior, Henderson-Hesselbach 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 supplimentation, 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 :

		Theory	Practicals
1st semester	-	80	40

Suggested Books :

1. Biochemistry by U. Sathyanrayana
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 1st 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	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 :

	Theory	Practicals
2nd semester -	80	40

Examination pattern – Internal Exam
(At the end of 2nd semester)

S.No	Paper	Theory				
		Theory	Min. Pass	Int. Assmt. (IA)	Min. pass	Aggregate
1	Elements of Health & Nursing Principles	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:

		Theory	Practicals
1st 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 1st 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
2nd semester -	80	40

Suggested Books :

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

Examination pattern – University Exam
(At the end of 2nd 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 :

	Theory	**Practicals**
2nd semester -	80	40

Suggested Books :

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

Examination pattern – University Exam
(At the end of 2nd 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
Total Hours		**80**

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
1st semester	-	80	40

Suggested Books :

1. Essence of Pharmacology by K.D. Tripathi
2. Phamacology and Pharmacotherapecutics by Sethoskar
3. Text book of Pharmacology for Allied Sciences – Padmaja Udaykumar

Examination pattern – University Exam
(At the end of 2nd 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 HIMS
6. Telemedicine

III. Basics of computer networks :

1. Internet
    a) Define the Internet
    b) How the Internet woks
    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 Balvir singh
3. MS OFFICE 2010
4. Electronic medical records for clinicians and administrators by Jerome h.carter

Examination Pattern – Internal Exam
(At the end of 2nd 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	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, polimyclitis.
    c. Disease control programmes : Tuberculosis, Malaria, Filaria, S.T.D, Goitre, Cholera and other diarrhoeal diseases and National Programme for preventation 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
1st semester	-	30	20

Suggested Books :

1. Park's text book of Preventive and social Medicine – 23rd 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 1st 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 Pre-dominat 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

IT : 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 :

		Theory
1st semester	-	50
2nd semester	-	50

Suggested Books :

Paths to skills in English" published by orient blackswan PVT LTD by Sundaravalli, AS. Kamalakar etal

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

Examination pattern – University Exam
(At the end of 2nd 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**

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES

TIRUPATI – 517 507

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

1. B.Sc Anaesthesia Technology (AT)

(Semester pattern)

w.e.f 2015-16 Batch

SPECIALITY PAPERS

III Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Applied Anatomy and Physiology related to Anesthesia Technology -I	80	120	IE	80	20	50%
13	Applied Anatomy and Physiology related to Anesthesia Technology -II	80	120	IE	80	20	50%
14	Pharmacology related to Anesthesia Technology	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester:

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+Practical)
15	History of Anesthesia	80	120	UE	80	40%	20	40%	50%	50	50%
16	Principles of Anaesthesia -I	80	120	UE	80	40%	20	40%	50%	50	50%
17	Principles of Anaesthesia -II	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

V Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
18	Anesthesia Techniques in Regional and General Anesthesia including complications	80	120	IE	80	20	50%
19	Medical diseases influencing choice of Anesthesia	80	120	IE	80	20	50%
20	Complications in Anesthesia	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	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)
21	Anaesthesia for specialities – I (Cardiac Anaesthesia, Thoracic Anaesthesia, Neuro Anaesthesia)	80	120	UE	80	40%	20	40%	50%	50	50%
22	Anaesthesia for specialities – I (Geriatric Anaesthesia, Obstetrics Anaesthesia & Paediatric naesthesia)	80	120	UE	80	40%	20	40%	50%	50	50%
23	Regional, Daycare & Outside OR	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

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 - ANAESTHESIA TECHNOLOGY

III Semester

The objective of this subject is to provide an outline of anatomy and physiology to improve the students understanding the technical and diagnostic procedures used, with special emphasis on applied aspects.

PAPER - 12

Applied Anatomy And Physiology Related To Anaesthesia Technology – I :

1. Respiratory System

1. Structure and function of the respiratory tract in relation to anesthesia.
2. Nose :Role in humidification
3. Pharynx: Obstruction in airways
4. Larynx: Movement of vocal cords, cord palsies, trachea & bronchial
1. Tree – vessels, nerve supply, respiratory tract, reflexes,
2. Bronchospasm.
5. Alveoli- Layers, surfactants.
6. Respiratory Physiology
7. Control of breathing.
8. Respiratory muscles - diaphragm, intercostals.
9. Lung volumes – dead space, vital capacity, FRC etc.
10. Pleural cavity – intra pleural pressure, pneumothorax.
11. Work of breathing – airway resistance, compliance.
12. Respiratory movements under anesthesia.
13. Tracheal tug – signs, hiccup.
14. Pulmonary Gas Exchange and acid base status :
15. Pulmonary circulation - Pulmonary oedema, Pulmonary hypertension,
16. Hypoxic pulmonary vasoconstriction.
17. Pulmonary function tests.
18. Transfer of gases – oxygen & carbon dioxide.
19. Acid base status, definitions, acidosis types, alkalosis types, buffers in the body.
20. Oxygen : Properties, storage, supply, hypoxia.
21. Respiratory failure, type, clinical features, causes.

2. Cardiovascular System

1. Anatomy – Chambers of the heart, major vasculature. Coronary supply, innervations. Conduction system.
2. Cardiac output- determinants, heart rate, rhythms, preload, after load. Coronary blood flow & myocardial oxygen supply electrophysiology.
3. ECG - arrhythmias cardiovascular response to anesthetic & surgical procedures.
4. Hypotension – causes, effects, management.
5. Cardio pulmonary resuscitation.
6. Myocardial infarction, hypertension.

PAPER - 13

Applied Anatomy And Physiology Related To Anaesthesia Technology: Part – II

1. Fluid and Electrolytes :

- Body fluids – Composition.
- Osmolaltiy.
- Water, sodium and potassium balance.
- I.V. Fluids – composition & administration.
- I.V. Cannulation

2. Blood Transfusion :

- Blood grouping, Cross matching.
- Transfusion indications, hazards.
- Blood products – storage, administration.
- Plasma volume expanders.

3. Nervous System :

Cerebro spinal fluid – circulation, composition, raised intracranial pressure, methods of reduction. Anatomy of spinal cord and vertebrae.

4. Reproductive System :

Physiological changes in pregnancy and labour.

5. Liver:

Anatomy, portal circulation, functions of liver.
Jaundice – types and clinical features.

6. Kidney :

Anatomy, functions, renal failure.

PAPER –14

Pharmacology related To Anaesthesia Technology :

The objective of this subject is to provide training in general pharmacology with special emphasis on common drugs used, routes of administration, types of formulations, dose and frequency of administration, side effects and toxicity, management of toxic effects, drug interactions, knowledge of chemical and trade names, importance of manufacturing and expiry dates and instructions for handling of drugs.

1. Antisialagogues
2. Atropine, Scopolamine, Glycophyrrolate.
3. Sedatives / Anxiolytics
4. Diazepam, Phenergan, Lorazepam, Chloropromazine, Droperidol.
5. Narcotics
6. Morphine, Pethidine, Antiemetics, Methoclopramide, Ondanseteron.
7. Antacids
8. Na citrate, Gelusil, Mucaine gel.
9. H2 Blockers:Cimetidine, Ranitidine, Famotidine
10. Induction Agents: Intravenous and Inhalational (Barbiturates, Benzodiazepines, Ketamine, Propofol, Etomidate, Halothane, Sevoflurane and Desflurane).
11. Muscle Relaxants :Depolarising and Non depolarising muscle relaxants

12. Narcotics – Morphine,Pethidine, Fentanyl, Sufentanyl, Alfentanyl, Fortwin.
13. Inhalational Gases: 02, N20, Air
14. Agents - Ether, Halothane, Isofluranes.
15. Reversal Agents :Physostigmine, Neostigmine, Atropine, Glysopyrrolate, Nalorphine, Naloxone, Flumazenil (Diazepam).
16. Local Anaesthetics :Xylocaine, Preparation, Local – Bupivacaine – Topical, Prilocaine – Jelly, Emla – Ointment, Etidocaine.
17. Emergency Drugs:

- Adrenaline : Mode of administration, dilution, dosage, effects, Isoprenaline.
- Atropine, bicarbonate, calcium, ephedrine, xylocard, other ionotropes: dopamine, dobutamine, amrinone.
- Aminophylline, hydrocortisone, antihistaminics, potassium.

A) Cardiovascular drugs.
   a. Antihypertensives
   b. Antiarrhythmics
   c. Beta – Blockers
   d. Ca – Channel blockers
   e. Vasodilators: nitroglycerin & sodium nitroprusside

B) Respiratory system -Bronchodilators, respiratory stimulants, Bronchiolytic agents.

C) Renal system -Diuretics, furosemide, mannitol

D) Obstetrics -Oxytocin, methergin

E) Miscellaneous: Antibiotics, pencillins, aminoglycosides, cephalosporins

F) IV fluids, various preparations: Crystalloids and Colloids

G) Heparin, protamine, insulin analgesics, NSAIDS.

IV Semester

The objective of this subject is to provide an introduction to the types of equipment used in Anesthesia, the purposes for which they are used and their maintenance.

PAPER – 15

History of Anaesthesia :

- First successful clinical demonstration
- Pre-historic (ether) era
- Inhalational anaesthetic era
- Regional anaesthetic era
- Intravenous anaesthetic era
- Modern anaesthetic era

1. Minimum standard of anaesthesia
2. Who should give anaesthesia ?
3. Ten golden rules of anaesthesia –
4. Assess & prepare, starve, check the drugs and equipment suction, keep the airway clear, be ready to control ventilation, have a vein open, monitor pulse & BP, have someone in the room to apply cricoid pressure – if needed.
5. Pre-op preparation :
6. Pre anaesthetic assessment, History –, Past history – disease / surgery / anaesth, Personal history – smoking / alcohol.
7. General physical assessment, Systemic examination – CVS, RS, CNS, P.A., Local examination.

Investigations :

1. **Routine**
   i. Haematological – their significance, ii. Urine, iii. E.C.G., iv. Chest & X-ray
2. **Special**
   i. Endcorine, hormonal assays, ii. Echocardiography, iii. Angiography, iv. Others
3. **Anesthesia risk standardization**- ASA grading – I, II, III, IV

PAPER – 16

Principles of Anaesthesia - I :

1. **Medical Gas Supply**
   Compressed gas cylinders
   Colour coding
   Cylinder valves; pin index.
   Gas piping system
   Recommendations for piping system
   Alarms & safety devices
2. **Anaesthesia Machine**
   Hanger and yoke system
   Cylinder pressure gauge
   Pressure regulator
   Flow meter assembly
   Vapourizers-types, hazards, maintenance, filling & draining, etc.
3. **Face Masks & Airway Laryngoscopes**
   Types, sizes
   Endotracheal tubes – Types, sizes,
   Cuff system
   Fixing, removing and inflating cuff, checking tube position, complications

PAPER – 17

Principles of Anaesthesia – II :

1. Breathing System
   - General considerations: humidity & heat
   - Common components – connectors, adaptors, reservoir bags
   - Capnography; etco2
   - Pulse oximetry
   - Methods of humidification
   - Classification of breathing system
   - Mapleson system – A, B, C, D, E, F.
   - Jackson rees system, Bain circuit
   - Non rebreathing valves – ambu valves
   - The circle system
   - Components
   - Soda lime, indicators
2. Monitoring – ECG, Temperature, Neuromuscular; Nerve stimulators; Invasive blood pressure and central venous pressure and cardiac output monitoring
3. Oxygen delivery devices; Suction; Ambu bag; Reservoir bag.
4. Electrical safety in theatres
5. Endotracheal suction, Suction devices; Ambu bag; Reservoir bag.

V Semester

PAPER – 18

Anaesthetic Techniques in Regional & General Anaesthesia Including Complications :

The objective of this subject is to cover techniques in general anaesthesia including preoperative preparation, intra operative management, complications in anaesthesia due to coexisting diseases and their management**.**

Pre-Anaesthetic Orders

Patient	-	Informed consent
	-	Npo
	-	Premedication – advantages, drugs used
	-	Special instructions – if any
Machine	-	Checking the machine
	-	02, N2O, suction apparatus Laryngoscopes, et tubes, airways
	-	Things for IV accessibility
	-	Other monitoring systems
Drugs	-	Emergency drugs
	-	Anaesthetic drugs

Intra-operative Management

1. Confirm the identification of the patient
2. Monitoring – minimum (ISA standards)
3. Noninvasive & Invasive monitoring
4. Induction – drugs used
5. Endotracheal intubation
6. Maintenance of anaesthesia
7. Positioning of the patient
8. Blood/Fluid & electrolyte balance
9. Reversal from anaesthesia – drugs used
10. Transferring the patient
11. Recovery room - set up
    i. things needed
    ii. problems
12. Post operative complications & management

PAPER – 19

Medical Diseases Influencing choice of Anesthesia :

This course will cover the concept of individualizing anesthetic technique in the presence of a comorbid condition in patients coming for routine and emergency surgical procedures. Upon completion of this course the students will be able to assist the anesthesiologist in selecting or modifying the anesthetic technique in presence of coexisting medical condition.

1. Ischemic Heart Disease
   Risk factors : Medications
   Acute MI
   Anaesthesia for IHD cases. Post op management
2. Valvular Heart Disease
   Mitral stenosis: Anaesthetic problems
   Mitral Regurgitation: Aortic stenosis. Aortic regurgitation.

3. Congenital Heart Disease
   ASD : VSD : Tetrology of fallot, PDA
4. Hypertension : Drugs
   Anaesthesia for hypertensives
   Hypertensive crises. Complications
5. Pericardial Disease: Pericardial Effusion;Cardiac Tamponade
6. Aneurysm Of Aorta; Types, Treatment
7. Chronic Obstructive Pulmonary Disease.
   Bronchiectasis.
8. Acute Respiratory Failure.
9. Diseases of Cns – Cerebral Oedema & Its Management
   Ocular Trauma.
10. Diseases of Liver And Bilary Tract
    Liver Functions.
    Liver Function Tests, Hepatitis
    Jaundice, Types; Cirrhosis; Hepatorenal Syndrome
11. Diseases of Git
    Peptic Ulcer : Gi Bleeding
    Oesophageal Varces
12. Renal Disease
    Functions of Kidney
    Kidney Function Tests
    Renal Failure
    Anaesthesia for renal failure patients.
13. Water Electrolyte & Acid Base Disturbances
    Distribution of Body Water, Dehydration
    Hyperkalemia, Hypokalemia. Sodium, Calcium
    Acid Base Disturbances – Types And Treatment.
14. Endocrine Disease :
    Diabetes Mellitus
    Thyroid Dysfunction – Thyrotoxicosis, Hypothyroidism
    Adrenal Gland Dysfunction
    Diabetes Insipedus.
15. Obesity
16. Anaemia.

PAPER – 20

Complications in Anaesthesia :

1. Minor Sequelae

- Nausea & vomiting
- Sore throat
- Laryngeal granuloma
- Neurological complications
- Awareness
- Vascular complications
- Trauma to teeth
- Headache
- Backache
- Ocular complications.
- Auditory complications

2. Major Catastrophes

- Mortality
- Causes of death
- Cerebral damage
- Prevention.

3. Intensive Care

- Monitoring and diagnostic procedures in ICU
- Central venous access
- ECG monitoring
- Invasive hemodynamic monitoring

4. General care of patient in ICU

- Eye, GI tract
- Bladder, skin
- Case of mechanically ventilated patient
- Tracheostomy, humidification
- Vascular lines – arterial, venous line
- Radiography
- Physiotherapy – chest physiotherapy

5. Regional Anaesthesia

- Introduction
- Indication
- Contraindication
- Check list
- Procedure
- Complications
- Management
- Spinal
- Epidural
- Nerve Block

6. Anaesthetic consideration in

a) Endocrine disease: Pheochromocytoma
b) Renal disease: Urolithiasis, TURP

VI Semester

PAPER – 21

Anaesthesia for specialities - I

This course will cover anaesthetic techniques for various specialities including cardiac anaesthesia, neuroanaesthesia, obstetric anaesthesia, thoracic anaesthesia, paediatric anaesthesia and anaesthesia for shock trauma. Upon completion of this course the students will be able to assist the anaesthetist in administration of anaesthesia required in various specialities.

Introduction: Importance of different specialities of anaesthesia:

I. Cardiac Anaesthesia :

1. NYHA classification
2. Arrhythmias
3. Angina
4. Dysponoea
5. Special investigations

- Echocardiography
- Angiography
- Premedication
- Setting up of monitoring system
- Monitoring – invasive and non-invasive
- Getting ready for the case
- Induction of cardiac patient, precautions to be taken
- Cardiopulmonary bypass
- Weaning of EPB
- Transferring the patient to ICU
- Care to be taken
- ICU management

II. Thoracic Anaesthesia :

1. Pulmonary function tests: Bedside and Laboratory spirometry (vitalograph)
2. Preoperative preparation
3. Premedication
4. Pre anaesthetic evaluation
5. Checklist
6. Induction/intubation
7. Double lumen tubes
8. Lop-monitoring
9. Pain management
10. Extubation
11. ICU management
12. Chest tube management

III. Neuro Anaesthesia :

1. Glasgow coma scale
2. Pre anaesthetic evaluation
3. Premedication
4. Special investigation –
   i. CT , ii. Angiography, iii. MRI
5. Check list
6. Induction of a patient armoured ett
7. Positioning in neuro surgery
8. I.C.P monitoring
9. Air embolism
10. Reversal of the patient
11. Transferring to I.C.U / ward

PAPER – 22

Anaesthesia For Specialities - II

I. Geriatric Anaesthesia :

1. Physiological changes in ageing
2. Diseases of aging
3. Pre anaesthetic evaluation
4. Nervous system
5. Geriatric pharmacodynamics/pharmacokinetics
6. Postoperative nervous system dysfunction
7. Anaesthesia for Trauma & Shock
8. Resuscitation
9. Preop investigation/assessment
10. Circulatory management
11. Management of anaesthesia

12. Rapid sequence induction
13. Lop monitoring
14. Other problems

II. Obstetric Anaesthesia :

1. Differences between a pregnant and a normal lady
2. Risks for anaesthesia
3. Precautions to be taken
4. Check list
5. Regional vs general anaesthesia
6. Induction / maintenance
7. Resuscitation of the new born, APGAR score
8. Reversal and extubation
9. Emergencies – Manual removal of placenta
    - A.P.H and P.P.H
    - Ruptured uterus
    - Ectopic pregnancy

III. Peadiatric Anaesthesia :

1. Theatre setting
2. Check list
3. Pae
4. Premedication – modes
5. Induction
6. Intubations-securing the ett
7. Lop-management monitoring
8. Reversal & extubation – problems
9. Transferring/IC management
10. Pain management

PAPER – 23

Regional, Daycare, Outside the OR :

I. Regional Anaesthesia :

1. History
2. Introduction
3. Contraindication
4. Check list
5. Procedure
6. Complications
7. Subarachnoid block
8. Epidural block
9. Nerve blocks

II. Day Care Anaesthesia :

1. Special features
2. Set up
3. Advantages/Disadvantages
4. Complications
5. Future

III. Anaesthesia Outside the O.R :

1. Situations
2. Cath lab
3. Radiology and Imaging Science Technology natural calamities
4. E.C.T
5. Features
6. Shortcomings and Complications

Reference Books :

1. Morgan and Mikhail's Clinical Anesthesiology
2. Dorsch and Dorsch's Understanding Anesthesia Equipment
3. Wylie Churchill-Davidson's A Practice of Anesthesia
4. Drugs & Equipment in Anesthetic Practice by A.K Paul
5. Step by Step Regional Anesthesia by A.K Paul
6. Essentials of Anaesthesiology by A.K Paul
7. Dorsch and Dorsch's Understanding Anesthesia Equipment

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

2. CARDIAC PULMONARY PERFUSION TECHNOLOGY (CPPT) COURSE

(Semester pattern)

w.e.f 2015-16 Batch

SPECIALITY PAPERS

III Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical	Min. for Pass
12	Applied Anatomy of Cardiovascular System related to CPPT	**80**	**120**	IE	80	20	50%
13	Applied Physiology of Cardiovascular System related to CPPT	80	120	IE	80	20	50%
14	Applied Pharmacology related to cardiopulmonary tecchnology & Physiology of Blood and temperature regulation	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester:

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	UE /IE	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical	Min. for pass (Theory +Practic
15	Principles of Cardiopulmonary bypass I : History and Components	80	120	UE	80	40%	20	40%	50%	50	50%
16	Principles of Cardiopulmonary bypass II : Institution of CPB and Myocardial protection	80	120	UE	80	40%	20	40%	50%	50	50%
17	Principles of Cardiopulmonary bypass III : Complications and their Management , Advances in CP Perfusion	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

V Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical	Min. for Pass
18	Concepts of Cardiovascular Disease and outlines of clinical Evaluation related to Cardiovascular Technology	80	120	IE	80	20	50%
19	Advances in Cardiopulmonary bypass: Heart and heart lung transplantation	80	120	IE	80	20	50%
20	Non Cardiac uses of Cardiopulmonary bypass and assist Devices	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	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)
21	Intensive Care, Cardiopulmonary Resuscitation	80	120	UE	80	40%	20	40%	50%	50	50%
22	Engineering concept and clinical applications of various Cardiopulmonary perfusion devices	80	120	UE	80	40%	20	40%	50%	50	50%
23	Interventional Cardiology and Recent Advances in Cardiopulmonary perfusion	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

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 - CARDIAC PULMONARY PERFUSION TECHNOLOGY (CPPT)

III Semester

The objective of this subject is to provide the basic knowledge of anatomy and physiology to the various disease aspects and to also to provide training in all aspects of cardiopulmonary perfusion trechnology. At the end of the course the student under the supervision of a Surgeon and Chief Perfusionist shall be able to apply the knowledge to the cardiopulmonary perfusion and receive training to perfuse the patient who are undergoing 0020 open heart surgical procedure. They shall be able to calculate the basic need at the time of the cardiopulmonary bypass.

PAPER - 12

Applied Anatomy of Cardiovascular System related to CPPT :

I. Anatomy :

1. Anatomy of the Heart and great vessels.
   Gross anatomy and structural features of cardiac chambers.
   - Atrium
   - Ventricle.
   - AV junction
   - Heart valves.

II. Specialized conduction tissues:

- Sinus node.
- Internodal tracts.
- Av node.
- Bundles.

2. Innervations of the Heart.
   - Sympathetic.
   - Parasympathetic.
   - Sensory.
3. Coronary vascular system.
   - Coronary arteries.
   - Myocardial capillary bed.
   - Venous drainage.
   - Lymphatic drainage.
4. Pericardium.
5. Anatomy of Great vessels
6. Systemic Circulation.
   - Arterial system.
   - Venous system.
   - Lymphatic system.
   - Tissue perfusion and microcirculation
7. Pulmonary circulation.
   - Pulmonary artery.
   - Pulmonary veins.
   - Bronchial artery.
8. Anatomy of Respiratory system
   - Larynx, Trachea, Bronchi, Lungs
   - Histology of the respiratory system
   - Anatomy of the Chest wall
9. Anatomy of the renal system
10. Anatomy of the gastrointestinal and hepatobiliary system
11. Anatomy of the central nervous system

Books for study :

Test Book : 1. Medical Embryology Langmans, Inderbir Singh
2. Anatomy : Chaurasia

Reference Book : Gray's Anatomy

PAPER - 13

Applied Physiology of Cardiovascular System related to CPPT:

I. Physiology :

1. Over view of the cardiovascular system.
   - Function of CVS.
   - Circulation of blood.
   - Central control of cardio vascular system.
2. Cardiac cycle.
   - Mechanical events.
   - Arterial cycle and central venous pressure cycle.
   - Clinical aspects of human cardiac cycle.
3. Structure and Properties of Myocardium
4. Ultrastructure of Myocardium
5. Cardiac Excitation and contraction.
   - Mechanism of contraction.
   - Pacemaker of conduction system.
   - Nodal electricity.
   - Nervous control of the heart rate.
6. Basics of ECG:
   - Electrocardiography
   - The electrical field of heart.
   - The leads; standard limb leads; precordial leads; Augmented limb leads.
   - Basic ECG deflections, basic action of electrocardiograph.
   - Normal ECG
   - The Electrical Axis
   - Chamber Enlargement
   - Myocardial infarction.
   - Coronary insufficiency
   - Recognition of ECG pattern.
   - Bundle Branch Block: General principles. Right bundle branch block. Left bundle branch block. The hemi blocks (fasicualr blocks).
   - Coronary Artery Disease: Myocardial infarction, Coronary insufficiency, Recognition of ECG pattern.
   - Sinus Rhythm: Sinus arrhythmia. Sinus tachycardia and Bradycardia
   - Ectopic Arterial Rhythm : Atrial extra systoles. Paroxysmal atrial tachycardia. Atrial fibrillation and flutter.
   - Atrio Ventricular (Av) Nodal Rhythm
   - Ventricular Rhythm : Ventricular extra systoles.
   - Ventricular tachycardia.
   - Ventricular flutter / fibrillation.
   - Disorder of Impulse Conduction : Sinotrial (SA) nodal block. Atrioventricular (AV) nodal block. First degree AV block. Second degree AV block. Third degree AV block
7. Assessment of cardiac output.
   - Ficks principle.
   - Thermal dilution and indicator dilution methods.
   - Pulse Doppler method.

- Miscellaneous methods.

8. Control of stroke volume and cardiac output.
9. Hemodynamics.
    - Relationship between pressure, flow and resistance.
    - Hemodynamics derived from cardiac catheterisation
10. Solute transport between blood and tissues.
    - Circulation of fluid between plasma, interstitium and lymph.
11. Vascular smooth muscle.
    - Mechanism of contraction.
    - Pharmaco mechanical coupling, automaticity.
12. Control of Blood vessels.
    - Local Control mechanism.
    - Nervous control.
    - Hormonal Control.
13. Cardiovascular receptors, reflexes and central control.
14. Coordinated cardiovascular responses.
    - Posture.
    - Valsalva manoeuvre
    - Exercise.
    - Diving reflex.
15. Cardiovascular responses in pathological situations.
    - Shock and hemorrhage.
    - Syncope.
    - Essential Hypertension.
    - Chronic cardiac failure.
16. Physiology of the Respiratory system
    - Mechanism of Ventilation
    - Perfusion
    - Diffusion
    - Cellular respiration
    - O2 and CO2 transport
    - Physical Loss governing gases and circulation
    - Blood gas analysis and their interpretation
17. Physiology of the renal system
    - Principles of Glomerular filteration , reabsorption and secreations
    - Urine analysis and interpretation
18. Electrolytes
19. Cerebral circulation
20. Renal Circulation
21. Anatomy of respiratory system.
22. Specialization in individual circulation.
    - Coronary circulation.
    - Cerebral circulation.
    - Pulmonary circulation.
    - spleenic and renal ceirculation
    - Cutaneous circulation.
23 . Respiratory Physiology.
    - Mechanics of respiration.
    - Principles of gas exchange.
    - Regulation of respiration.

Books for study :

Test Book	:	1. Physiology - Ganong 2. ECG - Schamroth
Reference Book	:	Text book physiology – Guyton

PAPER – 14

Applied Pharmacology related to Cardiopulmonary Technology & Physiology of Blood and temperature regulation:

1. Physiology of the blood and blood components
2. Coagulation Cascade including the blood clotting factors
3. Structure of the RBC, WBC, platelets and plasma proteins
4. Components of plasma
5. Physiology and temperature regulation
   a) Intermediatory metabolism
      - Carbohydrates
      - Proteins
      - Lipids
      - Nutrition
      - Metabolic rate
   b) Basic Pharmacology of the crystalloid solution
      - Colloid preparation
      - Diuretics
6. Cardiovascular drugs: related to heart and respiratory system including inotropes.
7. Hematology and coagulation Physiology Blood Components.
      - Structure of RBC, WBC, platelets, Plasma proteins
      - Blood groups
      - Blood transfusions.
      - Hemostasis.
8. Hematology and coagulation Physiology
9. Anti Anginal Agents:

   a) Beta Blocking Agents - Propranolol, Atenolol, Metoprolol, Labetolol, Pindolol.
   b) Nitrates – Nitroglycerine, Isosorbide dinitrate, Isosorbide mononitrate, Transdermal nitrate patches.
   c) Calcium channel blockers – nifedipine, verapamil, diltiazem, new calcium channel blockers.
10. Anti-Failure Agents :
   a) Diuretics – Furosemide, Thiazide diuretics, other thiazide like agents, Potassium sparing diuretics, combination diuretics, special diuretic problems.
   b) Angiotensin converting enzyme (ACE) inhibitors, Types of ace inhibitors Captopril, Enalapril, ACE inhibitors for diabetics and hypertensive renal disease.
   c) Digitalis and acute ionotropes – Digoxin, Digitoxin, Doubutamine, Dopamine, Adrenaline, Nonadrenaline, Isoprenaline, Mixed ionotropic vasodilators Mibrinone.
11. Anti-Hypertensive Drugs :
   Diuretics, Beta Blockers, Ace inhibitors, ARBS, Calcium antagonists, direct vasodilators, centrally active and peripherally active vasodilators.
12. Anti-Arrhythmic Agents :
   Quinidine and related compounds, Procainamide, Lidocaine, Mexiletine, Phenytoin, Flecainide, Amiodarone, Bretylium, Combination therapy, Verapamil.
13. Antithrombotic Agents :
   a) Platelet inhibitors : Aspirin, Persantinem clopidogrel, Prasugrel
   b) Anticoagulants : Heparin, low molecular weight heparin. Warfarin
   c) Fibrinolytics: Streptokinase Urokinase, Combination therapy.
14. Lipid lowering and anti-atherosclerotic drugs.
15. Which drug for which condition?
16. Miscellaneous drugs – Adenosine. Protamine, Emergency drugs, Narcotics, Sedatives, Steroids, Antihistamines, Antibiotics.
17. Basic information on biocompatibility

Books for study :

Text Book : Gabriel Khan
Reference Book : Drugs for the heart – Opie

IV Semester

PAPER – 15

Principles of Cardiopulmonary bypass I : History and Components :

1. History of Cardiopulmonary bypass
2. Components/ equipments of Cardiopulmonary bypass circuit
3. Principles of oxygenator function
4. Engineering design of oxygenators
5. Cardiopulmonary bypass circuit
6. Material used in cardiopulmonary bypass, their structure and chemistry

Books for study :

Text Book : 1. Text Book on Cardiopulmonary bypass Principles and Practice
Author : Glen P. Gravalee, Richard F Davis, Alfred H Stammers and Ross M. Ungerleider

2. Cardiopulmonary bypass Principles and management
Edited by : Kanneth M. Taylor

PAPER – 16

Principles of Cardiopulmonary bypass II : Institution of CPB and Myocardial protection :

1. Cannulation techniques
2. Priming techniques
3. Anticoagulation techniques
4. Pathophysiology response to Cardiopulmonary bypass
5. Myocardial protection
6. Heart lung machine and technical problems
7. Principles of hypothermia and circulatory arrest
8. Clinical concept and monitoring of Cardiopulmonary bypass
9. Cardiopulmonary bypass techniques in peadiatric : Neonate and infants and children
10. Detail study of standard heart lung machine and their Engineering concept
11. Neutralization of anticoagulation
12. Cardioplegia devices

Books for study :

Text Book : 1. Text Book on Cardiopulmonary bypass Principles and Practice
Author : Glen P. Gravalee, Richard F Davis, Alfred H Stammers and Ross M. Ungerleider

2. Cardiopulmonary bypass Principles and management
Edited by : Kanneth M. Taylor

PAPER – 17

Principles of Cardiopulmonary bypass III : Complications and their Management , Advances in CP Perfusion :

1. Hazards in CPB
2. Embolic problems
3. Organ system function in cardiopulmonary bypass :Brain and kidney, Lung, Metabolic and coagulation cascade
4. Principles of extracorporeal membrane oxygenation (ECMO)
5. Counterpulsation : Intra aortic balloon pump
6. Left ventricular assist Devices
7. Pacemakers / defibrillator
8. Heart and lung transplantation
9. Centrifugal pump
10. Blood salvage techniques during CPB

Books for study :

Text Book : 1. Text Book on Cardiopulmonary bypass Principles and Practice
Author : Glen P. Gravalee, Richard F Davis, Alfred H Stammers and Ross M. Ungerleider

2. Cardiopulmonary bypass Principles and management
Edited by : Kanneth M. Taylor

V Semester

PAPER – 18

Concepts of Cardiovascular Disease and outlines of clinical Evaluation related to Cardiovascular Technology :

1. Structural and functional diagnosis of congenital heart diseases
2. Management of CPBin infants and children, DHCA, TCA
3. How does CPB management in an infant differ from adult
4. Myocardial Protection in Children
5. Pulmonary Vascular Disease
6. **Pathological states in patients:** Clinical presentations, pathophysiology and management
7. **Congenital Heart Disease:** PDA, ASD and Partial Anamoulous Venous Connection, VSD, Coarctation Of Aorta, Pulmonary Stenosis, Pulmonary Atresia with intact IVS &VSD, Single Pulmonary Artery, Pulmonary Artery Aneurysm Cor-Triatriatum , AV Canal Defects , Aortopulmonary Septal Defects, Double Inlet Ventricle, Tetrology Of Fallot, Transposition Of Great Arteries, Tricuspid Atresia, Total Anamolous Pulmonary Venous Connection, Ebsteins Anamoly, Double Outlet Right Ventricle, Congenital Abnormalities Of Aortic Valve And LVOT , Coronary Artery Anomalies
8. **Valvular heart disease**: Rheumatic heart disease, mitral stenosis, mitral regurgitation, aortic stenosis and regurgitation. Tricuspid regurgitation and tricuspid stenois and mixed valvualar lesions
9. **Coronary artery disease**
10. **Pericardial Disease**: Constriction, Effusion, Transponade
11. **Myocardial Disorders**: Ischemia and infarction, LV aneurysm, Cardiac tumors

Books for study :

Text Books : 1. Davidson's Principles and Practice of Medicine,
Edited by Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston.

2. Perloff's Clinical Recognition of Congenital Heart Disease.
Author: J K Perloff , Ariane J. Marelli

3. Valvular heart Disease
Author . Joseph S Alpert, James E Dalan and Shahbuddin H Rahimtoola

4. Cardiac Surgery
Authors: Kirklin / Barratt-Boyes

Reference Books **:** Text Book of Cardiology : Braunwald

PAPER – 19

Advances in Cardiopulmonary bypass : Heart and heart lung transplantation:

1. Heart transplantation
2. Lung transplantation single and double
3. Heart and lung transplantation
4. In each group
   - Donor selection
   - Recipient selection
   - Indications
   - Contraindications
   - Donor Management
5. Postoperative care of the patient
6. Immunosuppressant schedule
7. Prophylactic medications
8. Complications: Chronic rejections and infections, Organ retrieval

Books for study :

Textbooks
1. Cardiac Surgery
Authors: Kirklin / Barratt-Boyes
2. Text Book on Cardiopulmonary bypass Principles and Practice
Author: Glen P Gravalee, Richard F Davis, Alfred H Stammers and Ross M Ungerleider
3. Cardiopulmonary bypass Principles and management
Edited by: Kenneth M Taylor

PAPER – 20

Non Cardiac uses of Cardiopulmonary bypass and assist Devices :

1. Perfusion for Thoracic Aortic surgery
2. Left Heart bypass
3. Principles of extracorporeal membrane oxygenation (ECMO)
4. Counterpulsation : Intra aortic balloon pump
5. Left ventricular assist Devices
6. Pacemakers / defibrillator
7. Centrifugal pump
8. Blood salvage techniques during CPB

Books for study :

Text Books : 1. Text Book on Cardiopulmonary bypass Principles and Practice
Author: Glen P Gravalee, Richard F Davis, Alfred H Stammers and Ross M Ungerleider

2. Cardiopulmonary bypass Principles and management
Edited by: Kenneth M Taylor

Reference books : Cardiac Surgery
Authors: Kirklin / Barratt-Boyes

VI Semester

PAPER - 21

Intensive Care, Cardiopulmonary Resuscitation :

A. Intensive Care

1. Monitoring and diagnostic procedures in ICU.
   - Central venous access
   - ECG monitoring
   - Invasive hemodynamic monitoring.
   - Cardiac arrhythmia recognition.

2. General care of patient in ICU
   - Eye, GI tract and bladder system
   - Care of mechanically ventilated patient.
   - Tracheostomy, Humidification
   - Vascular line, arterial line, venous line.
   - Radiography
   - Chest physiotherapy

3. Intensive care management of myocardial infarction & unstable angina.

4. Fluid management and parenteral nutrition.
5. Infectious disease in ICU, antibiotics in ICU.

6. Respiratory failure
   - Oxygen therapy
   - Mechanical ventilation.
7. Acid base disorders electrolyte imbalance.
8. Cardio vascular failure
   - Plan of management
   - Inotropic support
   - Vasodilator drugs.
9. Renal failure and liver failure.
10. Head injury.
11. Principles of transfusion therapy.

B. Cardio Pulmonary Resuscitation and First Aid Techniques :

Introduction of this training is to ensure that each student learn and retain the knowledge and skill to manage patients through cardio pulmonary emergencies.

1. Basic Life Support
   - An Open Airway.
   - Adequate Breathing.
   - Sufficient Circulation.
2. Adult One-Rescuer CPR
   - Assess the victim's need for CPR.
   - Call for help.
   - Open Airway & checking breathing.
   - Mouth to mouth breathing.
   - Manual resuscitation bag and mask.
   - Determine pulselessness.
   - External chest compression.
3. Adult - Two Rescuer CPR
4. CPR Equipment
   - Manual resuscitator (Bag – value).
   - Mouth to valve mask resuscitator.
   - Patient assessment.

   a) Resuscitation For Children
   Artificial ventilation for children & babies under two External chest compression for children & babies.

   b) The Recovery Position - ACLS: (Advanced Cardiac Life Support).

   c) Skill Steps

   d) Station One : Basic Life Support
   - One rescuer CPR.
   - Two rescuer CPR.
   - Obstructed airway.

   e) Station Two : Airway Management
   - Mouth to mask ventilation.
   - EDA
   - Endo tracheal intubation.
   - Endotracheal intubation with DOA in place.

   f) Station Three: ECG And Treatment.
   - Modalities.
   - Statue ECG slip.
   - Case histories and ACLS.
   - Treatment modalities.

   g) Station Four : Mega Code
   - Serving as code leader.
   - Defibrillation.

   h) Lecture Topics : ACLS In Perspective
   - Myocardial infarction.
   - Adjunct for airway control.
   - Dysarhythmia therapy.
   - Electrical therapy.
   - Cardio vascular pharmacology.
   - Putting it all together.

   i) First Aid Techniques
   - AIM – First aid treatment given to a casualty.
   - To preserve life.

- To prevent the condition worsening.
- To promote recovery.

j) Action At Emergency
- Approach.
- Assessing the situation.
- Examination & diagnosis.
- Treatment.
- After treatment.
- Making a report.
- Removing clothing.
- Removing crash – helmets.

k) Asphyxia
- Suffocation (External obstruction).
- Hanging, stranging & throuting.
- Drowning.
- Smoke inhalation.
- Carbon monoxide poisoning.
- Choking.
- Blast injuries.
- Stove-in-chest
- Asthma
- Electrical injuries.
- Winging.
- Hiccups.

l) Wounds & Bleeding
- Types of wound.
- How the body responds to injury.
- Foreign external bleeding.
- Minor external bleeding.
- Internal bleeding.
- Infecting wounds.
- Special forms of bleeding.

Books for study :

Textbook	: Text Book of Anaesthesia Kaplan
Reference books	: Cardiac Surgery Authors: Kirklin / Barratt-Boyes Sabistons

PAPER – 22

Engineering concept and clinical applications of various Cardiopulmonary perfusion devices :

1. Heart lung machine
2. Oxygenators and types
3. Haemofilters
4. Bubble traps
5. Cardioplegia delivery system
6. Centrifugal pump
7. Biopump and other pumps
8. Counterpulsation : Intra aortic balloon pump
9. Left ventricular assist Devices
10. Radiofrequency ablator

Books for study :

Text Books : 1. Text Book on Cardiopulmonary bypass Principles and Practice
Author: Glen P Gravalee, Richard F Davis, Alfred H Stammers and Ross M Ungerleider
2. Cardiopulmonary bypass Principles and management
Edited by: Kenneth M Taylor

PAPER - 23

Interventional Cardiology and Recent Advances in Cardiopulmonary perfusion :

1. Pericardiocentesis
2. IABP
3. PCPS
4. End myocardial Biopsy
5. PBPV/PBAV
6. PTMC
7. Alcohol septal ablation
8. Electro Physiological studies.
9. RF Ablation
10. TPI
11. PPI
12. CRT
13. ICD

Books for study :

Text Books : Davidson's Principles and Practice of Medicine,
Edited by Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston.
Text Book of Cardiology by Braunwald

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

3. DIALYSIS TECHNOLOGY (DT)

(Semester pattern)

w.e.f 2015-16 Batch

SPECIALITY PAPERS

III Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Applied Anatomy and Physiology Related to Dialysis Technology	80	120	IE	80	20	50%
13	Concepts of Disease and Outlines of Clinical Evaluation related to Dialysis Technology	80	120	IE	80	20	50%
14	DT Directed Clinical Education - I	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester :

Paper No.	Paper	Hours of		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+ Practical)
15	Pharmacology related to Dialysis Technology	80	120	UE	80	40%	20	40%	50%	50	50%
16	Concepts of Disease and Outlines of Clinical Evaluation related to Dialysis Technology	80	120	UE	80	40%	20	40%	50%	50	50%
17	DT Directed Clinical Education – II	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

V Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
18	Applied Dialysis therapy Technology - Part I	80	120	IE	80	20	50%
19	Applied Dialysis therapy Technology - Part II	80	120	IE	80	20	50%
20	DT Directed Clinical Education - Part III	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	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)
21	Applied Dialysis therapy Technology Part III	80	120	UE	80	40%	20	40%	50%	50	50%
22	Applied Dialysis therapy Technology Part IV	80	120	UE	80	40%	20	40%	50%	50	50%
23	Renal Transplantation & Coordination	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

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 - DIALYSIS TECHNOLOGY COURSE

III Semester

PAPER - 12

Applied Anatomy And Physiology Related To Dialysis Technology :

Unit I: Gross structures of excretory system

- Structure of Kidney
- Structure of Ureter
- Structure of Urinary bladder
- Structure of Nephron, renal corpuscle, glomerular apparatus, proximal tubule, loop of Henle, distal tubule and collecting tubule.

Unit II: Vascular supply of kidney and Peritoneum

- Renal Artery
- Renal vein
- Veins used for dialysis (Jugular, Femoral and Sub clavian vein)
- Artery and Veins used for AV fistula and Graft
- Innervations of Kidney and Urinary bladder
- Peritoneum in general

Unit III: Physiology related to Dialysis technology- Mechanism of urine formation

- Glomerular filtration
- Factors affecting GFR
- Methods of estimating GFR
- Tubular Reabsorption
- Concentration
- Dilution and acidification

Unit IV: Functions of excretory system

- Excretory and regulatory functions of kidney
- Metabolic and Secretory functions of kidney
- Physiology of bladder function
- Renal function test
- Micturition
- Types of bladder dysfunction

Unit V: Regulatory functions of excretory system

- Role of Kidney in blood pressure regulation in health and diseases
- Role of peritoneum in peritoneal dialysis
- Mechanism of blood formation and regulation
- Role of kidney in bone formation
- Other endocrine functions of the kidney
- Body fluids and electrolytes and their regulation in health and disease
- Disorders of metabolism (Water, Potassium, Sodium, Phosphate, Calcium)
- Role of kidney in acid-base balance

Reference Books :

1. Hand book of Anatomy – P.Saraswathi
2. Human Anatomy – B.D.Chaurasia
3. Human physiology – A.K.Jain
4. Anatomy and physiology in health and illness – Ross and Willson
   Gray's anatomy for the students - Richard L.Drake

Practical's :

Gross Specimens / Spotters

1. Kidney
2. Ureter
3. Urinary bladder

Charts/Spotters :

1. Renal corpuscle
2. Glomerular apparatus
3. Nephron(proximal tubule, loop of Henle, distal tubule and collecting tubule)
4. Renal Artery, Renal vein, Subclavian vein, Femoral vein, Jugular vein, Radial artery,
5. Innervations of kidney and urinary bladder,
6. Peritoneum in general
7. Functions of excretory system(Excretory, regulatory, Metabolic and endocrine functions)
8. Renal function tests
9. Physiology of bladder function
10. Micturition
11. Types of bladder dysfunction
12. Mechanism of urine formation
13. Role of kidney in blood pressure regulation in health and diseases
14. Role of peritoneum in peritoneal dialysis
15. Mechanism of blood formation and regulation
16. Role of kidney in bone formation
17. Other endocrine functions of the kidney
18. Body fluids and electrolytes and their regulation in health and disease
19. Disorders of water metabolism (Potassium,Sodium,Phosphate,Calcium)
20. Role of kidney in acid-base balance.

PAPER – 13

Concepts Of Disease And Outlines Of Clinical Evaluation Related To Dialysis Technology - I

Unit I : Basic Renal disorders

1. Glomerular Diseases
2. Post infectious glomerulonephritis
3. Acute Kidney Injury (AKI)
4. Chronic kidney disease (CKD)

Unit II : Acid-Base, Fluids and Electrolyte Disorders

1. Metabolic Acidosis
2. Metabolic Alkalosis
3. Respiratory acidosis and alkalosis
4. Edema and the clinical use of diuretics
5. Disorders of sodium (Hyponatremia, Hypernatremia)
6. Disorders of potassium metabolism
7. Disorders of calcium, and Phosphorous Homeostasis

Unit III: The Kidney in systemic disease

1. Renal function in congestive heart failure
2. Renal function in liver disease
3. Renal involvement in systemic vasculitis
4. Renal manifestations in SLE and other rheumatic disorders

Unit IV: Diabetic nephropathy

1. Epidemiology
2. Stages and Pathogenesis
3. Diagnosis
4. Management
5. Prevention

Unit V: Renal Biopsy

1. Indications
2. Contraindications
3. Techniques of Renal Biopsy
4. Pre and post biopsy care
5. Complications of Renal Biopsy

Reference Books :

1. Primer on Kidney Disease – Arthur Greenburg
2. Text book of Pathology - Harsh Mohan
3. Basic pathology –pocket Robbins
4. Principles and practice of medicine – Davidson's
5. Principle of Internal Medicine – Harrison
6. Kidney diseases in primary care – K.Mandal ,Stanly

Practicals :

Specimens And Charts/Case Discussions :

1. Glomerular Diseases
2. Post infectious glomerulonephritis
3. Acute Renal Failure
4. Chronic renal Failure - chronic kidney disease (CKD)
5. Acid-Base, Fluids and Electrolyte Disorders
6. Renal function in congestive heart failure
7. Renal function in liver disease
8. Renal involvement in systemic vacuities
9. Renal manifestations in SLE and other rheumatic disorders

10. Diabetic nephropathy
11. Renal biposy

Urine Analysis :

1. Physical examination
2. Chemical examination
3. Microscopic examination

PAPER – 14

DT Directed Clinical Education - I :

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a nephrologist or senior Dialysis Therapy Technologist. Students are tested on intermediate clinical dialysis therapy technology skills.

IV Semester

PAPER – 15

Pharmacology Related To Dialysis Technology :

Course Objective

The course will cover general pharmacology with special emphasis on common drugs used, route of administration, type of formulations, dose and frequency of administration, side effects and toxicity, management of toxic effects, drug interactions, knowledge of chemical and trade names, importance of manufacturing and expiry dates and instruction about handling each drug.

Unit I: Common drugs used in renal medicine

1. I.V Fluids in renal patient
2. Diuretics
3. Anti-hypertensive Drugs
4. Bicarbonate
5. Potassium
6. Magnesium
7. Calcium
8. Vitamin-D analogs
9. Erythropoiesis stimulating agents (ESA)
10. Iron therapy in dialysis patients
11. Phosphate Binders including Sevelamer HCL, Lanthanum carbonate
12. Vaccines used in dialysis patients - Hepatitis B, Pneumococcal, Influenza etc
13. Antibiotics
14. Antihistamines used in Dialysis unit
15. Chemicals used in the dialysis room including composition and mechanism of action
16. Hemodialysis concentrates
17. Replacement fluids for CRRT
18. Chemicals used for sterilization including formaldehyde, Hydrogen peroxide, Sodium Hypochlorite, Peroxyacetic acid , Citrate and its mechanism of action

19. Peritoneal Dialysis Solutions including Icodextrin
20. Vitamins used in Dialysis patients
21. Calcimimetic Agents

Unit II: Cardio vascular drugs & inotropic drugs

1. Digoxin
2. Betablockers
3. Dopamine
4. Dobutamine
5. Adrenaline,
6. Isoprenaline
7. Lipid lowering Agents

Unit III: Vasodilators

1. Nitro-glycerine
2. Nitroprusside

Unit I V: Drugs affecting coagulation

1. Heparin
2. Low molecular weight heparin
3. Tri sodium citrate
4. Protamin sulphate
5. Heparinoids
6. Direct thrombin Inhibitors
7. Regional Citrate Anticoagulation

Unit V: Immunosuppressive agents

1. Calcineurin Inhibitors
2. mTOR Inhibitors
3. Steroids
4. Azathioprine
5. Cyclosphosphamide
6. Mycophenolate mofetil
7. Induction Immunosuppressive drugs

Reference Books :

Medical pharmacology : Padmaja Udaykumar
KD Tripathi : Essentials of Medical Pharmacology

Practicals :

Course Objective :

The course will cover general pharmacology with special emphasis on common drugs used, route of administration, type of formulations, dose and frequency of administration, side effects and toxicity, management of toxic effects, drug interactions, knowledge of chemical and trade names, importance of manufacturing and expiry dates and instruction about handling each drug.

Spotters and Charts :

1. I.V Fluids in renal patient
2. Diuretics
3. Antihypertensive drugs
4. Steroids
5. Azthioprine
6. Calcineurin Inhibitors, mTOR inhibitors and Cyclosphosphamide
7. Vit-D analogs
8. Erythropoietin
9. IV iron
10. Antibiotics
11. Chemicals used in the dialysis room including composition and mechanism of action
12. Hemodialysis concentrate
13. Peritoneal dialysis fluid
14. Replacement fluids for CRRT
15. Chemicals used for sterilization(Formaldehyde, Hydrogen peroxide ,Citrosterile,Renalin)
16. Vaccines used in dialysis patients - Hepatitis B etc
17. Fluids used in peritoneal dialysis
18. (Digoxin,Betablockers,Dopamine,Dobutamine,Adrenaline,Isoprenaline)
19. Vasodilators (Nitro-glycerine, Nitroprusside)
20. Anticoagulation
21. Protamine
22. Bicarbonate
23. Electrolytes(Potassium, Magnesium)
24. Antihistamine

PAPER – 16

Concepts Of Disease And Outlines Of Clinical Evaluation Related To Dialysis Technology - II

Unit I: Secondary diseases affecting the kidney

1. Amyloidosis
2. Hyperoxaluria
3. HUS / TTP
4. Hereditary renal disorders
5. Kidney disorders in pregnancy

Unit II: Obstructive Renal disorders

1. Obstructive uropathy
2. VUR and Reflux nephropathy
3. Nephrolithiasis

Unit III: Infectious Diseases

1. Renal diseases associated with HIV infection
2. UTI(Urinary tract infection)
3. Opportunistic infections in dialysis patients
4. Viral infections in dialysis and transplantation

Unit IV: Drugs and the kidney

1. Analgesics and the kidney
2. Principles of drug therapy in kidney failure

Unit V: Renal hypertension

1. Pathogenesis
2. Essential HTN
3. Renovascular HTN
4. Therapy of HTN

Reference Books :

1. Primer on Kidney Disease – Arthur Greenburg
2. Text book of Pathology - Harsh Mohan
3. Basic pathology –pocket Robbins
4. Principles and practice of medicine – Davidson's
5. Principle of Internal Medicine - Harrison
6. Kidney diseases in primary care – K.Mandal, Stanly

Practicals :

Specimens And Charts/Case Discussions :

1. Amyloidosis
2. Hyperoxaluria
3. HUS / TTP
4. Heriditary renal disorders
5. Kidney disorders in pregnancy
6. Obstructive uropathy
7. VUR and Reflux nephropathy
8. Nephrolithiasis
9. Renal diseases associated with HIV infection
10. UTI(urinary track infection)
11. Drugs and the kidney
12. Renal hypertension

Urine Analysis :

1. Physical examination
2. Chemical examination
3. Microscopic examination

PAPER – 17

DT Directed Clinical Education - II

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a Nephrologist or senior Dialysis Therapy Technologist. Students are tested on intermediate clinical dialysis therapy technology skills.

V Semester

PAPER – 18

Applied Dialysis Therapy Technology - I:

Unit I: Introduction to Hemo Dialysis

1. Dialysis Team (Doctors, Technologist, Nurses, Technician, Renal Dietician- rights, responsibilities and relationship with patients)
2. Basic chemistry of body fluids and Electrolytes
3. History of Hemodialysis
4. Principles of Hemodialysis
5. Indications for dialysis
6. Types of Hemodialysis

Unit II: Water Treatment

1. Purpose of water treatment
2. Filtration
3. Softener and carbon filtration
4. Deioniser
5. RO system
6. UV radiation
7. Ultrafiltration
8. AAMI and European standards
9. Ultrapure water

Unit III: Hemo Dialysis Equipment's and Assessment of dialysis

1. Components and function HD equipment
2. Dialyser membranes – Types and biocompatibility
3. Types of dialyser
4. Hemodialysis adequacy
5. Dialyser reprocessing and reuse of dialyzers

Unit IV: Vascular access

1. History
2. Types of access
3. Access care
4. Access complications and management
5. Vascular access recirculation

Unit V: Current research in hemodialysis

1. Hemodialysis therapies
2. Hemodialysis machines

Practical's :

Charts/Slides/Spotters :

1. Basic chemistry of body fluids and Electrolytes
2. History, principles and indications of Hemodialysis

3. IV fluids used in dialysis patients
4. Types of Hemo dialysis
5. Water Treatment system
6. Dialyser membranes – Types and biocompatibility
7. Types of dialyser
8. Hemodialysis adequacy
9. Anticoagulation
10. Composition of dialysate
11. Current research in hemodialysis

Case Study /Hemodialysis Procedures :

1. Preparing the concentration of the dialysate depending upon the situation
2. Priming
3. Vascular access assessment
4. Skin suturing
5. Temporary catheter care and its exit site dressing
6. Dialyser reprocessing and reuse of dialysers
7. AV fistula/AV graft cannulation
8. Initiation of dialysis through Central venous catheter
9. Termination (closing of dialysis)

PAPER – 19

Applied Dialysis Therapy Technology - II

Unit I: Hybrid and continuous therapies

1. Continuous hemofiltration
2. Continuous Hemodiafiltration
3. Continuous and Intermittent hemodialysis
4. Sustained low efficiency dialysis(SLED)
5. Slow continuous ultrafiltration(SCUF)
6. High flux and high efficiency dialysis

Unit II: Assessment of complications and its management in Hemodialysis patients

1. Patient assessment, management and prevention– General, pre, intra and post dialysis
2. Lab data analysis
3. Machine monitoring during hemodialysis
4. Acute complications during hemodialysis

Unit III Paediatric Hemodialysis

1. Hemodialysis in infants and children
2. CRRT in infants and childrens

Unit IV: Special procedures pertaining to dialysis technology

1. Plasmapheresis
2. Hemoperfusion
3. MARS

Unit V: Role of dialysis technologist in hemodialysis unit

1. Infection control and universal precautions
2. Psychosocial aspects of dialysis
3. Quality assurance in dialysis
4. Management of dialysis unit – supplies, equipment and accessories.

Reference Books :

1. Hand Book of Dialysis : J.T.Daugirdas
2. Dialysis therapy : Allen R.Nissenson,Richard N.Fine

Practical's :

Charts/Slides/Spotters :

1. Infection control and universal precautions
2. Psychosocial aspects of dialysis
3. Drugs and dialysis
4. Quality assurance in dialysis
5. High flux and high efficiency dialysis
6. Hemodialysis in infants and children
7. Acute complications in hemodialysis patients
8. CRRT (continuous renal replacement therapy)
9. Plasmapheresis
10. Hemoperfusion
11. MARS (molecular adsorbent re circulating system)
12. Nutrition management in hemodialysis patients
13. Hemodialysis associated reactions

Case Study /Hemodialysis Procedures :

1. Preparing the concentration of the dialysate depending upon the situation
2. Priming
3. Vascular access assessment
4. Skin suturing
5. Temporary catheter care and its exit site dressing
6. Dialyser reprocessing and reuse of dialysers
7. Patient assessment – General, pre, intra and post dialysis
8. Machine monitoring during hemodialysis/setting of dialysis machine
9. Sequential dialysis
10. Sodium profiling

PAPER – 20

BSc.DT Directed Clinical Education – III

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a nephrologist or senior Dialysis Therapy Technologist. Students are tested on intermediate clinical dialysis therapy technology skills.

VI Semester

PAPER – 21

Applied Dialysis Therapy Technology – III:

UNIT I: Introduction to peritoneal dialysis

1. History of peritoneal dialysis
2. Physiology of PD – Kinetics of PD,
3. Acute peritoneal dialysis
4. Indications and contraindications for chronic PD

UNIT II: PD apparatus

1. Solution
2. Transfer set,
3. Connectologies.
4. Access for PD
5. Catheter and Exit site care

UNIT III: PD process and evaluation of peritoneum

1. PD therapies – intermittent & continuous
2. Assessment of peritoneal membrane permeability
3. Adequacy of peritoneal dialysis

UNIT IV: PD complications & management

1. Non infectious complications of PD – Mechanical and metabolic
2. Infectious complications of PD,
3. Patient Education

UNIT V : Systemic diseases in dialysis patients

1. Nutrition in dialysis patient
2. Diabetes in dialysis patient
3. Hypertension in dialysis patient
4. Serum enzyme levels
5. Hematologic abnormalities.

Reference Books :

Hand Book of Dialysis – J.T.Daugirdas
Text Book of Peritoneal Dialysis – Ram Gokul

Practical's :

Charts/Slides/Spotters

1. History of peritoneal dialysis
2. Physiology of PD – Kinetics of PD
3. Acute peritoneal dialysis
4. PD solution
5. Transfer set
6. Adequacy of peritoneal dialysis

Case Study

1. Non infectious complications of PD – Mechanical and metabolic
2. Infectious complications of PD
3. Patient Education

PD Procedure :

1. PD Catheter and exit site care
2. Performance of PD exchanges manually
3. Setting up of automated PD equipments
4. First assessment in minor procedures
5. PET analysis

PAPER – 22

Applied Dialysis Therapy Technology - IV

UNIT I : Infectious diseases in dialysis patients

1. Infections in dialysis patients
2. Hepatitis B
3. Hepatitis C
4. HIV
5. Catheter related bacteraemia (CRBS)

UNIT II : Special problems

1. Endocrine disturbances
2. Bone disease
3. Aluminium toxicity
4. Sleep disorders
5. Musculoskeletal & rheumatologic diseases in CRF patients
6. Special problems pertaining to Heart & circulatory system in CRF patient,
7. Special problems pertaining to digestive tract in CRF patients
8. Special problems pertaining to genitourinary tract and male reproductive organs in CRF patient
9. Special problems pertaining to obstetrics & gynaecology in CRF patients
10. Special problems pertaining to nervous system in CRF patients.

UNIT III Urosurgical procedures

1. Common urosurgical procedures, instruments & their management
2. ESWL

UNIT IV Principles of ICU care

1. Ventilator mode
2. Basics of ECG
3. Basics of ICU dialysis

Reference Books :

1. Hand Book of Dialysis – J.T.Daugirdas
2. Text Book of Peritoneal Dialysis – Ram Gokul

Practical's :

Case Study

1. Types of renal donor & cadaver donor maintenance
2. Recipient and donor workup for renal transplantation
3. Principles of post transplant management and follow up
4. Diabetes in dialysis patient
5. Hypertension in dialysis patient
6. Serum enzyme levels
7. Hematologic abnormalities
8. Infections in dialysis patients
9. Endocrine disturbances
10. Bone disease
11. Aluminum toxicity
12. Nutrition management in peritoneal dialysis patients
    - Introduction to the science of nutrition
    - Definition
    - Food pattern and its relation to health
    - Factors influencing food habits
    - Selection of food stuffs
    - Food storage and preservation
13. Sleep disorders
14. ESWL
15. Principles of ICU care

CPR demonstration

PAPER – 23

Renal transplantation and Coordination

Unit I : Basics of Kidney Transplantation

1. History of Kidney Transplantation
2. Transplant Immunology
3. Histocompatibility Testing , Cross matching Techniques in Renal Transplantation
4. Immunosuppressive drugs used in Renal Transplantation
5. Nutrition in Kidney transplant recipients

Unit II : Evaluation of Donor and Recipient

1. Living Donor Kidney Transplantation and Donor Evaluation
2. Evaluation of Adult Kidney Transplant patients
3. Indication and Contraindications for Renal Transplantation
4. Indication and Contraindications for Kidney Donation

Unit III : Renal Transplantation Coordination

1. Human Organ Transplant Act and its Amendments
2. Role of Transplant Coordinator in Organ Transplantation
3. Ethical Aspects in Renal Transplantation
4. Psychosocial aspects in Renal Transplantation

Unit IV : Deceased Donor Transplantation

1. Brain Death
2. Diagnosis of Brain death
3. Deceased Donor Organ Donation
4. Deceased Donor Maintenance

Unit V : Renal Transplant Surgery and Complications of Renal Transplantation

1. Transplantation Surgery and Surgical complications
2. Post-Transplant Management – Short and Long Term
3. Medical Complications of Renal Transplantation
4. Infectious Complications of Renal Transplantation

Reference Books :

Handbook of Kidney Transplantation – Gabriel Danovitch

Practical's :

Charts/Slides/Spotters

1. History of Kidney Transplantation
2. Transplant Immunology
3. Histocompatibility Testing , Cross matching Techniques in Renal Transplantation

4. Transplantation Surgery and Surgical complications
5. Post-Transplant Management – Short and Long Term
6. Medical Complications of Renal Transplantation
7. Infectious Complications of Renal Transplantation
8. Human Organ Transplant Act and its Amendments
9. Role of Transplant Coordinator in Organ Transplantation

Case Study

1. Types of renal donor & cadaver donor maintenance
2. Recipient and donor workup for renal transplantation
3. Principles of post transplant management and follow up

Reference Books :

1. Anatomy and Physiology

Ross and Wilson by Anne Waugh, Allison grant
Hand book of Anatomy – P.Saraswathi
Human Anatomy – B.D.Chaurasia
Human physiology – A.K.Jain
Anatomy and physiology in health and illness – Ross and Willson
Gray's anatomy for the students - Richard L.Drake

2. Pharmacology

Medical pharmacology – Padmaja Udaykumar
KD Tripathi - Essentials of Medical Pharmacology

3. Concepts of Disease and Outline

Primer on Kidney Disease – Arthur Greenburg

Text book of Pathology - Harsh Mohan
Basic pathology –pocket Robbins
Principles and practice of medicine – Davidson's
Principle of Internal Medicine - Harrison
Kidney diseases in primary care – K.Mandal ,Stanly

4. Dialysis Technology - I & II

Hand Book of Dialysis – J.T.Daugirdas
Dialysis therapy – Allen R.Nissenson,Richard N.Fine
Text Book of Peritoneal Dialysis – Ram Gokul
Principle and Practice of Dialysis - Henrich

5. Renal Transplantation

Handbook of Kidney Transplantation – Gabriel Danovitch
Kidney Transplantation Principle and Practice – Peter Morris

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

4. B.Sc. ECG & CARDIOVASCULAR TECHNOLOGY (ECG & CVT)

(Semester pattern)

w.e.f 2015-16 Batch

SPECIALITY PAPERS

III Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Applied Anatomy & Physiology related to Cardiovascular Technology	80	120	IE	80	20	50%
13	Electro Cardiography	80	120	IE	80	20	50%
14	Exercise testing & Holter Analysis	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester:

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+ Practical)
15	Applied Pharmacology	80	120	UE	80	40%	20	40%	50%	50	50%
16	Echo Cardiography	80	120	UE	80	40%	20	40%	50%	50	50%
17	Doppler Echo Cardiography, TEE, Contrast Echo	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

V Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
17	Concepts of Cardiovascular Disease and outlines of clinical Evaluation related to cardiac technology	80	120	IE	80	20	50%
18	Invasive Cardiology	80	120	IE	80	20	50%
19	Angiography, EP studies	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours : 600

VI Semester:

Paper No.	Paper	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)
20	Intensive Care, Cardiopulmonary Resuscitation	80	120	UE	80	40%	20	40%	50%	50	50%
21	Interventional Cardiology (Coronary, Congenital)	80	120	UE	80	40%	20	40%	50%	50	50%
22	Interventional Cardiology (Non-Coronary, Electro Physiology)	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

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 - ECG & CARDIOVASCULAR TECHNOLOGY

III Semester

The objective of this subject is to provide training in all aspects of instrumentation and recording techniques for Electrocardiography, exercise stress testing, holter monitoring. At the end of the course the student under the supervision of a physician will be able to perform a 12 lead ECG, assist in Treadmill exercise testing, assist in Holter analysis.

PAPER – 12

Applied Anatomy & Physiology Related to Cardiovascular Technology:

I. Anatomy :

1. Anatomy of the Heart and great vessels.
   a) Gross anatomy and structural features of cardiac chambers.
      1. Atrium
      2. Ventricle.
      3. AV junction
      4. Heart valves.

   b) Specialized conduction tissues.
      1. Sinus node.
      2. Internodal tracts.
      3. Av node.
      4. Bundles.
2. Innervations of the Heart.
      1. Sympathetic.
      2. Parasympathetic.
      3. Sensory.
3. Coronary vascular system.
      1. Coronary arteries.
      2. Myocardial capillary bed.
      3. Venous drainage.
      4. Lymphatic drainage.
4. Pericardium.
5. Systemic Circulation.
      1. Arterial system.
      2. Venous system.
      3. Lymphatic system.
      4. Tissue perfusion and microcirculation
6. Pulmonary circulation.
      1. Pulmonary artery.
      2. Pulmonary veins.
      3. Bronchial artery.
7. Cerebral circulation
8. Renal Circulation
9. Anatomy of respiratory system.

II. Physiology :

1. Over view of the cardiovascular system.
      1. Function of CVS.
      2. Circulation of blood.
      3. Central control of cardio vascular system.

2. Cardiac cycle.
    1. Mechanical events.
    2. Arterial cycle and central venous pressure cycle.
    3. Clinical aspects of human cardiac cycle.

3. Cardiac Excitation and contraction.
    1. Mechanism of contraction.
    2. Pacemaker of conduction system.
    3. Nodal electricity.
    4. Nervous control of the heart rate.

4. Basics of ECG.

5. Assessment of cardiac output.
    1. Ficks principle.
    2. Thermal dilution and indicator dilution methods.
    3. Pulse Doppler method.
    4. Miscellaneous methods.

6. Control of stroke volume and cardiac output.

7. Hemodynamics.
   Relationship between pressure, flow and resistance.

8. Solute transport between blood and tissues.
   Circulation of fluid between plasma, interstitium and lymph.

9. Vascular smooth muscle.
    1. Mechanism of contraction.
    2. Pharmaco mechanical coupling, automaticity

10. Control of Blood vessels.
    1. Local Control mechanism.
    2. Nervous control.
    3. Hormonal Control.

11. Specialization in individual circulation.
    1. Coronary circulation.
    2. Cerebral circulation.
    3. Pulmonary circulation.
    4. Cutaneous circulation.

12. Cardiovascular receptors, reflexes and central control.

13. Coordinated cardiovascular responses.
    1. Posture.
    2. Valsalva manoeuvre
    3. Exercise.
    4. Diving reflex.

14. Cardiovascular responses in pathological situations.
    1. Shock and hemorrhage.
    2. Syncope.
    3. Essential Hypertension.
    4. Chronic cardiac failure.

15. Respiratory Physiology.
    1. Mechanics of respiration.
    2. Principles of gas exchange.
    3. Regulation of respiration.

16. Hematology and coagulation Physiology
    1. Blood Components.
    2. Blood groups
    3. Blood transfusion.
    4. Hemostasis.

PAPER – 13

Electrocardiography :

1. Basic Principles
    1. The electrocardiographic paper.
    2. Electrocardiography
    3. The electrical field of heart.
    4. The leads; standard limb leads; precordial leads;
    5. Augmented limb leads.
    6. Basic ECG deflections, basic action of electrocardiograph.
2. Normal ECG
    1. The P wave
    2. The qrs complex
    3. The genesis of the qrs complex
    4. The wave; the ST segment
    5. The Q wave
    6. Rate and rhythm
    7. Rotation of the heart
    8. The Q-T interval.
3. The Electrical Axis
4. Pre Cardial Pattern Of ECG
5. Chamber Enlargement
    1. Myocardial infarction.
    2. Coronary insufficiency
    3. Recognition of ECG pattern.
6. Bundle Branch Block
    1. General principles.
    2. Right bundle branch block.
    3. Left bundle branch block.
    4. The hemi blocks (fasicualr blocks).
7. Coronary Artery Disease
    1. Myocardial infarction.
    2. Coronary insufficiency.
    3. Recognition of ECG pattern.
8. Pericarditis, Myocarditis, Congestive Cardiomyopathy.
9. Systemic Hypertension And Rheumatic Heart Disease.
10. Corpulmonale, Acute, Pulmonary Embolism Emphysema.
11. Drugs And Electrolytes.
12. Congenital And Hereditary Heart Disease
    Wolf Parkinson white syndrome and related syndromes.
13. Sinus Rhythm
    1. Sinus arrhythmia

2. Sinus tachycardia and Bradycardia

14. Ectopic Arterial Rhythm
    1. Atrial extra systoles.
    2. Paroxysmal atrial tachycardia
    3. Atrial fibrillation and flutter.

15. Atrio Ventricular (Av) Nodal Rhythm

16. Ventricular Rhythm
    1. Ventricular extra systoles.
    2. Ventricular tachycardia.
    3. Ventricular flutter / fibrillation.

17. Disorder Of Impulse Conduction
    1. Sinotrial (SA) nodal block
    2. Atrioventricular (AV) nodal block
    3. First degree AV block
    4. Second degree AV block
    5. Third degree AV block

PAPER – 14

Exercise Testing & Holter Analysis

I. Exercise Stress Testing

a) Exercise Physiology
b) Exercise protocols
c) Electrocardiograph measurements.
d) Exercise testing.
e) Indication & techniques.

II. Holter Analysis

IV Semester

PAPER – 15

Applied Pharmacology :

The objective of this subject is to cover general pharmacology with special emphasis on common drugs used, route of administration, types of formulations, dose and frequency of administration, side effects and toxicity, management of toxic effects, drug interaction, knowledge of chemical and trade names, importance of manufacture and expiry dates and instructions about handling each drug.

1. Anti Anginal Agents:
    1. Beta Blocking Agents - Propranolol, Atenolol, Metoprolol, Labetolol, Pindolol.
    2. Nitrates – Nitroglycerine, Isosorbide dinitrate, Isosorbide mononitrate, Transdermal nitrate patches.
    3. Calcium channel blockers – nifedipine, verapamil, diltiazem, new calcium channel blockers.

2. Anti-Failure Agents :
    1. Diuretics – Furosemide, Thiazide diuretics, other thiazide like agents, Potassium sparing diuretics, combination diuretics, special diuretic problems.
    2. Angiotensin converting enzyme (ACE) inhibitors, Types of ace inhibitors Captopril, Enalapril, ACE inhibitors for diabetics and hypertensive renal disease.
    3. Digitalis and acute ionotropes – Digoxin, Digitoxin, Doubutamine, Dopamine, Adrenaline, Nonadrenaline, Isoprenaline, Mixed ionotropic vasodilators Mibrinone.

3. Anti-Hypertensive Drugs :

Diuretics, Beta Blockers, Ace inhibitors, ARBS, Calcium antagonists, direct vasodilators, centrally active and peripherally active vasodilators.

4. Anti-Arrhythmic Agents :

   Quinidine and related compounds, Procainamide, Lidocaine, Mexiletine, Phenytoin, Flecainide, Amiodarone, Bretylium, Combination therapy, Verapamil.

5. Antithrombotic Agents :

   1. Platelet inhibitors : Aspirin. Persantinem clopidogrel, Prasugrel
   2. Anticoagulants : Heparin, low molecular weight heparin, Warfarin
   3. Fibrinolytics
      - Streptokinase.
      - Urokinase
      - Combination therapy.

6. Lipid lowering and anti-atherosclerotic drugs.
7. Which drug for which condition?
8. Miscellaneous drugs – Adenosine.

   Protamine, Emergency drugs, Narcotics, Sedatives, Steroids, Antihistamines, Antibiotics.

PAPER – 16

Echocardiography :

The objective of this subject is to provide training in all aspects of instrumentation and recording techniques for echocardiography. At the end of the course the student under the supervision of a physician will be able to perform ultrasonography, perform echo cardiography using colour Doppler.

1. Principles of echo cardiography
   1. Basic principles of ultrasound
   2. M-mode echo cardiography
   3. Two dimensional echo cardiography
2. Instrumentation
   1. Basic pulse echo system
   2. Transducers
   3. Pulse generation
   4. Echo detection Echo discplays
   5. A mode; B mode; m-mode Display and recording.
3. Echo Cardiographic examination.
   1. Selecting transducers
   2. Position of the patient
   3. Placement of the transducer
   4. Setting controls
   5. M-mode labeling
   6. 2 D Echo
   7. Normal variants
   8. Terminology
   9. Identification of segments.
4. Echo Measurements – Ase Recommendation
5. Acquired Valvular Heart Disease.
   1. Mitral stenosis.
   2. Mitral regurgitation
   3. Mitral valve prolapse

4. Aortic stenosis
5. Aortic regurgitation
6. Tricuspid stenosis and regurgitation

6. Congenital Heart Disease
    1. Atrial septal defect.
    2. Ventricular septal defect
    3. Patent ducts arteriosis
    4. Tetralogy of fallot
    5. Transposition of great arteries
    6. Tricuspid atresia

7. Pericardial Disease
    1. Constriction, 2. Effusion, 3. Transponade

8. Myocardial Disorders
    1. Ischaemia, 2. Infarction, 3. Aneurysms, 4. L V Function assessment.
9. Evaluation Of Cardiomyopathy
10. Evaluation Of Tumors And Thrombi

PAPER - 17

Doppler Echo Cardiography, TEE, Contrast Echo :

I. Doppler Echocardiography

a. Introduction to Doppler echocardiography
    1. The Doppler principle.
    2. Doppler ultra sound techniques
    3. Colour Doppler flow imaging.
    4. Clinical Application of Doppler echocardiography.

b. Physical principles and instrumentation in spectral and colour Doppler flow imaging.
    1. Physical principles of the Doppler effect, the Doppler echocardiography system
    2. display.
    3. Blood flow pattern.
    4. Non laminar flow
    5. Doppler echo cardiograph modes
    6. Continuous wave Doppler system
    7. Pulsed Doppler system
    8. High pulse repetition frequency.
    9. Colour display.
    10. Problems of colour imaging.

II. Transesophageal echocardiography

III. Contrast echo

V Semester

PAPER – 18

Concepts Of Cardiovascular Disease And Outlines Of Clinical Evaluation Related To Cardiac Technology :

This subject in the course will cover common diseases and their casues, pertinent microbiology, pathology of the system involved, outline of major signs and symptoms and management of the disease including medical and surgical intervention.

1. Congenital Heart Disease In The Adult Anatomical Abnormalities
    1. Obstruction.
    2. Valvular regurgitation.
    3. Abnormal communication between chambers.
    4. Abnormal connection.
    5. Surgical treatment.

2. Valvular Heart Disease Anatomic Abnormalities:
    1. Congenital valvular heart disease.
    2. Rheumatic valvulitis.
    3. Aortic Valve Disease
        - Aortic Stenosis.
        - Aortic regurgitation.
    4. Mitral Valve Disease
        - Mitral stenosis
        - Mitral regurgitation
        - Mitral valve prolapse
        - Combined valvular disease

3. Coronary Artery Disease
    1. Patho physiology and clinical recognition.
    2. Silent myocardial ischaemia
    3. Angina pectoris
    4. Symptomatic venous and asymptomatic myocardial ischaemia.
    5. Types and locations of myocardial infarction.
    6. Thrombolytic therapy.
    7. Medical treatment.
    8. Other treatment modalities.
    9. Surgical treatment.
    10. Cardiac rehabilitation services.

4. Myocardial Diseases
    1. Dilated cardiomyopathy.
    2. Hypertrophic cardiomyopathy.
    3. Restrictive cardiomyopathy.
    4. Myocarditis.
    5. Heart failure.
    6. Surgical and medical treatment.
5. Pericardial Disease
6. Electrical Disturbances Of The Heart.
    1. Sinus node dysfunction.
    2. Arrhythmias.
    3. Surgical treatment.
7. Pulmonary Hypertension.
8. Tumours Of The Heart.

9. Congenital Heart Disease In Infancy And Childhood.
    a) Cyanotic Congenital Heart Disease:
        1. Tetralogy of fallot.
        2. Pulmonary stenosis with atrial septal defect.
        3. Transposition of great arteries.
        4. Double outlet right ventricle.
        5. Pulmonary atresia.
        6. Total anamolous pulmonary venous connection.
    b) Acyanotic Heart Disease Septal Defects:
        1. Atrial septal defects.
        2. Ventricular septal defects.
        3. Congenital valvular disease.
        4. Patent ductus arteriosus.
        5. Coarctation of aorta.
10. Hypertension.

PAPER - 19

Invasive Cardiology :

1. Cine angiographic imagiology
2. Radiation hazards in Cath lab
3. Contrast media
4. Cardiac catheterization standard practice
5. Cardiac catheterization complications
6. Pressure recording.
7. Oxymetry / shunt quantification
8. Vascular resistance
9. Calculation of cardiac output
10. Gorlins formula
11. Pressure wave forms – normal
12. Pulmonary arterial hypertension

PAPER – 20

Angiography, EP Studies :

1. Percutaneous approach in Cardiology
2. Cath findings in TOF
3. Cath findings in left to right shunt
4. Cath findings in HCM
5. Cath findings in valvular diseases.
6. Hemodynamics of constrictive pericarditis and restrictive cardiomyopathy.
7. Coronary angiography views
8. Classification of coronary artery stenosis
9. Peripheral angiography
10. IVUS
11. Sinus node function tests.
12. AV node function tests.

VI Semester

PAPER - 21

Intensive Care, Cardiopulmonary Resuscitation :

I. Intensive Care

1. Monitoring and diagnostic procedures in ICU.
    1. Central venous access
    2. ECG monitoring
    3. Invasive hemodynamic monitoring.
    4. Cardiac arrhythmia recognition.
2. General care of patient in ICU
    1. Eye, GI tract and bladder system
    2. Care of mechanically ventilated patient.
    3. Tracheostomy, Humidification
    4. Vascular line, arterial line, venous line.
    5. Radiography
    6. Chest physiotherapy
3. Intensive care management of myocardial infarction & unstable angina.
4. Fluid management and parenteral nutrition.
5. Infectious disease in ICU, antibiotics in ICU.
6. Respiratory failure
    1. Oxygen therapy
    2. Mechanical ventilation.
7. Acid base disorders electrolyte imbalance.
8. Cardio vascular failure
    1. Plan of management
    2. Inotropic support
    3. Vasodilator drugs.
9. Renal failure and liver failure.
10. Head injury.
11. Principles of transfusion therapy.

II. Cardio Pulmonary Resuscitation and First Aid Techniques :

Introduction of this training is to ensure that each student learn and retain the knowledge and skill to manage patients through cardio pulmonary emergencies.

1. Basic Life Support
    1. An Open Airway.
    2. Adequate Breathing.
    3. Sufficient Circulation.
2. Adult One-Rescuer CPR
    1. Assess the victim's need for CPR.
    2. Call for help.
    3. Open Airway & checking breathing.
    4. Mouth to mouth breathing.
    5. Manual resuscitation bag and mask.
    6. Determine pulselessness.
    7. External chest compression.
3. Adult - Two Rescuer CPR

4. CPR Equipment

    1. Manual resuscitator (Bag – value).
    2. Mouth to valve mask resuscitator.
    3. Patient assessment.

5. Resuscitation For Children

    Artificial ventilation for children & babies under two External chest compression for children & babies.

6. The Recovery Position

    ACLS: (Advanced Cardiac Life Support).

7. Skill Steps

8. Station One : Basic Life Support
    1. One rescuer CPR.
    2. Two rescuer CPR.
    3. Obstructed airway.

9. Station Two : Airway Management
    1. Mouth to mask ventilation.
    2. EDA
    3. Endo tracheal intubation.
    4. Endotracheal intubation with DOA in place.

10. Station Three: ECG and Treatment.
    1. Modalities.
    2. Statue ECG slip.
    3. Case histories and ACLS.
    4. Treatment modalities.

11. Station Four : Mega Code
    1. Serving as code leader.
    2. Defibrillation.

12. Lecture Topics : Acls In Perspective
    1. Myocardial infarction.
    2. Adjunct for airway control.
    3. Dysarhythmia therapy.
    4. Electrical therapy.
    5. Cardio vascular pharmacology.
    6. Putting it all together.

13. First Aid Techniques

14. Action at Emergency
    1. Approach.
    2. Assessing the situation.
    3. Examination & diagnosis.
    4. Treatment.
    5. After treatment.
    6. Making a report.
    7. Removing clothing.
    8. Removing crash – helmets.

15. Asphyxia
    1. Suffocation (External obstruction).
    2. Hanging, stranging & throuting.
    3. Drowning.
    4. Smoke inhalation.
    5. Carbon monoxide poisoning.

6. Choking.
7. Blast injuries.
8. Stove-in-chest
9. Asthma
10. Electrical injuries.
11. Winging.
12. Hiccups.

16. Wounds & Bleeding
    1. Types of wound.
    2. How the body responds to injury.
    3. Foreign external bleeding.
    4. Minor external bleeding.
    5. Internal bleeding.
    6. Infecting wounds.
    7. Special forms of bleeding.

PAPER - 22

Interventional Cardiology (Coronary, Congenital) :

1. PTCA techniques
2. Primary PTCA
3. Coronary stents
4. Drug coated stents
5. Advanced coronary interventions
6. Peripheral interventions
7. Trans catheter ASD closure
8. Trans catheter VSA closure
9. Tran catheter PDA closure
10. Coil Embolisation
11. Diagnosis & Treatment of coarctation of aorta
12. Balloon arterial septostomy.

PAPER - 23

Interventional Cardiology (Non- Coronary& Electro Physiology) :

14. IABP
15. PCPS
16. End myocardial Biopsy
17. PBPV/PBAV
18. PTMC
19. Alcohol septal ablation
20. Electro Physiological studies.
21. RF Ablation
22. TPI
23. PPI
24. CRT
25. ICD

Reference Books :

1) Anatomy : Chaurasia
2) Physiology : Ganong
3) Pharmacology : Gabriel Khan
4) ECG : Narasimhan's Indian Edition of Schamroth
5) Echo : Cathetre otto's text book of Echocardiography
6) TMT : Ellstead
7) Cath & Angio : Mortin Kern / Topol's hand book
8) Cardiology : From Davidson's text book of Medicine.

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

5. B.Sc EMERGENCY MEDICAL SERVICES TECHNOLOGY (EMST)

(Semester pattern)

w.e.f 2015-16 Batch

TEACHING HOURS & EXAMINATION PATTERN

III Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Principles of Emergency Medicine	80	120	IE	80	20	50%
13	Gastro intestinal, Liver, Kidney Emergencies	80	120	IE	80	20	50%
14	Toxicology	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester:

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+ Practical)
15	Environmental Injuries & Endocrine Emergencies	80	120	UE	80	40%	20	40%	50%	50	50%
16	Paediatrics & Obtetrics and Gyenecological Emergencies	80	120	UE	80	40%	20	40%	50%	50	50%
17	Neurological Emergencies	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

V Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
18	Cardiac & Pulmonary Emergencies	80	120	IE	80	20	50%
19	Pharmacology related to Emergency Medicine	80	120	IE	80	20	50%
20	Basic & Advanced Life support management	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	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)
21	Trauma Care - I	80	120	UE	80	40%	20	40%	50%	50	50%
22	Trauma Care - II	80	120	UE	80	40%	20	40%	50%	50	50%
23	Disaster Management, Poly Trauma & Paediatric Trauma	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

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 - EMERGENCY MEDICAL SERVICES TECHNOLGY

III Semester

PAPER - 12

Principles of Emergency Medicine :

Course Objective : The objective of this subject is to provide an introduction to the types of equipment used in Emergency Medicine, the purposes for which they are used and their maintenance.

I. Breathing System

1. General considerations: humidity & heat
2. Capnography; etco2
3. Pulse oximetry
4. Methods of humidification
5. Classification of breathing system
6. Non rebreathing valves – Ambu valves
7. Components

II. Face Masks & Airway Laryngoscopes

1. Types, sizes
2. Endotracheal tubes – Types, sizes,
3. Cuff system
4. Fixing, removing and inflating cuff, checking tube position, complications.

Investigations :

Routine	-	Haematological – their significance
	-	Urine
	-	E.C.G.
	-	Chest & x-ray
Special	-	Endocrine, hormonal assays
	-	Echocardiography
	-	Angiography
	-	Others

PAPER –13

Gastro intestinal, Liver, Kidney Emergencies :

I. Gastrointestinal Emergencies :

1. Acute Abdominal pain
2. Nausea and Vomiting
3. Disorders presenting primarily with Diarrhea
4. Acute and chronic constipation
5. Upper Gastrointestinal Bleeding
6. Lower Gastrointestinal Bleeding
7. Esophageal Emergencies, Gastroesophageal Reflux Disease, and Swallowed Foreign Bodies
8. Peptic Ulcer Disease and Gastritis
9. Pancreatitis and Cholecystitis
10. Hepatic Disorders, Jaundice, and Hepatic Failure
11. Acute Appendictis
12. Diverticulitis

13. Bowel Obstruction and Volvulus
14. Gastrointestinal Procedures and Devices
15. Complications of General Surgical Procedures

II. Liver:

Anatomy of the Liver, portal circulation, functions of the liver.
Jaundice – types and clinical features.

III. Kidney:

Anatomy of the kidney, functions of the kidney, and renal failure.
AKI, CKD, Haemodialysis

PAPER – 14

Toxicology :

1. General Management of poisoned patients
2. Principles of Drug Interactions
3. Atypical Antidepressants, Serotonin Reuptake Inhibitors, and Serotonin Syndrome
4. Monoamine Oxidase Inhibitors
5. Lithium
6. Barbiturates
7. Benzodiazepine Sedatives
8. Opioids
9. Aspirin and Sallicylates
10. Acetaminophen
11. Nonsteroidal Anti-Inflammatory Drugs
12. Digitalis Glycosides
13. B-Blockers
14. Calcium Channel Blockers
15. Antihypertensive Agents
16. Hydrocarbons and Volatile Substances
17. Caustics
18. Pesticides
19. Anticholinergics
20. Industrial Toxins

IV Semester

PAPER - 15

Environmental Injuries & Endocrine Emergencies :

I. Environmental Injuries :

1. Frostbite and Other Localized Cold Injuries
2. Hypothermia
3. Heat Emergencies
4. Bites and stings
5. Trauma and Envenomations from Marine fauna
6. Thermal Burns
7. Chemical Burns

II. Endocrine Emergencies :

1. Type 1 Diabetes Mellitus
2. Type 2 Diabetes Mellitus
3. Diabetic Ketoacidosis
4. Thyroid Disorders: Hypothyroidism and Myxedema Crisis
5. Thyroid Disorders: Hyperthyroidism and Thyroid Storm

PAPER – 16

Pediatric & Obstetrics and Gyenocological Emergencies:

I. Pediatric Emergencies :

1. Emergency care of children
2. Neonatal Emergencies and common Neonatal problems
3. Fever and serious Bacterial Illness
4. Stridor and Drooling
5. Pediatric Heart Disease: Congenital Heart Defects
6. Pediatric Heart Disease: Acquired Heart Disease
7. Vomiting, Diarrhea, and Dehydration in Children
8. Acute Abdominal Pain in Children
9. Seizures and Status Epilepticus in Children

II. Obstetrics And Gynaecological Emergencies :

1. Vaginal Bleeding in the Nonpregnant patient
2. Abdominal and Pelvic pain in the Nonpregnant Female
3. Ectopic pregnancy and |Emergencies in the First 20 weeks of pregnancy
4. Normal pregnancy
5. Emergency Delivery

PAPER – 17

Neurological Emergencies :

1. The Neurologic Examination in the Emergency Setting
2. Headache and Facial Pain
3. Spontaneous Subarachnoid and Intracerebral Hemorrhage
4. Stroke, Transient Ischemic Attack, and Cervical Artery Dissection
5. Seizures and status Epilepticus in Adults
6. Traumatic brain injury
7. Interpretations of plain X-Ray, CT Scan, MRI
8. Positioning of Head Injury patient in prone & supine position
9. Glasgow – Coma score and its application
10. Aneurysm
11. Brain death
12. Organ Donation
13. Apnea test

V Semester

PAPER – 18

Cardiac & Pulmonary Emergencies :

I. Cardiac Emergencies:

1. M.I
2. Pulmonary Oedema
3. Angina
4. Hypertensive crisis
5. Interpretation of ECG
6. Interpretation of 2D echo
7. Holter analysis text
8. Shifting of a cardiac patient to Cath Lab
9. Bleeding disorders
10. Mitral stenosis
11. Cardiomyopathies

II. Pulmonary Emergencies :

1. Respiratory Distress
2. HEMOPTYSIS
3. Acute Bronchitis and Upper Respiratory Tract Infections
4. Community-Acquired Pneumonia, Aspiration Pneumonia, and Noninfectious Pulmonary Infiltrates
5. Empyema and Lung Abscess
6. Tuberculosis
7. Spontaneous and Iatrogenic Pneumothorax
8. Acute Asthma in Adults
9. Chronic Obstructive pulmonary Disease

PAPER – 19

Pharmacology related to Emergency Medicine :

1. Organophosporous compounds
2. Antidote
3. Oximes
4. Narcotic Abuse
5. Narcotics
6. Atropine
7. Medazolam
8. Thiopentone
9. Muscle relaxants
10. Dopomine
11. Dobutamine
12. Nor _ adrenaline
13. Adrenaline
14. Isoprenaline
15. Anti emitics
16. Phenytoin
17. Navalproate

18. Manitol
19. Lasix
20. Fluid Challenge
21. Analgesics
22. Antibiotics – 1st & 2nd gen. of cephalosporins & penicillines

PAPER – 20

Basic & Advanced Life support management :

1. BLS
2. Airway Assessment
3. Airway Equipment
4. Technique of Mask Ventilation & Endo tracheal intubation
5. Advanced airway management skill (Use of bogie stellate, supraglottic devices)
6. Basic settings of a ventilator
7. Basic modes of ventilator
8. General case of patient on ventilator including endotracheal suctioning
9. Classification and management of shock
10. Central and peripheral venous access
11. Defibrillators
12. ECPR

VI Semester

PAPER - 21

Trauma Care – I :

I. Traumatic Disorders :

i) Principles of care

ii) Prehospital trauma care

1. Triage
2. Resuscitation and stabilization
3. Hemorrhagic shock
4. Neurogenic shock
5. Role of emergency physician
6. Team response
7. Reassessment and monitoring
8. Diagnosis
9. Treatment
10. Disposition

iii) Cause of injury:

1. Homicide
2. Suicide
3. Family violence
4. Motor vehicle crashes
5. Falls
6. Drowning/near drowning
7. Poisoning
8. Burns and fire related injuries

9. Occupational injuries

iv) Radiological evaluation:
1. Plain radiography
2. Contrast radiography
3. CT scan
4. Angiography
5. MRI
6. Ultrasound

v) Spinal cord and peripheral nervous system trauma:
1. Complete spinal cord injuries
2. Incomplete cord injuries
3. Cauda equine injuries
4. Peripheral nerve injuries

vi) Injuries of the spine:
1. Fractures
2. Dislocations/subluxations

v) Facial fractures

vi) Soft tissue facial injuries
1. Complex lacerations
2. Avulsions

vii) Neck trauma

vii) Vascular injuries
1. Carotid artery
2. Internal and external jugular veins

PAPER - 22

Trauma Care – II :

I. Laryngotracheal injuries:
1. Lacerations
2. Crush injuries
3. Vocal cord avulsions/hematomas
4. Fracture larynx
5. Compression with hematomas

II. Chest Trauma:
1. Penetrating chest trauma
2. Rib fractures
3. Sterna fractures
4. Flail chest
5. Clavicle fracture/dislocation
6. Pulmonary contusion
7. Pericardial tamponade
8. Vascular injuries
9. Tracheo bronchial tree injuries
10. Pneumo thoraces
11. Hemothorax

III. Abdominal Trauma:
1. Penetrating abdominal trauma
2. Abdominal wall contusion
3. Solid-viscus injuries

4. Hollow viscus injuries
5. Vascular injuries
6. Diaphragmatic rupture
7. Mesenteric avulsion, hematoma
8. Bladder rupture, contusion
9. Renal injuries
10. Urethral injuries

IV. Upper extremity bony trauma:

Fractures (open and closed)

1. Forearm
2. Supra condylar
3. Humeral shaft and head
4. Scapula

V. Dislocations / subluxations /fracture dislocation

1. Shoulder
2. Elbow
3. Wrist
4. Hand

VI. Lower extremity bony Trauma:

Fractures (open and closed)

1. Phalangeal
2. Metatarsal
3. Tarsal
4. Ankle
5. Leg (tibia-fibula)
6. Patellar
7. Midshaft and distal femur
8. Proximal femur (hip)

VII. Pelvic fractures:

1. Public rami
2. Iliac crest

VIII. Dislocations / fracture dislocations:

1. Ankle
2. Knee
3. Hip

IX. Injuries of the genitalia:

1. Cutaneous injuries
2. Lacerations
3. Avulsions
4. Burns
5. Puncture wounds
6. Bite wounds

PAPER - 23

Disaster Management, Poly Trauma & Paediatric Trauma :

I. Disaster Management :

1. Disaster-Definition
2. Types of disasters
3. Different classifications of disaster
4. Characteristics of disaster
5. Disaster preparedness and hospital planning
6. Hospital community co-ordination
7. Field triage and medical care –START technique
8. Training and disaster drills

II. Poly trauma / Multiple skeletal injuries:

III. Special considerations for paediatric trauma victim:

1. Clinical assessment and management
2. Anatomic/physiologic differences from adults
3. Airways management
4. Fluid resuscitation
5. Recognition of child abuse
6. Head injury
7. Spinal injuries
8. Without radiological abnormality
9. Chest trauma
10. Abdominal trauma
11. Burns
12. Fractures
    i. Green stick
    ii. Torus

Text books to study :

1. Nancy Caroline – Paramedic text book
2. Tintinalli's Emergency Medicine. A comprehensive study Guide eighth edition by David cline; Garth Meckler; Judith E. Tintinalli.
3. Roberts and Hedge's clinical procedures in Emergency Medicine 6th edition by James R. Roberts.
4. Short Text books of Anaesthesia by Ajay Yadav 5th edition.
5. Lee synopsis of Anesthesia 13th edition by Davies.
6. Oxford Hand book of Emergency Medicine by Michael J. Clancy; Kerstin Hogg.

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

6. B.Sc. MEDICAL LAB TECHNOLOGY (MLT)

(Semester pattern)

w.e.f 2015-16 Batch

Course co-ordinator :

The course co-ordinator shall be nominated for B.Sc MLT course in alphabetical order for each academic year i.e. for the year 2016-17, the course in-charge from the dept. of Biochemistry, 2017-18, the course in-charge dept. of Microbiology and 2018-19 the course in-charge from the dept. of Pathology and so on...

He / She will be responsible for taking attendance, maintaining internal assessment marks, clinical training postings and intimation to the HoD's concerned, Prof. i/c AHS and to the University.

TEACHING HOURS & EXAMINATION PATTERN

III Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Biochemistry-I	60	140	IE	80	20	50%
13	Microbiology-I	60	140	IE	80	20	50%
14	Pathology-I	60	140	IE	80	20	50%
	Total	**180**	**420**				

T600

Practical including Oral, Spotters & Record

IV Semester:

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+ Practical)
15	Biochemistry-II	60	140	UE	80	40%	20	40%	50%	50	50%
16	Microbiology-II	60	140	UE	80	40%	20	40%	50%	50	50%
17	Pathology-II	60	140	UE	80	40%	20	40%	50%	50	50%
	Total	**180**	**420**								

Total hours: 600

Practical including Oral, Spotters

V Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
18	Biochemistry -III	60	100	IE	80	20	50%
19	Microbiology -III	60	100	IE	80	20	50%
20	**Part A :** Pathology-III	60	100	IE	80	20	50%
	Part B : Transfusion Medicine - I	20	100	-	-	-	-
	Total	**200**	**400**				

Total hours: 600

Practical including Oral, Spotters

VI Semester:

Paper No.	Paper	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+
21	Biochemistry-IV	60	100	UE	80	40%	20	40%	50%	50	50%
22	Microbiology--IV	60	100	UE	80	40%	20	40%	50%	50	50%
23	Part-A : Pathology IV	60	100	UE	50	40%	15	40%	50%	30	50%
	Part-B: Transfusion Medicine -II	20	100	UE	30		5			20	
	Total	**200**	**400**								

Total hours: 600

Practical including Oral, Spotters

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 - MEDICAL LAB TECHNOLOGY COURSE

III Semester

PAPER – 12

Biochemistry-I :

1. **Biological Oxidation**:
   High energy compounds, Mitochondrial Electron transport. Inhibitors and uncouplers of oxidative Phosphorylation.

2. **Digestion And Absorption**:
   Digestion and absorption of carbohydrates, lipids, proteins

3. **Carbohydrate Metabolism**:
   Glycolysis, Pyruvate oxidation, TCA cycle, energetic of glucose oxidation. Glycogenesis, glycogenolysis, gluconeogenesis and their regulations. Glycogen storage disease, hormonal regulation of blood sugar. Brief account of Diabetes mellitus, GTT.

4. **Lipid Metabolism**:
   Beta oxidation, energetics of fatty acid oxidation, Fatty acid biosynthesis. Lipogenesis, ketosis. Basic idea on formation of bile salts and steroid hormones. Plasma lipoproteins. Starvation, obesity, fatty liver.

5. **Metabolism Of Amino Acids**:
   Deamination, decarboxyiation and trarisamination. Essential & non-essential amino acids. Metabolism of glycine, methionine and cysteine, phenylalanine, tyrosine

6. Radioactive Isotopes and their applications.

7. **General Laboratory Techniques & Procedures**:
   Water, reference materials, glassware & plastic ware, volumetric equipment, centrifuges, solutions, mixers & homogenizers, filtration & concentration, balances, units, buffers, safety

8. **Photometry**: Beer's law, colorimetry

Practicals :

1. Weighing of substances
2. Preparation of solutions- 1NHCl, 2/3NH2SO4, 0.9% Normal saline
3. End Point Assays : Total protein and albumin

PAPER – 13

Microbiology- I :

I. General Bacteriology :

1. History of Microbiology.
2. Classification of Micro organisms
3. Microscopes.
4. Structure of Bacterial cells.
5. Staining methods.
6. Growth & Nutrition of bacteria.
7. Culture media and culture methods – Aerobic, Anaerobic.

8. Biochemical Tests for identification.
9. Bacterial Metabolism.
10. Theory and practical aspects of sterilization, disinfection.
11. Bacterial genetics.
12. Molecular methods of Diagnosis : NAT.
13. Antimicrobial agents and resistance.
14. Antibiotic sensitivity tests.
15. Hospital waste management.
16. Quality control in Microbiology.
17. Laboratory safety.
18. Infection, source, Transmission.
19. Virulence factors and toxins.

II. Immunology:

1. Immunity : Types.
2. Innate Immunity.
3. Antigens and Antibodies.
4. Antigen – Antibody reaction : Agglutination, precipitation, CFT.
5. Specialized Techniques : RIA, ELISA, Immunofluorescence, Dot – Blot & Rapid assays.
6. Humoral Immune response and CMI.
7. Monoclonal antibody and hybridoma techniques.
8. Hypersensitivity reactions.
9. Autoimmunity, tumour immunity, transplantation.
10. Immunodeficiency: Primary, Secondary, AIDS.

PAPER – 14

Pathology - I :

Introduction to Pathology :

I. Histopathology :

1. Structure and functions of normal cell
2. Reception of specimens
3. Various fixatives – Mode of action, indications, preparation
4. Grossing- Preparation & Taking blocks
5. Steps of tissue processing and embedding
6. Use of microscopes – Light microscope, Polarizing microscope

II. Clinical Pathology :

1. Urine examination, physical, chemical and microscopic examination
2. Examination of Urine for occult blood

III. Haematology :

1. Blood collection
2. Anticoagulants used in hematology, Normal values in hematology
3. Basic hematological Techniques
4. RBC, HB, PCV, Red cell indices
5. Total and Differential counts absolute eosinophil count
6. Platelet count, ESR
7. Preparation of blood films stain used in hematology
8. Morphology of Red cells, leucocytes and Platelets
9. Preparation of Glass ware

IV. Cytology:

1. **Respiratory Tract**
   Anatomy, Histology and physiology of the respiratory Tract collections
   Characteristics of normal and malignant cytology
2. **Gastrointestinal Tract**
   Anatomy, Histology, Physiology of GIT
   Classification and preparation of samples
   Characteristics of normal and malignant cytology
3. **Urinary Tract**
   Anatomy, Histology and Physiology
   Collection and preparation of samples
   Urinary sediment cytology
   Body fluids(CSF, Pleural, Peritoneal)& cell counts
   Fixation and Fixatives in cytology
   Processing of samples in the laboratory
   Pap staining
   FNAC

IV Semester

PAPER – 15

Biochemistry – II :

1. **Non-protein Nitrogenous Compounds**:
   Urea, creatinine and uric acid - formation, excretion, normal value
2. **Iron, Porphyrins And Bile Pigments**:
   Chemistry of porphyrins, catabolism of heme. Disorders of porphyrin metabolism, hemoglobinopathies.
3. **Electrochemistry**:
   Potentiometery, voltammetry, amperometry, coulometry, conductometry, biosensors.
4. **Photometry**:
   Spectrophotometry, flame photometry, atomic absorption spectrophotometry
5. **Electrophoresis**:
   Definition, Principle, Basics, method, types, clinical applications including scrum protein electrophoresis, hemoglobin electrophoresis
6. **Function Tests** :
   Liver function tests, renal function tests, gastric function tests
7. **Toxicology**:
   Definitions, mechanisms of toxicity, factors influencing toxicity, detoxification, antidotes, drug interactions, medico legal aspects.

Practicals :

1. Measurement of Ph
2. Preparation of reagents- Benedicts, BCG, Jaffe's reagent, Phosphate buffer
3. End Point Assays : Urea, serum and urine creatinine, total & conjugated bilirubin, uric

acid.
4. Kinetic Assays : Alkaline phosphatase, Amylase
5. Normal urine analysis
6. Analysis of abnormal constituents in urine.
7. Serum protein electrophoresis, flame photometry : Demonstration

PAPER – 16

Microbiology- II :

I. Systematic Bacteriology:

1. Gram positive cocci : Staphylococcus, streptococcus, Enterococcus.
2. Gram Negative cocci : Neisseria, Moraxella.
3. Gram positive bacilli : Corynelbacterium, Nocardia, Actinomyces, Bacillus, Listeria.
4. Gram Negative Bacilli : Enterobacteriaceae : E.coli, klelesiella, enterobacter, proteus pseuduomonas, vibrios, camphylobracter, brucella, haemophilus, bordetella, pasterella, francisella.
5. Anaerobic Bacteria : Clostridium, Gram negative bacilli.
6. Mycobacterium.
7. Spirochactes : Treponema, Borrelia, Leptospira.
8. Chalmydia, Mycoplasma, Rickettsia.

II. Bacterial Infections and Diagnosis:

1. Urinary Tract infection.
2. Respiratory tract infection.
3. Diarrhoeal diseases.
4. CNS Infections.
5. Wound Soft tissue and bone infections.
6. Blood stream infection.
7. Sexually transmitted infections.
8. Hospital acquired infections

PAPER - 17

Pathology-II :

I. Histopathology :

1. Steps of tissue processing and embedding
2. Section Cutting
3. Mode of preparation and theory of H&E staining
4. Various aspects of mounting, staining the slides.
5. Theory of decalcification and various methods
6. Phase contrast microscope and Fluorescent microscope
7. Museum techniques
8. Quality control in Histopathology

II. Clinical Pathology :

1. Examination of body fluids(CSF, Pleural, Peritoneal), cell counts
2. Urine examination
3. Physical, chemical & microscopic examination
4. Semen analysis

III. Hematology:

1. Bone marrow: Technique of aspiration, preparation, staining, Bone marrow biopsy
2. Myeloperoxidase stain in bone marrow

3. Preparation of Buffy coat smears, Reticulocyte count, Toluidine blue stain for Reticulocyte
4. Laboratory methods used in the investigation of deficiency anemias
   a) B12 and Folate assay
   b) Schilling Test
   c) Serum Iron and Iron binding capacity
   Lab methods used in the investigation of Hemolytic anemias
   a) Osmotic fragility
   b) G6 P Deficiency
   c) Sickling Tests
5. HbF, Hb A2, Plasma hemoglobin, Haptoglobin,
6. Demonstration of Hemosiderin in Urine.
7. Hemoglobin electrophoresis
8. Test for auto immune hemolytic anemias
9. Abnormal Hb pigments
10. Automation in hematology
11. Organization and quality control in Hematology laboratory
12. QBC

IV. Cytology :

1. Bronchial aspiration and Brushing
2. Characteristics of normal, benign and malignant cytology

V. Gastrointestinal Tract :

1. Classification and preparation of samples
2. Characteristics of normal and malignant cytology
3. Urinary sediment cytology
4. Bladder irrigation cytology
5. Processing of samples in the laboratory
6. Pap staining
7. H& E Stain
8. MGG stain
9. Rapid staining for frozen & squash
10. Interventional Cytology
11. Imprint cytology
12. Sputum cytology
13. Crush / squash smear cytology
14. Biopsy sediment Cytology (cell block preparation)

V Semester

PAPER - 18

Biochemistry- III :

1. Chromatography:
Definition, Principle, Basics, method, types, clinical applications.

2. Biostatist1cs:
Fundamental concepts, sampling distributions, measures of central tendencies and variation, regression and correlation, F-test, t-lest.

3. Photometry:
Flurometry, nephelometry, turbidimetry

4. Endocrine System:

Chemistry and classification of hormones, mechanism of action of hormones, hormones secreted by hypothalamic pituitary axis, thyroid, parathyroid, pancreas, adrenal, gonads, associated pathological conditions and function tests.

5. Water & Electrolyte Balance:

Body water compartments, osmotic pressure, regulation of body fluid osmolarity and volume, metabolism of water, sodium, potassium and chloride along with associated disorders

6. Acid Base Balance:

Acids, bases, oxygen and carbon dioxide homeostasis, acid base balance, acidosis, alkalosis

Practicals :

1. End Point Assays : Calcium, phosphorus
2. Kinetic Assays : LDH
3. Paper chromatography: Demonstration

PAPER - 19

Microbiology- III :

I. Virology:

1. General Properties & Classification of Viruses
2. Replication of Virus
3. Lab : Diagnosis ofViral infections – Tissue culture, Cell culture
   Electron microscopy, Fluorescent tests
   Serology, PCR
4. Bacteriophage, phage typing
5. Viral vaccines, antiviral agents
6. Characteristics, mode of infection, spread, diseases and lab diagnosis of:
   a. Herpes viruses : HSV, VZV, EBV, CMV
   b. Adenovirus
   c. Papilloma virus
   d. Respiratory virus : Influenza, PIF, RSV, Rhinovirus, Mumps, Measles, Rubella
   e. Polio virus
   f. Rabies virus
   g. Important ambo viruses : Dengue, JEV, KFD, Chickunguniya
   h. HIV
   i. Hepatitis Viruses

II. Mycology:

1. Fungi – Characteristic, Classification, Lab Diagnosis
2. Cryptococcus
3. Dermatophytes
4. Subcutaneous Mycoses : Sporothrix, Mycetoma, Rhinosporidium
5. Dimorphic Fungi
6. Apergillus, Mycetoma

PAPER - 20

Part A : Pathology – III :

I. Flow And Imaging Cytometry :

1. Methodology in Flow Cytometry
2. Imaging Cytometry – Principles, Equipment, Techniques of image analysis and evaluation.
3. Automated Cytology

II. Tissue Culture :

1. Equipment necessary for carrying out tissue culture studies
   i. Laminar Flow Equipment
   ii. Carbondioxide Incubator
   iii. Inverted tissue culture Microscope
2. Basic Procedure for preparation of glassware, Media etc. for tissue culture (Sterilization)
   i. Dry Heat sterilization
   ii. Autoclaving in an atmosphere of steam
   iii. Chemical sterilization
   iv. Fitter sterilization of liquid media etc.
3. Preparation of cell lines
   i. Enzymatic digestion of the tissue using Trypsin
   ii. Plating of cells in tissue culture media
   iii. Observation of cells in inverted Microscope
   iv. Subculturing and derivation of cell lines
4. Characterization of cell lines
   i. Determination of biochemical markers in cells
   ii. Chromosomal and DNA content of cells
   iii. Immunological properties of cells
5. Preservation of Immortalized cell lines
   i. Storage in glycerol in liquid nitrogen
   ii. Storage in Dimethyl sulfoxide in liquid nitrogen

III. Cytogenetics:

1. Human genetics: An introduction to the subject
2. Terminology, classifications and nomenclature of human chromosomes.
3. Methods for karyotypic analysis.
   a. Culture of one marrow, peripheral blood lymphocytes, solid tumours, skin fibroblasts etc.,
   b. Direct preparation from tumour material
4. Characterisation of human chromosomes by various banding techniques
5. Sex chromatin identification
6. Karyotyping and analysis of chromosomal abnormalities
7. Common chromosomal observations observed in cancer, mechanisms of their production and role of oncogenes
8. Photomicrography in cytogenetics.

IV. Frozen Sections And Cryostat :

1. Frozen Sections:
   a. Freezing Microtome
   b. Frozen Section Technique

2. Cryostat:
    a. Types
    b. Operation of cryostat
    c. Cryostat Cut sections

V. Instrumentation :

1. Freezing Microtome
2. Cryostat
3. Photographic equipment
4. Automation in pathology (Cell counters etc)
5. Application of Computers in Pathology

Part B : Transfusion Medicine – I :

Hemorrhagic Disorders:

1. Mechanism of coagulation
2. Collection and anticoagulants used in coagulation studies
3. Bleeding time and clotting time
4. Other coagulation studies PT, KPTT etc.
5. Assay of clotting factor
6. Test for blood fibrinolytic activity and detection of FDP
7. Platelet count
8. Platelet function tests.
9. LE Cell

VI Semester

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Biochemistry – IV :

1. **Osmometry**:
   Osmosis and osmometers
2. **Immunoassays**:
   Principle, Basics, ligand binding immunoassays including RIA, ELISA & CLIA.
3. **PCR**:
   Principle and applications of polymerase chain reaction (PCR).
4. **Analytical Goals**:
   Precision and accuracy, bias, sensitivity and specificity
5. **Method Evaluation**:
   Purpose, selection of method, laboratory evaluation, example/study.
6. **Total Quality Management**:
   Fundamental concepts, control of preanalytical, analytical and postanalytical variables, internal and external quality control programs.
7. **Automation**:
   Definition, instrumental concepts, auto analyzers, selection of instruments, trends in automation.
8. **Computers In Clinical Chemistry**:
   Laboratory information systems.

Practicals :

1. **End Point Assays**: Glucose, cholesterol, urinary proteins, CSF-protein and glucose.
2. **Kinetic Assays** : SGOT, SGPT, CPK, CPK-MB
3. **Immuno Assays**: Ferritin, PSA - Demonstration
4. **Method evaluation**: Within run precision for Glucose, Urea standard curve
5. **Spotters** : LJ charts, GTT, LFT, RFT, Reference ranges

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Microbiology- IV :

Parasitology:

1. Types of parasites, classification of protozoa and Helminths.
2. Collection, preservation and processing of stool specimen.
3. Examination of blood parasites : Methods.
4. Basic structure, Life history, forms seen in clinical specimen and Lab diagnosis of
   a. Protozoa: Entamoeba, Giardia, Trichomoras, B.Coli, Trypanosomes, Leishmania, Plasmodium, Toxoplasma, Isospora, Cryptosporidium, Microsporidium.
   b. Helminths : Ascaris, Hookworms, strongyloides, Trichinella, Enterobius, Trichuries, Filarial worms, Guinea worm, Taenia, Echinococcus, Hymenolepis, schistosona, Diphyllobothrium, paragonimus.
5. Roles of Arthropds in disease transmission.
6. Mosquito Borne Diseases, morphology of anopheles, culex, aedes mosquitoes.

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Part A : Pathology- IV :

I. Immuno Histochemistry & Immunocytochemistry :

1. Introduction
2. Overview of immuno histochemistry
3. Applications of Immuno histochemistry
4. Basic concepts of Immunohistochemistry
5. Monoclonal antibodies and their preparations
6. Fluorescent reactions
7. PAP Technique – principle, preparation of reagents and procedure
8. Immunocytochemical methods (immuno peroxidase and immune aniline phosphatase etc.)
9. In Situ Hybridization
10. Immunofluorescence

II. Special Stains :

1. Carbohydrate stains
2. Periodic Acid Schiff, ALPAS, Mucicarmine
3. Muscle stains
4. Massons Trichrome, PTAH
5. Neural stains
6. Luxol fast blue, Eriochrome cyanine, Glees stain
7. Connective tissue fibres stain

8. Jones, MSB, Van Gieson, Reticulin, Verhoeff's stain
9. Organisms
10. Zn stain, Fite Ferraco stain, Warthin Starry stain
11. Pigments, mineral
12. Schmorl's, Vonkossa, Melanin Bleach, DOPA, Massons fonata,
13. Perls Prussian blue stain
14. Fat stains
15. Sudan Black, Sudan III, Oil red O stain
16. Congo red stain

PART B : Transfusion Medicine – II :

Blood Transfusion and Immuno-Haematology :

1. ABO Blood Group System
2. Rh typing and weaker variants in Rh system
3. Subgroups and weaker variants of A and B Bombay Phenotype
4. Preparation and standardization of Anti Human Globulin reagent
5. Coombs test
6. Blood grouping and cross matching in blood bank
7. Investigations of transfusion reactions
8. Care and selection of donors
9. Role of Australia Antigen in Blood Transfusion
10. Screening for Australia Antigen
11. HLA Antigens and their significance in Blood transfusion
12. Preservation of blood, principles and its application in blood banking
13. Component therapy in clinical practice
14. Screening the blood for infective material
15. Blood Bank Administration

Reference Books :

I. Biochemistry:

1)Textbook of Biochemistry – U Satyanarayana
2) Clinical Chemistry – TEITZ
3) Chemical Chemistry – KAPLAN
4) Textbook of Laboratory Medicine – Praful Godkar
5) Varley's Clinical Chemistry – IV Edition

II. Microbiology:

1)Text book of Microbiology – Ananthanarayan & Panikar
2) Text book of Microbiology – Prof. C.P.Baveja
3) Text book of Medical Parasitology – CK Jayaram Panikar
4) Text Book of Practical Microbiology – Dr. S.C. Parija

III. Pathology:

1)Text Book of Pathology by Harsh Mohan
2) Practical Haematology by DACIE & LEWI'S
3) Haematology practice by Dr. Tejendra Singh
4) Histopathology Techniques by Bancraft
5) Clinical Diagnosis and laboratory methods by Todd & Sanfort

IV. Transfusion Medicine:

1) R.N. Makroo's compendium of Transfusion Medicine

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

7. B.Sc Nuclear Medicine Technology (NMT)

(Semester pattern)

w.e.f 2015-16 Batch

TEACHING HOURS & EXAMINATION PATTERN

III Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Nuclear Medicine physics & instrumentation-I	80	120	IE	80	20	50%
13	Radiopharmacy, Radiation Biology and Radiation Safety -I	80	120	IE	80	20	50%
14	Nuclear Medicine Techniques and procedures -I)	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester :

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+Practical)
15	Nuclear medicine physics and instrumentation -I I	80	120	UE	80	40%	20	40%	50%	50	50%
16	Radiopharmacy, Radiation Biology and Radiation Safety - II	80	120	UE	80	40%	20	40%	50%	50	50%
17	Nuclear Medicine Techniques and procedures -I I	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters, Records on Basic Recording of EEG, nerve conduction and evoked potential.

V Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
18	Nuclear medicine physics and instrumentation - III	80	120	IE	80	20	50%
19	Radiopharmacy, Radiation Biology and Radiation Safety - III	80	120	IE	80	20	50%
20	Nuclear medicine techniques and procedures - III	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	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)
21	Nuclear medicine physics and instrumentation - IV	80	120	UE	80	40%	20	40%	50%	50	50%
22	Radiopharmacy, Radiation Biology and Radiation Safety - IV	80	120	UE	80	40%	20	40%	50%	50	50%
23	Nuclear medicine techniques and procedures - IV	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters, Record on Advanced Recording of EEG, nerve conduction and evoked potential

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 - NUCLEAR MEDICINE TECHNOLOGY

III Semester

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Nuclear Medicine Physics And Instrumentation - I :

Unit 01 : Basics for handling of computers in nuclear medicine

Personal computer and specialized computers/ workstations in Nuclear Medicine.
Hardware and software in work stations.
Input and output devices. Types of memories and storage devices.
Concept for nuclear medicine scintigraphy, image formation, matrix size, picture element, vox cell element, grey scale, color scale.
Nuclear Medicine image hard copies, glossy prints, paper prints etc.,
X-Ray films, types, basic film structure & quality, choosing films for different studies, film processing techniques: dry and wet processing, manual and automatic.
Wet film, processing solutions. Film processing rooms, film processing equipments.

Unit 02 :

Elementary introduction to structure of matter, elements, compounds and mixtures, molecules and atoms. Atomic & Nuclear structures, Atomic models, Periodic table, simple ideas of quantum mechanics, Mass energy equivalence, fluorescence, Phosphorescence, luminescence, electromagnetic spectrum.

Unit 03 :

Electricity, Magnetism and Electromagnetic induction: Electricity in ionized gases-electric charges-electric induction- Coloumb law-unit of charge-resistance-ohms law-electric power-Joules law. Magnetism-magnetic properties-electromagnetic effect-electrical instruments like Voltmeter, Ammeter & Multimeter. Transformer, transistor, rectifier, pre amplifier, pulse amplifier, power supply, circuits. Filters and their types.

Unit 04 :

Atomic structure, atomic number, mass number, isotopes, radioisotopes, radioactivity, specific activity, types of radioactive disintegrations, electron capture, characteristics of alpha, beta and gamma rays, energy ionizing radiation, half-life (Physical, Biological), effective half life, isomeric transitions, secular, transient and no-equilibrium, production of radioisotopes and X-rays (characteristic and Bremsstrahlung), neutron sources.

Discovery of radioactivity, Natural & Artificial Radioactivity, Isotopes and nuclides, binding forces between nuclear particles, types of radiation, alpha, beta particles and gamma radiation.

Unit 05:

Mechanisms of radioactive decay, decay scheme for important radio isotopes used in nuclear medicine. Interaction of X-rays & γ-rays with matter - Radiation intensity & exposure - radiation dose - Radiation quality – law of exponential attenuation – half value thickness, tenth value thickness – linear attenuation coefficient – Scattering – photoelectric effect – Compton-scattering – pair production – particle interactions – total attenuation coefficient-relative clinical importance.

Books for Study :

1. Physics in Nuclear Medicine – Simon Cherry, James Sorenson & Michael Phelps.
2. Basic Medical Radiation physics: Stanton
3. Medical Radiation Physics – William R. Hendee.
4. Basics of Computers and Image hard copy production in Nuclear Medicine.
5. Computers in Nuclear Medicine –A practical Approach – Kai.H.Lee
6. Computer Fundamentals-concepts, systems & Applications – D.P Nagpal
7. Effective use of computers in Nuclear Medicine: Michael J.Gelf and Stephen.RThomas.
8. Radiographic Latent Image Processing – W.E.J. McKinney
9. General principles of Hospital practice and care of patient
10. Anatomy & Physiology for nurses.
11. Ramesh Chandra; physics in Nuclear Medicine.

PAPER - 13

Radiopharmacy, Radiation Biology and Radiation Safety - I :

1. Basics of radiation chemistry :

(a) Atomic and molecular structure (b) Bonding: Electrovalent, covalent, Dative covalent bond and hydrogen bonds (c) Valency, Atomic wt., -Molecular wt -Normality and molarity of solution, (d) Acids and Bases - Hydrogen Ion concentration - pH value - The role of pH in the preparations of radiopharmaceuticals -(e) chemical reaction - solute - Solvents - Solubility - crystallization - (f) The chemical elements which are necessary for life (carbon - Hydrogen, oxygen and nitrogen, Phosphorous, Iron etc.). (g) Fundamental chemistry of carbohydrates and carbonyl groups (h) - Oxidation and Reduction (i) proteins and amino acids. Lipids and profiles. Enzymes - vitamins, Hormones.

2. Basic in Laboratory Techniques

(i) Laboratory glassware (ii) Washing and autoclaving of glassware for the use in Radio-pharmacy areas (iii) Correct use of Pipettes, Balance, Centrifuge, gloves, syringes, vacuum vials, saline bottles, elution vials etc. (iv) hot lab tools for safe handling of active vials and syringes.

Radio isotope receipt, storage and log book entries in radio pharmacy laboratory. Radio active and non radio active waste, segregation active and non active waste in nuclear medicine laboratory, segregation of glass and plastic material, common methods of safe disposal of radio-active waste in nuclear medicine, permissible limits of waste disposal for various radio nuclides used in nuclear medicine. International symbols of radioactivity labels.

3.Tracer methods :

Behavior of radioactive tracers in biological process - characteristics of radio pharmaceuticals - Half life, Physical, Biological and effective half life. Dispensing of radio pharmaceuticals - Specific activity, Tracer dose preparation - Tracer dose administration etc.

4. Radiation Biology and safety:

Interaction of radiation with cell, direct and indirect interactions, mechanism of radiation damage in living cells, tissue/organ damage, pre-natal effects, radiation modifying factors.

5. Radiation Quantities and Units :

Activity(Becquerel/Curie), energy, exposure (C/kg/Roentgen), LET, charged particle equilibrium (CPE), air kerma, absorbed dose (Gray/Rad), radiation weighting factors(WR), tissue weighting factors (WT) equivalent dose (Sievert/Rem), effective dose(Sievert/Rem), Collective Effective dose (Person Sv), Annual Limit of intake {ALT} (Becquerel), Derived Air Concentration {DAC} (Becquerel/m3).

Books for study :

Textbooks :

1. The handbook of Radio pharmaceutical -Mohan Patel & Samij Sadack, Chapman & Hall Medicals, London.
2. Technetium 99m radiopharmaceuticals. Preparation and quality control by Ilse Zolle, Springer.

Reference books :

3. Fundamentals of Nuclear Pharmacy-Gopal B. Saha, Springer-Verlag, New York.
4. Nuclear Medicine Technology & Techniques-Donald R. Bernier , Paul E. Christian & James K. Langan Mosby.
5. Radiobiology for the radiologist. Eric J Hall. J B Lippincott company.

PAPER - 14

Nuclear Medicine Techniques and Procedures - I :

I. Techniques :

This section will emphasize the students to learn the special and necessary care to be taken for a patient who will come to the nuclear medicine investigation or therapy. After initial interaction he will learn the method to study the available records, drug history, previous investigations and treatment related details for executing the test with optimal preparation. He will also learn some of the tests performed for assay of hormones.

1. Ordering nuclear medicine procedure-

Checking relevant patient data in the request, scheduling the procedures by giving appointments, study based proper instructions, pre test preparation for the procedures to the out patients as well as the in patients through the written appointments.

2. Preparation of the patients before the procedure :

Identification of patient by checking data (Name, age, gender, unique hospital ID No, name of referring physician, Referring unit etc before take the patients for the nuclear medicine procedure. Precautions to avoid confusion in patient selection, misadministration etc.

3. Check the patients about their previous medications :

Related drug history, especially for thyroid studies, renal studies for patients with RAS problem. Patients (female) should be checked for early pregnancies before starting any radioactive procedure. Patients also should be checked for the sensitivity for any particular medicine or dye or any contra indication for the particular study. e.g. Pulmonary hypertension is contra indication for Lung perfusion studies.

4. Care of Patients :

During the Nuclear Medicine Procedure: regarding the care to be taken while Transferring the patients from the wheel chair or stretcher to the treatment couch especially the bone scan patients with spine metastasis and lung scan patients connected with oxygen cylinders, Post renal Tx patients with IV line and drain tubes. etc neuro patients under coma stage or with epileptic convulsions or children care regarding using the immobilizing devices etc. Build confidence to take all necessary steps before starting the NM procedures.

II. Procedures :

This section is intended to educate the students about the physiology of different system in human body in brief and also about the different pathological conditions occur in various systems and their indications for the need of Nuclear Medicine Procedures in an elaborate manner to the best of the ability.

1. Diagnostic – In vitro techniques:

Principles of Radio immunoassays (RIA) standard curve, data analysis, Quality Control (QC) and applications, Methods of receptor assays, hormones, drugs. IRMA Immuno-radiometric assay, ELISA, RIA, estimation, T3, T4, TSH, thyroid antibodies, and current applications using similar techniques.

2. In vivo techniques:

Non imaging procedures. General Principles and procedures of non-imaging techniques, Tracer dose, uptake studies, compartmental analysis in radio nuclide studies, volume dilution studies.

3. Urinary tract:

Anatomy and physiology, common pathological conditions affecting kidneys in pediatric and adults, Radio pharmaceutical, dosages, route of administration, patient preparation, data acquisition, processing, quantitative parameters GFR, ERPF, split function, T max, T half, types of renogram curves, pharmacological interventions. Native kidney Renogram study, Evaluation of Reno vascular hypertension, Transplant kidney scintigraphy. Radionuclide cystography, Radio pharmaceutical & imaging techniques. Scrotal scintigraphy: Radio pharmaceutical, dosimetry, methodology. Renal cortical imaging, procedure, RP doses, imaging protocol, common views, utility of pin hole and SPECT images.

4. Heptobiliary scintigraphy:

Anatomy and pathology. Radio pharmaceutical, patient preparation, dosimetry, dynamic flow, static imaging procedures, applications. Hepatic artery perfusion scintigraphy.

5. Liver, spleen scintigraphy:

Pathology, basis of scintigraphic localization – Patient dosage, Procedures, Patient preparation, applications. 99mTc Heat damaged - RBCs - basics of Tagging procedure dose administration - Imaging procedure.

Books for study :

1. Nuclear Medicine Technology & Techniques, -Donald R. Bernier, Paul E. Christian & James K. Langan Mosby
2. Care of the patient in diagnostic radiology, Chesney & Chesney Blackwell
3. Notes on radiological emergencies Ansell, Churchill
4. A guide to Oncological nursing Deeley Livingstone

5. First aid (Hamlyn) Haugher & Gardner, Hamlyn
6. Care of the injured, Ring Livingstone
7. Practical Nursing and first aid -Ross & Wilson, Livingstone
8. Hand book of Nuclear Medicine – Frederick L Datz and
9. Essentials of Nuclear Medicine Imaging – Fred A Mettler , Milton J Guiberteau.

IV Semester

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Nuclear Medicine physics and instrumentation *- II :*

Unit 01 :

1. Interaction of Radiation with Matter

Interaction of charged particulars with matter, interaction of neutrons with matter, range of charged particles, interaction of photons with matter (photoelectric, Compton and pair production), absorption and attenuation of photons, Half Value Thickness (HVT) and Tenth Value Thickness (TVT).

2. Operational Limits

Introduction to natural background radiation, concept of occupational risk, philosophy of radiation protection, system of dose limitation, ALARA, dose limits to radiation workers and general public, AERB/CRP/ national regulatory guidelines, dose constraints for comforters of patients.

Unit 02 :

1. Basics of radiation detectors:

Construction and Principles of Operation – Ionization Chamber, Isotope calibrator – Proportional Counter – Geiger muller counter – Voltage calibration of a Geiger Mueller tube, optimum operating condition – Dead time correction – Uses of Gas – filled detectors – Semiconductor detectors.

2. Scintillation detector: Thallium activated Sodium Iodide crystal – Photo multiplier tube, electron multiplication, high voltage supply, Shielding, collimators, field of view. Well counter, construction, design of shielding. Signal output, Pre amplifier: reasons for use of Voltage amplifier, liquid scintillation detector.

Unit 03 :

Tools and techniques for demonstration and processing of Gamma rays signals:

1. Spectrometer:

Basic principles of Pulse – height analyzer single channel and Multi – channel analyzers. Optimum operating conditions, window settings – Determination of gamma energy spectrum, Integral and differential counting. Spectra of commonly used radio nuclides e.g I131, Tc99, Cr51, Cs137. Radiation measurements.

2. Gamma camera:

Camera head construction and principle of operation, Collimators: parallel hole, high resolution, high sensitivity, pin hole, diverging & converging hole, slant hole. Scintillation crystal, optical coupling, Photo multiplier tubes, per amplifiers. Pulse height analyzer, Timer, Data Processor and their function. Application of Cathode ray tube, persistence scope. Resolving time

characteristics, Gamma camera Uniformity and intrinsic resolution, Sensitivity, Total – system resolution, Spatial volume resolution saturation.

Unit 04 :

Radiation detection and working principle of Nuclear medicine equipments:

Principal of radiation detection, gas detector (ionizing chamber, proportional counter and GM counter), solid state detector (scintillator, semiconductor and Thermoluminescent Dosimeter {TLD}), liquid scintillation counting systems, radiation monitoring instruments, personnel monitoring, area monitoring, environmental monitoring, direct reading devices, calibration and response of radiation monitoring instruments. Working principle of isotope calibrators, Planar Gamma Camera, SPECT gamma camera.

Books for study :

1. Physics of Nuclear Medicine, - James A. Sorenson & Michael
2. Nuclear Medicine and PET CT, technology and techniques. By Paul E Christian and Kristen M. Waterstram, publisher (Mosby Elsevier)

Reference books :

1. Nuclear Radiation Detection – William J. Price, McGraw – Hill Book Company.
2. Principles of Nuclear Medicine – Henry N. Wagner, W.B. Saunders company, London.
3. Principles and practice of Nuclear Medicine, Paul J. Early, D. Bruce Sodes. C.V. Mosby company Princeton.
4. Instrumentation in Nuclear Medicine – Gerald J. Hine.
5. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.

Practicals :

1. Loading and development of x ray film.
2. Preparation of paper hard copy of a Nuclear procedure.
3. Preparation of CD of given image in JPEG format and DICOM format.
4. Handling of a radiation survey meter.
5. Identification of a dosimeter, specific applications, radiation/clinical importance and safe handling in Nuclear medicine.
6. Identification of a shielding device, specific application radiation/clinical importance and safe handling in nuclear medicine.
7. Identification of a non shielding protective device, specific application, radiation/clinical importance and safe handling in nuclear medicine.
8. Plateau of G M counter.
9. Dead time and resolving time of G M counter.
10. Radiation exposure: effect of time, distance and shielding.
11. Radiation survey of nuclear medicine lab.

PAPER – 16

Radiopharmacy, Radiation Biology and Radiation Safety-II :

1. Isotope generators:

Production of radio nuclides by artificial methods (b) Accelerator produced radio nuclide (c) Nuclear reactor produced radio nuclides, construction and Principles of generator systems - Ion Exchange system - Solvent extraction system - Parent - daughter relationship-growth of daughter product equilibrium with parent elements etc. Chemistry of Tc99m, Mo99-Tc99m generators Mo99 contamination check, Aluminum break through test etc (f) sterilization.

2. Radiopharmaceuticals:

Principles of cold kits & lyophilisation, importance of lyophilisation in preparation of cold kits. Common pharmaceutical cold kits, contents, pharmacological properties, physiological principle in use of a particular cold kit, pediatric and adult doses, route of injection, route of excretion, radiation exposure, critical organ for DTPA, GHA, DMSA, MDP, macro aggregated albumin, sulphur colloid, MIBI, Tetrofosmin, Mebrofenin, etc. (c) Labeling procedure of cold kits with required radio isotopes, Quality control tests: RC purity, RN purity, sterility check, Chromatography (Various methods) pyrogen test, bio distribution studies.

3. Radiation Biology and safety :

Chromosomal aberration, deterministic and stochastic effects, partial body and whole body exposures. Acute radiation syndrome. Radiation sensitizers. Radiation Protectors.

4. Radiation Hazard Evaluation and Control:

Internal and external radiation hazards and their perspective, evaluation and control of hazard due to external radiation, individual and workplace monitoring – time, distance and shielding, specific gamma ray constant, external radiation monitoring, survey meters, internal hazard evaluation and control, protective measures for handling unsealed sources(eg. fume-hood, glove box), air contamination monitoring, personnel contamination monitoring and decontamination procedures, surface decontamination procedures.

5. Radiation Accidents, Case Studies and Lessons Learned: Radiation accidents involving radioisotopes, orphan and vulnerable sources, handling of emergency situations resulting from spillage of radiopharmaceuticals / liquid radioisotopes, misadministration of radiopharmaceuticals and its consequences, general methods of prevention of accidents, loss of radioisotope, fire accidents and explosions; follow up actions through emergency response plans, case studies and mitigation, lessons learned.

Books for study :

Textbooks :

1. The handbook of Radio pharmaceutical -Mohan Patel & Samij Sadack, Chapman & Hall Medicals, London.
2. Technetium 99m radiopharmaceuticals. Preparation and quality control by Ilse Zolle, Springer.

Referencebooks :

3. Fundamentals of Nuclear Pharmacy-Gopal B. Saha, Springer-Verlag, New York.
4. Nuclear Medicine Technology & Techniques-Donald R. Bernier , Paul E. Christian & James K. Langan Mosby.

Practicals :

1. Elution techniques of generator (solvent extraction / column generator).
2. Determination of 99Mo breakthrough in a fresh eluted specimen of 99mTc -pertechnetate.
3. Determination of Half life of given radio isotopes.
4. Daughter and parent relationship of radioactive decay and radionuclide.
5. Gamma ray spectrometry calibration, spectrum, energy resolution, linearity.
6. Identification of unknown radionuclide and check the activity.
7. Preparation of different radio pharmaceuticals for Gamma camera Imaging.
8. Dispensing of low dose from bulk supply, radiation safety precautions.

PAPER - 17

Nuclear Medicine Techniques and procedures – II :

I. Techniques :

This section will emphasize the students to learn the special care of patient referred for nuclear cardiology test. Apart from this he will learn how to perform a scintigraphic test in a patient reported with intervention in the form of a catheter or drainage tube, without disturbing the same. Learn preparation of a renal transplant patients and thrombo embolic disorder patients.

1. Nuclear cardiology techniques and patient care:

In NM department, arrangement and operational use of TMT machine, ECG monitors, Defibrillator, emergency drugs, infusion pump etc. Preparation of patient, for cardiac study, flushing of IV lines, proper heparinization of I V canulae, quality check methods of I V fluids, safe techniques to prepare I V lines and fluids.

2. Preparation of the radioactive tracer for the study-

Selecting the appropriate tracer for the particular study should be assayed before use and to be properly labeled and to be kept within the lead shielded container. Usage of the gloves and over coats during the dispensing of the radio active tracer. Proper tray should be used during the transporting the tracer from the hot room to the injection room. And should be administered carefully and properly in the vein or required spot without causing any extra vasation and the management of the local hemorrhage and swelling.

3. Care of seriously ill patients:

In this student will understand the structure and function of inserted tube of clinical importance and perform the nuclear scintigraphy without disturbing it. Urinary catheters, surgical dressing, chest tube, PCN tube etc. and also learn to insert feeding tube and urinary catheter. Learn handling of patients referred with Cardiac monitors, central venous pressure line, with oxygen and other life support equipment. Assist in management of seizure patients, vaso vagal attack patient and cardiac arrest patients.

4.Speciman collection

in a safe manner and properly label them and store in a proper place for counting or sampling - safety precautions to be followed during the sampling of radio active specimen and precautions to be followed while disposing the same. Care regarding the disposal of contaminated swabs syringes and needles etc.

II. Procedures :

1. Endocrine system:

Thyroid: anatomy, physiology and different pathology. Radionuclide imaging of thyroid gland, patient preparation, drug interaction, radio pharmaceuticals, doses, precautions, indications and contraindications. Image acquisition, image processing, uptake studies procedure, interventions in thyroid imaging.

Imaging of thyroid cancer patients, patient preparation, important instructions, radio tracer administration, imaging protocols, data acquisition and processing, hard copy preparation. Parathyroid scintigraphy, adrenal cortical scintigraphy, principle, patient preparation, imaging protocol, imaging technique, data acquisition and processing.

2. Skeletal system:

Bone: Pathology of bone diseases, indications for scintigraphy -patient preparation-Radio active tracer doses and their administrations, Imaging techniques- whole body sweep, spot views, iso-count and iso-time studies, three phase & four phase bone scans - care to be taken while handling patients with bone fractures-applications. Bone marrow scintigraphy: Radio pharmaceutical used, technique Measurement of bone mineral density, technique & applications.

3. Respiratory system:

Pathology of respiratory diseases-Indication for scintigraphy.-Perfusion studies - Patients preparation - radio pharmaceuticals and dose administration-precautions to be followed and drugs to be kept for any anaphylactic reactions- contraindication for the procedure. Ventilation studies --Radio pharmaceuticals - Aerosols - inhalation procedures - Imaging procedures - precautions to be followed during inhalation of Aerosols.

4. Gastrointestinal tract:

Anatomy and pathology, Esophageal transit study- Radio pharmaceutical dosimetry, technique & analysis. Gastro esophageal reflux- Radio pharmaceutical dosimetry, technique & analysis. Gastric emptying- radio pharmaceutical dosimetry, technique & analysis. Gastrointestinal bleed scintigraphy: Radio pharmaceutical, dosimetry, methodology including RBC tagging procedures, Meckels' scintigraphy- Radio pharmaceutical, patient preparation. Pancreatic imaging: Radio pharmaceutical, dosimetry, methodology

5.Liver, spleen scintigraphy:

Pathology, basis of scintigraphic localization - Patient-Dosage- Procedures-Patient. Preparation, applications. 99mTc Heat damaged - RBCs - basics of - Tagging procedure dose administration - Imaging procedure.

Books for study :

1. Nuclear Medicine Technology & Techniques, -Donald R. Bernier, Paul E. Christian & James K. Langan Mosby
2. Care of the patient in diagnostic radiology, Chesney & Chesney Blackwell
3. Notes on radiological emergencies Ansell, Churchill
4. A guide to Oncological nursing Deeley Livingstone
5. First aid (Hamlyn) Haugher & Gardner, Hamlyn
6. Care of the injured, Ring Livingstone
7. Practical Nursing and first aid -Ross & Wilson, Livingstone
8. Hand book of Nuclear Medicine – Frederick L Datz and
9. Essentials of Nuclear Medicine Imaging – Fred A Mettler , Milton J Guiberteau.

Practicals :

1. Image acquisition and processing for a given dynamic /static study.
2. Gamma camera Patient positioning, Image acquisition and display (planar/ dynamic/whole body study) for a given patient.
3. Preparation, positioning, image acquisition and processing for MUGA scan.
4. Patient preparation, pharmaceutical administration, vital monitoring, precautions, image acquisition in a hypertens.

V Semester
PAPER - 18

Nuclear Medicine Physics And Instrumentation – III :

I. Mathematical application and counting statistics:

Basic mathematics covering integration, disintegration, vector, function, radioactivity calculations, use of various types of graphs to display or represent the radioactivity calculations (linear, semi log, logit-log, Log-Log etc).

Types of measurement error, Precision and Accuracy, Nuclear counting statistics, Mean, Mode, Median, Poison, Normal (Gaussian) distribution, Standard deviation, coefficient of variation, Probable error, confidence limits, Percent standard deviation, Statistical tests. – Chi – square test, Figure of Merit test, students " t" test.

II. Radiation dosimetry

Compartmental Model – single compartment model, two compartment model with and without back transference; in-vivo dosimetry using classical dosimetry mechanism, beta dosimetry, gamma dosimetry, geometrical factor, dosimetry of low energy electromagnetic radiation, MIRD formulation – cumulated activity, equilibrium absorbed dose constant, absorption factor, specific absorbed fraction and the dose reciprocity thereon, mean dose per cumulated activity, limitation of MIRD method; extremity dosimetry.

III. Quality assurance of Nuclear Medicine equipments & general maintenance of the department:

New equipment purchase and installation: Technical specification and selection process of equipment, site preparation and installation**,** Acceptance test during installation.

Routine daily checks for prevention of physical damage and malfunctioning of equipment by performing - checking of power line - Air conditioning efficiency - dust free atmosphere. Equipment Log book. Approach to resolve a detected technical / functional problem in system– Making the availability of service as and when required, procurement of comprehensive annual maintenance contract and preventive periodical maintenance. – importance of routine and periodical quality control study of different equipment.

Gamma Camera QC tests: concept, types of tests, recommendations, with reference to

Flood checks, linearity-uniformity, dead time, resolution. QC of dose calibrator at installation, routine and after major repair. Routine departmental survey for to document the level of radiation in restricted and un restricted areas. Periodic calibration schedule of important equipment.

Books for study :

Textbooks :

1. Quality Control of Nuclear Medicine Instruments, International Atomic Energy Agency
2. Physics of Nuclear Medicine, - James A. Sorenson & Michael
3. Nuclear Medicine and PET CT, technology and techniques. By Paul E Christian and Kristen M. Waterstram, publisher (Mosby Elsevier)

Referencebooks :

1. Principles and practice of Nuclear Medicine, Paul J. Early, D. Bruce Sodes. C.V. Mosby company Princeton.
2. Instrumentation in Nuclear Medicine – Gerald J. Hine.
3. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.
4. Quality Control of Gamma Cameras and Associated Computer Systems, The Institute of Physical Sciences in Medicine
5. Quality Control of Nuclear Medicine Instrumentation, The Institute of Physical Sciences in Medicine.
4. "Quality Control in diagnostic imaging"-J.E. GRAY, University Park Press.
5. "Processing and Quality Control "William, E.J. Mckinney.J.B. Lippincott Company.
6. "Concepts in Medical Radiographic imaging"Marianne Tortoice,W.B. Saunders Company.
7. "Quality assurance Management"G.E. Hayes Charger production.
8. Diagnostic Imaging: Quality Assurance M.M. Rehani, Jaypee Bros Medical Publishers.
9. IAEA TECDOC.
10. NEMA standards.

PAPER - 19

Radiopharmacy, Radiation Biology and Radiation Safety –III :

I. Radiopharmacy:

Basic concept of good manufacturing practice (GMP). Preparation of common radiopharmaceuticals (RP) used in Nuclear medicine department to perform thyroid, bone scan, renal, hepato-biliary tract, lymphoscintigraphy etc. Performance of routine tests to assess the quality of radiopharmaceutical prepared for radionuclide scintigraphy. Basic concept for physiological and biological localization of a radio pharmaceuticals in a organ system.

II. Radiation Biology:

Effect of radiation on Biological system, induction of Radiation injury, effect of dose fractionation on tissue repair, somatic and hereditary effects of radiation, effects of radiation on embryo, normal and abnormal human exposure to radiation, maximum permissible levels, Choice of Radiopharmaceutical for the clinical situation and the equipments.

III. Radiation Safety:

1. Radionuclide Therapy-Radiation Safety Aspects

Radionuclide administration techniques, pre-and post-therapy precautions, nursing care, patient monitoring and discharge criteria, optimization of radiation dose to non-target tissues, radiation safety consideration in treatment of Ca-thyroid, palliative bone metastases, and other therapeutic procedures such as radiation synovectomy, peptide therapy.

2. Emergency Response Plans and Preparedness

Normal and potential exposures, accident situations involving radioisotopes, elements of emergency planning and preparedness including procedures for notification and communication, emergency response accessories, responsibilities of employer, licensee, RSO, technologist and radioisotope / equipment supplier.

3. Disposal of Radioactive Waste

Origin and types of waste, classification of wastes and methods of disposal, disposal of short- lived solid, liquid and gaseous radioactive waste, disposal of animal carcasses and radioactive foliage, disposal limits for ground burial and sanitary sewage system, incineration, disposal of long-lived and in dispersible radioactive wastes.

Books for study :

Textbooks :

1. The handbook of Radio pharmaceutical -Mohan Patel & Samij Sadack, Chapman & Hall Medicals, London.
2. Technetium 99m radiopharmaceuticals. Preparation and quality control by Ilse Zolle, Springer.

Referencebooks :

3. Fundamentals of Nuclear Pharmacy-Gopal B. Saha, Springer-Verlag, New York.
4. Nuclear Medicine Technology & Techniques-Donald R. Bernier , Paul E. Christian & James K. Langan Mosby.

PAPER – 20

Nuclear Medicine Techniques and Procedures - III :

1. Central nervous system:

Brain: Anatomy and brief physiology, different pathology and indications for scintigraphy. Conventional brain scintigraphy- radio pharmaceuticals, dose & dosimetry, patients preparation, precaution to be taken with post operative patients, epileptic patients, brain secondaries. Cerebral perfusion imaging: radio pharmaceuticals, dose & dosimetry, patients preparation, Cisternography, indication, :radiopharmaceuticals dose & dosimetry, methodology. Scintigraphy for CSF leak.

2. Cardio vascular system:

Anatomy and pathological conditions, Indications for studies. Cardiac cycle, ECG, Terminology of cardiac cycle - diastole - systole - diastolic volume - stroke volume cardiac output, Ejection Fraction - Pulmonary Transit time, Hypokinesia - akinesia - diskinesia etc. Dynamic study-first pass study: Purpose - radio nuclide - dosage - Bolus Injection - computer settings - Image acquisition - processing etc.

Multi Gated Blood Pool Acquisition (MUGA) scan, patient preparation, In vitro and in vivo RBC labeling with radionuclide, indication, administration dosage, Imaging procedures, Processing - E.F. calculation - Global and Regional stroke volume - Histogram phase angle etc.

Myocardial perfusion scintigraphy, patient preparation, drug interaction, important instructions, selection of mode of stress, physical, pharmacological, preparation of patient for physical stress with tread mill machine, preparation of patient for pharmacological stress e.g. Dobutamine and Adenosine infusion, important precautions, emergency medicines, function and handling of

defibrillator. Scintigraphic protocols for myocardial perfusion scintigraphy, protocols for assessment of myocardium viability, with respect to SPECT and PET tracers.

Processing of myocardial scintigraphy, preparation of images and CD recording.

3. **Haematological studies**: Hematological disorders total blood volume. Estimation of RBC volume, Blood volume - using 51Cr, 99mTc - Red cell survival study.
4. **Special procedures**: Dacryascintigraphy, Lymphoscintigraphy: Radio pharmaceuticals, dosimetry, imaging techniques. Venography: Radio pharmaceuticals, imaging techniques. Protein loss studies: Radio pharmaceuticals, dosimetry, imaging techniques, precautions prior to imaging. Salivary gland imaging: Radio nuclide - dosage - Imaging procedures. Vitamin B12 absorption study: Folic acids study etc. Schilling test.

Books for study :

1. Nuclear Medicine Technology & Techniques, -Donald R. Bernier, Paul E. Christian & James K. Langan Mosby
2. Care of the patient in diagnostic radiology, Chesney & Chesney Blackwell
3. Notes on radiological emergencies Ansell, Churchill
4. A guide to Oncological nursing Deeley Livingstone
5. First aid (Hamlyn) Haugher & Gardner, Hamlyn
6. Care of the injured, Ring Livingstone
7. Practical Nursing and first aid -Ross & Wilson, Livingstone
8. Hand book of Nuclear Medicine – Frederick L Datz and
9. Essentials of Nuclear Medicine Imaging – Fred A Mettler , Milton J Guiberteau.

VI Semester

PAPER - 21

Nuclear Medicine Physics And Instrumentation – IV :

Unit 01 :

Computerized Tomography:

Basic principle of Computed Tomography, Generations of CT scanners. X-ray tube, performance of x ray tube, Filters, Collimators, CT detectors, Data Acquisition System (DAS), CT Image Quality, CT Dose Vs image quality. Image Formation in CT, Image Reconstruction, Hounsfield Unit, Windowing, image display, CT artifacts. Helical CT scan: Slip ring technology, Advantages, Multi Detector CT, Cone-beam geometry, Reconstruction of helical CT images, CT Fluoroscopy, HRCT, Post Processing Techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR. Contrast material, contrast reaction, contrast material doses and route of administration. Whole body CT acquisition.

Unit 02 :

Basic principle of SPECT, SPECT data acquisition techniques, SPECT reconstruction techniques, SPECT filters. QC of SPECT gamma camera. Artifacts in SPECT image, SPECT image correction techniques with reference to attenuation correction using software, radionuclide techniques and CT volume data. Historical developments in PET technology, basic principle of PET imaging, concept of PET CT hybrid imaging, construction of PET scanner, crystals and PMT in PET CT scanner, co-incidence circuit, PET CT attenuation correction technique. PET CT image reconstruction techniques, daily QC of PET CT scanner. Concept of MRI, types of MR sequences, concept of PET MRI fusion imaging. Patient safety precaution required in PET MR imaging.

Miscellaneous equipments:

Nuclear Medicine probes, thyroid probe, sentinel lymph node probe, H pylori probe, construction and principle of operation.

Utility of Modern technology for maintain digital images and patient management with reference to DICOM image format, PACS, LAN, telemedicine.

Record keeping:

Test procedure – maintenance-provisional appointment – Registration of the patients in the department, Register with proper ID number – Isotope Radio pharmaceuticals administration – dosage – Date – Time – mode of Administration etc. Details of Test done – storing of results – Hard copies like Films, Report forms etc. - Dispatch of the results to the respective departments – maintaining the records – maintaining original report copy in the department safely etc.

Equipment maintenance:

Calibration of radiation protection equipment - Date of installation – Defects raised service done on date and time – done by whom – service record. Periodical quality control study on equipment and their record keeping – Preventive maintenance service on periodical interval either by the engineers in the institution or engineers from the company. Stocking of important spares and PC boards for the rectification of the defects during the time of repair.

Books for study :

Textbooks :

1. Quality Control of Nuclear Medicine Instruments, International Atomic Energy Agency
2. Physics of Nuclear Medicine, - James A. Sorenson & Michael
3. Nuclear Medicine and PET CT, technology and techniques. By Paul E Christian and Kristen M. Waterstram, publisher (Mosby Elsevier)

Reference books :

1. Principles and practice of Nuclear Medicine, Paul J. Early, D. Bruce Sodes. C.V. Mosby Company Princeton.
2. Instrumentation in Nuclear Medicine – Gerald J. Hine.
3. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.
4. Quality Control of Gamma Cameras and Associated Computer Systems, The Institute of Physical Sciences in Medicine
5. Quality Control of Nuclear Medicine Instrumentation, The Institute of Physical Sciences in Medicine.
4. Quality Control in diagnostic imaging - J.E. GRAY, University Park Press.
5. Processing and Quality Control William, E.J. Mckinney. J.B. Lippincott Company.
6. Concepts in Medical Radiographic imaging Marianne Tortoice,W.B. Saunders Company.
7. Quality assurance Management G.E. Hayes Charger production.
8. Diagnostic Imaging: Quality Assurance M.M. Rehani, Jaypee Bros Medical Publishers.
9. IAEA TECDOC.
10. NEMA standards.

Practicals :

1. QC of dose calibrator.
2. Daily QC of Gamma Camera.
3. QC of SPECT scanner
4. Daily QC of PET CT scanner.
5. Contamination level and methods of decontamination in nuclear medicine laboratory.
6. Segregation & Disposal methods of solid and Liquid Radioactive wastes.

PAPER - 22

Radiopharmacy, Radiation Biology and Radiation Safety – IV :

I. Radiopharmacy:

Procedure of cell labeling and safety precaution in nuclear medicine with respect to biohazard while radionuclide ventriculography, GI bleed scintigraphy and infection imaging.

Procedure of ventilation and perfusion scintigraphy for detection of pulmonary embolism and safety precautions. Preparation of SPECT scan RP and labeling efficiency check for bone, brain and cardiac study.Procedure and safety precaution to perform elution from a generator system.

Preparation of F18 FDG and F18 Sodium fluoride patient doses for PET CT scan.
Nuclear reactor and Cyclotron produced radio nuclides.
Generators based PET tracers.
Procedure and precautions for a therapeutic radionuclide in nuclear medicine with reference to Iodine 131, Samarium-153 and other radionuclides.

II. Radiation Biology and Radiation Safety:

Acute radiation syndrome, methods of renal protection, methods of thyroid protection from radiation, Radiation protectors, radiation sensitizers. Radiation-hormesis theory.

1. Planning of Nuclear Medicine (NM) Laboratories

Classification and general features of NM Laboratories (site, typical floor plans, ventilation, surface, walls, floor and ceiling, work surfaces, containment systems, fume-hood, glove box etc.), planning of NM laboratories, such as diagnostic and high dose therapy, PET-CT and medical cyclotron installation, shielding evaluation of NM laboratories and medical cyclotron, model layouts of various NM laboratories.

2. Transport of Radioactive Material

Rules governing transport of radioactive material, types of packages, A1 and A2 values, category of packages, excepted limit, special form and other than special form, TREMCARD, procedure of packing, marking, labeling, transport documents, responsibilities of consignor and consignee, consignor's declaration, instruction to the carrier, transport of surface contaminated objects, off-normal situations during transport of radioactive material, handling of off-normal situations, emergency planning.

3. Regulatory Aspects for Nuclear Medicine Laboratories

Regulations with respect to nuclear medicine laboratories, relevant regulatory documents such as Act, Rules, Code, Standards and Guides, responsibilities of employer, licensee, Radiation Safety Officer (RSO), technologist and radioisotope supplier, safety and security of

radioactive sources, regulatory requirements for import/export, procurement, use, handling, transfer and disposal of radioisotopes, inventory control, Radiation Protection Program (RPP).

Books for study :

Text books:

1. The handbook of Radio pharmaceutical -Mohan Patel & Samij Sadack, Chapman & Hall Medicals, London.
2. Technetium 99m radiopharmaceuticals. Preparation and quality control by Ilse Zolle, Springer.

Reference books :

3. Fundamentals of Nuclear Pharmacy-Gopal B. Saha, Springer-Verlag, New York.
4. Nuclear Medicine Technology & Techniques-Donald R. Bernier , Paul E. Christian & James K. Langan Mosby.
5. Radiation Protection in Hospitals. Richard F.Mould

Practicals :

1. QC of generator elute in nuclear medicine hot lab.
2. Radio labeling and QC of RP for SPECT Imaging using paper chromatography.
3. Safe handling and preparation of pharmaceutical stress dose for a given nuclear cardiology test, method of infusion, dose calculation, pre and post test precautions.
4. Segregation & Disposal methods of solid and Liquid radioactive wastes.

PAPER - 23

Nuclear Medicine Techniques and Procedures - IV :

1.Infection and inflammation imaging:

Radio pharmaceuticals, dosimetry, data acquisition protocols, comparison of image, information obtained from different radio pharmaceuticals, leukocyte labeled studies- leukocyte labeling procedures, imaging techniques and applications, advantage and limitations.

2. Tumor imaging:

Gamma camera and SPECT imaging, common radio-pharmaceuticals, dosimetry, patient preparation, imaging protocols and techniques, applications. PET CT imaging, radio pharmaceuticals, dosimetry, patient preparation, imaging protocols and techniques, CT contrast protocols and techniques in PET CT.

3.Therapeutic application of radio nuclides:

General precaution regarding contamination and radiation dosage. Radio iodine therapy for Thyrotoxicosis: Dosage Administration - Precaution to be followed.

4. Radio iodine therapy for Thyroid malignancy:

Dosage. Administration - Precaution and care of patient during administration. mIBG I13l - Indications - Dosage - Administration - Precaution to be taken during administration. Post therapy in patient care, concept of barrier nursing, regular radiation survey procedure, and permissible limits for patient discharge from isolation ward. Contamination, decontamination, tools and techniques for decontamination.

5. **Palliative treatment for bone metastasis :**

common radio isotope and radio pharmaceuticals used for bone pain palliation, pre therapy investigations, medicine order, understanding of schedules from BRIT, external agency, dosage - Administration - Precaution to be followed during administration. Instructions for patient after therapy. Basic concept of Radio-immunotherapy and receptor therapy.

Books for study :

1. Nuclear Medicine Technology & Techniques, -Donald R. Bernier, Paul E. Christian & James K. Langan Mosby
2. Care of the patient in diagnostic radiology, Chesney & Chesney Blackwell
3. Notes on radiological emergencies Ansell, Churchill
4. A guide to Oncological nursing Deeley Livingstone
5. First aid (Hamlyn) Haugher & Gardner, Hamlyn
6. Care of the injured, Ring Livingstone
7. Practical Nursing and first aid -Ross & Wilson, Livingstone
8. Hand book of Nuclear Medicine – Frederick L Datz and
9. Essentials of Nuclear Medicine Imaging – Fred A Mettler , Milton J Guiberteau.

Practicals :

1. Patient preparation, positioning, image acquisition and processing for a SPECT study.
2. Patient preparation, TMT stress/ pharmaceutical stress procedure for cardiac patient, Pre and post test precautions.
3. Patient preparation, table positioning, image acquisition and display of PET CT scan in a Oncology patient.
4. Patient preparation, positioning, image acquisition processing and display of SPECT scan in neurology patient.
5. Patient preparation, positioning, image acquisition, processing and display of bone scan planar and SPECT in a cancer patient.
6. Low dose radio iodine therapy, patient preparation, dose dispensing and safety precautions.
7. Preparation and execution of a radionuclide therapy dose in a cancer patient, pre administration precautions, post administration precautions.

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

8. B.Sc NEUROPHYSIOLOGY TECHNOLOGY (NPT)

(Semester pattern)

w.e.f 2015-16 Batch

TEACHING HOURS & EXAMINATION PATTERN

III Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Basic Neurosciences-I	**80**	**120**	IE	80	20	50%
13	Instrumentation & their Circuits-I	80	120	IE	80	20	50%
14	Clinical Neurology-I	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester:

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+ Practical)
15	Basic Neurosciences-II	80	120	UE	80	40%	20	40%	50%	50	50%
16	Instrumentation & their Circuits-II	80	120	UE	80	40%	20	40%	50%	50	50%
17	Clinical Neurology-II	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

**** Practical including Oral, Spotters, Records on Basic Recording of EEG, nerve conduction and evoked potential.***

V Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
18	EEG & Telemetry-I	80	120	IE	80	20	50%
19	Electroneuromyography-I	80	120	IE	80	20	50%
20	Management of Patients & Machine	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	Hours of		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)
21	EEG & Telemetry-II	80	120	UE	80	40%	20	40%	50%	50	50%
22	Electroneuromyography-II	80	120	UE	80	40%	20	40%	50%	50	50%
23	Evoked potential studies and others	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters, Record, Advanced Recording of EEG, nerve conduction and evoked potential.

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 - NEUROPHYSIOLOGY TECHNOLOGY

III Semester

PAPER – 12

Basic Neurosciences – I :

Basic Neuroanatomy and Neurophysiology as applied to various electrophysiological procedures.

1. Neuro Anatomy :

a) Gross anatomy of brain and various areas.
b) Cranial nerves – visual system, auditory system.
c) Automatic nervous system.
d) Spinal cord.
e) Formation of plexus.
f) Peripheral nerves.
g) Muscles.
h) Myoneural junction.

2. Sub Divisions of Nervous System :

a) Central
b) Peripheral
c) Autonomic

PAPER - 13

Instrumentation and their circuits – I :

I. Electronics – Biomedical Department :

1. Electrical Concepts :

Definition and units of Basic electrical quantities: Voltage, current, charge, power, resistance, capacitance, inductance, impedance, reactance, Ac and Dc, power factor, RMS, average and maximum value of Ac.

a) Circuit Elements : Resistors, capacitors, inductors - types symbol, colour code representation series and parallel combination and their equivalent. Transformer – types and construction detail.

b) Circuit Laws : Ohm's law, Kirchoff's voltage law, Kirchoff's current law, Wheat stone bridge.

c) Motors : Types and Uses.

2. Elements of Electronics :

a) Atomic structures, material classification according to their conduction, electronic emission.
b) Semi conductors – intrinsic, extrinsic, P type, N type, diodes, transistors, characteristics, schematic representation.
c) Application of diodes as a switch and rectifier, HWR, FWR, bridge rectifier.
d) Application of transistor as an amplifier.
e) Power supply unit.
f) Introduction to integrated circuit.
g) Introduction to operational amplifiers – adder, subtractor multiplier, sine wave generator, square wave generator triangular generator, Schmitt trigger.

3. Digital Circuits :

Binary number system, bits, bytes, octal, hexadecimal, addition, subtraction, 1"s comprement and 2"s complement.

a) **Gates :** Universal gates OR. AND. Not. EXOR. EXNOR. Truth table and booleam expression.
b) A-D converter.

PAPER – 14

Clinical Neurology – I :

Concepts of Disease and outlines of Clinical Evaluation related to Neural Science :

1. Epilepsies
2. CNS Infections.
   - Meningitis
   - Encephalitis
3. Stroke
4. Parkinsonism

IV Semester

PAPER – 15

Basic Neurosciences – II :

1. Brain :

a) Lobes, functions – Dissection Hall
b) Gyri, Sulci, Cortical areas – Demonstration
c) Association commissural areas.
d) Brain stem, cerebellum
e) Sensory and motor pathways
f) Pyramidal system
g) Upper and lower motor neuron
h) Spinal cord
i) Peripheral nervous system
   i. Cranial nerves – origin, distribution, pathways.
   ii. Spinal cord and spinal nerves.
   iii. Formation of plexus.
   iv. Muscles – Origin, insertion nerve supply and action.
j) Concept of myotomes and dermatomes

2. Neuro Physiology :

a) Membrane potentials and action potentials.
b) Synapse and synaptic transmission.
c) Excitation and inhibition.
d) Dendrites and dendritic physiology.
e) EEG generators.
f) Physiology of Nerve conduction and Muscle contraction.
g) Commissural pathways and association areas.
h) Physiology of Neuromuscular Junction transmission.
i) Motor and sensory tracts.
j) Sensory receptors.

3. Pulmonary Resuscitation.

PAPER - 16

Instrumentation and their circuits – II :

1. Electrical Safety and Medical Equipments :

Physiological effect of electrical current, shock hazards from electrical equipment, methods of accident prevention.

Classification of medical equipments according to the

a. Type of protection.
b. Mode of protection.

2. Bioelectricity :

Biological potentials, ECG, EEG, EMG sources of Bio-electric potential, cell testing potential, action potential and their propagation, electrodes and transducers.

3. Transducers :

Their principle, active and passive transducer, transducer used in biomedical applications.

4. Electro Encephalogram :

a) Block diagram, EEG amplifier – preamplifier, differential amplifier, basic concept, input impedance, common mode rejection ratio, pen amplifier, buffer amplifier, driving amplifier, isolation amplifier.
b) Electrodes, types, surface or sub-dermal, ground reference electrode metal clip on the ear lobe.
c) Filters – low frequency filters, high frequency filters, 60 Hz or notch filters, frequency response curves and time constant.
d) Sensitivity and calibration of EEG amplifiers, paper speed, pen mechanism, other recording devices – CRO, principles of averaging, analogus section, digital section S/N ratio.

5. Principles Of Averaging :

a) Introduction to computers – Application of computers – Concepts of Data and Information – A typical computer system – Memory concepts – History of computers – Types of computers.
b) Input-output devices – Data storage devices –Software – the identification – the role of software – Housekeeping.
c) The computer internals – Typical PC configuration – Booting – virus, anti virus – Data compression techniques – on software – versions of software.
d) Number systems – Binary Arithmetic – Standard codes for unit of information.
e) Operating system – Definition – Classification – Introduction to windows – Features of windows – Desktop and Desktop icons – Starting programs – Browsing and managing windows explorer – setting – Taskbars and creating shortcuts.

Introduction to MS –DOS and WINDOWS.
MS Office – MS Word, PowerPoint, Access & Excel.
Introduction to Internet, Intranet and E-mail.

6. Instrumentation :

a) Grounding.
b) Electrodes – Surface electrodes, needle electrodes, dechloriding, microelectrodes, electrode – materials, application, 10-20 system referential system electrode paste.
c) Instrumentation in relation to
   i. EEG
   ii. Electrocardiogram.

iii. ENMG
iv. EPs
v. Polysomnography.
vi. Dop scan
vii. Brain mapping

Should be trained in identifying any defects and rectify them.

7. Basic Records of EEG, nerve conduction, evoked potentials.

PAPER - 17

Clinical Neurology – II :

1. Alzheimer Disease
2. Cerebellar ataxia (Fredrich's ataxia)
3. Peripheral Neuropathies.
4. Muscle Disorders.
5. Neuromuscular Junction Disorders.
6. Demyelinating disorders.

V Semester

PAPER - 18

EEG & Telemetry – I :

Recording Technique :

1. Electrodes :
a) Types, materials and characteristics.
b) Modes of application.
c) Impedance.
d) Effects on E.E.G.
2. The 10-20 system.
3. Reference and Bipolar Technique
4. Reference contamination.
5. Fields.
6. Montage and localization.
a) Cancellation and summation
b) Phase reversal.

PAPER - 19

Electroneuromyography – I :

1. Nerve conduction studies – Median, Ulnar, Radial, CP, Tibial, Femoral Sural etc.
2. H-Reflex and F-Wave.
3. Repetitive stimulation.

PAPER - 20

Management of Patients and Machine :

1. Cerebral vascular diseases.
2. Space occupied lesion.
3. Toxic, metabolic and endocrine conditions.
4. Infections, disease.
5. Psychiatric disorder.
6. Pediatric condition.
7. Drug effects on E.E.G.
8. Disorders of sleep.
9. Electro cerebral silence.

VI Semester

PAPER - 21

EEG & Telemetry– II :

1. Normal EEG patterns ;
   - Awake / Resting : Normal / Abnormal.
   - Sleep : Normal / Abnormal.
   - Activation procedures.
2. Artifacts and correction.
3. Seizures – Classification.
   - Clinical pattern.
   - EEG pattern.
4. EEG in toxic, metabolic, endocrine
5. EEG in space occupying lesion.
6. EEG in pediatric conditions.
7. Disorders of sleep.
8. Drug effects on EEG.
9. Telemetry – Principles of recording uses in clinical setting.
10. Signal analysis.
11. Sphenoid EEG recording :
    - Assisting in inserting leads.
    - Techniques of recording.
12. Epilepsy surgery :
    - Prolonged telemetry EEG.
    - Recording ictal period and reporting pre/ictal/postal phases.
    - Intraoperative recording (Corticogram)
13. Polysomnography
14. Magneto-encephalography
15. Advanced records of EEG, nerve conduction and evoked potential

PAPER - 22

Electroneuromyography – II :

1. Long loop reflexes.
2. Sympathetic skin response.
3. Refractory period.
4. Electromyography – Insertion activity, Spontaneous activity, Fibrillations, Fasciculation, Positive sharp waves, Myotonia, Pseudomyotonic discharges, interference patterns, single fibre EMG, Quantitative EMG
5. R-R Response

PAPER - 23

Evoked potential studies :

1. Definition of short term, Event related potentials.
   - Principle of varying.
   - Signal to noise ratio.
   - Frequency response
   - Different types of EPs
2. VEP (Visual Evoked Potential).
3. BAER (Brainstem Auditory Evoked Response).
4. SSEP (Somato Sensory Evoked Potential).
   - Upper limb
   - Lower limp.
5. Blink reflex.
6. Trans canal magnetic stimulation.
7. Trans cranial Doppler evaluation

Reference Books :

1. UK. Misra, J. Kalita : Clinical Neurophysiology, 3rd edition, India Elseiver,2014
2. UK. Misra, J. Kalita : Clinical Electro Encephalography, India Elseiver,2005
3. John.S.Ebersole, Thimothy A. Pedley : Current Practice of clinical Electro Encephalopathy, 3rd Edition, Lippincots, Willian & Wilkins
4. Donald L. Schomer Fernando M.Lotes Dasilva : Electro Encephalography 6th Edition Lippincots, William & Wilkins
5. Aminoff : Electrodiagnosis in clinical Neurology.
6. Elsevier Health Bookshop
7. Kimura : Electrodiagnosis in disease of Nerve & Muscle
8. Shin J Oh : Clinical Electromyography & Nerve conduction

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

9. B.Sc RADIOGRAPHY & IMAGING TECHNOLOGY

(RIT)

(Semester pattern)

w.e.f 2015-16 Batch

TEACHING HOURS & EXAMINATION PATTERN

III Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical *	Min. for Pass
12	Radiological Physics & Dark Room Techniques	80	120	IE	80	20	50%
13	Radiological Equipments	80	120	IE	80	20	50%
14	Positioning in Radiography	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester :

Paper No.	Paper	Hours of		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+ Practical)
15	Radiographic Procedures	80	120	UE	80	40%	20	40%	50%	50	50%
16	Basic and Advanced Ultrasound Imaging & Physics	80	120	UE	80	40%	20	40%	50%	50	50%
17	Techniques In Ultrasonography	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

V Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical *	Min. for Pass
18	Basics & Advanced CT Imaging and Physics	80	120	IE	80	20	50%
19	Techniques in CT scan Imaging	80	120	IE	80	20	50%
20	Interventional Procedures and Angiography	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	Hours of		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)
21	Basic & Advanced MRI Imaging and Physics	80	120	UE	80	40%	20	40%	50%	50	50%
22	Techniques in MRI	80	120	UE	80	40%	20	40%	50%	50	50%
23	Care of Patients in Diagnostic Radiology	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

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 - RADIOGRAPHY & IMAGING TECHNOLOGY

III Semester

PAPER - 12

Radiological Physics & Dark Room Techniques :

I. X-rays - Generation, Properties and Interaction:

Electromagnetic radiation, spectrum and general properties: Wave and quanta concept, Processes of x-ray generation: General and characteristic radiation, X-ray spectrum, factors influencing the intensity of x-rays.

Basic interactions between diagnostic x-rays and matter: Coherent scattering, photo electric effect and Compton Effect – probability of occurrence and its applications in radiology. Biological effects of radiation. Attenuation: Linear and mass attenuation coefficients, Half Value Layer, Factors affecting attenuation, practical aspects of these phenomenon in Radiology, scatter radiation.

II. Radiation Protection & Measurements:

Radiation quantities and units, Radiation measuring instruments: Gas filled detectors: ionization chamber, proportional counter, Geiger-Muller counter, scintillation counter, solid state detector, Personal monitoring devices: Film, Thermo luminescent and Pocket dosimeters.

Aim of radiation protection, concept of As Low As Reasonably Achievable, International Commission on Radiation Protection (ICRP) and Atomic Energy Regulatory Board (AERB) recommendations, maximum permissible dose, Principles of protection in X-ray department for patient, personnel and public, Time-Distance-Shielding, protective devices, X-ray room design.

III. Radiographic photography:

X-ray films, Screen – film cassette, Characteristic curve, Radiographic Image Quality, Automatic Film Processor, Laser camera: Wet and Dry, Computed Radiography & Digital Radiography.

Construction of dark room, dry bench, wet bench, processing of film, developer, fixer, hangers, safelight

PAPER – 13

Radiological Equipments :

I. Electric Power & Transformers:

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.

II. X-Ray equipment & units :

Construction of diagnostic X-ray tube: Stationary and rotating anode type, Line – Focus principle, Heel effect, X-ray tube rating, Grid controlled and Metal - Ceramic X-ray tubes.
Mammography, Mobile X-ray unit, Dental x-ray unit, Dual Energy X-ray Absorptiometry.

III. X-ray generators:

Filament and High Voltage circuits, Single phase generators. Self, Half wave and Full wave rectified, Three 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.

IV. Accessories in Fluoroscopy :

X-ray beam restrictors, filters: Inherent, added, k-edge filters. Grids: Types, grid-ratio grid cut-off, moving grid. Air gap technique.

Basic principle, construction and working principle of image intensifier tube. Image characteristics, Image display and recording devices.

PAPER – 14

Positioning in Radiography :

Age, subject types and sex, anatomical landmarks-postural variations-erect and horizontal technique-respiratory movement and diaphragm level-regional densities-preparations-and immobilization of patient –pathological conditions-injuries, fractures and dislocations congenital, localized views-periodic examinations-use of dry bones-positioning terminology identification systems.

I. Positioning Radiography – I

Skeletal System

i) Upper Limb

Techniques for hand-fingers-thumb-wrist joint-forearm-elbow joint-humerus-shoulder joint and sterno-clavicular joint.

ii) Lower Limb

Techniques for foot-calcaneum-ankle joint-leg-knee joint-patella-and femur(lower two thirds)

iii) Pelvic Girdle

Techniques for pelvic-iliac fossa-ischium-and sacro iliac joint.

iv) Vertebral Column

Techniques for Atlanto-occipital articulation, cervical vertebrae, cervico-thoracic junction, thoracic vertebrae, lumbar vertebrae, lumbosacral articulation, sacrum

v) *Coccyx*

vi) Bones of Thorax

Techniques for sternum, ribs (upper and lower).

vii) Skull

Techniques for cranium, facial bones, sella turcica, temporal Bone, martoids and optic foraminae, sinuses, mandible and temporo mandible joint.

Viii) Chest

Chest X-Ray, PA, AP lateral, decubitus etc.

ix) Abdomen

Routine and radiographs in acute condition

Bedside radiography –techniques for acute chest conditions-intestinal obstruction, abdominal perforations-vertebral injuries-skull injuries-fractures immobilized.

Theatre radiography-introduction to C-arm image intensifier- exposure & training.

II. Soft tissue radiography

Neck, abdomen, skull, mammogram

Practicals :

1. X-ray beam alignment test
2. Determination of magnification by changing Source to Image Distance
3. Determination of magnification by changing Object to Image Distance
4. Radiation Protection Survey
5. Leakage radiation test
6. Positioning Radiography

IV Semester

PAPER - 15

Radiographic Procedures :

I. Contrast Media

Types, composition, uses, contraindications

II. Contrast Procedures - I

Barium swallow-Barium meal series-Barium enema-double contrast barium enema, small bowel enema, double and single contrast,
ERCP, PTBD, sinograms, fistulograms.

III. Contrast Procedures - II

IVU, retrogrde pyelogram, MCU, AUG, Opposing Urethrogram,
Dacrography, Sialogram, HSG,
T-Tube cholangiogram, operative cholangiogram (on table in theatre).

PAPER – 16

Basic and Advanced Ultrasound Imaging Physics :

I. Ultrasound - Generation, Properties and Interaction:

Basic Acoustics, Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity.

Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients.

Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, Construction and Working, Characteristics of US beam.

II. Image Formation, Display and Quality:

Ultrasound display modes: A, B, M, T-M mode, B-scan, Scan-converters: Analog and Digital, US Machine Controls, US focusing.

Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducers: mechanical and electronic arrays, Ultrasound Artifacts

III. Doppler Ultrasonography Physics :

Doppler Effect, Doppler ultrasound techniques: Continuous Wave Doppler, Pulsed Doppler, Duplex scanning, Doppler spectrum, Color Doppler, Power Doppler

PAPER - 17

Techniques In Ultrasonography :

Techniques for imaging different anatomic areas, Patient preparation for Doppler, Vascular sonography, Neurosonogram, Sonohysterography, Sonourethrography, Elastography, Musculoskeletal USG.

I. Techniques in Doppler Ultrasonography:

Doppler Effect, Doppler ultrasound techniques: Continuous Wave Doppler, Pulsed Doppler, Duplex scanning, Doppler spectrum, Color Doppler, Power Doppler

II. Recent Advances in Ultrasonography :

1. USG Contrast agents
2. Harmonic imaging
3. Extended FOV imaging
4. 3D US imaging: acquisition methods & reconstruction
5. 4D & 5D US imaging.

Practicals :

1. Basic Ultra sound techniques, Practicals based on theory
2. Contrast Procedures and Positioning Radiography.

V Semester

PAPER -18

Basics & Advances in CT Imaging Physics :

I. CT Imaging - Principle:

Basic principle of Computed Tomography, Comparison of CT with Conventional Radiography and Tomography, Generations of CT

II. Instrumentation:

Gantry, Patient couch, X-ray tube, Filters, Collimators, Detectors, Data Acquisition System (DAS).

III. Advances in CT Imaging

1. Image Formation:

Image Formation in CT, CT Image Reconstruction, Hounsfield Unit, Windowing, CT image display, CT Image Quality, CT artifacts

2. Recent methods in CT Imaging:

Helical CT scan: Slip ring technology, Advantages, Multi Detector CT, Cone – Beam geometry, Reconstruction of helical CT images, CT Fluoroscopy, HRCT, Post Processing Techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose

PAPER – 19

Techniques In CT Scan Imaging :

Patient preparation, Imaging techniques and protocols for various parts of body,

i. CT contrast enhanced protocols
ii. CT angiography:
iii. Aortogram,
iv. Selective angiogram head, neck and peripheral,
v. Image documentation: Filing, Maintenance.

Practicals :

Practicals based on theory.

PAPER – 20

Interventional Procedures and Angiography :

I. Principle & Instrumentation:

Digital Subtraction Angiography: Instrumentation, Principle of Digital Subtraction Angiography, Various Digital Subtraction Techniques

II. Basics Of Invasive Radiology:

Procedure of image guided biopsies and drainage procedure.

III. Invasive Angiography & Venography

4 Vessel DSA, Aortogram, Selective Angiogram, Venogram

IV. Invasive Monitoring

Cardiac resuscitation measures, Management of shock.

V. Interventional Procedures & Angiography

Stenting, PTA + stenting, stent graft, Embolisation

VI. Neuro Interventional Procedures

Embolisation, GDC
Glue embolisation
Vertebroplasty

VII. Adult & Paediatric Invasive Cardiology:

Basics of cardiac catheterization Coronary angiogram

Practicals :

Practicals based on theory + Interventional procedures techniques

VI Semester

PAPER -21

Basic & Advanced MRI Imaging Physics :

I. MRI Imaging - Principle:

Basic principle and concepts of MRI, the need for MRI, Role of hydrogen in MR Imaging, Advantages and disadvantages of MRI, MR Contrast media.

II. Instrumentation:

MR architecture, magnet system and gradient system, patient screening before scanning, Safety aspects, types of magnets and RF coils,
Basic types of pulse sequence and advanced pulse sequences

III. Image Formation:

Fourier transformation, K space imaging, Image formation in MRI, Gating mechanism in MRI. MR artifacts , factors influencing image quality

PAPER -22

Techniques in MRI :

I. Protocols:

Protocols in MRI for whole Body

II. Advanced MRI techniques:

MR Angiography, (TOF, phase contrast and dynamic contrast MR angiography), Functional MRI, MR Spectroscopy, Recent advancement in MRI and open MRI, MRCP, DWI, SWI, perfusion etc.

PAPER -23

Care of Patients in Diagnostic Radiology :

Care of the Patient and Fundamentals of Nursing and Medical Emergencies

Unit - 01 :

Introduction To Patient Care:

Clinical Responsibility, Legal Responsibility, Hospital And The Radiographer.
General Patient Care:

A. Patient Transfer Technique
B. Turning The Patient (Patient Conditions, Mechanic Safety).
C. Restraint Techniques - Trauma, Paediatric, Geriatric, Physically Handicapped Emotionally Disturbed Patients, Anaesthetised Patient, Moving Chair And Stretcher Patients.
D. Specific Patient Conditions.
Tubes And Catheters, Nasogastric, Chest, Urinary, Intravenous, Oxygen And Other. (Cast Surgical And Cardiac) Alcoholic, Bed Pans And Urinals.
E. Security Of Patient Properties.
Out Patient, Inpatient.
F. General Comfort And Reassurance For The Patient.

Unit -02 :

I. Practical Nursing Procedures In Radiology :

Temperature, Pulse, Respiration, B.P., Laying Up A Sterile Trolley, Assisting At An Iv Injection, A Simple Sterile Dressing, O2 Therapy And Resuscitation, Giving A Patient Bed Pan, Giving An Enema, The Catheterized Patient, The Use Of A Sucker.

II. Preparation Of The Patient:

General Abdominal Preparation, Clothing Of The Patient.

Unit -03 :

I. Sterilization and sterile techniques:

Methods Of Sterilization, Central Sterile Supply, Preparation Of The Hands For Aseptic Procedures.

II. Drugs in the X-Ray department:

Poisons And Dangerous Drugs, Units Of Measurement, Drugs Used In Preparation Of The Patient, Contrast Agents Used In X Ray Examinations, Drugs Used In Resuscitation, Labeling And Issuing.

Unit -04 :

Infection Control :

A. Infections Pathogens, Communicable Disease
Nasocomial Infection, Other
B. Isolation Technique:
Category, Purpose, Procedure.
C. Infection Sources:
Bacteria Virus, Other.
D. Transmission Modes:
Aerobic, Contact, Other.
E. Procedures:
Institutional, Departmental
F. Physiological Considerations:
G. The Infection Patient In The X Ray Department.
The Infections Patient In The Ward.

Unit -05 :

Contrast Media:

A. Definitions:
I) Air, Gasses.
II) Radiopaque: Barium Compounds, Aqueous Iodine Compounds, Oily Iodine Compounds, Other.

B. Pharmacology:
Barium Compounds & Iodine Compounds : Patient History/Allergy, Chemical Composition,Patient Precautions, Patient Reactions, Emergency Care.

C. Methods of Administration:
I) Systemic: Oral, Rectal, Tube, Catheter, Inhalation.
II) Parental: Intravenous, Intra-Arterial, Intra Spinal.

D. Administration Technic: Oral (Spoon, Cup, Capcule),Tube/Catheter,

Nasogastric, Urinary, Enema, Other.

E. Intravenous : Syringe, Needle/Infusion Container, Catheter,Needle

Unit-06 :

I. Patient's Care During Investigation:

G.I. Tract, Renal Tract, Biliary Tract, Respiratory Tract, Gynecology, Cardiovascular, Lymphatic System, C N S.

II. First Aid In The X Ray Department:

Radiological Emergencies, Shock, Hemorrhage, Burns, Scalds, Cpr, Loss Of Consciousness, Asphyxia, Fractures, Electricshock.

III. Medico-Legal Aspects Of The Radiographers Work:

Breach Of Professional Confidence, Negligence, Procedure In The Event Of Accident, The Importance Of Records.

IV. The Patient And The Radiation Hazards:

The Nature Of The Risk, Significant Examinations And Protective Measures.

References:

1. Care Of Patients In Diagnostic Radiography – Chesney And Chesney
2. Guidelines On Patient Care In Radiography – C.Gunn & C.S.Jackson.
3. Hospital Infection Control For Nurses – Peter Meers.

Reference Books :

Text Books (Latest Edition):

1. Dark room procedures & Radiography - a text of Radiology for Technician by Latest edition of Satish K. Bhargava
2. Christensen's Physics of Diagnostic Radiology – Latest edition of Thomas S. Curry.
3. Step by step cross sectional Anatomy by D. Karthikeyan & Deepa Chegu.

I. Anatomy and Physiology-

Ross and Wilson by Anne Waugh, Allison grant

II. Radiological physics and radiological equipments -

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.

III. Positioning Radiography and Contrast Procedures

1. A guide to Radiological Procedures - 2nd edition, Stephan Chapman & Richard Nakielny, 1986.
2. Clark's Positioning in Radiography.
3. Merrill's atlas of radiographic positioning and radiologic procedures, 1,2 & 3 Volumes.
4. Diagnostic radiography: A concise practical manual, Glenda J. Bryan, Churchill Livingstone, 1987.

5. Handbook of Medical Radiography - C. Ram Mohan
6. Radiological Procedures (A guideline) – Bhushan N. Lakkar

IV. Basic and advanced ultrasound imaging

1. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.
2. The Essential Physics of Medical Imaging – 2nd edition, , 2001
3. Doppler Ultrasound: Principles & Instruments – 2nd edition, Frederick W. Kremkav, 1995.
4. Text book of Color Doppler Imaging – 2nd edition, Satish K. Bhargava, Jaypee Brothers Medical Publishers (P) Ltd., 2010.
5. Essentials of Ultrasound Physics, James A Zagzebski, Mosby, 1996.
6. Three Dimensional Ultrasound, Thomas R. Nelson, Donal B. Downey, Dolores H. Pretorius, Aaron Fenster, Lippincott Williams & Wilkins, 2009.
7. Diagnostic Radiology – recent advances and applied physics in imaging AIIMS, MAMC – PG I Imaging series

V. Basic and advanced CT Imaging

1. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.
2. Euclid Seeram Computed Tomography – Physical principles, Clinical applications and Quality Control, 3rd edition, Saunders Elsevier, 2009.
3. A Practical Guide to CT Technologist, C. Ramamohan, Paras Publishing, 2002.
4. High Resolution CT of the Lung – 4th edition, W.Richard Webb., Nestor L. Muller & David P. Naidich, Lippincott Williams & Wilkins, 2009.
5. Diagnostic Radiology – recent advances and applied physics in imaging AIIMS, MAMC – PG I Imaging series

VI. Basic and advanced MRI

1. MRI in Practice by Catherine Westbrook
2. MRI Physics for Radiologist by Alfred Horowitz
3. MRI made easy (for beginner) - Govind B. Chavhan
4. Diagnostic Radiology – recent advances and applied physics in imaging AIIMS, MAMC – PG I Imaging series

VII. Interventional procedures and angiography

1. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.
2. Applied Angiography for Radiographers, Laudicina & Wean, W.B. Saunders Company, 1994.
3. The Requisites: Vascular & Interventional Radiology, John A. Kaufman, Michael J.Lee, Mosby, 2004.

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
24	a) Basic Life support b)Trauma life support	Anesthesia Emergency Medicine	10 10	-	IE	50	50%
25	Cardiac life support	Cardiology	15	-	IE	50	50%
26	Medical Ethics	Forensic Medicine	15	-	IE	50	50%
	Internship	In the Specialty Dept.	-	850	-	-	-
	Total		**50**	**850**			

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	Practical Max. Marks	Mim. for Pass
27	Fundamentals in Research	In the Specialty Dept.	**100**	**-**	IE	50	-	50%
28	Internship & Project work		-	800	-	-	50	50%
	Total		**100**	**800**				

Total hours : 900

Note :

1. For B.Sc ECG & CVT Course, during the internship, the internees may be posted in OPD & IPD for clinical learning, to be able to take BP, Pulse and identify certain clinical conditions. BLS certification training may be given from an authorized agency.

2. For B.Sc MLT course, the internship posting for 12 months in the specialties of Biochemistry, 4M, Microbiology – 4M, Pathology - 3 M and Transfusion medicine – 1 M, students may be divided into 3 or 4 specialties as per the convenience of the course In-Charge / HoDs.

24. 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 & Endo tracheal intubation
5. Advanced airway management skill (Use of bogie stellate, supraglottic devices)
6. Basic settings of a ventilator
7. Basic modes of ventilator
8. General case 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

25. 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

26. 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

6. MODEL PAPER for III – VIII SEMESTERS

For all B.Sc PM courses except MLT

I. 80 Marks Paper

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

II. 50 Marks Paper

i. Two essays out of four	- 2x10 = 20
ii. Three short notes out of six	- 3x5 = 15
iii. Five questions- very brief answers out of eight	- 5x3 = 15

III. 40 Marks Paper

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

For MLT Course

I. 80 Marks Paper

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

II. 50 Marks Paper

i. Two essays out of four	- 2x10 = 20
ii. Three short notes out of six	- 3x5 = 15
iii. Five questions- very brief answers out of eight	- 5x3 = 15

III. 40 Marks Paper

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

IV. For VI Semester the model paper for Pathology & Transfusion Medicine is as given under :

A) For Pathology (50 marks)

i. Two essays out of four	- 2x10 = 20
ii. Three short notes out of six	- 3x5 = 15
iii. Five questions- very brief answers out of eight	- 5x3 = 15

B) For Transfusion Medicine (30 marks)

i. One essay out of two	- 1x10 = 10
ii. Four short notes out of six	- 4x5 = 20

Note:

i. *The duration of each theory paper for 80 marks - 3 hours, 50 marks - 2 ½ hours and 40 marks - 2 hours.*

ii. *The duration of each practical examination shall be 3 hours.*

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES

TIRUPATI – 517 507

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

PG Programme in Allied Health Sciences

M. Sc Clinical Virology

TIRUMALA TIRUPATIDEVASTHANAMS

INDEX

General Regulations

1. Title of the Course
   Master of Science degree in clinical virology
2. Duration of the Course
   The duration of the course shall be 2- years on full time basis
3. Eligibility for Admission-BSC – Microbiology/Biotechnology/Zoology/Botany
4. Selection Criteria
   a) All the PG (M.Sc) will have a common entrance exam
   b) The selection is based on the combined merit in the qualifying examination (degree) and marks secured in the entrance test conducted by the university (SVIMSPGCET) in the ratio of 80:20.
   c)The entrance test will be conducted on the subjects and weightage as mentioned below-
   English -30%, logical reasoning 30%, biology 20%, physical sciences 20% (+ 2 level) (intermediate).
   d) There are no qualifying marks in the entrance test. All the candidates appearing for the entrance test will be awarded ranks based on the marks secured.
5. Admission schedule:
   a) Commencement of Course: August every year
   b) The admissions are closed by 30th September or 60 days from the date of commencement of the programme.
6. Medium of instruction.
   English shall be the medium of instruction for the subjects of study as well as for the Examination.
7. Course of study
   - The course shall be pursued on full time basis. In the end of first year there shall be an examination. Students shall be posted to SVIMS and SPMC hospitals during the practical hours.
   - Subjects for study and teaching hours for first year and second year of the PG courses are shown below.
   -

Distribution of Teaching Hours

First Year

S. No	Main subject	Theory No. of Hours	Practical No. of Hours	Total
1.	**Basic- Microbiology and Virology**	100	30	130
2.	**Immunology and Medical Entomology**	60	30	90
3.	**Basic and Applied Viral Genetics**	80	30	110

4.	**Epidemiology and biostatics**	**50**	**-**	**50**
5.	**Dissertation**			**70**
	Total:	**290**	**90**	**450**

Second year

S. No.	Main subject	Theory No. of Hours	Practical No. of Hours	Total
6.	**Diagnostic Virology**	**110**	**30**	**140**
7.	**Applied Epidemiology, Applied Biostatistics & Applied Entomology**	**35**	**75**	**110**
8.	**Recent Advances in molecular virology**	**30**	**30**	**60**
9.	**Dissertation**			**140**
	Total:	**465**	**225**	**900**

8 a) Attendance:

A candidate is required to put in minimum 80% of attendance both in theory and practical separately of each paper before admission to the university examination. Participation in NCC, NSS, sports and games, educational tours, professional meetings and conference or other co-curricular activities representing the institution/university will not count as absence.

b) Condonation for lack of attendance:

The condonation of attendance on medical grounds or on absence under extraordinary circumstances to those who are having the attendance between 70% and 79% in each paper will be granted in genuine cases. The students who have shortage of attendance in the particular papers have to apply to the controller of examinations, indicating the reasons for shortage of attendance. The representation to be forwarded by the HOD & Prof. i/c AHS. If the reason is on the medical grounds, the relevant medical certificate has to be enclosed to the representation. If any student falls below the 70% of attendance, he/she will not be allowed to write the university examinations.

9. Scheme of examination

a) The examination for the degree shall consist of written papers, practical and oral.
b) There shall be two examinations viz. Preliminary and final. The preliminary

c) examination shall be taken at the end of the first year. The final examination shall be taken at the end of 2nd year.
d) The examination shall be conducted ordinarily twice a year, viz. July/August and January/February.

Preliminary Examination

This consists of theory, practical and oral. There will be separate papers for each specialization.

10. Examination fee structure: The examination fee shall be applicable as existing to the Other M.Sc. Courses (AHS).

11. University Examination and Distribution of marks.

First year

S. No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
1.	Basic- Microbiology and Virology	I	20	80	15	60	25	200
2.	Immunology and medical entomology	11	20	80	15	60	25	200
3.	Basic and Applied Viral Genetics	III	20	80	15	60	25	200
4.	Epidemiology and Biostatistics	IV	20	80	-	-	-	100
	Total		80	320	45	180	75	700

Second year

S. No	**Subjects**	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
5.	Diagnostic Virology	V	20	80	15	60	25	200
6.	Applied Epidemiology, Applied Biostatistics & Applied Entomology	VI	20	80	15	60	25	200
7.	Recent Advances in molecular virology	VII	20	80	15	60	25	200
8.	Dissertation		100(evaluation)				50	150
	Total							750

Dissertation

The student should submit dissertation one month before the final examination. Those students who have not submitted the dissertation shall not be allowed to appear for the final examination. The dissertation shall be confidentially assessed by an internal faculty other than the guide. At the time of practical university exam soft copy of the dissertation should be sent to the external examiner for proper evaluation and viva on the dissertation should be taken during orals at the time of practical examinations by all the examiners. The dissertation shall be written under the following headings:

Introduction; Aims or objectives of study; Review of literature; Materials and methods Results; Discussion; Conclusion; Summary; References; Tables; Annexure

The written text of dissertation shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should not be done. A declaration by the candidate that the work was done by him/her shall be included. The guide and head of the department shall certify the Bonafide of the dissertation.

Three copies of dissertation shall be submitted to the university through proper channel along with a soft copy (CD), one month before the final examinations.

Internal assessment (IA):

a) A student must secure at least 35% marks of the maximum marks fixed for internal assessment in a particular subject to be eligible to appear for the university examination of that subject.
b) There shall be three internal assessment tests and the average of these tests shall be considered for awarding final marks.
c) If the candidate is absent for any of the exams, the marks in that exam shall be taken as zero.
d) The computed internal assessment marks as per the regulation shall be sent to the controller of exams 15 days before the commencement of the University exam.
e) The internal assessment marks should be signed by the concerned teaching faculty or HOD and counter signed by the HOD before being forwarded to the Controller of Examinations.
f) For those who failed in internal assessment test/s, have to reappear as per the regulation 9 a) & b) before he/she appears for the university examination.
g) For those who want to improve their marks in internal assessment tests, they can

appear again as per the regulation 9 a) & b). For such students, the internal assessment marks of the student at the time of first appearance will be compared with the marks obtained at the present appearance and the higher of the two will be taken as his/her internal assessment marks.

12. Minimum for a pass

a) 35% in internal assessment of each theory paper and practical's / viva voce

b) 40% in each theory paper of university examination.

c) 50% on the total marks of theory university examination and internal assessment clubbed together, applicable to each paper.

d) Where, viva voce involved which is part of theory examination, 50% on the total marks of theory university examination, internal assessment and viva voce clubbed together, applicable to each paper.

e) Where there is no internal assessment marks, 50% on the total theory marks, 50% in practical's/viva voce applicable to each subject.

Note: For 2-year PG course, where any paper contains both theory and practical's/viva voce, the student has to pass both theory and practical's/viva voce, if any student pass in theory examination and fail in practical's/viva voce examination or vice versa, the student concerned has to appear again for both theory and practical's/viva voce examination.

13.Classification of successful candidates

Percentage of Marks for declaring Class:

Distinction	- 75% and above of the total marks.
First Class	- 65 - 74% of the total marks.
Second Class	- 50- 64% of the total marks.
Pass Class	- If the student does not pass all the subjects with in 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 attendance shortage, it will be taken into consideration as not completed within the duration of the course and the final results will be declared as "Pass".

14.Reappearance

The student has to pass both theory and practical's/via voce, if any student pass in theory examination and fail in practical's/viva voce examination or vice versa, the concerned student has to appear again for both theory and practical's/viva voce examination. Supplementary examination shall be conducted after 6 months of declaration of results.

15. Carry-over Provision

The students are permitted to complete the course period irrespective of their success in the preliminary part. However, the final results will be kept under "withheld" until he/she passes all the previous papers".

16. Maximum duration for completion of course

A candidate shall complete the course within four years from date of admission. Failing which, the candidate will be discharged.

17. Eligibility for award of degree

A candidate shall have passed in all the subjects of first and second year to be eligible for award of degree.

18. Panel of examiners:

a) There shall be a panel of four external examiners as advised by the Head of the department.

b) Theory paper setting to be done by the examiners locally, within the state or outside the state. For practical and viva-voce

c) No. of Examiners Required - Two
No. of Internal Examiner - One
No. of External Examiner – One

Eligibility for the examiner ship:

a) The examiner shall be a full-time teacher in the college or institution he or she is working.

b) Academic qualification and teaching/professional experience for examiners:

External / Internal Examiner: MD microbiology shall have not less than 5 years of teaching experience in the specialty concerned and working as Asst Prof. or above in a teaching hospital

First year

Course content (syllabus) Theory

Paper I: Basic- Microbiology and Virology

Unit no.	Unit title	Content	Hours	Method of evaluation
1.	Basic virology	1.History and principles of virology, virus taxonomy, introduction to replication strategies. 2. Virus structure and morphology. 3. Viruses of veterinary importance. 4. Principles of bio-safety, containment facilities, maintenance and handling of laboratory animals and requirements of virological laboratory. 5.Bacteriophages.	3 2 2 2	Sessional examination
2.	Tissue culture	1.Introduction to tissue culture Principles of tissue culture, applications, maintenance of sterility, use of antibiotics, mycoplasma and other contaminations 2. Cell environment. 3. In vitro cultures 4. Cell characterization 5. Large scale production 6. Quality assurance in animal tissue culture.	2 2 2 2 2 2	Sessional examination
3.	Cell biology	1.Microscopy 2. Cell ultra-structure and electron microscopy	1 3	Sessional examination

		3. Structure and function of cellular organelles 4. Cell division and cell cycle 5. Cell signalling 6. Cell growth and differentiation 7. Stem cells -adult and embryonic 8. Cell dynamics, cell death	2 2 2 2 2 2	
4.	Concepts of biosafety and biosecurity	1.Infectivity/Pathogenicity/Virulence, Routes of entry/exit, Modes of transmission, Secondary spread, Immune status of staff and immunization issues 2. Biosafety Levels and Risk group, Classification, Containment, Good microbiological practices, Disinfection, Decontamination and Sterilization 3. Primary Barriers and Secondary Barriers, different zoning and BSC] 4. Risk & Hazard Assessment 5. Safe laboratory Practices: Good microbiological practices, Good clinical practices (GCP), Good clinical and laboratory practices (GCLP), Good Laboratory practices (GLP)] 6. Decontamination procedures: Disinfection, Methods of sterilization, Decontamination Waste categories &Color coding of Bio-Medical Waste Containers/Bags, various types of Standards International norms & local government regulations 7. Regulatory Framework: [Code of conduct for scientists, Statuary roles of Department of Biotechnology (DBT), Indian Council of Medical Research (ICMR), Various types of committees for biosafety International Issues for Biosafety & Biosecurity, Laboratory certification, accreditation and standards, Commissioning, Certification &Validation, Accreditation, ISO, NABL,	2 2 2 1 2 2 3	Sessional examination

		8. Public health structure / system: [Disease surveillance and reporting, Disease control program	1	
5.	Bioethics	1.Ethics in Biomedical Research. 2. Ethical and regulatory issue in animal experiment. 3. Ethical issues in biotechnology. 4. Basics of Intellectual Property Rights. 5. Indian patenting system. 6. Issues related to Good Manufacturing Practices (GMP). 7. Issues related to Good Clinical Practices (GCP). 8. Issues related to Good Clinical Laboratory Practices (GCLP). 9. Development of consent document for clinical trials.	1 1 1 1 1 1 1 1 1	Sessional examination
6.	Virological Methods	1.In vivo, in vitro and in ovo systems for virus growth 2. Introduction to PCR 3. Fluorescence, confocal and electron microscopic techniques – principles and applications.	5 2 3	Sessional examination
7.	Analytical techniques	1.Characterization of biomolecules 2. Concentration of biomolecules 3. Electrophoresis of molecules from paper/gels. 4. Cell sorting and Flow cytometry: Principles and Applications. 5. Radioisotope techniques 6. Spectroscopy, Spectrophotometry, ORD and CD; Xray diffraction and Xray crystallography, surface plasmon resonance. 7. Micro array-based techniques 8. Introduction to Histological techniques 9. Detection of molecules in living	2 2 2 2 2 5 2 2 2	Sessional examination

		cells, in situ localization by techniques such as FISH and GISH		
8.	General Microbiology	1. Origin and evolution of microorganisms. 2. Cultivation of microorganisms hrs. 3. Isolation from different natural samples 4. Enumeration / measurement and preservation of growth of microorganism 5. Medical Microbiology: *Vibrio cholera, Salmonella typhii, S. pneumoniae*.	1 1 1 1 5	Sessional examination

Paper II: Immunology and medical entomology

Unit no.	Unit title	Content	Hours	Method of evaluation
1.	Immunology	1.Introduction and history; Primary and secondary organs of the immune system, Cells of the immune system. 2. Innate immune response & inflammation, complement system. 3. Hapten/antigen; antibody, structure & Function, Immunoglobulin classes. Antigen & antibody interaction, Antibody diversity. 4. Major histocompatibility complex, Polymorphism, Human leukocyte Antigen association with disease, Ontogeny, Positive and negative selection. 5. Antigen processing and presentation, Co-stimulation, T and B cell stimulation, Cytokines& Chemokines. 6.Cells and organs of the mucosal immune system. Mucosal effector	5 5 6 8 6 4	

		mechanisms. 7. Phagocytosis. Cytotoxic and T helper response. Natural killer and gamma delta cells. 8. Antigen-antibody, cytokine-mediated immune regulation. Complement mediated regulation. Hypersensitivity. Autoimmunity; immunodeficiency. Transplantation immunology.	4 7	
2.	**Vector Biology**	1.General entomology, insect morphology and classification of Insects and other arthropods of medical importance and their structures and functions. 2. Biology and life history of *Aedes, Culex* and *Anopheles* mosquitoes, their behaviour 3. Biology, morphology and disease relationship of sandflies, fleas, lice, ticks and mites in relation to viral infections prevalent in India 4. Vector virus relationship Xenodiagnosis- methods and application. 5. Vector Control, insecticide resistance mechanism and control dynamics	2 2 3 3 5	

Paper III- Basic and Applied Viral Genetics

Unit no.	Unit title	Content	Hours	Method of evaluation
1.	Molecular biology	1.Genomes: types, diversity in size, structure and organization in viruses, prokaryotes (nucleoid) and eukaryotes. Genome complexity and sequence components. Central dogma theory and flow of genetic information. 2. Genes: gene	4 1	Sessional examination

		structure and architecture, types of genes. 3. Plasmids 4. Mobile genetic elements 5. Gene transfer mechanisms and gene mapping in bacteria 6. Genetic recombination 7. Replication / perpetuation of nucleic acids: Concepts, definitions, and strategies / models for replication. 8. DNA damage and repair 9. Mutations: Types, causes and consequences of mutations 10. Transcription (RNA biosynthesis): Types of RNA and their role. Types of RNA polymerases. DNA foot printing. Promoters, enhancers, silencers, insulators. Events of transcription. Maturation and processing of different RNA transcripts capping, methylation, polyadenylation, splicing, RNA editing and modification of nucleosides in tRNAs. 11. Translation, post-translational modification of	1 1 1 2 3 1 2 4 4	

		proteins and their sorting and targeting. regulation of translation 12. Regulation of gene expression 13. Gene silencing mechanisms	 5 1	
2.	Recombinant DNA Technology	1.Scope and importance of recombinant DNA technology. 2. Tools for Recombinant DNA Technology 3. Cutting and joining of DNA molecules 4. Techniques for gene manipulation 5. Molecular diagnostics: Nucleic acid blotting and hybridization PCR, DNA profiling and DNA finger printing and their applications. 6. Site directed mutagenesis and protein engineering 7. Gene cloning strategies 8. Gene cloning & Expression in bacteria, yeast, plant and animal cells Insect cell system Construction of vectors 9. Phage display libraries, reverse genetics, viral replicons 10. Functional genomics – transcriptome and gene expression profiling	1 4 2 3 6 2 2 8 3 2 1	Sessional examination

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		11. Proteomics- proteome and analysis of protein expression.		
3.	Virus cell interactions	1.Definition, structure and methods of discovery of viral receptors (polio, herpes, VSV, HIV). Cellular interactions 2. Replication sites and their characterization, IRES, replicons, transport of viral proteins. 3. Host cell 'shut off', apoptosis, necrosis, stress response, alteration of signalling pathways, cellular basis of transformation, types of cenotaphic effects, ultrastructural cytopathology. 4. Cellular injury associated markers, mechanism of viral persistence and latency—	5 3 3 5	Sessional examination

Paper IV- Epidemiology and Biostatistics

Unit no.	Unit title	Content	Hours	Method of evaluation
1.	Basic epidemiology and biostatistics	1.History, evolution, definitions and concepts in Epidemiology. 2. Descriptive and analytical epidemiology 3. Sample size estimation and introduction to study designs	5 8 5	Sessional examination

		4. Introduction, types of data, tabular and graphical presentation of data. 5. Measures of central tendency. 6. Concept of probability. Concept of significance tests 7. Introduction to Sampling Methods 8.Types and methods of public health and infectious disease surveillance, establishing surveillance system. 9. Case control and cohort studies. 10. Needs and steps to be taken for outbreak investigations, collaboration with State and National health authorities. 11. Veterinary Epidemiology [2 hrs]	5 5 5 2 5 4 4 2	

Paper V- Diagnostic Virology

Unit no.	Unit title	Content	Hours	Method of evaluation
1.	Viral Enteric Diseases and Oncogenic viruses	1. Epidemiological scenario with respect to Viral Enteric Diseases at National And International level 2. Enteric viral infections: Clinical course, disease burden, risk factors, prevention, and treatment.	1 2	Sessional examination

		3. Rotavirus diversity, emerging strains, immunopathogenesis and vaccines under development. 4. Other viruses associated with diarrhoea and gastroenteritis: 5. Polio & Non-polio Enteroviruses 6. Viral oncogenesis, oncogenic viruses HPV, HTLV, Epstein Barr virus	2 6 3 2	
2.	Viral hepatitis	1.Physiology of Jaundice, clinical features and differential diagnosis, presentations of hepatitis caused by different hepatitis viruses. 2. Structure & genomic organization, replication, genotypes, serotypes of HAV, HBV, HCV & HEV. Mutations in hepatitis viruses. 3. Serological and molecular diagnosis of different hepatitis viruses. [3 hrs]. 4. Immunopathogenesis of different hepatitis viruses. Animal models and their uses. 5. types of hepatitis vaccines, vaccines presently used & vaccines of the future.	3 4 3 2 3	Sessional examination
3.	Viral respiratory diseases	1.Epidemiology of to respiratory diseases 2. History, clinical features, epidemiology, of	1 5	Sessional examination

		influenza, RSV and other respiratory diseases. 3. Biology and pathogenesis of SARS, Metapneumovirus, human rhino virus and Corona virus etc. 4. Differential diagnosis of different respiratory diseases. 5. Vaccines against different viral respiratory diseases.	3 3 4	
4.	Skin diseases	1.Epidemiology of Exanthematous diseases. 2. Viruses associated with Exanthematous Diseases 3. Measles, mumps, rubella, Parvovirus B-19, Chicken pox and other viral pox diseases. 4. Common features of viral pox diseases and case definitions. Para specific immunity due to pox vaccination, eradication and control programs.	1 5 7 3	Sessional examination
5.	Viral haemorrhagic fevers	1. Epidemiology of Viral Haemorrhagic Fevers 2. Common clinical features of Viral Haemorrhagic Fevers, History and Disease burden, Risk factors and geographical distribution of viruses associated with haemorrhagic fevers and their impact on global health. Clinical samples required,	1 3	Sessional examination

		choice of laboratory diagnostic tests and their interpretation for differential diagnosis. 3. Virus replication strategy, Pathogenesis, Prevention and treatment of Dengue. 4. Virus replication strategy, Pathogenesis, Prevention and treatment of Yellow Fever, Kyasanur forest disease, Chikungunya, Rift Valley Fever, Crimean Congo haemorrhagic fever, Hanta, Marburg and Ebola, and Rickettsial fevers.	 6 6	
6.	Viral encephalitis	1. Epidemiology of Viral Encephalitis 2. Viral Encephalitis, encephalopathy and meningitis, clinical symptoms and causative agents, treatment modalities, transmission, spread of an outbreak in relation to causative agent. Laboratory diagnosis of viral encephalitic agents, basic principles, preferred methods and problems. 3. Japanese encephalitis and West Nile viral infection 4. Chandipura encephalitis, other rhabdoviral neurotropic agents. 5. Encephalitis caused by measles, mumps	1 3 3 2 4	Sessional examination

		, alpha viruses, Nipah and Hendra virus, Herpes 6. Routes and modalities of infections of the nervous tissue, blood brain barrier, factors affecting the neurovirulence	3	
7.	HIV/ AIDS	1.Epidemiology of HIV/ AIDS, Introduction to retroviruses 2. Sexually transmitted diseases and their relation with HIV, opportunistic infections in HIV infected individuals. Social and behavioural aspects of prevention and control. Natural history. 3. Structure and replication of HIV, immunopathogenesis of infection, laboratory diagnosis of HIV infection. HIV isolation, characterization and viral load estimation. 4. Antiviral therapy and drug resistance, HIV vaccines. 5. Origin of HIV-1, HIV -2, SIV.	1 4 5 2 3	Sessional examination

Paper VI: Applied Epidemiology, Applied Biostatistics & Applied Entomology

Unit no.	Unit title	Content	Hours		
1.	**Applied epidemiology**	1.Types and methods of public health and infectious disease surveillance, establishing	5		

		surveillance system. 2. Case control and cohort studies. 3. Needs and steps to be taken for outbreak investigations, collaboration with State and National health authorities. [4 hrs.] 4. Veterinary Epidemiology 5. Medical surveillance: Medical first aid, Vaccination requirements, Accident reporting and investigation, post-exposure assessments & management, Hospital infection control 6. Preparedness and Response for emerging infections and outbreaks 7. Engineering and laboratory maintenance: general maintenance program of facility, environment controls, Laboratory AHUs, filters etc and other decontamination procedures, Various Alarms, Biosafety Cabinets, Autoclaves, keeping, Freezers, Incubators, Centrifuges etc.	4 4 2 1 2 2		
2.	**Bioinformatics**	1. search engines, sequence data	3		

		formats and submission tools, scoring matrices for sequence alignments, algorithms, database similarity searches—BLAST, FASTA. 2. Methods for sequence analysis: Multiple sequence alignment, phylogenetic analysis and tree building methods, data mining tools and applications 3. Structure based Approaches, homology based methods for protein tertiary structure prediction, visualization tools, structure evaluation and validation 4. Primer designing for PCR.	7 3 2		

Paper VII: Recent Advances in Molecular Virology

Unit no.	Unit title	Content	Hours	Method of evaluation
	Antivirals and Viral Vaccines	1.Conventional vaccines, immunomodulators (cytokines), vaccine delivery & adjuvants, large scale manufacturing-QA/QC issues. 2. Animal models and vaccine potency testing. 3. Vaccine induced	8 2 2	Sessional examination

		immune response and immune markers of protection 4. Interferons, designing and screening for antivirals, mechanisms of action, antiviral libraries, antiretrovirals- mechanism of action & drug resistance. 5. Anti-sense RNA, siRNA, miRNA, ribozymes, *in silico* approaches for drug designing.	10 8	

PRACTICALS

Paper 1: Basic- Microbiology, Virology -30 hours

Analytical methods (30 hours)
1. Preparation of reagents and buffers
2. Protein estimation by Lowry method
3. DNA estimation (spectrophotometric)
4. Polyacrylamide gel electrophoresis
5. Gel Filtration chromatography (Demonstration)

Tissue culture techniques (30 hours)
1. Glassware decontamination, washing, sterilization, packing and sterile handling.
2. Media and reagents preparation, sterility checks
3. Maintenance of cell cultures
4. Growth studies. cell count, mitotic index.
5. Preparation of primary cell culture (CEC)

Virus / Antigen detection (30 hours)
1. ELISA
2. Immunofluorescence assay
3. Heamagglutination
4. Agar gel diffusion
5. Polymerase chain reaction
6. Electron microscopy (Demonstration)

Propagation of viruses (15 hours)
1. Estimation of virus yields-- plaque assay & TCID50
2. Preparation virus stocks and determination of mouse LD50
3. Routes of inoculations in embryonated eggs
4. Handling of animals: Rules & Regulation

Paper II-Immunology and Entomology -30 hours

Entomological methods (15 hours)
1. Mosquito collection & taxonomy
2. Taxonomy of ticks and sandflies
3. Processing of arthropods
4. Mosquito inoculation &immunofluorescence
5. Insecticide testing
6. Water Sample Analysis (As Breeding Sources of Vector Mosquitoes)
7. Feeding Patterns of Mosquitoes & Houseflies & Mouthparts Dissection
8.Agar Gel Diffusion
9. Lymphocyte Separation
10.ELISA
11.IFA
12.Serodiagnosis of HCV, Serodiagnosis of HBV, Serodiagnosis of HIV
13.Water Sample Analysis (As Breeding Sources of Vector Mosquitoes)

Paper III- Basic and Applied Viral Genetics -30 hours

1. Nucleic Acid Extraction
2. Detection of DNA & RNA
3. Estimation of DNA & RNA
4. PCR
5. RT-PCR
6. Real Time PCR
7. Agarose Gel Electrophoresis
8. PAGE
9. Identification of PCR Amplified Products of Viral Antigens
10. Rt-PCR-Arbovirus
11. RT-PCR-Influenza

Paper IV- NO PRACTICALS

Paper V- Diagnostic Virology -30 hours

1. Sample collection
2. Sample processing for virus isolation and IFA
3. IFA
4. Virus isolation
5. HA test
6. HI test

Viral Exanthematous Diseases (15 hours)

1. Rubella (IgG, IgM) diagnosis
2. Measles (IgG, IgM) diagnosis
3. Measles PCR

Viral Hemorrhagic Fevers (Special reference to Dengue) (30 hours)

1. MAC-ELISA, Multiplex RT-PCR for serotyping
2. RNA extraction by Trizol method, Reverse transcription- PCR, agarose gel electrophoresis, interpretation
3. Hemagglutination inhibition assay

Viral Encephalitis ((15 hours)

1. Flavivirus neutralization tests for differential diagnosis
2. RT PCR of JE

HIV / AIDS ((15 hours)

1. HIV Diagnosis
2. HIV subtyping
3. CD4, CD8 counts

Paper VI: Applied Epidemiology, Applied Biostatistics & Applied Entomology-30 hours

Statistical software (EPI-Info)-

1: Introduction to the software
   Design data entry form
   Importing MS Excel data in Epi-Info
2: Basic commands in Epi-Info
   Recoding/transforming a variable
   Preparing frequency distributions/cross tables
   Computing descriptive statistics and interpretation
3: Graphical presentation of data:
   Bar diagram, Line diagram, Pie chart, Histogram, EpiCurve
   Interpretations
4: Computing correlation coefficient
   Comparing proportions using chi-square test
   Comparing means using t test
   Computing risk using univariate logistic regression
   Interpretations

1. Biological data banks.
2. Pairwise sequence alignments.
3. Phylogeny & tree building 1.
4. Phylogeny & tree building 2.
5. Secondary structure prediction.
6. Secondary databases – Motif, family searches, Epitope prediction(B-cell).
7. Epitope predictions (T-cell).
8. Biomolecular Structure visualization 1.
9. Biomolecular Structure visualization 2.
10. Primer designing.

Applied epidemiology

1. Laboratory emergency response issues: [Spills: laboratory simulation on Splashes/spills CIP protocol, Needle stick injury, Cuts, & Medical emergencies etc. Air & surfaces decontaminations of the facility based on incidents/accidents, Safeguarding against accidents in the facility, Ventilation failure and emergency protocols, Fire and other emergencies, Simulation fire alarm system, immediate remedial measures, emergency exit protocol, Safety measures & preparedness for Natural disasters & Terrorist threats].

2. Engineering requirements for Containment laboratory (BSL- II, III): Construction (Civil, Plumbing, drain line), HVAC & BMS, Electrical system (UPS, DG set), Access control system, Furniture, Communication, Fire alarm system, Definition of HEPA/ ULPA filter, Percentage (%) of penetration, In place testing, HEPA filters, Autoclave, BSC working & testing, Equipment's use in waste management: Incinerator & Shredder]

Paper VII: Recent Advances in Molecular Virology-30 hours

1. Biological Data Banks & Bioinformatics
2. NCBI, IVR, SWISSPROT & GISAID
3. Sequence Alignment Tools
4. Multiple Alignment
5. BLAST
6. Nucleic Acid to Translation
7. Sequence Assembly
8. Phylogeny Analysis
9. Software's : Mega & Bio Edit

Interdepartmental postings- 4 weeks

Students will be posted in the microbiology, biotechnology, bioinformatics for the observation and to develop expertise in various the diagnostic/ research methods.

Clinical Department Postings -4 weeks

Students will be posted on rotation basis to various clinical departments such as medicine, pediatrics, neurology and skin & VD.

Peripheral postings –2 weeks

Students will be posted in the microbiology department of veterinary college and virology department of SV university to gain experience in plant and animal diagnostic and research methods.

MONITORING LEARNING PROGRESS

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured, and assessment be done using checklists that assess various aspects. Model Checklists are given in this Chapter, which may be copied and used.
The learning out comes to be assessed should include:

i) *Acquisition of Knowledge*: The methods used comprise of `Log Book' which records participation in various teaching / learning activities by the students. The number of activities attended and the number in which presentations are made are to be recorded. The logbook should periodically be validated by the supervisors. Some of the activities are listed. The list is not complete. Institutions may include additional activities, if so, desired.

Journal Review Meeting (Journal Club): The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting using a checklist (see Model Checklist – I, Section IV)

Seminars / Symposia: The topics should be assigned to the student well in advance to facilitate in depth study. The ability to do literature search, in depth study, presentation skills and use of audio- visual aids are to be assessed using a checklist (See Model Checklist-II, Section IV)

ii) Teaching skills: Candidates should be encouraged to teach undergraduate medical students and paramedical students, if any. This performance should be based on assessment by the faculty members of the department and from feedback from the undergraduate students (See Model checklist III, Section IV)

ii) Dissertation: Please see checklist IV and V in Section IV.

iii) Work diary / Log Book- Every candidate shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal, reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of experiments or laboratory procedures, if any conducted by the candidate.

iv)*Records:* Records, log books and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University.

Log book:

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

Format for the logbook for the different activities is given in Tables 1 and 2 of Section IV. Copies may be made and used by the institutions.

Procedure for defaulters: Every department should have a committee to review such situations. The defaulting candidate is counseled by the guide and head of the department. In extreme cases of default, the departmental committee may recommend that defaulting candidate be withheld from appearing the examination, if she/he fails to fulfill the requirements in spite of being given adequate chances to set himself or herself right. Format of Model Checklists

Checklist - I

Model Checklist for Evaluation of Journal Review Presentations

Name of the student: _____ Date: _____

Name of the faculty/Observer: _____

Sl. No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist - II

Model Check List for the Evaluation of the Seminar Presentations

Name of the student: _____Date:_____

Name of the faculty/Observer: _____

Sl. No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist – III

Model Check list for Evaluation of Teaching Skill

Name of the student: _____Date: _____

Name of the faculty/Observer: _____

SL.No.		Strong Point	Weak point
1	Communication of the purpose of the talk		
2	Evokes audience interest in the subject		
3	The introduction		
4	The sequence of ideas		
5	The use of practical examples and /or illustrations		
6	Speaking style (enjoyable, monotonous, etc., specify)		
7	Summary of the main points at the end		
8	Ask questions		
9	Answer questions asked by the audience		
10	Rapport of speaker with his audience		
11	Effectiveness of the talk		
12	Uses of AV aids appropriately		

Checklist - IV

Model Check list for Dissertation / Project Work Presentations

Name of the student: _____Date: _____

Name of the faculty/Observer: _____

Sl. No.	Points to be considered	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Checklist – V

Continuous Evaluation of dissertation / project work Guide/ Co-Guide

Name of the student: _____Date: _____

Name of the faculty/Observer: _____

Sl. No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Periodic consultation with guide/ co-guide					
2	Depth of Analysis/ Discussion					
3	Department presentation of findings					
4	Quality of final output					
5	Others					
	Total score					

Overall Assessment Sheet

Date:

Check list No.	Name of the students			
	A	B	C	D
1				
2				
3				

Signature of the HOD Signature of the Prof. i/c AHS

The above overall assessment sheet used along with logbook should form the basis for certifying satisfactory completion of course of study, in addition to the attendance requirement.

KEY

Mean score: Is the sum all the scores of checklists 1 to 5

A, B, C: Name of the students

LOG BOOK

Table 1: Academic activities attended

Name: Admission

Year:

Date	Type of activity, Specific Seminar, Journal club, presentation, UG teaching	Particulars

Table-2: Academic presentations made by the student

Name:

Admission Year:

Date	Topic	Type of activity, Specific Seminar, Journal club, presentation and UG teaching

Management Information System Report

1. Name of the college imparting MSc clinical virology
2. Details of M.Sc.

Sl. No	**Name of the Branch & Teaching faculty**	**Sanctioned Strength**	**Admitted**	**Name of the subjects to be studied at 1st Year M.Sc.**	
1					
2					

3. No. of experiments/assignments conductedfor1st year M.Sc. clinical virology

Sl.No	Branch	Subject		Assigned by SVIMS University	Conducted	%	Remarks
1.		No	Name				
2							

4. No. of theory classes conducted for 1st year M.Sc. clinical virology

Sl.No	Branch	Subject		SVIMS University Norms (25)	Conducted	%	Remarks
1.		No	Name				
2.							

5. Number of theory and practical classes taken by 2nd year M.Sc. clinical virology students for undergraduate program (Optional).
6. No. of Journal club's department wise for 1st year and 2nd year M.Sc. Clinical virology students

Total No. of students Dept. Wise	Norms for half yearly Report	Achieved Number	% Achievement	Remarks
1st year M.Sc. Cardiac catheterization and Interventional Technology No.=	10 per candidate per year			
2nd year M.Sc. Cardiac catheterization and Interventional Technology No.=	10 per candidate per year			

7. Number of seminarsfor1st yearand2nd year M.Sc. Clinical virology students

Total No. of students: 10	Norms for half yearly Report	Achieved Number	% Achievement	Remarks
1st year M.Sc. Cardiac catheterization and Interventional Technology No.=10	10 per candidate			
2nd year M.Sc. Cardiac catheterization and Interventional Technology No.= 08	10 per candidate			

8. Number of inter departmental meetings

Norms for half yearly Report	**Achieved Number**	**% Achievement**	**Remarks**
6			

Overall Assessment of the student by the clinical/Lab work:

Sl. No	Points to be considered	Poor 0	Below Average 1	Average 2	Good 3	Very Good 4	Excel lent 5
1	Attendance						
2	Punctuality						
3	Interaction with colleagues and support staff						
4	Performance in the lab						
5	Topic Presentation						
7	Time sense						
8	Knowledge						
9.	Clinical orientation						
10	Overall quality of work						
	Total Score	- -	- -	- -			

MODEL QUESTION PAPER

THEORY

Each theory paper will have

1) Essay questions – 03 nos. carrying 10markseach - 03 x 10 =30
2) Short answer questions – 10 nos. carrying 05markseach - 10 x 05 =50

Total =80

Internal assessment =20

PRACTICAL

(a) Preliminary:

Internal assessment : 15
University examination : 60

Total =75

(b) Viva =25

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES

TIRUPATI – 517 507

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

1ST BOARD OF STUDIES MEETING

M.Sc. CARDIO-PULMONARY PERFUSION TECHNOLOGY COURSE

12/03/2021

TIRUMALA TIRUPATI DEVASTHANAMS

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES,TIRUPATI

BOS Members

1.	Dean, SVIMS	-	Chairman
2.	Registrar, SVIMS	-	Member
3.	Controller of Examinations, SVIMS	-	Member
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7.	Sri Narsimhan Swaminathan Professor of Physiotherapy Vice Principal, Faculty of AHS Sri Ramachandra Institute of Higher Education and Research (Deemed to be University), Chennai	-	Member

CONTENTS

SECTION-I

AIMS AND OBJECTIVES

1. Aims and Objectives:

The main goals of postgraduate training in M.Sc Cardio Pulmonary Perfusion Technology are :

- The student should be thought full and have an understanding of the basic sciences relevant to respective department.
- He/ She should be able to acquire the detailed knowledge about the fundamentals and the upcoming advances in the respective field.
- He/ She should be able to critically analyse and evaluate various concepts and views and to adopt the one which is appropriate.
- He/ She should efficiently, effectively and skillfully practice cardio pulmonary perfusion which would be based on the scientific knowledge.
- The student should continue to strive and have keen interest in professional development both in teaching and in clinical practice.
- He / She should have a caring and a gentle attitude and would be empathic towards all,
- The student should be able to maintain high ethical standards.
- He/ She should be willing to share the knowledge and skills with the fresh learners, junior or a colleague.
- Medicine is a continuous processes of learning. Every second there is change in the technology and the techniques hence one needs to keep updated with the recent. This knowledge could only be acquired by self-study and by attending courses, conferences and seminars relevant to the speciality.
- He/ She should be able to undertake audit; use information and carryout research with the aim of publishing or presenting the work at various scientific gatherings**.**

The student should be able to acquire adequate skills and competence in performing various tasks as required.

- He or She should be able to adopt ethical principles in all aspects of the professional practice**.**
- He or She should be able to practice professional honesty and integrity.
- He or She should be able to carry out the duties irrespective of social status, caste, creed or religion of the patient.
- He or She should develop oral and written communication skills, which is very important for efficient functioning of the team.
- He or She should have leadership quality so as to get the best out of his or her team in a congenial working atmosphere.
- The student should be able to apply high moral and ethical standards while carrying out research related in its field.
- The student should be humble and accept the limitations in his or her knowledge and skill and should not hesitate to ask for help from colleagues when needed.

SECTION - II
GENERAL REGULATIONS

1. **Title of the Course**
   Master of Science degree in Cardio-Pulmonary Perfusion Technology
2. **Duration of the Course**
   The duration of the course shall be 2- years on full time basis
3. **Eligibility for Admission**
   a) B.Sc. in Cardio Pulmonary Perfusion Technology (B.Sc. CPPT)
   b) B,Sc. in Perfusion technology with an equivalent course / syllabus from a recognized University.
   c) B.Sc. Degree + 2 yrs. PG Diploma in CPPT.
   d) Candidates with Correspondence and Diploma courses in CPPT shall not be considered
   e) Candidates passing B.Sc. in Perfusion technology (Pertaining to dialysis Perfusion) shall not be eligible.
4. **Selection Criteria**
   Selection shall be based on the academic merit/entrance test conducted inthe qualifying exam.
5. **Admission schedule :**
   a) Commencement of Course: August every year
   b) The admissions are closed by 30th September or 60 days from the date of commencement of the programme.
6. **Yearly intake: 2 students per year.**
7. **Medium of instruction.**

   English shall be the medium of instruction for the subjects of study as well as for the Examination.

8. **Course of study**

   The course shall be pursued on full time basis. In the end of first year and second year there shall be an examination. Students shall be posted to SVIMS and SPMC hospitals during the practical hours.

   Subjects for study and teaching hours for first year and second year of the PG courses are shown below;

M.Sc.Cardio-Pulmonary Perfusion Technology

Table - I Distribution of Teaching Hours

First Year

S.No.	Main subject	Theory No. of Hours	Practical No. of Hours	Total
1.	Cardiology and Cardiac Surgery	80	60	140
2.	Introduction to OT& Cardio Pulmonary Perfusion Technology	80	60	140
3.	Equipments In Cardio Pulmonary Perfusion Technology & Physiology & Pathology Of Cardio Pulmonary Perfusion Pharmacology of Cardiovascular Drugs	80	60	140

4.	Epidemiology & Bio-statistics including Research Methodology	80	-	80
	Total:	**320**	**180**	**500**

Second year

S.No.	Branches	Theory No. of Hours	Practical No. of Hours	Total
5.	Clinical Applications Of Cardio Pulmonary Perfusion Technology	60	80	140
6.	Cardiac Surgery Without CPB Mechanical Circulatory Support & Robotic Cardiac Surgery.	60	80	140
7.	Organ Transplantation.	60	80	140
8.	Hematology as Relevant to Cardio Pulmonary Perfusion, Blood Transfusion and Blood Conservation	60	80	140
	Total:	**240**	**320**	**560**

9 a) Attendance:

A candidate is required to put in minimum 80% of attendance both in theory and practical separately of each paper before admission to the university examination. Participation in NCC, NSS, sports and games, educational tours, professional meetings and conferences or other co-curricular activities representing the institution/university will not count as absence.

b) Condonation for lack of attendance:

The condonation of attendance on medical grounds or on absence under extraordinary circumstances to those who are having the attendance between 70% and 79% in each paper will be granted in genuine cases. The students who have shortage of attendance in the particular papers have to apply to the controller of examinations, indicating the reasons for shortage of attendance. The representation to be forwarded by the HOD &Principal I/c,AHS. If the reason is on the medical grounds, the relevant medical certificate has to be enclosed to the representation. If any student falls below the 70% of attendance, he/she will not be allowed to write the university examinations.

10. Scheme of examination

a) The examination for the degree shall consist of written papers, practical and oral.
b) There shall be two examinations viz., Preliminary and final. The preliminary examination shall be taken at the end of the first year. The final examination shall be taken at the end of 2nd year.
c) The examination shall be conducted ordinarily twice a year, viz., July/August and January/February.

Preliminary Examination

This consists of theory, practical and oral.

Table - I. University Examination and Distribution of marks

First year

S.No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
1.	Cardiology and Cardiac Surgery	I	20	80	15	60	25	200
2.	Introduction to OT & Cardio Pulmonary Perfusion Technology	II	20	80	15	60	25	200
3.	Equipments In Cardio Pulmonary Perfusion Technology & Physiology & Pathology of Cardio Pulmonary Perfusion Pharmacology of Cardiovascular Drugs	III	20	80	15	60	25	200
4.	Epidemiology & Bio-statistics including Research Methodology	IV	20	80	-	-	-	100
	Total							**700**

Second year

S.No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
5.	Clinical Applications Of Cardio Pulmonary Perfusion Technology	V	20	80	15	60	25	200
6.	Cardiac Surgery without CPB Mechanical Circulatory Support & Robotic Cardiac Surgery.	VI	20	80	15	60	25	200
7.	Organ Transplantation	VII	20	80	15	60	25	200
8.	Hematology as Relevant to Cardio Pulmonary Perfusion, Blood Transfusion and Blood Conservation	VIII	20	80	15	60	25	200
9.	Dissertation					100	50	150
	Total							**950**

11. Dissertation:

The student should submit dissertation one month before the final examination. Those students who have not submitted the dissertation shall not be allowed to appear for the final examination. The dissertation shall be assessed at the time of orals by all the examiners.

The dissertation shall be written under the following headings:

Introduction; Aims or objectives of study; Review of literature; Materials and methods; Results; Discussion; Conclusion; Summary; References; Tables; Annexure

The Dissertation shall be reviewed in the form of a presentation every month by the Guide / HOD CVTS.

The written text of dissertation shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and other annexures. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should not be done. A declaration by the candidate that the work was done by him/her shall be included. The Guide and Head of the Department shall certify the bonafide of the dissertation.

Three copies of dissertation shall be submitted to the university through proper channel along with a soft copy (CD), one month before the final examinations.

12. Internal assessment (IA):

a) A student must secure at least 35% marks of the maximum marks fixed for internal assessment in a particular subject, to be eligible to appear for the university examination of that subject.
b) There shall be three internal assessment tests and the average of these tests shall be considered for awarding final marks.
c) If the candidate is absent for any of the exams, the marks in that exam shall be taken as zero.
d) The computed internal assessment marks as per the regulation a & b shall be sent to the controller of exams 15 days before the commencement of the University exam.
e) The internal assessment marks should be signed by the concerned teaching faculty or HOD and counter signed by the HOD before being forwarded to the Controller of Examinations.
f) For those who failed in internal assessment test/s, have to reappear as per the regulations before he/she appears for the university examination.
g) For those who want to improve their marks in internal assessment tests, they can appear again as per the regulation. For such students, the internal assessment marks of the student at the time of first appearance will be compared with the marks obtained at the present appearance and the higher of the two will be taken as his/her internal assessment marks.

13. Examination fee structure : The examination fee shall be applicable as existing to the Other M.Sc. Courses (AHS).

14. Minimum for a pass:

a) 35% in internal assessment of each theory paper and practicals/viva voce
b) 40% in each theory paper of university examination.
c) 50% on the total marks of theory university examination and internal assessment clubbed together, applicable to each paper.
d) Where, viva voce involved which is part of theory examination, 50% on the total marks of theory university examination, internal assessment and viva voce clubbed together, applicable to each paper.
e) Where there is no internal assessment marks, 50% on the total theory marks, 50% in practicals/viva voce applicable to each subject.

15. Classification of successful candidates:

Percentage of Marks for declaring Class:

Distinction	- 75% and above of the total marks.
First Class	- 65 - 75% of the total marks.
Second Class	- 50- 64% of the total marks.
Pass Class	- If the student does not pass all the subjects withinthe 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 attendance shortage, it will be taken into consideration as not completed within the duration of the course and the final results will be declared as "Pass".

16. Panel of examiners:

a) There shall be a panel of four external examiners as advised by the Head of the department..
b) Theory paper setting to be done by the examiners locally, within the state or outside the state. For practical and viva-voce

c) No.of Examiners Required - Two
No.of Internal Examiner. - One
No.of External Examiner. - One

Eligibility for the examinership:

a) The examiner shall be a full time teacher in the college or institution he or she is working.

b) Academic qualification and teaching/professional experience for examiners:

- External / Internal Examiner: M.Sc in Cardio pulmonary Perfusion Technology / or equivalent syllabus for M.Sc Perfusion technology with minimum of five years of teaching / professional experience.
- External / Internal Examiner: M.Ch / DNB in Cardio Thoracic Surgery shall have not less than 5 years of teaching experience in the speciality concerned and working as Asst Prof. Or above in a teaching hospital.

17. Reappearance:

The student has to pass both theory and practicals/viva voce, if any student pass in theory examination and fail in practicals/viva voce examination or vice versa, the concerned student has to appear again for both theory and practicals/viva voce examination.

18. Carry-over Provision:

The students are permitted to complete the course period irrespective of their success in the preliminary part. However, the final results will be kept under "withheld" until he/she passes all the previous papers".

19. Maximum duration for completion of course:

A candidate shall complete the course within four years from date of admission. Failing which, the candidate will be discharged.

20. Eligibility for award of degree:

A candidate shall have passed in all the subjects of first and second year to be eligible for award of degree.

21. Model Question Paper:

(Common for all papers – 1st & 2nd year)

THEORY

Each theory paper will have

1) Essay questions – 03 nos. carrying 10 marks each	- 03 x 10	= 30
2) Short answer questions – 10 nos. carrying 05 marks each	- 10 x 05	= 50
Total		**= 80**
Internal assessment		= 20

PRACTICAL

(a) Internal assessment	:	15
University examination	:	60
Total	=	**75**
(b) Viva	=	25

22. Minimum Requirement of Infrastructure, Laboratory Facilities and Staff:

(i). Basic Infrastructure:

Institute should have its own hospital with full-fledged cardiac surgical service with the following facilities:

- 3 cardiac operating rooms
- Chief Perfusionist and 2 Assistant Perfusionist
- Class Room with capacity for 10 students
- One departmental Seminar room with capacity of 30 students with A.V aids – OHP, Slide projector and computer with accessories are compulsory. LCD Projector (optional)
- Institute should have the following infrastructure criteria- Principals room, students common room, staff room, Library, office room, Store room, preparation room etc will be as per minimum criteria.
- Minimum of 250 open-heart procedures per year.

(ii). Infrastructure subject wise

- Anatomy laboratory
- Physiology laboratory
- Perfusion equipments
    i. Heart Lung Machine and Accessories
    ii. Heater Cooler – one machine per patient
    iii. IABP - 2
    iv. A C T Machine - 2
    v. Blood Gas Analyzer - 2

(iii). Teaching staff requirement:

Teaching staff should be actively involved in imparting education in the particular subject:

- Professor – 1
- Associate Professor (5 years teaching experience) – 1
- Assistant Professor (3 years teaching experience) – 1
- Chief Perfusionist / Lecturer (B.Sc. Cardio Pulmonary Perfusion Technology) - 1
- Assistant Perfusionist / Tutor (B.Sc. / Diploma with experience of 5 years in Cardio pulmonary Perfusion Technology).

SECTION -III
Course content (Syllabus)

I YEAR THEORY

Paper –I: CARDIOLOGY and CARDIAC SURGERY 80 Hours

CARDIOLOGY

1. **The Electrical Activity of the Heart: the Electrocardiogram:** The cardiac action potential, the electrocardiogram.
2. **Diseases of the Coronary Arteries:** Causes, Pathology and Prevention, Coronary Heart Disease – Angina and Unstable Angina; Coronary Heart Disease – Myocardial Infarction: Treatment of acute infraction, complications of acute myocardial infarction and their management, late complications of infraction, risk stratification at hospital discharge, drug treatment at discharge, rehabilitation.
3. **Heart Failure:** The Pathophysiology of heart failure, clinical syndromes of heart failure, the management pf cardiac failure, acute circulatory failure (shock), cardiac transplantation.
4. **Disorders of Rate, Rhythm and Conduction:** Mechanisms of arrhythmias, disturbances of rate and rhythm, disorders of conduction, investigation of arrhythmias, management of arrhythmias.
5. **Rheumatic Fever and its Sequelae, Disorders of the Cardiac Valves:** Mitral valve disease, aortic valve disease, tricuspid valve disease, pulmonary valve disease, infective endocarditis.

6. Congenital Heart Disease: The varieties of congenital heart disease.

CARDIAC SURGERY

1. **Ischaemic Heart Disease:** Pathophysiology of ischaemic disease: Indications for CABG, Contraindication to CABG, Planning coronary artery surgery, Conduit, selection, Principles of saphenous vein harvest, Saphenous vein harvest, LIMA harvest, RIMA harvest, Alternative conduits, Distal anastomoses on bypass, Jump or sequential grafts, Endarterectomy, Positioning the heart in OPCAB , Proximal anastomoses to aorta, Redo coronary artery bypass surgery , Problem scenarios in redo surgery , Left ventricular aneurysm , LV aneurysmectomy ,Ischaemic ventriculoseptal defect (VSD), Ischaemic mitral regurgitation, Results of coronary artery bypass surgery.

2. **Valvular Heart Disease:** Pathophysiology of aortic stenosis, Pathophysiology of aortic regurgitation, Timing of surgery – aortic, Principles of aortic valve replacement, Aortic valve implantation, Stentless aortic valve replacement, Homograft aortic valve replacement, The Ross procedure, Aortic root replacement, Aortic root enlargement, Principles of valve sparing procedures, Results of aortic valve surgery, Pathophysiology of mitral stenosis, Pathophysiology of mitral regurgitation, Timing of surgery – mitral, Principles of mitral valve repair, Mitral Valvotomy, Principles of mitral valve repair, Mitral valve replacement, Tricuspid valve disease, Surgery for infective endocarditis, Combined Valvular procedures, Alternative approaches, Results of mitral and tricuspid valve surgery.

3. **Congenital heart disease:** Overview of congential heart surgery, Patent ductus arteriosus, Anomalous pulmonary venous connection, Coarctation of the aorta, Atrial septal defects, Ventricular septal defects, Atrioventricular septal defects, Truncus arteriosus, AV alignment abnormalities, Transposition of the arteries, Ebstein's anomaly , Tetralogy of Fallot ,

Hypoplastic left heart syndrome, Basic operative technique , Arterial switch (Jatene), Rastelli operation, Damus-kaye-stansel operation, Norwood operation, Glenn shunt and hemi – Fontan, Fontan operation, Pulmonary artery banding, Aortopulmonary shunts, Tetralogy of Fallot repair, Pulmonary valvotomy, Aortopulmonary window repair, Coarctation of the aorta repair, Interrupted aortic arch repair, LVOT obstruction repair.

4. **Diseases of the thoracic aorta**: Pathology of aortic dissection, Diagnosis of type A aortic dissection, Management of type A dissections, Set – up for repair of aortic dissection, Repair of Debakey type II dissection, Repair of Debakey type I dissection, Management of type B dissections, Other repair techniques, Pathology of aortic aneurysms, Diagnosis of aortic aneurysms, Management of aortic aneurysms, Surgery for ascending aneurysms, Valve sparing surgery techniques, Surgery for aortic arch aneurysms, Repair of descending aortic aneurysms, Bypass for descending aorta surgery, Traumatic aortic transaction.

5. **Minimal access surgery:** Incisions, Options for Cardiopulmonary bypass, LIMA harvest, Coronary artery bypass grafting (CABG), Valve surgery.

6. **Complications of cardiac surgery:** Normal postoperative course, Overview of complications, Hypotension and tamponade, Chest pain and ischemia, Late arrhythmias, Hypertension, Pericardial problems, Complications of valve surgery, Respiratory complications, Renal Complications, Gastrointestinal symptoms, Gastrointestinal complications, Hepatobiliary complications, Stroke, Management of stroke, Neurological complications, Wound infections, wound complications, Haematological complications.

7. **Cardiac Anaesthesia:** Basic Principles of anaesthesia, Conduct of anaesthesia, Pre-bypass anaesthetic management, Anaesthetic management of bypass, Anaesthetic management post – bypass, Anaesthesia for off – pump surgery.

PAPER - II INTRODUCTION TO – OT & CARDIO PULMONARY PERFUSION TECHNOLOGY: 80 Hours

1. **Introduction to the operating room environment & protocols:** General protocols followed in the operating room, Hand washing, Unsterile-substerile-sterile methods followed in the O R environment, Handling of Disposables in the O R, Handling &maintenance of equipments in the OR, Protocols followed in CCU

2. **Introduction to the various components of Cardiopulmonary bypass system**

3. **Introduction to the basics of CPB procedures**

4. **Basics of electricity & functioning of electro medical equipments.** Electric safety (Earthing) & care of apparatus. Electricity & electro medical equipments& safe guards Static electricity

5. **Sterilization – material & methods**

6. **Cardiopulmonary resuscitation:** Basic cardiac life support, Advanced cardiac life support

7. **Intensive coronary unit & recovery room concepts**

8. **Biomedical waste & its management**

Textbooks:

1. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis , Mark Kurusz& Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
2. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch

PAPER III : EQUIPMENTS IN CARDIO PULMONARY PERFUSION TECHNOLOGY & PHYSIOLOGY & PATHOLOGY OF CARDIO PULMONARY PERFUSION

PHARMACOLOGY OF CARDIOVASCULAR DRUGS 80 Hours

EQUIPMENTS IN CARDIO PULMONARY PERFUSION TECHNOLOGY

1. Blood Pumps, Principles of Oxygenator Function: Gas Exchange, Heat Transfer, and Operation
2. Circuitry and Cannulation Techniques, Cardiotomy Suction and Venting

PHYSIOLOGY & PATHOLOGY OF CARDIO PULMONARY PERFUSION

3. Blood – Surface Interface, Pulsatile Cardiopulmonary Bypass
4. Hemodilution and Priming Solutions, Hypothermia: Physiology and Clinical Use
5. Surgical Myocardial protection, Changes in the pharmacokinetics of Drugs Administered During Cardiopulmonary Bypass
6. Immune and Inflammatory responses after Cardiopulmonary Bypass, Embolic Events, Endocrine, Metabolic, and Electrolyte response
7. Cardiopulmonary Bypass and the Lung, Cardiopulmonary Bypass and the Kidney
8. Splanchnic, Hepatic, and Visceral effects, Neurologic Effects
9. Recent developments in equipments in cardio Pulmonary perfusion technology & physiology & pathology of Cardio Pulmonary perfusion

Textbooks:

1. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis, Mark Kurusz& Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
2. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch
3. Warm heart surgery, Tomas Antonio Salerno

PHARMACOLOGY OF CARDIOVASCULAR DRUGS

1. Anti-anginal agents: Beta-blocking antes, nitrates, calcium channel blockers

2. Anti-failure agents: Diuretics

3. Angiotensin – converting enzyme (ACE): inhibitors, angiotensin-II, Receptor Blockers (ARBs) and aldosterone antagonism

4. Digitalis: acute inotropes and inotropic dilators

5. Antihypertensive drugs:

6. Antiarrhythmic drugs

7. Antithrombotic agents: platelet inhibitors, anti coagulants and fibrinolytics

8. Lipid –lowering and antiatherosclerotic drugs

9. Recent developments in pharmacology of cardiovascular drugs

Textbooks:

Drugs for the heart, Lionel HOpie, Bernard J Gersh, 5th Edition

Paper – IV

Epidemiology & Bio-statistics including Research Methodology

Total hours: 80

Sl. No.	Topics	80 Hours
1	**Introduction** Introduction to Biostatistics& Research Methodology, types of variables & scales of measurements, measures of centraltendency and dispersion, Skewness and Kurtosis Rate, Ratio, proportion, incidence, prevalence and their meaning.	6
2	**Sampling** Random & non random sampling, various methods ofsampling-simple random, stratified, systematic, cluster andmultistage. Sampling and non sampling errors.	6
3	**Basic probability distribution and sampling distributions** Concept of probability distribution, normal, Poison andBinomial distributions, parameters and applications.Concept of sampling distributions. Standard error andconfidence intervals.	8
4	**Tests of Significance** Basics of testing of hypothesis – Null and alternate, hypothesis, type I and type II errors, level of significance and power of the test, p value. Tests of significance (parametric) T – test (paired & unpaired), Chi square test and test of proportion, one way analysis of variance. Repeated measures analysis of variance. Tests of significance (nonparametric) – Mann Whitney U Test,Wilcoxon Test, Kruskal – Wallis analysis of variance Friedmann's analysis of variance.	12
5	**Correlation and Regression** Simple correlation –Pearson'sand Separman's methods ;testing the significance of correlation co-efficient simple and multiple linear regression.	6
6	**Sample size determination** General concept Sample size for estimating means andproportion, testing of difference in means, proportions oftwo groups and more than two groups.	6

7	**Study Designs** Descriptive epidemiological methods – case series analysis and prevalence studies. Analytical epidemiological methods– case control and cohort studies, Clinical trials / inter ventionstudies, odds ratio and relative risk, stratified analysis.	12
8	**Multivariate analysis** Concept of multivariate analysis, introduction to logisticregression and survival analysis	8
9	**Reliability and validity evaluation of Diagnostic Tests** Cronbach's alpha and Test- retest methods	6
10	**Format of Scientific documents** Structure of Research protocol, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta analysis.	10

Suggested Reading

1. Surendar a Rao PSS and J Richard. Introduction Biostatics an Research Methods, Prentice Hall of India (2006).
2. AbhayaIndrayan and Rajeev Kumar Malhotra, Medical Biostatics, 4thEditiin, CRC Press (2017)
3. Indrayan and Satyanarayana, Biostatics for Medical, Nursing and pharmacy students, prentice Hall of India (2006)
4. Sarma K.V.S, Statistics made simple – do it yourself on PC, 2nd edition, Prentice Hall (2010)

PRACTICALS – I YEAR

Paper –I :

CARDIOLOGY AND CARDIAC SURGERY **60 Hours**

CARDIOLOGY

Clinical scenario given to the candidate for diagnosis and treatment of following disorders:

a. Unstable angina
b. Myocardial infarction
c. Left ventricular aneurysm
d. Congestive heart failure
e. Cardiac arrhythmia
f. Atrial septal defect
g. Ventricular septal defect
h. Tetralogy of Fallot
i. Hypertension

CARDIAC SURGERY

Brief description of surgical steps involved in:

a. Coronary artery bypass grafting (on pump CABG)
b. Mitral valve replacement
c. Aortic valve replacement
d. ASD closure
e. VSD closure
f. TOF repair
g. Redo sternotomy
h. Off-pump CABG

Recommended Reading and Reference books

Textbooks:

Cardiology:

1. Cardiology, 7th Edition, Desmond G. Julian, J. Campbell Cowan, James M. McLenachan

2. Davidson's Principles and Practice of Medicine, Edited by Nicki R.Colledge, Brian R.Walker, StuaratH.Ralston.

3. Pefloff's Clinical Recognition of Congenital Heart Disease. Author: JK Perloff, Ariane J.Marelli

4. Valvular heart Disease Author. Joseph S Alpert, James E Dalan and Shahbuddin H Rahimtoola

5. Text Book of Cardiology by Braunwald

Cardiac Surgery :

6. Cardiac Surgery: Oxford specialist handbook in surgery (Cardio thoracic surgery), Indian Edition, Joanna Chikwe, Emma Beddow, Brain Glenville.

7. Cardiac Surgery Author: Kirklin/ Barratt-Boyes

Cardio Pulmonary Perfusion:

8. Text Book on Cardiopulmonary bypass Principles and Practice Author: Glen P. Gravalee, Richard F Davis, Alfred H Stammers and Ross M.Ungerleider

9. Cardiopulmonary bypass Principles and management Edited by : Kanneth M. Taylor

Pharmacology:

10. Test Book of Pharmacology : . Gabriel Khan

11. Drugs for the heart – Opie

12. Text Book of Pharmacology by Satoskar

Anatomy

Test Book
1. Medical Embryology Langmans, Inderbir Singh
2. Anatomy : Chaurasia
3. Anatomy by Gray's Anatomy

ECG : Schamroth

Paper –II :

INTRODUCTION TO – OT & CARDIO PULMONARY PERFUSION TECHNOLOGY:

60 hours

- Practical aspects of the theory topics

Simlation:

Priming techniques
Assembly of a circuit
Leakage detection
Air bubble removal
Roller pump Caliberation
Wet runs
Monitoring parameters, Sampling and data Recording
Drug management
Equipment maintenance
Coordination with Surgeon and Anaesthetist

Paper –III:

EQUIPMENTS IN CARDIO PULMONARY PERFUSION TECHNOLOGY & PHYSIOLOGY & PATHOLOGY OF CARDIO PULMONARY PERFUSION PHARMACOLOGY OF CARDIOVASCULAR DRUGS:

60 hours

Equipments In Cardio Pulmonary Perfusion Technology & Physiology & Pathology of Cardio Pulmonary Perfusion:

1. The candidate should be able to recognize and describe the various parts of the following equipments:
   a. Integrated membrane Oxygenator system
   b. Roller pump.
   c. Centrifugal pump.
   d. Arterial line filter.
   e. Various types of connectors & tubing's.
   f. Various types of cannulae.
   g. Cardioplegia delivery system
2. Able to assemble an Adult Extra Corporeal Bypass Circuit..
3. Able to handle a Heart Lung machine with an Extra Corporeal circuit.
4. Priming and de-airing of an assembled Extra Corporeal Circuit.
5. Priming and de-airing of an Online Cardioplegia delivery system.
6. Determination of occlusion in a roller pump.
7. Method to calibrate the Heart Lung machine.
8. Should know about the Safety features of the Heart Lung machine.
9. Calculation PCV on CPB and amount of blood to be added to bring the PCV to the target PCV. Calculation body surface area of an individual, Systemic Vascular Resistance.

(1). Interpretation and correction of a given arterial blood gas report. (2). Interpretation and correction of a given electrolyte abnormality, (3). Performing and ACT estimation and interpretation of results (4). Other methods to monitor anti coagulation on CPB.

Pharmacology of Cardiovascular Drugs:

Common cardiovascular drugs and main actions & side effects:

a. Nitrates
b. β-Blockers
c. Calcium channel blockers
d. Digoxin
e. Angiotensin receptor antagonists
f. Angiotensin receptor blockers
g. Common anti-arrhythmic agents
h. Heparin
i. GP II b / III a blockers
j. Aspirin &clopidogrel

Second Year– Theory

Paper I : CLINICAL APPLICATIONS OF CARDIO PULMONARY PERFUSION TECHNOLOGY **60 Hours**

1. Conduct of cardiopulmonary bypass & termination of bypass
2. Management of unusual problems encountered in initiating and maintaining cardiopulmonary bypass.
3. Cardiopulmonary bypass in infants and children
4. Extra corporeal membrane oxygenation for respiratory or cardiac support
5. Extra corporeal cardiopulmonary support for resuscitation and invasive cardiology outside the suite
6. Non-cardiovascular applications of cardiopulmonary bypass
7. Perfusion for thoracic aortic surgery
8. Cardiopulmonary bypass for port – access cardiac surgery
9. Recent developments clinical applications of Cardio Pulmonary perfusion technology

Textbooks:

1. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis, Mark Kurusz& Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
2. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch
3. Warm heart surgery , Tomas Antonio Salerno

Paper II : CARDIAC SURGERY WITHOUT CPB
MECHANICAL CIRCULATORY SUPPORT &ROBOTIC CARDIAC SURGERY

60 Hours

Cardiac surgery without CPB

Patients selection for less invasive operations (MID CAB, OP-CABG), technical considerations in off-pump surgery, stabilizing devices, intra coronary stunts, primary off-pump CABG in impaired left ventricular function, alternative approaches to coronary artery disease, beating heart surgery supported by assist devices.

Mechanical circulatory support

1. IABP
2. Should have knowledge of Cardiac assist devices
   a. General aspects of mechanical support
   b. Extracorporeal devices
   c. Intracorporeal devices
   d. Future devices
3. Knowledge regarding the Devices used as bridge to transplantation
   a. Thoratec VAD
   b. Novacor LVAD
   c. Heart mate
   d. Totally artificial heart

Robotic cardiac surgery: The candidate should have knowledge regarding the following :
Cardio pulmonary bypass during port – access surgery and robotic surgery: endovascular catheter system, minimally invasive cardiac surgery, directs vision, micro-incision and video-assisted, and robotic operations.

Recent developments issues in Cardio Pulmonary perfusion

Textbooks:

1. Cardiac assists devices, Daniel J. Goldstein & Mehmet C.Oz, Futura Publishing Company, 2000
2. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis, Mark Kurusz& Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
3. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch

PAPER III: ORGAN TRANSPLANTATION 60 Hours

1. Heart transplantation

Basic transplant immunology, Patient and donor selection, Matching donor to recipient, Donor preparation, Orthotopic / heterotropic Cardiac transplantation, Intensive care management, Immunosuppression and rejection, Surgical complications and results.

2. Heart-lung transplantation

Recipient selection, donor selection and graft harvest, surgical procedure, Pathophysiology before / after transplantation, preoperative management.

3. Lung transplantation

Recipient selection, Donor selection and graft harvest, surgical procedures of lung transplantation (single-lung / double-lung transplantation) , Pathophysiology before / after transplantation, postoperative management.

4. Liver transplantation: role of perfusionist

5. Renal transplantation: role of perfusionist

6. Prosthetic heart valves (mechanical/ bioprosthetic) and the **annuloplasty rings**

Mechanical and bioprosthetic heart valves: ball & cage valve, tilting-disc valves (porcine, bovine and stent – less valves), Annuloplasty rings: Rigid rings, complete & partial rings, soft rings, bio-degradable sings.

7. Homografts

Grafts (Synthetic): synthetic grafts, pre-clotted grafts, collagen – coated grafts, bifurcatedgrafts:

Recommended Books for organ transplantation

Text Book: Cardiac Surgery Author: Kirklin/ Barratt-Boyes Sabistons

Reference books :

1. Clinical Guide to Heart Transplantation Editors: **Kobashigawa**, Jon (Ed.)
2. Lung And Heart - Lung Transplantation(Lung Biology In Health And Disease Vol. 217) by Joseph P Lynch and David J Ross, Taylor & Francis

3. Kaplan's Cardiac Anaesthesia, 5th Edition, Joel A Kaplan (Editor) Elsevier Saunders, Philadelphia 2006.

4. Oxford specialist handbook in surgery (Cardio thoracic surgery), Indian Edition, Joanna Chikwe, Emma Beddow, Brain Glenville.
5. Ventricular Assist Devices in Advanced-Stage Heart Failure Editors: **Kyo**, Shunei (Ed.)

Paper IV: HEMATOLOGY AS RELEVANT TO CARDIO PULMONARY PERFUSION, BLOOD TRANSFUSION AND BLOOD CONSERVATION 60 Hours

A.Hematology: Anticoagulation for cardiopulmonary bypass, Heparin neutralization, Hematologic effects of cardiopulmonary bypass, Management of coagulopathy associated with cardiopulmonary bypass. Coagulation Cascade and clotting factors

B.Blood transfusion: Transfusion practices, Transfusion algorithms Various transfusion reactions

C.Blood conservation: Autologous blood donation, acute perioperative normovolemichemodilution or "blood pooling", intraoperative blood salvage, postoperative autologous blood salvage, erythropoietion therapy to replace blood loss, Pathophysiology and epidemiology of hemostatic abnormalities, Topical agents for reducing blood loss.

Textbook

1. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis, Mark Kurusz& Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
2. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch
3. Physiology - Ganong
4.Text book physiology – Gluyton

PRACTICALS – II YEAR

Paper –I :

CLINICAL APPLICATIONS OF CARDIO PULMONARY PERFUSION TECHNOLOGY

80 Hours

1. Able to assemble an ideal pediatricCPB circuit and should be able to describe the differences between adult and pediatric circuit.
2. Should be able to assemble an ECMO circuit and describe the components
3. Should be able to assemble ECMO circuit and prime it.
4. Should be able to design an ideal CPB circuit for an Aortic arch repair surgery and should know the advantages
5. Should know how to change an oxygenator during CPB
6. Should know how to change of pump loop
7. Management of massive air embolism during CPB.
8. Management of arterial pump failure
9. Should be able to deal with the catastrophic events which could occur during CPB like : Manage a simulated perfusion accident on a dummy CPB circuit including changing oxygenators when on CPB, managing falling/leaking reservoir levels, venous airlocks, air in the arterial line, cardioplegia delivery failure, increased arterial line pressure, recognition of a possible dissection, run away pump head, recognition of heat exchanger water leak into the CPB circuit, reaction time assessment etc.
10. Should be able to calculate vascular resistance on CPB and management of increased perfusion pressure on bypass.

Paper –II :

CARDIAC SURGERY WITHOUT CPB

MECHANICAL CIRCULATORY SUPPORT &ROBOTIC CARDIAC SURGERY

80- hours

1. Should know about the LVAD / RVAD circuit and be able to know the parts of the components
2. Should have knowledge of LVAD/RVAD circuit and prime.
3. Set up of an IABP; indentation the dicrotic notch, end diastolic point, unassited systole, and assisted systole.
4. Description of proper timing, timing errors, complications and contra indications of IABP therapy. Diagrammatic representation of picture of pressure wave of 1:2 assist.
5. Identification & use of octopus in off-pump CABG
6. Identification & use of star fish in off-pump CABG
7. Indications for use of IABP for off-pump procedures
8. Shunts used for systemic –pulmonary shunts in pediatric cardiac surgery and for aortic surgery.
9. Intra coronary shunts in off-pump CABG

Paper –III:

ORGAN TRANSPLANTATION **80- hours**

PRACTICALS

i). Should be able to identify
various mechanical and bioprosthetic heart valves
ball & cage valve, tilting-disc valves (porcine, bovine and stent – less valves),
Annuloplasty rings : Rigid rings , complete & partial rings , soft rings , bio-degradable sings.

ii). Should be able to identify various homografts specimens.
Describe the process of harvest, processing preservation and handling of homografts

iii).Should have knowledge and be able to identify various grafts (synthetic):
Desirable materials used for manufacture of synthetic grafts, pre-clotted grafts, collagen – coated grafts, bifurcated grafts:
Methods of sterilization of systemic grafts.
Difference between homografts and synthetic grafts.

Paper –IV

HEMATOLOGY AS RELEVANT TO CARDIO PULMONARY PERFUSION, BLOOD TRANSFUSION AND BLOOD CONSERVATION **80- hours**

1. Draw and discuss coagulation cascade
2. Describe action and uses of heparin
3. Describe action & side effects of protamine
4. Describe on heparin alternatives
5. Platelet dysfunction during CPB
6. Leukocyte depletion during CPB
7. Factors causing hemolysis during CPB
8. Monitoring of anti-coagulation during CPB

    a). ACT
    b). Heparin protration titration
    c). Heparin concentration
    d). Sonoclot
    e). Thromboelastography
9. Discuss coagulation disorder associated CPB
10. Draw and discussion on algorithm approach for hemostatic therapy in cardiac patients.
11. Draw and discussion on algorithm approach for postoperative red cell transfusion in cardiac surgical patients.
12. Cost effectiveness of autologous blood donation in cardiac surgery.

SECTION-IV
MONITORING LEARNING PROGRESS

It is essential to monitor the learning progress of each candidate through continuous appraisal and

regular assessment. It not only also helps teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment be done using checklists that assess various aspects. Model Checklists are given in this Chapter, which may be copied and used.
The learning out comes to be assessed should include:

i) ***Acquisition of Knowledge***: The methods used comprise of `Log Book' which records participation in various teaching / learning activities by the students. The number of activities attended and the number in which presentations are made are to be recorded. The logbook should periodically be validated by the supervisors. Some of the activities are listed. If the list is not complete, the department may include additional activities, if so, desired.

Journal Review Meeting (Journal Club): The ability to do literature search, in depth study,presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting using a checklist (see Model Checklist – I, Section IV)

Seminars / Symposia: The topics should be assigned to the student well in advance tofacilitate in depth study. The ability to do literature search, in depth study, presentation skills and use of audio- visual aids are to be assessed using a checklist (see Model Checklist-II, Section IV)

ii) Teaching skills: Candidates should be encouraged to teach undergraduate medicalstudents and paramedical students, if any. This performance should be based on assessment by the faculty members of the department and from feedback from the undergraduate students (See Model checklist III, Section IV)

iii) Dissertation: Please see checklist IV and V in Section IV.

iv) Work diary / Log Book- Every candidate shall maintain a work diary and record his/herparticipation in the training programmes conducted by the department such as journal, reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of experiments or laboratory procedures, if any conducted by the candidate.

v) *Records:* Records, log books and marks obtained in tests will be maintained by the Headof the Department and will be made available to the University.

Logbook:

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

Format for the logbook for the different activities is given in Tables 1 and 2 of Section IV.
Copies may be made and used by the department.

Procedure for defaulters: Every department should have a committee to review suchsituations. The defaulting candidate is counseled by the guide and head of the department. In extreme cases of default the departmental committee may recommend that defaulting candidate be withheld from appearing the examination, if she/he fails to fulfill the requirements in spite of being given adequate chances to set himself or herself right. **Format of Model Checklists**

SECTION - V

Checklist - I

Model Checklist for Evaluation of Journal Review Presentations

Name of the student:_____ Date:_____

Name of the faculty/ Observer:_____

Sl. No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist - II

Model Check List for the Evaluation of the Seminar Presentations

Name of the student:_____Date:_____

Name of the faculty/ Observer:_____

Sl. No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist – III

Model Check list for Evaluation of Teaching Skill

Name of the student:_____Date:_____

Name of the faculty/ Observer:_____

SL. No.		Strong Point	Weak point
1	Communication of the purpose of the talk		
2	Evokes audience interest in the subject		
3	The introduction		
4	The sequence of ideas		
5	The use of practical examples and /or illustrations		
6	Speaking style (enjoyable, monotonous, etc., specify)		
7	Summary of the main points at the end		
8	Ask questions		
9	Answer questions asked by the audience		
10	Rapport of speaker with his audience		
11	Effectiveness of the talk		
12	Uses of AV aids appropriately		

Checklist - IV

Model Check list for Dissertation / Project Work Presentations

Name of the student:_____ Date:_____

Name of the faculty/ Observer:_____

Sl. No.	Points to be considered	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Checklist – V

Continuous Evaluation of dissertation / project work By

Guide/ Co-Guide

Name of the student: _____Date:_____

Name of the faculty/ Observer:_____

Sl. No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Periodic consultation with guide/ co-guide					
2	Depth of Analysis/ Discussion					
3	Department presentation of findings					
4	Quality of final output					
5	Others					
	Total score					

Overall Assessment Sheet

Date:

Check list No.	Name of the students			
	A	**B**	**C**	**D**
1				
2				
3				

Course i/c **Signature of the HOD** **Signature of the Principal i/c AHS**

The above overall assessment sheet used along with logbook should form the basis for certifying satisfactory completion of course of study, in addition to the attendance requirement.

KEY

Mean score: Is the sum all the scores of checklists 1 to 5

A, B, C: Name of the students

LOG BOOK

Table 1: Academic activities attended

Name:

Admission Year:

College:

Date	**Type of activity, Specific Seminar, Journal club, presentation, UG teaching**	**Particulars**

LOG BOOK

Table-2: Academic presentations made by the student

Name:

Admission Year:

College:

Date	Topic	Type of activity, Specific Seminar, Journal club, presentation and UG teaching

SECTION-VI

ETHICS IN M.Sc. CARDIO PULMONARY PERFUSION TECHNOLOGY

(Should be taught to the 1st year students of M.Sc. Cardio Pulmonary Perfusion Technology)

Introduction: With the advances in science and technology and the increasing needs of the patient, their families and community, there is a concern for the health of the community as a whole. There is a shift to greater accountability to the society. It is therefore absolutely necessary for each and every one involved in the health care delivery to prepare themselves to deal with these problems. Technicians like the other professionals are confronted with many ethical problems.

Standards of professional conduct for technicians are necessary in the public interest to ensure an efficient laboratory service. Every technician should not only be willingly to play his part in giving such a service, but should also avoid any act or omission which would prejudice the giving of the services or impair confidence, in respect, for technician as a body.

To accomplish this and develop human values, it is desired that all the students undergo ethical sensitization by lectures or discussion on ethical issues.

Introduction to ethics-

What is ethics?
General introduction to Code of Laboratory Ethics
How to form a value system in one's personal and professional life?
International code of ethics

Ethics of the individual-
Technician relation to his job
Technician in relation to his trade
Technician in relation to medical profession
Technician in relation to his profession

Professional Ethics-
Code of conduct
Confidentiality
Fair trade practice
Handling of prescription
Mal practice and Negligence
Professional vigilance

Research Ethics-
Animal and experimental research/ humanness
Human experimentation
Human volunteer research - informed consent
Clinical trials
Gathering all scientific factors
Gathering all value factors
Identifying areas of value – conflict, setting priorities
Working out criteria towards decision

ICMR/ CPCSEA/ INSA Guidelines for human / animal experimentation

Recommended reading

- Francis C.M., Medical Ethics, I Edition, 1993, Jay pee Brothers, New Delhi p189.
- Good Clinical Practices: GOI Guidelines for clinical trials on Pharmaceutical Products in India (www.cdsco.nic.in)
- INSA Guidelines for care and use of Animals in Research – 2000.
- CPCSEA Guidelines 2001(www.cpcsea.org).
- Ethical Guidelines for Biomedical Research on Human Subjects, 2000, ICMR, New Delhi.
- ICMR Guidelines on animal use 2001, ICMR, New Delhi.

SECTION -VII

ANNEXURE-I

CATEGORIES OF BIO-MEDICAL WASTE

	Waste Category ** Type	Treatment a Disposal ** Options
Category No. 1	Human Anatomical Waste: (human tissues, organs, body parts)	Incineration deep burial
Category No. 2	Animal Waste: (animal tissues, organs, body parts, carcasses, blooding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge form hospitals, animal houses)	Incineration deep burial
Category No. 3	Microbiology & Biotechnology Waste: (wastes from laboratory cultures, stocks or specimens or micro-organisms live or attenuated vaccines, human and animal Cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins, dishes and devices used for transfer of cultures)	Local autoclaving / micro waving / incineration.
Category No. 4	Waste sharps: (Needles, syringes, scalpels, blades, glass, etc, that may cause puncture and cuts. This includes both used and unused sharps)	Disinfection (chemical treatment / autoclaving / micro –waving and mutilation / shredding
Category No. 5	Discarded Medicines and Cytotoxic drugs: (wastes comprising of outdated, contaminated and discarded medicines)	Incineration / destruction and drugs disposal in secured landfills.
Category No. 6	** Solid Waste: (Items contaminated with blood, and body fluids including cotton, dressings, soiled plaster casts, Eners, beddings, other material contaminated with blood)	Incineration Autoclaving / micro waving
Category No. 7	Solid Waste: (Wastes generated form disposable items other than the waste ** sharps such as tubings, catheters, intravenous sets, etc)	Disinfection by chemical treatment, autoclaving / micro-waving and mutilation / shredding
Category No. 8	Liquid Waste: (Waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)	Disinfection by chemical treatment and discharge into drains
Category No. 9	Incineration Ash: (Ash from incineration of any biomedical waste)	Disposal in municipal landfill

SECTION - VIII

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES

TIRUPATI – 517 507

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

TRANSCRIPT

Master of Science in Cardio-Pulmonary Perfusion Technology

We hereby certify that the person named here below was a bonafide post-graduate student of SVIMS University. Further, we certify that the contents herein are accurate and complete.

Name

University Reg. No.

Gender :

Date of Birth :

Nationality :

Permanent Address :

Mailing Address :

EDUCATION

School/University	Place	Years	Degree obtained

Sl. No.	Subject	No. of Contact Hours	Code	Grade	Remarks
1.	Cardiac Embryology	20	C,L	P	
2.	Fetal and neonatal circulation	2	C,L	P	
3.	Ultrasound physics and instrumentation	146	C,L,P,PL	P	
4.	Clinical Cardiology	133	C,L,PL	P	
5.	Cardiovascular Pharmacology	10	C,L	P	
6.	Electrophysiology	4	C,L	P	
7.	Acute coronary syndrome	8	C,L	P	
8.	BLS/ACLS	10	C,L,P	P	
9.	Ischemic Heart Disease	17	L	P	
10.	Valvular Heart disease	32	L	P	
11.	Congenital Heart Disease	44	L	P	
12.	Cardiac surgery	10	L,C, PL	P	
13.	Echocardiography for lschemic Heart disease	70	C,P,PL	P	
14.	Echocardiography for Valvular heart disease	70	C,PL,P	P	
15.	Echocardiography for Congenital Heart disease	140	C,PL,P	P	
16.	Epedemiology and Biostastics	60	L	P	
18.	Ehocardiography of other heart diseases	25	PL, C,L,P	P	
19.	Myopericardial, Aortic, Systemic disorder & non cardiac diagnosis	137	C,L,P,PL	P	
20.	Recent Advances	168	C,L,PL,P	P	
21.	Medical ethics	10	L	P	
22.	Fetal Echocardiography	2	L,P	P	
23.	Peripheral Ultrasound	2	L,P	P	
24.	Seminar presentation	SS, I(G)	Classes for UG's		
25.	Attending rounds with Cardiologists	10	C	P	

DESCRIPTION OF CODES

C : Clinical Teaching

D : Demonstration of Faculty

I : Independent Work by Student

I (G) : Independent Work by Student Guided by Faculty

L : Classroom Lectures by Faculty

P : Hands on Practical Work by Students

SD : Self Directed Study by Student

SD (E) : Self Directed Study by Student with Faculty Evaluation
SS : Student Conducted Seminars with Faculty Moderation and Evaluation by Peers and Faculty
PL : Practical / Clinical Lab Posting

Prof.& Course Incharge Prof.& HOD Principal I/c AHS

CHECKLIST - I
Model Check List for Evaluation of Teaching Skill

SL. No.		Poor 0	Below average 1	Average 2	Good 3	Very good 4
1	Communication of the purpose of the talk					
2	Evokes audience interest in thesubject					
3	The introduction					
4	The sequence of ideas					
5	The use of practical examples and /or illustrations					
6	Speaking style (enjoyable,monotonous, etc., specify)					
7	Summary of the main points at theend					
8	Ask questions					
9	Answer questions asked by the audience					
10	Rapport of speaker with his audience					
11	Effectiveness of the talk					
12	Uses of AV aids appropriately					

CHECKLIST - II

Model check list for Dissertation / Project Work Presentations

Sl. No.	Points to be considered	Poor 0	Below average 1	Average 2	Good 3	Very Good 4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Overall Assessment of the student by the clinical/Lab work:

Sl. No	Points to be considered	Poor 0	Below Average 1	Average 2	Good 3	Very Good 4	Excellent 5
1	Attendance						
2	Punctuality						
3	Interaction with colleagues and support staff						
4	Maintenance of case records						
5	Topic Presentation						
7	Time sense						
8	Knowledge						
9	Rapport with patient.						
10	Overall quality of work						
	Total Score	- -	- -	- -			

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES

TIRUPATI – 517 507

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

PG Programme in Allied Health Sciences

M.Sc DIALYSIS TECHNOLOGY COURSE

TIRUMALA TIRUPATI DEVASTHANAMS

INDEX

General Regulations

1. Title of the Course

Master of Science degree in Dialysis Technology(M.Sc – DT)

2. Duration of the Course

The duration of the course shall be 2- years on full time basis

3. Eligibility for Admission

B. Sc in Dialysis Technology (4 yrs duration including one year internship)

(or)

B. Sc in Dialysis Technology(3 yrs duration) with one year of experience in a teaching institute)

4. Selection Criteria

Selection shall be based on the academic merit/entrance test conducted in the qualifying exam.

5. **Admission schedule :**

a) Commencement of Course: In August during every year
b) The admissions are closed by 30th September or 60 days from the date of commencement of the programme.

6. Medium of instruction.

English shall be the medium of instruction for the subjects of study as well as for the Examination.

7. Course of study

The course shall be pursued on full time basis. In the end of first year, there shall be an examination. Students shall be posted in SVIMS and SPMC hospitals during the practical hours.

Subjects for study and teaching hours for first year and second year of the PG course is an shown below.

Distribution of Teaching Hours

FIRST YEAR – THEORY

S.No.	Main subject	Theory No. of Hours
1.	Basic Sciences in Nephrology *	200
2.	Clinical Nephrology	100
3.	Basic principles and overview of types of renal replacement therapies (HD & PD)	130
4.	Epidemiology & Biostatistics	60
5.	**Subsidiary subject:** Medical Ethics	10
	Total:	**500**

*The attendance for the speciality subject shall be maintained by the HOD's i.e. Anatomy, Physiology, Pathology etc. Both University Theory and Practical will be evaluated by the Nephrologist and the expert.

PRACTICALS

Sl. No.	Area of posting / Subject	Total no. of contact hours
1	Dialysis Room	430
2	Water treatment plant	50
3	Electronics, Plumbing , Computer	70
4	Management of Dialysis unit	50
5	ICU Side Dialysis	20
6	Peritoneal Dialysis	20
7	Special & advanced dialysis procedures	20
8	CPR Demo	10
9	Teaching Methodology	100
10	Groups Discussion	30
	Total :	**800**

SECOND YEAR – THEORY

S.No.	Branches	Theory No. of Hours
6.	Recent advances in HD Procedures & complications in renal disease patients, Dialysis patients & Renal Nutrition	220
7.	Management of Dialysis Unit & Biomedical Instrumentation , Biotechnology & Molecular Biology	140
8.	Emergency Medicine, ACL, Nephro – Radiological and imaging sciences, Nuclear Medicine and Nephro-psychiatry	60
	Total:	**400**

PRACTICALS

Sl. No.	Area of posting / Subject	Total no. of contact hours
1	Dialysis Room	400
2	Water treatment plant	20
3	Electronics, Plumbing , Computer	20
4	Management of Dialysis unit	100
5	ICU Side Dialysis	50
6	Peritoneal Dialysis	10
7	Special & advanced dialysis procedures	200
8	Teaching Methodology	300
9	Groups Discussion	20
10.	Machine Management	180
	Total :	**1300**

8 a) Attendance:

A candidate is required to put in minimum 80% of attendance both in theory and practical separately of each paper before admission to the university examination. Participation in NCC, NSS, sports and games, educational tours, professional meetings and conference or other co-curricular activities representing the institution/university will not count as absence.

b) Condonation for lack of attendance:

The condonation of attendance on medical grounds or on absence under extraordinary circumstances to those who are having the attendance between 70% and 79% in each paper will be granted in genuine cases. The students who have shortage of attendance in the particular papers have to apply to the controller of examinations, indicating the reasons for shortage of attendance. The representation to be forwarded by the HOD & Prof. i/c AHS. If the reason is on the medical grounds, the relevant medical certificate has to be enclosed to the representation. If any student falls below the 70% of attendance, he/she will not be allowed to write the university examinations.

9. Scheme of examination

a) The examination for the degree shall consist of written papers, practical and oral.
b) There shall be two examinations viz. Preliminary and final. The preliminary examination shall be taken at the end of the first year. The final examination shall be taken at the end of 2nd year.
c) The examination shall be conducted ordinarily twice a year, viz. July/August and January/February.

Preliminary Examination

This consists of theory, practical and oral. There will be separate papers for each specialization.

University Examination and Distribution of marks

FIRST YEAR

S.No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
1.	Basic Sciences in Nephrology	I	20	80	15	60	25	200
2.	Clinical Nephrology	II	20	80	15	60	25	200
3.	Basic principles and overview of types of renal replacement therapy (HD & PD)	III	20	80	15	60	25	200
4.	Epidemiology & biostatistics	IV	20	80		-	-	100
	Total							**700**

SECOND YEAR

S.No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
5.	Recent advance HD Procedures & complications in renal disease patients Dialysis patients & Renal Nutrition	V	20	80	15	60	25	200
6.	Management of Dialysis Unit & Biomedical Instrumentation	VI	20	80	15	60	25	200

	Biotechnology & Molecular Biology							
7.	Emergency Medicine / ACL Nephro – Radiological, Nuclear Medicine and imaging sciences Nephro-psychiatry	VII	20	80	15	60	25	200
8.	Dissertation					100	50	150
	Total							**750**

Dissertation

The student should submit dissertation one month before the final examination. Those students who have not submitted the dissertation shall not be allowed to appear for the final examination. The dissertation shall be assessed at the time of orals by all the examiners.

The dissertation shall be written under the following headings:

Introduction; Aims or objectives of study; Review of literature; Materials and methods Results; Discussion; Conclusion; Summary; References; Tables; Annexure

The written text of dissertation shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should not be done. A declaration by the candidate that the work was done by him/her shall be included. The guide and head of the department shall certify the bonafide of the dissertation.

Three copies of dissertation shall be submitted to the university through proper channel along with a soft copy (CD), one month before the final examinations.

10. Internal assessment (IA):

a) A student must secure at least 35% marks of the maximum marks fixed for internal assessment in a particular subject to be eligible to appear for the university examination of that subject.
b) There shall be three internal assessment tests and the average of these tests shall be considered for awarding final marks.
c) If the candidate is absent for any of the exams, the marks in that exam shall be taken as zero.
d) The computed internal assessment marks as per the regulation 10 a) & b) shall be sent to the controller of exams 15 days before the commencement of the University exam.
e) The internal assessment marks should be signed by the concerned teaching faculty or HOD and counter signed by the HOD before being forwarded to the Controller of Examinations.
f) For those who failed in internal assessment test/s, have to reappear as per the regulation 9 a) & b) before he/she appears for the university examination.
g) For those who want to improve their marks in internal assessment tests, they can appear again as per the regulation 9 a) & b). For such students, the internal assessment marks of the student at the time of first appearance will be compared with the marks obtained at the present appearance and the higher of the two will be taken as his/her internal assessment marks.

11.Minimum for a pass

a) 35% in internal assessment of each theory paper and practicals/viva voce
b) 40% in each theory paper of university examination.
c) 50% on the total marks of theory university examination and internal assessment clubbed together, applicable to each paper.

d) Where, viva voce involved which is part of theory examination, 50% on the total marks of theory university examination, internal assessment and viva voce clubbed together, applicable to each paper.
e) Where there is no internal assessment marks, 50% on the total theory marks, 50% in practicals/viva voce applicable to each subject.

Note: For 2 year PG course, where any paper contains both theory and practicals/viva voce, the student has to pass both theory and practicals/viva voce, if any student pass in theory examination and fail in practicals/viva voce examination or vice versa, the student concerned has to appear again for both theory and practicals/viva voce examination.

12. Classification of successful candidates

Percentage of Marks for declaring Class:

Distinction	- 75% and above of the total marks.
First Class	- 65 - 74% of the total marks.
Second Class	- 50- 64% 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 attendance shortage, it will be taken into consideration as not completed within the duration of the course and the final results will be declared as "Pass".

13. Reappearance

The student has to pass both theory and practicals/via voce, if any student pass in theory examination and fail in practicals/viva voce examination or vice versa, the concerned student has to appear again for both theory and practicals/viva voce examination.

14. Carry-over Provision

The students are permitted to complete the course period irrespective of their success in the preliminary part. However, the final results will be kept under "withheld" until he/she passes all the previous papers".

15. Maximum duration for completion of course

A candidate shall complete the course within four years from date of admission. Failing which, the candidate will be discharged.

16. Eligibility for award of degree

A candidate shall have passed in all the subjects of first and second year to be eligible for award of degree.

FIRST YEAR

Course content (Syllabus) Theory

Paper I: Basic Sciences in Nephrology

I. Anatomy of Urinary Tract & Kidney (30hrs)

1. Gross anatomy of the kidney **(6hrs)**

- Location of kidney
- Size
- Protection
- Structure of the kidney – gross structure blood supply, nerve supply, lymphatic flow, L.S of Kidney.

2. Basic anatomy of urinary system **(8hrs)**

- The Kidney (structural anatomy)
- The ureter
- The bladder
- The urethra
- Sphincters
- Prostate

3. Microscopic anatomy **(4hrs)**

- Nephron: Glomerular structure, tubules
- Interstitium
- Juxta Glomerular apparatus

4. Embryology and fetal development in brief **(2hrs)**

5. Anatomy of peritoneum **(4hrs)**

- Description
- Size
- Nature
- Blood supply
- Lymphatic drainage

6. Anatomy of Vascular system related to Hemodialysis. **(6hrs)**

- Upper limb vessels.
  (Course, distribution, branches, origin, and abnormalities)
- Neck vessels.
  (Course, distribution, branches, origin, and abnormalities)
- Femoral vessels.
  (Course, distribution, branches, origin, and abnormalities)

II. Physiology of Kidney: (30hrs)

1. Basic concepts **(6hrs)**

- Glomerular filtration

- renal auto regulation of blood supply & GFR
- clearance
- Tubular reabsorption
- Aldosterone, ADH & water homeostasis
- Tubular secretion
- Maximal tubular transport capacity

2. Summary of major functions of Nephron & its components in urine formation. **(4hrs)**
   - Glomerulus
   - PCT
   - Henley's loop (Descending limb & thick ascending limb)
   - DCT
   - Collecting duct: Cortical, Medullary.
3. Renal regulatory Mechanism **(4hrs)**
   - Water regulatory mechanism
   - Electrolyte regulation (Sodium, Potassium, Chloride, Calcium, Phosphate, Magnesium)
   - Regulation of acid – base balance (basic principles & abnormalities)
4. Renal hormones & vit D, erythropoietin, Renin, Prostaglandins **(2hrs)**
5. Physiological values **(2hrs)**
   - Urea, Creatinine, Electrolytes, Calcium, Phosphorus, uric acid, Magnesium, Glucose.
   - 24 hours urinary indices – urea, Creatinine, electrolytes Ca, M
6. Physiology of peritoneum during P.D **(2hrs)**

   Diffusion through the peritoneum.
   - Definition
   - Factors influencing solute transport

   i) Peritoneal permeability
   ii)Solute characteristics
   iii)Concentration gradient
   iv)Peritoneal blood flow
   v)Dialysis solution temperature
   vi)Available membrane area
7. Routes of solute transport. **(1hrs)**
   - Intracellular.
   - Extracellular.

8. Factors that enhance diffusion. **(1hrs)**
   - Increased dialysis solution flow.
   - Increased blood flow.
   - High concentration gradient.
   - Pre-warmed dialysis solution.
   - Osmotic pressure.
9. Osmosis through the peritoneal membrane. (**2hrs)**
   - Ultrafiltration.
   - Drug transport.
10. Composition and function of blood – Introduction **(4hrs)**
    - Red blood cells: Erythropoiesis, stages of differentiation function, count physiological variation.
    - Hemoglobin: structure, functions, concentration physiological variation methods of Estimation of Hb
    - White blood cells: Production, function, life span, count, differential count
    - Platelets: Origin, normal count, morphology functions.

- Plasma Proteins – Production, concentration, types, albumin, globulin, Fibrinogen, prothrombin functions.
- Hemostasis& Blood coagulation: Hemostasis: Definition, normal hemostasis, clotting factors, mechanism of clotting, disorders of clotting factors.
- Blood Bank :Blood groups –
  ABO system, Rh system
  Blood grouping & typing
  Cross matching: Rh system – Rh factor, Rh in compatibility.
- Blood transfusion – Indication, universal donor and recipient concept.
- Selection criteria of a blood donor. transfusion reactions Anticoagulants – Classification, examples and uses
- Anemia's: Classification – morphological and etiological. Effects of anemia on body
- Erythrocyte sedimentation Rate (ESR) and Packed cell volume
- Blood Volume :Normal value, determination of blood volume and regulation of blood
- Volume
- Body fluid: pH, normal value, regulation and variation
- Lymph: lymphoid tissue formation, circulation, composition and function of lymph

11. Hemostasis – basic principles **(2hrs)**
    - Coagulation cascade
    - Coagulation factors
    - Regulation of procoagulants & anticoagulants BT, CT, PT, PTT, thrombin time

III. Biochemistry (30hrs)

1. Biological oxidation oxidative reduction electron transport chain-bioenergetics system-high energy phosphate system.
2. Metabolism of carbohydrates- aerobic & anaerobic metabolic metabolism of glucose-Role of liver in carbohydrate metabolism-alternate aerobic pathway-Role of carbohydrate metabolism-Alternate aerobic pathway-pentose-muscle contraction-regulation of blood sugar-metabolism of other hexoses.
3. Lipid metabolism-Introduction-Blood lipids-absorption-oxidation of fatty acids-synthesis-energetic of fat metabolism-metabolism of cholesterol.
4. Proteinmetabolism-Absorption-storage-general pathway-nitrogen metabolism-anabolism-catabolism-Metabolism of amino acids
5. Water & Mineral Metabolism-Sodium – potassium- chloride-Sulphur-calcium-phosphorus-magnesium-Ion Iodine copper-Zinc etc.
6. Classification, mechanism of action of hormones regulating hormones calcium and phosphorous.
7. Regulation of pH of Blood and body fluids: Regulatory mechanisms, Renal Mechanism, Disturbances in acid-base balance, respiratory acidosis , respiratory alkalosis, metabolic acidosis, metabolic alkalosis, assessment of the acid- base balance, carbon-di-oxide combining power of blood, alkali reserve, anion gap, Evaluation of Acid –Base balance

8. Renal function Formation and composition of urine – Specific gravity and pH, solids and 24 hour urine, abnormal constituents of urine- Glycosuria - glycosuria, fructosuria, pentosuria, lactosuria, galactosuria. Proteinuria, Ketone bodies, Bile pigments and bile salts, Blood, porphyrins, Urinary lithiasis.
9. Function & Test of Liver.
10. Over view of estimation of serum creatinine, blood urea, serum electrolytes, 24 hrs. Urinary protein – Lab methods.

IV. Nephro pathology: (30hrs)

1. Renal histology.
2. Renal pathology
   - Glomerular diseases
   - Tubulo interstitial nephritis
   - Chronic renal failure
3. Allograft pathology
4. Hypertension and other vascular diseases
5. Hemogram
6. Peripheral blood smear
7. Urine analysis
   - Urine collection
   - Physical characteristics (Color, smell)
   - Specific gravity and osmolality
   - pH
   - Glucose
   - Ketones
   - Electrolytes
   - Protein & related substances
   - Sediments – cells, crystals, casts

V. Nephro-immunology (20hrs)

Nature of the Immune system

1. Historical concepts and introduction to serological testing:
   a. Immunity and immunization
   - Cellular verses humoral immunity
   - Antigens and haptens
   - Cells – mediated immunity

   b. The Age of serology
   c. Other historical developments
2. Natural Immunity:
   a. External defense system
   b. Internal defense system
   - cellular Defense mechanism
   - acute phase reactants
   - inflammation

   c. Summary
3. The lymphoid system:

a. Primary lymphoid organs
   - Bone marrow
   - Bursa of fabricius
   - Thymus

b. Secondary lymphoid organ
   - Spleen
   - Lymph nodes
   - Other secondary organs

c. Surface marker on lymphocytes

d. Stages in B-cell differentiation
   - Pro- B cells
   - Pre – B cells
   - Immature B cells
   - Mature B cells
   - Activated B cells
   - Plasma cells

e. T cells Differentiation
   - Double – negative stage
   - Double positive stage
   - Mature T cells
   - Antigen activation

f. Third population or natural killer
   - Mechanism of cyto toxicity
   - Antibody – Dependent cell

g. Laboratory identification of lymphocytes
   - Fluorescence Microscopy
   - Cell flow cytometry
   - Other methods

h. Summary

4. Nature of Antigens and the MHC Complex
   a. Factors influencing the immune response
   b. Traits of Immunogens
   c. Nature of epitopes
   d. Haptens
   e. Relationship of antigens to the Host
   f. Adjuvants
   g. Major Histocompatibility Complex
      - Genes coding for the HLA antigens
      - Class I Antigens
      - Class II antigens
      - Antigen presentation
      - MHC and Autoimmunity
5. Antibody structure and Function:
   a. Tetra peptide structure of immunoglobulin
      - Cleavage with papain
      - Pepsin digestion
   b. The Nature of Light Chains
   c. Heavy chain sequencing
   d. Antigen recognition unit
   e. Hings region

f. IgG
g. IgM
h. IgA
i. IgD
j. IgE
k. Theories of antibody diversity
l. Genes coding for immunoglobin
m. Monoclonal antibody
n. Summary

6. Cell-Mediated Immunity:
   a. Activation of T Helper cells
      - Adhesion Molecules
      - Specific Antigen recognition
      - Function of Interleukin-2
      - Triggering of Interleukin-1
      - T- Helper subsets
   b. Stimulation of B cells
   c. Activation of cytotoxic T cells
      - Role of cytokines in the inflammatory response
      - I-1, I-2, I-3, I-4, I-5, I-6, Other I , Interferon's, TNF, other factors
   d. Laboratory determination of T lymphocyte function
      - Summary
7. Complement:
   a. The classic pathway
      - The recognition unit
      - The activation unit
      - The membrane attack
   b. The alternative pathway
   c. System controls
      - fluid phase regulators
      - cell – bound regulators
   d. Other cell membrane Receptors
   e. Biologic manifestation of complement activation
   f. Complement and Diseases states
   g. Complement Deficiencies
      - Paroxysmal Nocturnal Hemoglobinuria
      - Other complement
        - Laboratory detection of complement abnormalities
        - summary
8. Transplantation:
   a. Review of MHC
   b. Transplantation
      - Descriptive terms
      - Graft rejection
      - Tissue matching
      - Types of tissues and organs transplanted
      - Prevention and treatment of rejections

VI. Microbiology Related To Dialysis **(40hrs)**

1. Morphology **2 hours**
   Classification of microorganisms, size, shape and structure of bacteria
2. Bacterial growth and nutrition **2 hours**
   Nutrition, growth and multiplications of bacteria
3. Sterilisation and Disinfection **2 hours**
   Principles and use of equipments of sterilization
4. Immunology **2 hours**
   Immunity, Vaccines and immunization
5. Systematic Bacteriology **15 hours**
   Morphology, cultivation, diseases caused and laboratory diagnosis (Staphyloccci, Streptococci, Pneumococci, Gonococci, Menigococci, *C. diphtheriae*, Mycobacteria, Clostridia, Bacillus, Shigella, Salmonella, *E. coli*, Klebsiella, Proteus, *vibrio cholerae*, Pseudomonas & Spirochetes)
6. Parasitology **5 hours**
   Morphology, life cycle, laboratory diagnosis of following parasites *E.histolytica*, Plasmodium, Tape worms, Intestinal nematodes
7. Mycology **3 hours**
   Morphology, diseases caused and lab diagnosis of Candida, Cryptococcus and opportunistic fungi
8. Virology **4 hours**
   General properties of viruses, diseases caused lab diagnosis and prevention of Hepatitis and HIV viruses
9. Hospital infection **3 hours**
   Causative agents, transmission methods, investigation, prevention and control
10. Biomedical waste management **2 hours**

VII. Pharmacology **(20hrs)**

1. Medications commonly used by patient with renal failure **(8hrs)**
   - Antacids and phosphate binders
   - Anti anemic drugs
   - Anticoagulants
   - Antihypertensives
   - Antimicrobials
   - Antipruritis
   - Cardiovascular drugs
   - Chelating agents
   - Electrolytes
   - Laxatives and
   - Local anesthetics
   - Potassium ion exchange resin
   - Thrombolytic agents
   - Vitamins
2. Pharmacology related to Renal disease, Hemodialysis and Peritoneal dialysis **(12hrs)**
   - Pharmaco kinetic and Pharmaco Dynamic principles
   - IV fluid therapy with special emphasis in renal disease.
   - Diuretics–Classification, actions, dosage, side effects & contraindications

- Antihypertensive–Classification, action, dosage, side effects & contraindications, special reference during dialysis, vasopressors
- Drugs used in hypotension.
- Drugs & Dialysis–Dose & duration of administration of drugs
- Dialysable drugs–Phenobarbitone, Lithium, Methanol etc
- Vit D & its analogues, phosphate binders, iron, folic acid & other vitamins of therapeutic value
- Erythropoietin in detail.
- Heparin including low molecular weight heparin
- Protamine sulphate.
- Gluteraldehyde, sodium hypochlorite, hydrogen peroxide role as disinfectants & adverse effects of residual particles applicable to gluteraldehyde
- Haemodialysis concentrates – composition & dilution (Acetate & bicarbonates)
- PD fluid in particular hypertonic solutions composition (Dextrose, icodextrin solutions)
- Potassium exchange resins with special emphasis on mode of administration.

Paper II: Clinical Nephrology (100hrs)

I. Kidney disease (60 hrs)

Basic concepts related to renal failure (**2hrs)**
Classification of renal disease –Acute Kidney Injury, Chronic Kidney Disease **(2hrs)**
(Diagnosis, Precaution, Management)
A. Acute Kidney Injury **(10hrs)**
Classification

- Pre renal uremia (Etiology, pathophysiology, assessment, management)
- Intra-renal uremia (Etiology, pathophysiology, assessment, management
- Post renal uremia (Etiology, pathophysiology, assessment, management)

Clinical course o AKI

- Initiating stage
- Oliguric stage
- Diuretic stage
- Recovery stage

B. Chronic Kidney Disease **(26hrs)**

1. (Includes causes, signs and symptoms, treatment)
    - Developmental/congenital disorder
    - Cystic disorder
    - Tubular disorder
    - Neoplasms
    - Infectious disease
    - Glomerulonephritis
    - Obstructive disorders
2. Renal problem and systemic disease
    - Diabetes mellitus (DM)
    - Diabetes insipidus (DI)
    - Primary hyperparathyroidism
    - Hepatorenal syndrome
    - Gout
    - Amyloidosis
    - Scleroderma or progressive systemic sclerosis
    - Good pasture syndrome

- SLE (Systemic lupus Erythromatosis)
- HUS
- Nephrotic syndrome
- Hypertensive nephropathy

C. Renal problem in pregnancy

D. Stages of renal dysfunction **(2hrs)**

Stages	Creatinine clearance ($ml/min/1.73m^2$)	Metabolic consequences
I. Stage Normal	>90	---
II. Stage Early Renal insufficiency	60-89	Increased serum PTH
III. C.K.D	30-59	Increased calcium absorption Anemia
IV. Pre-end stage failure	15-29	Increased TD, PO_4, K^+ acidosis
V. ESRD	<15	Uremic

E. Complications of chronic renal failure

- Anemia
- Polyneuritis
- Pericarditis
- Renal osteodystrophy
- Uremic carbohydrate intolerance
- Gynecomastia
- Infection
- Prurites

Approach to Patient with Renal Failure **(10hrs)**

F. Manifestations of renal failure:

- Systemic consequence of renal failure Alterations in following including signs, symptoms etiology & management.
- Uremia
- Fluid balance
- Electrolyte and ion balance (sodium, potassium, calcium, phosphate, Magnesium, hydrogen, bicarbonate, aluminium)
- Acid – base balance (Metabolic acidosis)
- Cardiovascular system (Hyperkalemia, Hypertension, Pericarditis, Pericardial effusion, Pericardial tamponade)
- Respiratory system
- Gastrointestinal system
- Hematological system (Anemia, Platelet dysfunction)
- Endocrine function
- Neuromuscular function & sleep problems
- Skeletal system
- Psycho-social function
- Dermatological manifestations

G. Patient history

H. Physical assessment of the renal system

I. Blood analysis

- Plasma Creatinine
- Blood urea nitrogen
- Plasma electrolytes
- Erythropoietin

- Plasma Renin
- Plasma substances (Antibodies & component with immunologic renal disorders like C3/C4 ANA

J. Clearance tests

- Creatinine clearance test, urea clearance.

K. Treatment **(5hrs)**

3 basic stages

a) Pressure reduction in remaining nephrons
b) Conservative treatment of uremic syndrome
c) Dialysis and transplantation

Indications of dialysis in AKI
Indications of dialysis in CKD

L. Contraindications for Dialysis (Including PD) **(3hrs)**

- Alzheimer's Disease
- Multi-infract denaturation
- Hepatorenal syndrome
- Advanced cirrhosis with encephalopathy
- Advanced malignancy etc

II. Renal transplantation **(40hrs)**

1. History and statistics
   - Historical events
   - Statistics
   - Data sources of renal replacement therapies
2. Immunological aspects
   - Functions of the immune system
   - Innate system
   - Acquired (lymphoid) immune system
   - Major histocompatibility complex
3. Evaluation of Potential Kidney transplant recipient & Donor
4. Storage & transplant of Kidneys
5. Pre/ Peri/Post-operative issues
6. Complications of renal transplant
7. Long term concerns
8. Commonly prescribed medications
9. Diagnosis of acute rejection
10. Other causes of sudden loss of renal function
11. The case with good initial renal function
12. The case with poor initial function
13. Uncontrollable rejection
14. Transplants in diabetes
15. Long term follow up
16. Late complications
17. Long term prognosis

Paper III: Basic Principles and overview of Types of Renal Replacement Therapy (HD & PD) (130hrs)

I. Renal Replacement Therapy **(30hrs)**

1. Indications **(10hrs)**

Most common cited clinical indications are

- Fluid overload
- Severe hypertension
- Hyperkalemia
- Metabolic acidosis
- Uremia

2. Indications for starting dialysis **(10hrs)**

- Oliguria (urine output < 200ml/12hr)
- Anurial/extreme oliguria
- Hyperkalemia ([K] >6.5mEg/l)
- Severe acidemia (pH<7.1)
- Azotemia ([urea] > 30mg/dl)
- Clinically significant organ (especially pulmonary) edema
- Uremic encephalopathy
- Uremic pericarditis
- Uremic neuropathy/myopathy
- Severe dysnatremia ([Na] <115 or > 160 meg/L)
- Hyperthermia
- Drug overdose with dialyzable toxin

3. Management of renal failure patients: **(10hrs)**

- Nutritional management in Renal failure (CKD, HD, CAPD, TRANSPLANT) (protein, calories, malnutrition).
- Anemia management in renal failure
- Medication for renal failure
- Investigation for renal failure
- Renal failure in children and pregnancy and its management

II. Concepts and principles of HD & PD and its application to patient care. (100hrs)

A. History & Types of Dialysis **(2hrs)**

- Hemodialysis
- Peritoneal dialysis
- Hemofiltration

Principles of Dialysis **(2hrs)**

- Reviewed basic knowledge

Basic Concepts Related To Dialysis **(6hrs)**

1. Basic chemistry concepts **(3hrs)**

A. Review

- an atom & atomic weight
- Molecules & molecular weight
- Mole
- Ions
- Density

B. Basic chemistry of Dialysate

- Blood electrolytes Vs dialysate composition
- Mixing ratios
- Dilution factors
- Concentrate composition
- Concentrate alteration
- Bicarbonate precipitation

2. Dialysis related Physics **(1hrs)**

- Fluid Dynamics
- Thermodynamics
- Temperature measurement

3. Dialysis & Electronics **(1hrs)**

- Electricity
- Conductivity
- Electrical leakage
- isolation transformer
- Electronic components- (Resistors, capacitors, Diodes, thermostats, transistors, integrated circuits, voltage regulators, microprocessors, memory, resistors color code)

4. Scientific terms used in Dialysis **(1hrs)**

- Solution
- Semipermeable membranes
- Diffusion (factors effecting diffusion)
- Filtration and ultrafiltration
- Fluid dynamics

B. Concepts and Principles of Hemodialysis **(90hrs)**

1. Applying scientific principles to dialysis **(3hrs)**
   - Fluid dynamics in dialysate (Diffusion in dialysis)
   - Ultrafiltration in dialysis
   - Osmosis in dialysis
   - convection in dialysis
2. Applying dialysis principles to the dialysis prescription **(3hrs)**
   - Dialyser, blood flow, rate, Dialysate flow rate, dialysis time, dialysate composition, anticoagulation
3. Dialysis and normal kidney (A comparison) **(2hrs)**
4. Hemodialysis Apparatus **(4hrs)**

A. Dialysers

a. Functions & Components

- Membranes
- Membrane materials
- Membrane manufacturing process
- Membrane characteristics
- Membrane permeability, Description.

b. Dialyser characteristics

- Biocompatibility
- Surface area
- Molecular weight cutoff
- UF coefficient
- Clearance
- Diffusion

- Connection
- Adsorption

c. Dialyser categories
- Convectional dialyser
- High efficiency dialyser
- High Flux dialyser

d. Dialyser types depending on their design and their comparative studies. (Hollow fibre, coiled, parallel plate)

e. Measuring Dialyser efficiency
- Determining Dialyser clearance

$$k \text{ ---------- x } Qb = \frac{CBi - CBo}{CBi}$$

- Determining UF rate --- Kuf

B. Dialysate

Purpose

Composition of dialysate

Sodium, Potassium, Magnesium, calcium, chloride, Glucose, Bicarbonate, Acetate

Dialysate delivery system.

i. Proportioning system

ii. Monitoring system

Conductivity, Temperature, flow rate, Dialysate pressure, TMP blood leak detection, pH.

5. Water treatment Plant (6hrs)

A. Purpose
- Preventing harm to Pt
- Preventing harm to equipments

B. How water become impure?

C. Types of contaminants and effects on Pts
- Micro – organisms
- Solid impurities
- Chemical impurities

D. Components of water treatment plant & their arrangement (Feed water components, R.O process)

E. Monitoring water treatment plant
- Continuous
- Periodic monitoring
- Microbiological testing
- Chemical monitoring (Chloramines, Na+, K+)
- Patient monitoring
  (Routine blood chemistries, Monitoring Pt. Symptoms)

F. Disinfection.

6. Dialysis Machine (5hrs)
- Types
- Function

Dialysate circuit

Blood circuit Delivery and monitoring Delivery and monitoring

Alarm function
- Equipment Dysfunction

- Maintenance & repair

7. Vascular access **(15hrs)**

- Historic forms of vascular access
  External A.V shunt
  Single needle devices
  Button devices
- Development of vascular access surgery
- Patient assessment and planning for vascular access surgery
- Anaesthesia for surgery of vascular access
- Surgical anatomy for HD access

Physiology of types of vascular access and clinical consideration

- Physiology of Arteriovenous fistula, Arteriovenous graft, Tunnelled Hemodialysis catheters
- Temporary type (IJC, S.C, F.C)
- Semi permanent
- Permanent Type

a) Types of catheter
b) Choice of device
c) Catheter placement
d) Placement techniques
e) Cut down techniques

- External jugular vein
- Internal jugular vein
- Femoral vein

f) Placement under radiographic guidance

- Ultrasound Complications
- Infectious complications
- Mechanical complications
- Thrombotic complications

Acute complications of central venous catheter

Thoracic

- Pneumothoracic
- Tension thoracic
- Subcutaneous emphysema

Hemothorax

- Hemomediastinum
- Hydro mediastinum
- Tracheal perforation

Arterial

- Subcutaneous hematoma
- Arterial laceration
- Arteriovenous fistula
- Pseudo aneurysm

Venous

- Venous laceration

- Air embolism
- Catheter embolism

Lymphatic
- Thoracic duct laceration

Cardiac
- Right ventricular interaction
- Arrhythmia
- Perforation and tamponade

Neurologic
- Brachial plexus
- Stellate ganglion
- Phrenic nerve
- Vegus nerve
- Recurrent laryngeal nerve

Catheter misplacement

Late complications

Thoracic
- Hydrothorax
- Hydro mediastinum

Venous
- Air embolism
- Central vein thrombosis
- Superior venacava syndrome
- Hepatic vein thrombosis

Cardiac
- Arrhythmia
- Perforation and tamponade
- Coronary sinus thrombosis

Lymphatic
- Lymphatic fistula
- Chylothorax

Septic
- Catheter sepsis
- Septic thrombosis
- Supperative thrombophlebitis
- Catheter performance and care
- Expected performances
- Complication , Prevention, Treatment
- Assessment and intervention for A.V.F maturation
- Non surgical methods for salvaging failed dialysis access
- Revisional surgery for failed access
- Nursing care for patient with dialysis access.
- New synthetic grafts and early access
- Biological properties of venous access devices.
- Complication of vascular access
- Infection in vascular access procedures
- Access in the neonatal and pediatric patients
- Improving vascular access outcomes

Continuous quality improvement (CQI) Clinical practice guidelines

8. Dialysis prescription (5hrs)

Duration, Dialysate, UF, Heparin, Investigation, Medication usually given during HD in the following cases,

- For acute renal failures
- For chronic renal failure
- First HD
- Regular HD
- HD & Surgery
- HD for transplant recipients
- HD for poisoning case
- Phlasmaphersis

9. Anticoagulation (7hrs)

a. Purpose
b. Anticoagulant requirement depending on
- Patient Characteristics
- Medical characteristics (Fever, infection, uremic etc)
- Dialyzer system characteristics
- Drug characteristics

c. Administration of Heparin during dialysis
d. Methodology
- Continuous
- Intermittent (Periodic)
- low dose (tight)
- Systemic
- Regional
- Baseline
- Controlled

e. Anticoagulation tests
- Whole blood clotting time
- Whole blood activated clotting time
- Whole blood partial thromboplastin time

f. Principles of anticoagulation
g. Heparinisation based on Pt's wt
h. Complications of Heparin therapy
i. Inadequate heparinisation
j. Heparin free dialysis
k. Other anticoagulants
l. Regional citrate anticoagulation
- Advantage
- Disadvantage

10. Adequacy of Dialysis (10hrs)

- Urea reduction ration (URR)
- Urea kinetic Modelling (UKM)
- K t/v

Factors affecting dialysis treatment
- Clearance factor

- Time factor
- Blood flow
- Dialysate flow & type
- Dialysis
- Vascular access
- Patient

Dialyser (reprocessing)

- History
- Purpose
- Safety
- Advantage
- Disadvantage
- Steps
- Methods of reprocess
- Disinfectants
- Fiber bundle volume
- Fiber integrity test

Concepts & Principles of Peritoneal Dialysis **(20hrs)**

A. PD Apparatus

- PD Catheter access
- Solution

B. Pt. selection
C. P.D Process
D. Modalities
E. Prescription
F. Type of PD
G. Adequacy of PD

Dialysis in Special Situations **(12hrs)**

- Pt's with congestive cardiac failure
- Advanced liver disease
- Pts positive for HIV, HCV, HBSAg
- Failed transplant
- Poisoning cases
- Pregnancy
- Dialysis infants & children and care of pediatric patients.
- ICU cases and patient care.

Special Dialysis Procedure **(5hrs)**

- Continuous Therapies in HD
- Haemodiafiltration
- Haemoperfusion
- SLED
- MARS
- Plasmapheresis **(3hrs)**

Paper IV: Epidemiology & Biostatics

(60 hours)

Unit 1: **Introduction:**

Introduction to bio statistics and research methodology, types of variables and scales of measurements, measures of central tendency and dispersion, Skewness and Kurtosis rate, ratio, proportion, Incidence and prevalence.

(4hrs)

Unit 2: **Sampling**:

Random and non-random sampling, various methods of sampling —simple random, stratified, systematic, cluster and multistage. Sampling and non-sampling errors and methods of minimizing these errors.

(4hrs)

Unit 3: **Basic probability distributions and sampling distributions**:

Concept of probability and probability distribution. Normal, Poisson and Binomial distributions, parameters and application. Concept of sampling distributions. Standard error and confidence intervals.

(6hrs)

Unit 4: **Tests of significance**:

- Basics of testing of hypothesis — Null and alternate hypothesis, type I and type II errors, level of significance and power of the test, p value.
- Tests of significance (parametric)- t — test (paired and unpaired),Chi square test and test of proportion, one way analysis of variance. Repeated measures analysis of variance.
- Tests of significance (non-parametric)-Mann-Whitney u test, Wilcoxon test, Kruskal-Wallis analysis of variance. Friedmann's analysis of variance. **(10hrs)**

Unit 5: **Correlation and regression**:

Simple correlation — Pearson's and Spearman's; testing the significance of correlation coefficient linear and multiple regression. **(4hrs)**

Unit 6: **Sample size determination**:

General concept, sample size for estimating mean and proportion, testing of difference in means and proportions of two groups **(4hrs)**

Unit 7: **Study designs**:

- Descriptive epidemiological methods — case series analysis and prevalence studies.
- Analytical epidemiological methods — case control and cohortstudies.
- Clinical trials/intervention studies, Odds ratio and relative risk, stratified analysis.

(10hrs)

Unit 8: **Multivariate analysis**:

Concept of multivariate analysis, introduction to logistic regression and survival Analysis

(6hrs)

Unit 9: **Reliability and validity evaluation of diagnostic tests**. **(4hrs)**

Cronbach's alpha and test – retest methods

Unit 10: **Format of scientific documents**.

Structure of research protocol, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta-analysis. **(8hrs)**

SECOND YEAR - THEORY

Paper V: Recent advances HD Procedures & Complications in renal disease patient Dialysis patients & Renal disease patients Dialysis patients & Renal Nutrition (220hrs)

1. Advanced HD procedures **(30hrs)**

1. Nocturnal Dialysis
2. Online dialysis
3. Daily dialysis
4. Telemedicine in Dialysis Practice
5. Peadiatric Dialysis

2. **Complications of renal disease patients, dialysis patients and Dialysis equipments.** **(110hrs)**

Clinical considerations in the Evaluation of Dialysis Patients

a. Hypertension in Dialysis Patients
b. Left Ventricular Dysfunction in Dialysis Subjects
c. Coronary Artery Disease in End-Stage Renal Disease
d. Autonomic Function and hemodynamic stability in End- Stage Renal Disease Patients
e. Infection and immunity in End-stage Renal Disease
f. B2-Microglobulin- Associated Amyloidosis of End-Stage Renal Disease
g. Renal Osteodystrophy
h. Dyslipidemias of End-Stage Renal Disease
i. Selection of Therapy for Patients with End-stage Renal Disease
j. Malnutrition and Intradialytic Parenteral Nutrition in ESRD Subjects
k. Disorders of Hemostasis in Dialysis Patients
l. Treatment of Anemia in Dialysis Subjects
m. Acquired Cystic Kidney Disease
n. Geriatric Dialysis Patients
o. Diabetic Dialysis Patients
p. Hemodialysis and Hemoperfusion for poisoning
q. Dialysis considerations in the patient with Acute Renal Failure
r. Infections in patients on Continuous Ambulatory Peritoneal Dialysis
s. Balancing outcomes in Dialysis with Economic Realities

3. Recent Advance in Dialysis and Nephrology (**10hrs)**

4. Cyber Nephrology **(10hrs)**

5. C**alculators** **(20hrs)**

- IV rate and dose
- Access recirculation
- URR
- Concentration
- GFR Adult/Pedi
- Kt/V (different formulas)
- Access recirculation
- Urea volume distribution
- Creatinine Clearance
- BMI
- Weight and measures (Length, volume, weight , Fahrenheit, Celsius etc)

6. Renal Nutrition **(40hrs)**
(30hrs)

Part I: Nutrition

1. Energy (Calories)
2. Protein
3. Lipid (Fats& Cholesterol)
4. Carbohydrates
5. Thiamine vitamin B1, aneurine
6. Riboflavin
7. Vitamin B6 (pyridoxine, adermin)
8. Nicotinic acid (Niacin, nicotinamide)
9. Folic acid (folate, folacin, pteroylglutamic acid)
10. Vitamin b12 (cobalamin)
11. Pantothenic acid(filtrate factor)
12. Choline, biotin
13. Ascorbic acid (vitamin C)
14. Vitamin A
15. Vitamin D
16. Vitamin E
17. Vitamin K
18. Bioflavonoid (vitamin P)
19. Sodium
20. Potassium
22. Iron
23. Calcium
24. Phosphate
25. Magnesium
26. Manganese
27. Iodine
28. Copper
29. Cobalt
30. Chloride
31. Fluoride
32. trace elements
33. Dietary Fibers
34. Water

Part II: Foods

1. Wheat
2. Rice
3. Pulses
4. Soya beans
5. Maize
6. Millets
7. Milk
8. Egg
9. Meats
10. Nuts & Dried Fruits
11. Sweet foods & sweetening agents
12. Fish
13. Vegetables
14. Fruits
15. Spices
16. Beverage

17. Alcohol

Part III: (A) Menu Planning (B) Dietary modifications

Part IV: Clinical dietetics

1. Diet Prescription
2. Peptic ulcer
3. Flatulence
4. Constipation
5. Diarrhea & dysentery
6. Protein- Energy malnutrition
7. Anemic
8. Under weight
9. Obesity
10. Diabetes mellitus
11. Kidney disease
12. Renal failure
13. Kidney stones
14. Coronary Heart Diseases and atherosclerosis
15. High BP
16. Congestive cardiac failure
17. Tube feeding

Part V: Principles of Nutritional Assessment

1. Introduction
    a. Nutritional assessment system
    b. Methods used in nutritional assessment
    c. The design of nutritional assessment system
    d. Evaluation of nutritional assessment indices
        Reference distribution
        Reference limits
        Cutoff points
2. Food consumption of Individual
    a. Methods
    b. New development in measuring food consumption
    c. Selecting an appropriate method
    d. Summary
3. Evaluation of nutrient intake data
    a. Tables of recommended nutrient intakes
    b. Evaluating Nutrient intakes of individuals
    c. Evaluating the nutrient intakes of population groups
    d. Probability approach to evaluating nutrient intakes
4. Anthropometric assessment
    a. Advantages and limitations of anthropometric assessment
    b. Sources of error in nutritional anthropometry
    c. Evaluation of anthropometric indices
5. Anthropometric assessment of growth
    a. Growth measurement
    b. Indices derived from growth measurements

VI: Bed side rounds & practices **(10 hrs)**

Paper VI: Basics of Hospital Administration and Management of Dialysis Unit & Biomedical Instrumentation Biotechnology & Molecular Biology (140hrs)

1. Patient education & health patient with rrt (30hrs)

- Patient Education
- Communication
- Patient communication problems
- Explanation of examinations
- Interacting with terminally ill patient
- Informed Consent
- Patient counselling on
  - Living with CKD
  - Life with HD and CAPD
  - Living with a transplanted kidney.

2. Basics of Management of health care organization include administrative aspects of dialysis unit

A. Hospital Structure (10hrs)

Basics of

- Intensive care units
- Hospital administration
- Resource management (personnel, material & finance)
- Quality management & infection control systems

B. Management of Healthcare Organizations (40hrs)

Management functions

- Planning
- MBO
- Decision making
- Organizing
- Staffing
- Controlling

Management and Economics

- Demand & Supply
- Nature of Costs
- Marginal cost and breakeven analysis
- Market structure: Business & Government
- Role of Government

Organizational Behavior

- Significance
- Structure & theories
- Individual & group behavior
- Leadership
- Motivation
- Organizational development
- Managing creativity and stress

Accounting for Hospital Management

- Budgeting & Budgetary control
- Difference between forecast & budgeting_ Preparation of budget

- Classification of budget
- Capital Budgeting

Concept of Hospital

- Departmentation in Hospital
- Clinical services management
- Organizing of support services
- Management of utility services
- Evaluation of Hospital services
- Issues related to Healthcare technology
- Present trend in healthcare technology
- Problems & constraints
- Planning & adopting appropriate technology in healthcare
- Evaluation method of health technology

Evolution of Quality management

- Quality assurance methods
- Patient satisfaction
- Standard operating procedure
- Quality certification
- Accreditation to national agencies

3. Biomedical Instrumentation (20hrs)

1. Introduction to Biomedical Instrumentation
    a. The Age of Biomedical Engineering
    b. Development of BM instrumentation
    c. Biometrics
    d. Introduction to the man-instrument system
    e. Components of the man-instrument system
    f. physiological systems of the body
    g. Problems encountered in measuring a living system.
2. Basic Transducer principles:
    a. The transducer and transduction principles
    b. Active transducers
    c. Passive transducers
    d. Transducers for Biomedical applications
3. Sources of Bioelectric potentials:
    a. Resting and action potentials
    b. Propagation of Action potentials
    c. The Bioelectric potentials
4. Electrodes
    a. Electrode theory
    b. Biopotential electrodes
    c. Biochemical transducers
5. The computer in Biomedical Instrumentation:
    a. The digital computer - Computer Hardware, Computer software
    b. Microprocessors - Types of microprocessors, Microprocessors in Biomedical Instrumentation- Calibration , Table lookup , Averaging , Formatting and printout
    c. Interfacing the computer and medical instrumentation and other equipment.- Digital interfacing requirement , Analog-to-digital and Digital-to-Analog conversion
    d. Biomedical computer application - Data acquisition, storage and retrieval, data reduction and transformation, mathematical operation, pattern recognition, limit detection, statistical analysis of data, data presentation ,control function - Computer

analysis of the ECG, the digital computer in the clinical chemistry laboratory, digital computerized in hemodialysis machine, other computer application

6. Electrical safety of Medical Equipment.
    a. Physiological effects of electrical current.
    b. Shock hazards from electrical equipment.
    c. Methods of accident prevention
    - Grounding
    - Double insulation
    - Protection by low voltage
    - Ground – fault circuit interrupter
    - Isolation of patient – connected parts
    - Isolated power distribution systems
7. Patient care and monitoring:
    a. The elements of intensive – care monitoring
    - Patient monitoring displays
    b. Diagnosis, calibration and repairability of patient – monitoring equipment
    c. Other instrumentation for monitoring patients
    d. The organization of the hospital for patient care monitoring
    e. Defibrillator
8. Description of Machine self test
9. Technical safety checks and maintenance
    a. General notes
    b. Technical safety checks and maintenance procedures
    c. maintenance checklist
10. Adjustment
    a. Overview of the Dip switches
    b. Calibration mode
    c. Hydraulics
    d. Dir detector
11. Calibration Program
12. Diagnostics Program
    a. General notes
13. Setup Menu
    a. Overview
    b. Main menu
14. Circuit diagram and circuit description
    a. Block diagram
    b. level detector control (LD)
    g. BLD
    h. Mother board
    i. CPU
    j. Input / output board
    k. Display board
    l. Power supply
    m. Hep - Module

4. **Molecular biology and biotechnology** **(40hrs)**
    1. Introduction to molecular Biology
    2. Concept
    3. Basic principles of Biotechnology
    4. Molecular Biology
        - Identification of the genetic materials

- Chemical nature of genetic materials
- Replication of DNA
- Non-genetic ribonucleic Acid (RNA) and transcription
- Genetic code
- Protein synthesis
- Regulation of gene action

5. Recombinant DNA technology
    - Biology & classification of Cloning strategies & Vectors.
    - Introduction of genes into the cell
    - DNA modifying enzymes and DNA synthesis
    - Genetic Recombination and Gene Transfer (Bacterial Conjugation, Transformation, Transduction, Episomes and Plasmids)
    - Genetic Engineering (Isolation, sequencing, Synthesis of Gene and DNA Fingerprinting)
    - Site Directed Mutagenesis.
    - Antisense Technology
    - Gene theraphy
6. Immunology
    - Antibody antigen reaction,
    - Hybridoma technology
    - Vaccines production (Principles)
7. Stem cell research: principles and application

Paper VII: Emergency Medicine /ACL Nephro-Radiological Nuclear Medicine and imaging sciences and Nephrophyshiatric (60hrs)

1. Emergency medicine/ACLS /renal nutrition (20hrs)

A. BLS (10hrs)

1. BLS in perspective
    a. The need for Medical interventions
    b. The ultimate Coronary Care Unit
    c. Emergency Cardiac Care
    d. The chain of Survival
    e. Role of the American Heart Association
2. Cardio Pulmonary Function and actions for survival
    a. The Cardiovascular and Respiratory system
    b. Action for survival
3. Risk factors and prudent Heart living
    a. Risk factors for Heart Attack
    b. Prudent Heart Living
    c. Summary: The role of Prevention
4. Adult BLS
    a. Citizen response to Cardio-pulmonary Emergency
    b. Indication for BLS
    c. The sequence of BLS; Assessment, EMS activations and the ABC of CPR
    d. CPR performed by one rescuer and two rescuers
    e. Foreign – Body airway obstruction Management
    f. CPR: The Human Dimension
    g. BLS Research Initiative

5. Special Resuscitation Situation
    a. Stroke
    b. Hypothermia
    c. Near – Drowning
    d. Cardiac arrest associated with Trauma
    e. Electric shock and lightning stroke
    f. Pregnancy
    g. Asphyseration
    h. Special techniques and pitfalls and complication
    i. Unique situation
6. Pediatric BLS
    a. Epidemiology
    b. Injury prevention
    c. Prehospital care
    d. The sequence of Pediatric BLS - the ABC of CPR
    e. Activation of the EMS system obstructive
    f. Foreign Body airway
    g. BLS in Trauma
7. Ethical and Legal considerations
    a. Values in Decision Making
    b. Instituting and Discontinuing CPR
    c. Legal mandates
    d. Conclusions
8. Safety during CPR Training and actual rescue
    a. Disease transmission during CPR Training
    b. Disease transmission during actual performance of CPR
9. Automated External Defibrillation
    a. Importance of Automated External Defibrillation
    b. Overview of Automated External Defibrillation
    c. Advantage and Disadvantage of Automated External Defibrillation
    d. Use of Automated External Defibrillation during Resuscitation attempts
    e. Automated External Defibrillation treatment algorithm
    f. Post resuscitation care
    g. Training
    h. Maintenance of Skills
    i. Medical control
    j. Quality assurance

B. ACLS **(10hrs)**

1. Cardiopulmonary Resuscitation and Advanced Cardiac Life Support
    a. Basic Life Support
    b. General Considerations of Advanced Cardiac Life Support: Arrhythmia recognition and defibrillation-ventilation and airway management-route of drug administration-IV fluids-diagnose and correct the underlying cause of the arrest-internal cardiac compression-initiation and discontinuation of resuscitation.
    c. Specific Arrest Sequences in Advanced Cardiac Life Support : VF and Pulseless VT – Systole-Bradycardia-Pulseless electrical activity(PEA)-Tachycardias
    d. Post resuscitation Management
    e. Common Medications Used in Advanced Cardiac Life Support : Epinephrine-Atropine sulfate-Lidocaine-Procainamide hydrochloride-Bretyliumtosylate-magnesium sulfate-adenosine-Diltiazem or verapamil-Isoproterenol-Sodium bicarbonate-Calcium

2. Critical Care
    a. Respiratory Failure: General considerations-pathophysiology-Blood gas analysis
    b. Oxygen therapy: Nasal prongs-venturi masks-Nonrebreathing masks-A continuous positive airway pressure mask-Bilevel positive airway pressure
    c. Airway Management and Tracheal Intubation: Airway Management-Endotracheal intubation-Surgical airways
    d. Mechanical Ventilation: Indications-Initiation of mechanical ventilation-Management of problems and complications-Weaning from mechanical ventilation-Drugs commonly used during endotracheal intubation and mechanical ventilation
    e. Shock: Resuscitative Principles-Individual shock states
    f. Hemodynamic Monitoring and Pulmonary Artery Catheterization: Indications-obtaining a pulmonary capillary wedge tracing-acceptance of PAOP readings-transmural pressure-Cardiac output-Interpretation of hemodynamic readings
3. Cardiac Arrhythmias
    a. Recognition and Management: Clinical diagnosis of arrhythmias-Electrocardiographic data-Bradyarrhythmias-premature complexes-Tachycardia-
    b. Antiarrhythmic Drug Therapy: General Principles-Antiarrhythmic agents
    c. Related Topics: Syncope-Electro-cardioversion-Cardiac pacing-Anti-tachycardia devices

2. Nephro-radiological and imaging sciences and nuclear medicine (20hrs)

3. Radiological and Imaging Sciences (15hrs)

1. Ultrasound Sonographic imaging characteristics
2. Doppler ultrasound – scanning techniques (ultrasound of the normal kidney – acute renal failure – surgical – medical renal disease – renal masses – cysts- solid renal masses – calculi – intrarenal hematomas – renal transplant evaluation – rejection – renal infections) Doppler ultrasound in evaluation of renal vascular disease and Transplant kidney evaluation.
3. Computed Tomography Of The Kidney: Anatomy – renal masses – cystic masses – solid renal masses – tumors of the renal pelvis – renal calculi – obstructive uropathy – infarction – acute renal cortical necrosis – renal vein thrombosis – renal artery stenosis – acute pyelonephritis – renal and perinephric abscess – emphysematous pyelonephritis – pylonephrosis – xanthogranulomatous pyelonephritis – tuberculous pyelonephritis – congenital anomalies – renal trauma – transplant kidneys
4. Urography: intravenous urography – indications – contra indications – interpretation.
5. Magnetic Resonance Imaging: normal kidney – congenital anomalies – obstruction – injection – renal parenchymal disease– hypertension and renal vascular disease – renal cysts – benign neoplasm's – malignancies of kidney.
6. Renal Angiography: Indications – relative contraindications.
7. Renal Biopsy

4. Nuclear Medicine (5hrs)

1. Basic of nuclear medicine.
2. DTPA, DMSA.
3. Peritoneal scintigrephy.
4. Reflex scintigrephy.
5. Transplant renal scintigrephy.

5. Nephropsychiatry (20hrs)

1. Psychiatric Assessment
   a. Introduction to clinical assessment
   b. The Psychiatric interview
   c. The mental status Exam
   d. Physical Exam and laboratory evaluation
   e. Intelligence testing and neuropsychological assessment
   f. Personality assessment
2. Psychiatric Aspects of Renal Care
   a. Introduction
   b. Psychiatric problems: uncooperativeness-cause of uncooperativeness
   c. Depression and Suicide, anxiety, rehabilitation problems, sexual problems
   d. Psychiatric fitness for Transplantation
   e. Treatment of psychiatric problems-preventive therapy-group therapies-environmental Manipulations-psychotherapy-pharmacotherapy-behavioral sexual techniques
3. Rehabilitation and Psychosocial Issues
   a. Endurance Exercise training in hemodialysis patients
   b. Psychosocial rehabilitation of Adult dialysis patients
   c. Ethical Dilemmas in Dialysis: To initiate or withdraw Therapy
4. Mental Disorders
   a. Diagnosis and classification in psychiatry
   b. Psychiatry history and examination
   c. Organic(Including Symptomatic) mental disorders
   d. Psychoactive substance use disorders
   e. Schizophrenia
   f. Mood Disorders, Anxiety and personality
   g. Other psychotic Disorders
   h. Neurotic, stress-related and somatoform disorders
   i. Disorders of Adult personality and behaviour
   j. Sexual disorders
   l. Sleep disorders
   m. Behavioural syndromes associated with psychological disturbances and physiological factors
   n. Mental retardation
   o. Child psychiatry
   p. Psychopharmacology
   q. Biological methods of treatment
   r. Psychoanalysis
   s. Psycho treatment
   t. Emergency psychiatry
   u. Legal and ethical issues in psychiatry
   v. Common psychiatry

PRACTICALS

(2100hrs)

1. Patient Care **(400hrs)**

A. Assessment

Collect & evaluate patient data

- Access Patency
- Apical pulse
- Blood pressure
- Breath sound
- Heart Sound
- Jugular vein distension
- Peripheral edema
- Pulse
- Respiration
- Signs of infection
- Temperature
- Weight
- Communication with patient

B. Pre dialysis procedures

a. Following HD orders and treatment plan

b. Equipment preparation procedures

- Preparing dialysate according
- Assembling the extracorporeal circuit
- Priming the dialyser & extracorporeal circuit
- Pre – initiation check

C. Initiation of Dialysis

a. Fluid removal procedures

- Calculating amount of fluid to be removed
- Predicting UF
- Calculating TMP
- Calculating UF rate
- Fluid replacement
- Isolated ultra filtration

b. Venipuncture procedure

- Needle insertion in a fistula or graft
- Initiating dialysis treatment
- Clean & dress access site (venous cannulation) using appropriate technique

c. Monitoring during dialysis

- Patient monitoring procedures
  - Taking vital signs
  - Monitoring general patient condition
  - Providing comfort and diversion during dialysis
- Technical monitoring
  - Monitoring devices
  - Equipment safety checks
  - Extracorporeal circuit
- Blood pump settings
- Adjust arterial & venous pressures

- Adjust fluid removal
- Monitor the dialysate delivery system
- Heparinisation during dialysis
- Recognize complications occurring during dialysis & their management
    - Chills
    - Cramps
    - Fever
    - Shock
- Recognize and management of complication due to operator & equipment error
    - Air embolism
    - Bleach or formaldehyde reaction
    - Chemical pyrogen reaction
    - Hemolysis and water quality
- Recognize problem regarding heparinisation (Coagulation, hemorrhage, hemostasis)
- Recognize access complication in patients (Clotting, infection, recirculation)
- Recognize blood leaks
- Recognize complication with administration of medication (Antihypertensive, Erythropoietin, iron dextran.

D. Post Dialysis Procedures

- Completing dialysis treatment procedures
- Discontinuing dialysis
- Post dialysis pt. check
- Taking vital signs and weight
- Documentation
- Equipment clearing / disinfection

E. Medications, solutions and laboratory test

a. Medications and solution procedures

- drawing solution
- Using I.V solutions

b. Laboratory tests procedures

- Drawing blood specimen
- Blood sampling pre & cost dialysis (Bun measurements)
- Monitoring of anemia
- determining R.B.S
- Determining Kt/V, recirculation, URR, Aluminum level, blood chemistry, culture, hematocrits, hepatitis study, iron study.
- Perform coagulation studies to determine Heparinisation

c. Documenting patient care

- Treatment record

2. Hemodialysis Catheterization Under Guidance (100hrs)

- Types of catheter
- Choice of device
- Catheter placement
- Placement techniques
- Cut down techniques
- External jugular vein
- Internal jugular vein
- Femoral vein
- Placement under radiographic guidance
- Ultrasound

3. Machine Technology **(400hrs)**

Maintenance of system:

- Clean & disinfect dialysis equipments as per unit policy (Protocol)
- Develop preventive maintenance schedules for all dialysis equipment and maintain record
- Document all dialysis equipment repair work performed
- Maintain emergency equipment in proper working condition for immediate use
- Maintain / verify the calibration of HD machines
- Order supplies & equipment for dialysis unit perform repairs to equipment
- Perform electrical leakage tests for all dialysis equipments
- Verify blood & dialysate flow rate.

Machine set up:

A. Assemble dialysis equipment for operation

B. Perform residual chemical checks

C. Perform required safety checks

- Conductivity
- pH
- Pressure holding test
- Temperature

D. Perform safety checks

- ABD (Air Bubble Detector)
- Arterial pressure gauge
- Blood leak alarm
- Blood pump
- Dialysis fluid
- Heparin pump
- Venous pressure gauge
- Dialysis check

E. Prepare bicarb solution

F. Prepare dialysis machine

- Rinse
- Prime
- Caliberate alarm
- Set monitor
- Fluid delivery system
- Connection

G. Perform Disinfection procedure of dialysis machine

4. Water Treatment Plant **(250hrs)**

A. Continuous monitoring

- Temperature, pressure, flow rate, conductivity resistivity, total dissolved solids (TDS)

B. Periodic monitoring

- Softener regeneration
- Hardness test
- total chlorine, chloramines test
- chemical analysis
- pH
- Others

Microbiological tests

- Disinfection
- Culture
- Record maintenance

Dialyser processing **(30hrs)**

- Process dialyser according to protocol
- Maintain processing record
- Perform reuse test
  - Bacterial culture
  - Presence of disinfectant
  - Pressure testing
  - Visual inspection

Electronics **(30hrs)**

- Components
- Relationship – voltage, amperage, resistance
- Basic multimeter skills
- Concepts
  - Transformer
  - Relays

- Reading wiring diagram / schematics
- Electrical safety
- Handing P.C boards
- Soldering skills

Computers **(20hrs)**

- Cabling
- Operating system
- Computer components

Plumbing **(20hrs)**

- Fittings
- Sizes
- Materials

Management of dialysis unit **(50hrs)**
Special and advanced dialysis procedures **(100hrs)**
Peritonial dialysis **(90hrs)**
Cpr demo **(10hrs)**
Teaching methodology **(600hrs)**
Distribution of marks for the first year

Subsidiary Subject

Ethics - 10 Hrs

(Should be taught to the 1st year students)

Introduction: With the advances in science and technology and the increasing needs of the patient, their families and community, there is a concern for the health of the community as a whole. There is a shift to greater accountability to the society. It is therefore absolutely necessary for each and every one involved in the health care delivery to prepare them to deal with these problems. Other professionals are confronted with many ethical problems.

Standards of professional conduct are necessary in the public interest to ensure an efficient laboratory service. Every sinologists or sonographer should not only be willingly to play his part in

giving such a service, but should also avoid any act or omission which would prejudice the giving of the services or impair confidence, in respect, for sinologists or sonographer as a body.

To accomplish this and develop human values, it is desired that all the students undergo ethical sensitization by lectures or discussion on ethical issues.

Introduction to ethics-

What is ethics?
General introduction to Code of Laboratory Ethics
How to form a value system in one's personal and professional life?
International code of ethics

Professional Ethics-
Code of conduct
Confidentiality
Fair trade practice
Handling of prescription
Mal practice and Negligence
Professional vigilance

Research Ethics-
Animal and experimental research/ humanness Human experimentation
Human volunteer research - informed consent Clinical trials
Gathering all scientific factors
Gathering all value factors
Identifying areas of value – conflict, setting priorities
Working out criteria towards decision
ICMR/ CPCSEA/ INSA Guidelines for human / animal experimentation

Suggested Readings :

1. Human Anatomy - B.D. Chaurasia
2. Gray's Anatomy for the students – Richard L.Drake
3. Human Physiology - A.K. Jain
4. Anatomy and physiology in health and illness – Ross and Willson
5. Text Book of Pathology - Harsh Mohan
6. Basic Pathology – pocket Robbins
7. Medical Pharmacology – Padmaja Uday Kumar
8. KD Tripathi – Essentials of Medical Pharmacology
9. The Kidney – By Barry Brenner, Floyd
10. Clinical Dialysis, Dialysis Therapy- By Nissenson, Fine
11. Complications of dialysis- By Norbert Lemeire, Ravindra Mehta
12. Dialysis technology- By Jim Curtis , Philip Varughese
13. Hand book of dialysis – By Daugirdas, Peter Gerard Blake
14. Renal Nursing – By Nicola Thomas
15. Review of HD – By C.F. Butch, Martha H Stoner, Anna L. Corea

16. Some are from internet sources.
17. Lwanga SK and Cho-YookTye (Editors). Teaching Health Statistics, Twenty lessons and seminar outlines, World Health Organization, Geneva.
18. Mahajan BK. Methods in Biostatistics for medical students and research workers. 6th Edition, Jaypee Brothers Medical Publishers, New Delhi, 1997.
19. Kothari CR. Research Methodology: Methods and Techniques. Wiley Eastern Ltd, New Delhi.
20. Sundar Rao P55 and Richard J. Introduction to Biostatistics: A Manual for Students in Health Sciences. Prentic-Hall of India Pvt. Ltd, New Delhi.
21. Park E. Park's Text book of Preventive and Social Medicine, M/S Banarasidas Bhanot, Jabalpur.
22. Nair S K. Essential Research Methodology, Epidemiology and Biostatistics. In: ShobhaTandon, editor. Text Book of Pedodontics, 2~ ed. Hyderabad: Paras Publishing; 2001 p 687-96.
23. Armitage P, Berry G. Statistical methods in medical research, 3rd ed. London: Blackwell Scientific Publications; 1994.
24. Daniel W W. Biostatistics: A foundation for analysis in health sciences, 2nd ed. New York; John Wiley and Sons, 1987.
25. Principles of Management by Koonz 'o' Donnel
26. Hospital planning Administration by B.M. Shakar

19. MODEL QUESTION PAPER

(Common for both specialities – 1st & 2nd year)

THEORY

Each theory paper will have

1) Essay questions – 03 nos. carrying 10 marks each - 03 x 10 = 30
2) Short answer questions – 10 nos. carrying 05 marks each - 10 x 05 = 50

Total = 80
Internal assessment = 20

PRACTICAL

(a) Preliminary:
Internal assessment : 15
University examination : 60

Total = 75
(b) Viva = 25

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES

TIRUPATI – 517 507

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

PG Programme in Allied Health Sciences

M.Sc Echocardiography

TIRUMALA TIRUPATI DEVASTHANAMS

INDEX

General Regulations

1. **Title of the Course**
   Master of Science degree in Echocardiography
2. **Duration of the Course**
   The duration of the course shall be 2- years on full time basis
3. **Eligibility for Admission**

   a) B. Sc in Cardiovascular Technology (3 yrs)
   (or)

   b) B.Sc Degree + 2 years PG diploma in ECG & CVT + 3 years Experience. Three years of Experience post 2 years Diploma in cardiovascular technology. Post general B.Sc. Degree from reputed institution on regular basis. correspondence course will not be considered.
4. **Selection Criteria**
   Selection shall be based on the academic merit/entrance test conducted in the qualifying exam.
5. **Admission schedule :**
   a) Commencement of Course: August every year
   b) The admissions are closed by 30th September or 60 days from the date of commencement of the programme.

5. Medium of instruction.

English shall be the medium of instruction for the subjects of study as well as for the Examination.

6. Course of study

The course shall be pursued on full time basis. In the end of first year there shall be an examination. Students shall be posted to SVIMS and SPMC hospitals during the practical hours.

Subjects for study and teaching hours for first year and second year of the PG courses are shown below.

Distribution of Teaching Hours
First Year

S.No.	Main subject	Theory No. of Hours	Practical No. of Hours	Total
1.	Embryology & Ultrasound Physics	46	120	166
2.	Clinical Cardiology	47	120	167
3.	Echocardiography for Ischemic/Valvular Heart Disease	57	140	197
4.	Epidemiology & Biostatistics	60	-	60
5.	Subsidiary subject: Medical Ethics	10	-	10
	Total:	220	380	600

Second year

S.No.	Branches	Theory No. of Hours	Practical No. of Hours	Total
6.	Paediatric Echocardiography	46	140	186
7.	Echocardiography in Myocardial, Pericardial, Aortic and Systemic Disorders& Non Cardiac Diagnosis	47	125	172
8.	Recent Advances	47	125	173
	Total:	140	390	530

8 a) Attendance:

A candidate is required to put in minimum 80% of attendance both in theory and practical separately of each paper before admission to the university examination. Participation in NCC, NSS, sports and games, educational tours, professional meetings and conference or other co-curricular activities representing the institution/university will not count as absence.

b) Condonation for lack of attendance:

The condonation of attendance on medical grounds or on absence under extraordinary circumstances to those who are having the attendance between 70% and 79% in each paper will be granted in genuine cases. The students who have shortage of attendance in the particular papers have to apply to the controller of examinations, indicating the reasons for shortage of attendance. The representation to be forwarded by the HOD & Prof. i/c AHS. If the reason is on the medical grounds, the relevant medical certificate has to be enclosed to the representation. If any student falls below the 70% of attendance, he/she will not be allowed to write the university examinations.

9. Scheme of examination

a) The examination for the degree shall consist of written papers, practical and oral.
b) There shall be two examinations viz. Preliminary and final. The preliminary examination shall be taken at the end of the first year. The final examination shall be taken at the end of 2^{nd} year.
c) The examination shall be conducted ordinarily twice a year, viz. July/August and January/February.

Preliminary Examination

This consists of theory, practical and oral. There will be separate papers for each specialization.

University Examination and Distribution of marks

First year

S.No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
1.	Embryology & Ultrasound physics	I	20	80	15	60	25	200
2.	Clinical cardiology	II	20	80	15	60	25	200
3.	Echocardiography Ischemic/valvular heart disease	III	20	80	15	60	25	200
4.	Epidemiology & biostatistics	IV	20	80		-	-	100
	Total							700

Second year

S.No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
5.	Pediatric Echocardiography	V	20	80	15	60	25	200
6.	Echocardiography in Myocardial, Pericardial, Aortic and Systmic Disorders & Non cardiac Diagnosis	VI	20	80	15	60	25	200
7.	Recent advances	VII	20	80	15	60	25	200
8.	Dissertation					100	50	150
	Total							750

Dissertation

The student should submit dissertation one month before the final examination. Those students who have not submitted the dissertation shall not be allowed to appear for the final examination. The dissertation shall be assessed at the time of orals by all the examiners.

The dissertation shall be written under the following headings:

Introduction; Aims or objectives of study; Review of literature; Materials and methods Results; Discussion; Conclusion; Summary; References; Tables; Annexure

The written text of dissertation shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should not be done. A declaration by the candidate that the work was done by him/her

shall be included. The guide and head of the department shall certify the bonafide of the dissertation.

Three copies of dissertation shall be submitted to the university through proper channel along with a soft copy (CD), one month before the final examinations.

10. Internal assessment (IA):

a) A student must secure at least 35% marks of the maximum marks fixed for internal assessment in a particular subject to be eligible to appear for the university examination of that subject.
b) There shall be three internal assessment tests and the average of these tests shall be considered for awarding final marks.
c) If the candidate is absent for any of the exams, the marks in that exam shall be taken as zero.
d) The computed internal assessment marks as per the regulation 10 a) & b) shall be sent to the controller of exams 15 days before the commencement of the University exam.
e) The internal assessment marks should be signed by the concerned teaching faculty or HOD and counter signed by the HOD before being forwarded to the Controller of Examinations.
f) For those who failed in internal assessment test/s, have to reappear as per the regulation 9 a) & b) before he/she appears for the university examination.
g) For those who want to improve their marks in internal assessment tests, they can appear again as per the regulation 9 a) & b). For such students, the internal assessment marks of the student at the time of first appearance will be compared with the marks obtained at the present appearance and the higher of the two will be taken as his/her internal assessment marks.

11.Minimum for a pass

a) 35% in internal assessment of each theory paper and practicals/viva voce
b) 40% in each theory paper of university examination.
c) 50% on the total marks of theory university examination and internal assessment clubbed together, applicable to each paper.
d) Where, viva voce involved which is part of theory examination, 50% on the total marks of theory university examination, internal assessment and viva voce clubbed together, applicable to each paper.
e) Where there is no internal assessment marks, 50% on the total theory marks, 50% in practicals/viva voce applicable to each subject.

Note: For 2 year PG course, where any paper contains both theory and practicals/viva voce, the student has to pass both theory and practicals/viva voce, if any student pass in theory examination and fail in practicals/viva voce examination or vice versa, the student concerned has to appear again for both theory and practicals/viva voce examination.

12. Classification of successful candidates

Percentage of Marks for declaring Class:

Distinction	- 75% and above of the total marks.
First Class	- 65 - 74% of the total marks.
Second Class	- 50- 64% 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 attendance shortage, it will be taken into consideration as not completed within the duration of the course and the final results will be declared as “Pass”.

13. Reappearance

The student has to pass both theory and practicals/via voce, if any student pass in theory examination and fail in practicals/viva voce examination or vice versa, the concerned student has to appear again for both theory and practicals/viva voce examination.

14. Carry-over Provision

The students are permitted to complete the course period irrespective of their success in the preliminary part. However, the final results will be kept under “withheld” until he/she passes all the previous papers”.

15. Maximum duration for completion of course

A candidate shall complete the course within four years from date of admission.

Failing which, the candidate will be discharged.

16. Eligibility for award of degree

A candidate shall have passed in all the subjects of first and second year to be eligible for award of degree.

M.Sc. ECHOCARDIOGRAPHY

FIRST YEAR

Course content (Syllabus) Theory

Paper I: Embryology and ultrasound Physics **Total hours: 47Hrs**

Unit No	Unit title	Unit objectives	Content	Hours	Method of evaluation
	Orientation and introduction to the course			1	-
1	Early development of embryo		mitosis, -meosis -Oogenesis -spermatogenesis -fertilization-formation of germ layers-formation of embryonic disc-placental formation	8	Sessional examination
2	Early blood vessel formation		Intra embryonic blood vessel - extra embryonic blood vessel	2	Sessional examination
3	Development of the heart		Heart tube formation -cardiac loop formation -interatrial septum formation, -interventricular septum formation -atrial formation -ventricular formation -formation of the cardiac valves -formation of the great systemic veins-aortic arch formation	10	
4	Basics of ultrasound	Ultrasound physics and instrumentation	Physical principles, -The transducer, Imaging by ultrasound –Image optimization & equipments -Signal processing -Tissue harmonic imaging-Artifacts	3	Sessional examination
5	Doppler Echocardiography		Principles of Doppler ultrasound -Doppler formats -CF imaging -Doppler artifacts-Tissue Doppler imaging-Doppler	10	Sessional examination

			application -Speckle tracking -Tissue characterization -The digital echo Lab –Storage & retrieval of echo Images, Post study processing and approaches to AFI,-Biological Effects of US		
6	Specialized Echocardiographic Techniques and methods		Hemodynamics, Use of echo to assess cardiac hemodynamics and guide therapy -Evaluation of 3D Echo, Transducer technology,	6	Sessional examination
6A	Basics of 3D US		Beam forming and rendering 3d quantification, 3d examination protocol and approach		
6B	TEE		Instrumentation and Examination-TEE views-complication and safety consideration		
7	Echocardiographic examinations	Cardiac chambers	LV systolic Function, LV diastolic Function, LA, RA RV Function, Echo in ICU, operative, pre-operative application	7	Sessional examination
		Stress Echocardiography	Methodology -Pharmacological stress echo-Interpretation -Stress echocardiography in valvular heart Disease		

Paper II: Clinical cardiology

Total hours: 47

Unit No	Unit Title	Unit Contents	Hours	Method of Evaluation
1	Introduction and basics	-	1	Sessional examination
2	Basic anatomy and physiology of the heart	Anatomy of the heart -Lymphatic system ,Arterial and venous supply of the heart -Conduction system and basic electrophysiology	3	Sessional examination
3	History and symptoms	Importance of history taking. -Causes of cardinal symptoms(Cardiovascular and non cardiovascular)- Assessment:-NYHA functional Classification -CCS functional classification -Specific activity scale -Chest Pain, Dyspnea, Shortness of breath, Palpitation, Fatigue, Syncope, Other symptoms: Hemoptysis, Hoarseness, Cyanosis, Fever	10	Sessional examination
4	General Examination	Facial appearance -Gesture and signs - Oral cavity-Skin, Extremities-Peripheral edema	4	Sessional examination
5	Arterial pulse	Definition –Genesis -Wave pattern-Examination of arterial pulse-Characteristic features of pulse in common clinical conditions	3	Sessional examination
6	Measurement of Blood pressure	Definition -Components and determinants of arterial blood pressure -Hypertension –Cause, mechanism and complications	2	Sessional Examination
7	Jugular venous pressure	Examination -Analysis-Abnormalities	2	Sessional Examination
8	Cardiovascular system examination	Inspection and palpation of the Precordium, Percussion	2	Sessional examination
9 Cardiac auscultation		Principle and Techniques First Heart sound Second heart sound Diastolic and systolic sounds Prosthetic valve sounds Extra cardiac sounds	4	Sessional examination
9A	Heart sounds			
9B	Heart Murmurs	Definition -Mechanism Characteristics -Systolic murmur		

		Diastolic murmur -Continuous murmur		
10 10A 10B	Basic investigation Chest X-ray Evaluating chest X-ray in heart disease:	 Normal chest X-ray Lung and Pulmonary vasculature Cardiac size Abnormal Densities and lucency Cardiac malposition Lungs and pulmonary vasculature Cardiac chambers Great vessels Pleura and pericardium Implantable devices and other post surgical findings	3	Sessional Examination
11	Clinical Electrocardiogram	Advanced ECG- ECG findings in Various cardiac Diseases -Clinical issues in ECG interpretation	4	Sessional examination
12	Cardiovascular pharmacology	Mechanism of action-Indications, Dosage -Precautions of cardiovascular Drugs, Atropine- Lidocaine - Procainamide- Verapamil and diltizem-Adenosine-Magnesium-Sodium Bicarbonate, Morphine-Calcium chloride -Dopamine- Dobutamine-Isoproterenol - Amrinone Sodium Nitroprusside -B- blockers: propranolol, Metoprolol, Atenolol-Diuretics -Thrombolytic agents: Streptokinase,Urokinase	10	Sessional examination

Paper III: Echocardiography for Ischemic and valvular heart disease

Total hours: 57hrs

Unit No	Unit title	Unit objectives	Content	Hours	Method of evaluation
1	Orientation and introduction to the course			1	Sessional examination
2	Ischemic Heart Disease	Echo cardiography and Coronary artery disease	Understanding Coronary circulation, -Pathophysiology of coronary artery syndrome -wall motion scoring,-Detection and quantification of RWMA -Global ventricular function,-myocardial infarction	3	Sessional examination
2A	Echo assessment Coronary arteries		Morphology and coronary flow reserve by TTE and TEE -Visualization of coronary arteries-Distal coronary Flow and coronary flow reserve	3	Sessional examination
2B	Congenital abnormalities		Anomalies and echo detection -Kawasaki Disease.	2	Sessional examination
2C	Echo in IHD		Detection of Ischemia -Role in acute coronary syndrome -Role in ischemic cardiomyopathy	3	Sessional examination
2D	Chronic coronary artery disease		LV aneurysm -Pseudo aneurysm, Chronic remodeling, Mural thrombus -MR –Ischemic cardiomyopathy	2	
2E	Echo in CCU		Management of acute MI – Pathophysiology and Echocardiographic correlation-Detecting and assessing MI,-correlation with coronary anatomy,-Prognostication following MI,-Complications of MI	3	Sessional examination
2F	Stress echocardiography		Fundamentals, Types of Stress Echo-Interpretation of stress Echo-Technical aspects of non exercise test -Protocol, reversible ischemia detection, inducible ischemia/-viability and sensitivity and specificity -Assessment of disease significance and prognostic evaluation	3	Sessional examination
2G	Echocardiography		Approach and clinical	2	Sessional

	evaluation of coronary blood flow		applications-Doppler evaluation of coronary flow -Technical aspects and detection-assessment and clinical application		examination
2H	Newer techniques and their application for IHD		TDI, Strain, Strain rate, vector imaging, -Myocardial contrast Echo	2	Sessional examination
2 I	Surgical aspects of IHD		Role of Echo cardiographer- pre and post operative evaluation for CABG, Ischemic MR-repair vs replacement -Coronary anomalies echo aspects Dorr's procedure	2	Sessional examination
3	Valvular Heart Disease	Valve anatomy	Mitral valve anatomy, -Mitral valve anatomy in surgeons view-Scallops of mitral valve in different echo views -Aortic valve anatomy -Tricuspid valve anatomy -Pulmonary valve anatomy	5	Sessional examination
3A	Echo in RF		Acute vs chronic RF and valvular involvement	2	Sessional examination
3B	Mitral valve disease		MVP, -Mitral regurgitation-etiology Mechanism, Severity assessment -Sequential Evaluation. Chronic asymptomatic MR-Indication and Timing of Intervention for chronic valvular regurgitation-Assessment of Mitral stenosis -Etiology,-Severity assessment, Indication and valve assessment for Mitral Intervention	6	Sessional examination
3C	Aortic valve		Aortic regurgitation -Etiology-Quantification of AR –severity - Timing of surgery -Aortic stenosis -Etiology, Valvular, subvalvular and supra valvular stenosis. -Severity assessment, Use of stress Echo and strain in evaluation of AS , Low gradient severe AS with depressed and preserved EF, Myocardial response to chronic AS.	4	Sessional examination
3D	Tricuspid valve		TR-etiology, Severity assessment, TS –etiology and severity assessment	2	
3E	Pulmonary valve		Pulmonary stenosis- valvular, supravalvular, Infundibular, Peripheral stenosis	4	

			Pulmonary regurgitation - Etiology and severity assessment, Ross procedure		
3F	Pulmonary hypertension		Etiology, PA pressure assessment by various methods	2	
3G	Infective Endocarditic		Dukes criteria Organisms, culture, Involvement of Valves, Indication for Echo, Prognostic stratification	3	
3H	Prosthetic valves		Types of prosthetic valves, Echo assessment in various valves, Prosthetic valve dysfunction, Prosthetic valve IE, Pannus formation and dehiscence, Fluid dynamics of PV, Recognition and quantification of PV Dysfunction , 3DE and TEE evaluation		

Paper IV: Epidemiology &Biostatistics

Total hours: 60

Sl. No.	Topics	60 Hours
1	**Introduction** Introduction to Biostatistics & Research Methodology, types of variables & scales of measurements, measures of central tendency and dispersion, Skewness and Kurtosis Rate, Ratio, proportion, incidence, prevalence and their meaning.	4
2	**Sampling** Random & non random sampling, various methods of sampling-simple random, stratified, systematic, cluster and multistage. Sampling and non sampling errors.	4
3	**Basic probability distribution and sampling distributions** Concept of probability distribution, normal, Poison and Binomial distributions, parameters and applications. Concept of sampling distributions. Standard error and confidence intervals.	6
4	**Tests of Significance** Basics of testing of hypothesis – Null and alternate, hypothesis, type I and type II errors, level of significance and power of the test, p value. Tests of significance (parametric) T – test (paired & unpaired), Chi square test and test of proportion, one way analysis of variance. Repeated measures analysis of variance. Tests of	10

	significance (nonparametric) – Mann Whitney U Test, Wilcoxon Test, Kruskal – Wallis analysis of variance Friedmann's analysis of variance.	
5	**Correlation and Regression** Simple correlation – Pearson's and Separman's methods ; testing the significance of correlation co-efficient simple and multiple linear regression.	4
6	**Sample size determination** General concept Sample size for estimating means and proportion, testing of difference in means, proportions of two groups and more than two groups.	4
7	**Study Designs** Descriptive epidemiological methods – case series analysis and prevalence studies. Analytical epidemiological methods – case control and cohort studies, Clinical trials / intervention studies, odds ratio and relative risk, stratified analysis.	10
8	**Multivariate analysis** Concept of multivariate analysis, introduction to logistic regression and survival analysis	6
9	**Reliability and validity evaluation of Diagnostic Tests** Cronbach's alpha and Test- retest methods	4
10	**Format of Scientific documents** Structure of Research protocol, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta analysis.	8

Suggested Reading

1. Surendar a Rao PSS and J Richard. Introduction Biostatics an Research Methods, Prentice Hall of India (2006).
2. Abhaya Indrayan and Rajeev Kumar Malhotra, Medical Biostatics, 4th Editiin, CRC Press (2017)
3. Indrayan and Satyanarayana, Biostatics for Medical, Nursing and pharmacy students, prentice Hall of India (2006)
4. Sarma K.V.S, Statistics made simple – do it yourself on PC, 2nd edition, Prentice Hall (2010)

Subsidiary Subject

Ethics in Echocardiography: 10 HRS

(Should be taught to the 1st year students of M.Sc. Echocardiography)

Introduction: With the advances in science and technology and the increasing needs of the patient, their families and community, there is a concern for the health of the community as a whole. There is a shift to greater accountability to the society. It is therefore absolutely necessary for each and every one involved in the health care delivery to prepare them to deal with these problems. Other professionals are confronted with many ethical problems.

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To accomplish this and develop human values, it is desired that all the students undergo ethical sensitization by lectures or discussion on ethical issues.

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How to form a value system in one's personal and professional life?
International code of ethics

Professional Ethics-
Code of conduct
Confidentiality
Fair trade practice
Handling of prescription
Mal practice and Negligence
Professional vigilance

Research Ethics-
Animal and experimental research/ humanness Human experimentation
Human volunteer research - informed consent Clinical trials
Gathering all scientific factors
Gathering all value factors
Identifying areas of value – conflict, setting priorities
Working out criteria towards decision
ICMR/ CPCSEA/ INSA Guidelines for human / animal experimentation

Recommended reading

Francis C.M., Medical Ethics, I Edition, 1993, Jay pee Brothers, New Delhi p189.

Good Clinical Practices: GOI Guidelines for clinical trials on Pharmaceutical Products in India (www.cdsco.nic.in)

INSA Guidelines for care and use of Animals in Research – 2000.

CPCSEA Guidelines 2001(www.cpcsea.org).

Ethical Guidelines for Biomedical Research on Human Subjects, 2000, ICMR, New Delhi.

ICMR Guidelines on animal use 2001, ICMR, New Delhi.

PRACTICALS

Paper –I: Embryology and ultrasound physics - 120 Hours

1. **Echocardiographic demonstration: 5Hours**

Candidate will be allocated equipment for demonstration of procedure of maintenance,

Will be required to accompany service engineers and biomedical engineers during service visits and prepare at least six analyses of error and corrective actions taken

Candidate will be required to perform rapid studies during OP peak hours under supervision and will participate in subsequent debriefing

Will assist consultant in quality control exercise on a weekly basis.

2. Basic Echocardiographic principles: 5 Hours

Transducer selection

Reduction of artifacts

Obtaining optimal gray scale images

Gain and depth controls

Use of M-mode for temporal analysis of cardiac events and obtaining measurements

Use of modalities to optimize colour flow such as colour maps, gain and scale

Adjustments related to Doppler such as scale, PRF, sweep, angle correction

Use of specialized techniques such as Tissue Doppler

3. Echocardiographic examination (10 Hours)

Will be required to perform calculations such as left ventricular mass and cardiac output, Calculation of cardiac mass,

Doppler equations, stroke distance, converting velocity to flow, flow to volumes, cardiac output, shunt ratios, modified Bernoulli equation and intra-vascular pressures, assessment of left ventricular, left atrial, right ventricular, right atrial pressures

Candidate would be required to store and retrieve studies of diagnostic quality-clinician satisfaction will be taken as a yardstick for performance

Applications of principles to obtaining, storing and retrieving optimal images.

Clinical lab posting: 75 hours

Students will be posted in the echocardiographic laboratory for the observation and to develop practice in the routine cardiac investigation by echocardiography.

Hands on practical work: 25hours

Students will be allowed to perform echocardiographic test independently under the supervision of the faculty to develop the skill and experience.

Paper-II : Clinical cardiology 120 hours

Clinical scenario given to the candidate for diagnosis and treatment of following disorders:

150 Hr

a. Unstable angina
b. Myocardial infarction
c. Left ventricular aneurysm
d. Congestive heart failure
e. Cardiac arrhythmia
f. Atrial septal defect
g. Ventricular septal defect
h. Tetralogy of Fallot
i. Hypertension

Cardiac Surgery

5 Hours

Brief description of surgical steps involved in:

a. Coronary artery bypass grafting (on pump CABG)
b. Mitral valve replacement
c. Aortic valve replacement
d. ASD closure
e. VSD closure
f. Off-pump CABG

Clinical lab posting: 75 hours

Students will be posted in the echocardiographic lab, for the observation and to identify the correlation of clinical diagnosis with the echo findings with the help of clinical features, blood investigations, ECG, X-RAY etc.

Students will be recruited to the operation theater for the observation of the cardiac surgeries and to understand various technics.

Students will be allowed to attend ward rounds with the cardiologists.

Students will be demonstrated for ACLS and BLS, and posted clinically in ICCU for the observation and experience.

Hands on practical work: 25hours

Students will be allowed to read ECG and report X-RAY, perform echocardiographic test independently under the supervision of the faculty.

Paper –III : Echocardiography for Ischemic valvular heart disease - 140 Hrs

Ischemic and valvular heart disease, Echocardiography for ischemic heart disease

20 Hours

1. **Understanding coronary circulation:** Coronary anatomy and physiology, pathogenesis of atherosclerotic plaques, abnormalities of coronary perfusion, wall thickening
2. **Wall motion scoring:** Regional left ventricular function, relationship to vascular supply, use of tissue Doppler where indicated, Segmental analysis for wall motion defects, coronary artery territories, detection and quantitation of Ischaemic muscle-wall motion scoring,
3. **Global ventricular function:** Linear measurements: indirect M-Mode markers of left ventricular function; Assessing global LV function; Evaluation of diastolic function: Methods for evaluating diastolic function, Doppler evaluation of diastolic function, Evaluation of mitral inflow, determination of isovolumic relaxation time, Evaluation of pulmonary vein flow, Doppler tissue imaging, Assessment of overall performance of the Ischemic left ventricle-systolic and diastolic function, estimating volumes rule of disks.
4. **Myocardial infarction:** Detecting and assessing MI, co-relation with coronary anatomy, prognostication following MI.
5. **Complications of MI**: Aneurysm, pseudo aneurysm, Ventricular Septal Defect, thrombi-embolic potential, right ventricular involvement.
6. **Stress echocardiography:** Protocols for stress echocardiography, detection of reversible Ischemic, detecting inducible ischemia/viability, specificity and sensitivity
7. **Newer techniques and their applications for IHD:** Tissue Doppler, strain, strain rate and velocity vector imaging, studying myocardial perfusion using contrast echocardiography.
8. **Surgical aspects of IHD-role of echo cardiographer:** Pre and postoperative evaluation for Coronary Artery Bypass Grafting (CABG), Linear endo-ventricular patchplasty (Dorr's procedure), Mitral regurgitation- morbid anatomy repair versus replacement decision/post-operative, coronary anomalies-echocardiographic aspects.
9. **Recent developments in echocardiography for ischemic heart disease Textbooks and Reference Books:**
    1. Echocardiography by Feigenbaum (Latest Edition)
    2. Echo manuals by Mayo Clinic Lecture notes.
    3. Journal articles
    4. Cardiology by Braunwald and Hurst (Latest edition)

Echocardiography for valvular heart disease **20 Hrs.**

1. **Hemodynamic information derived from echocardiography:** Aortic flow, pulmonary flow, mitral flow, left atrial flow, tricuspid valve flow, cardiac output, regurgitant fraction shunt ratios, echocardiographic detection of stagnant blood flow, modified Bernoulli equation and intravascular pressures, echocardiographic findings with elevated left ventricular diastolic pressure, elevated left atrial pressures, pulmonary hypertension, right ventricular pressure, right atrial pressure.

2. **Mitral stenosis:** Etiopathogeneisis, pathophysiology and hemodynamics, two-dimensional echocardiography in rheumatic mitral stenosis, congenital mitral stenosis, M-model echocardiographic appearance, transoesophageal echocardiography, three dimensional echo assessment for severity, anatomic determination of severity, exercise gradients, secondary features of mitral stenosis, Atrial fibrillation, secondary pulmonary hypertension, decision making regarding intervention; assessment for balloon mitral valvotomy-transesophageal echocardiography and its uses, post-procedural assessment,open mitral valvotomy versus mitral valve replacement- pre and post-operative assessment.

3. **Mitral regurgitation:** Doppler evaluation of mitral regurgitation, determination of mitral regurgitation, severity, Mitral valve prolapse and analysis of segments, Haemodynamics of MR, diagnosis of MR, assessing severity and secondary effects, pre-op, intra-op and post-operative, assessment for mitral valve repair, use of three dimensional echocardiography for mitral valve surgery, flail mitral valve, papillary muscle dysfunction. mitral annular calcium
4. **Tricuspid valve disease:** Anatomy and physiology of the healthy valve structural and functional changes in various disease states organic and functional involvement, tricuspid stenosis, tricuspid regurgitation and assessment of severity, approach to pulmonary artery hypertension.
5. **Aortic stenosis:** Etiopathogenesis and haemodynamics, sub-valvular, valvular and supravalvar lesions, cuspal morphology, diagnosis and assessment of secondary effects, time course and prognostication, pre-operative and post-operative assessment; Diagnosis, assessing mechanism and severity, assessing site, possible etiology, secondary effects such as LV function, impact on associated lesions and therapeutic approach
6. **Aortic regurgitation**: Etiopathogenesis and haemodynamics, secondary effects, establishing a diagnosis, evaluating the severity of aortic regurgitation, acute versus chronic aortic regurgitation, relevant aspects of left ventricular function, timing of surgery, pre-operative and post-operative assessment.
7. **Pulmonary valve disease:** Embryology, morphology, infundibular, valvular, supra valvular and peripheral pulmonic stenosis, evaluation of the right ventricular outflow tract, miscellaneous abnormalities of the pulmonary valve assessing severity of pulmonic stenosis, pre and post procedural assessment for pulmonary valvuloplasty, pulmonary regurgitation.
8. **Prosthetic valves:** Types and normal function of mechanical valves, stenosis regurgitation, use of tranesophageal echo for prosthetic valves, endocarditis: and its sequelae in native and prosthetic heart valves.

9. **Recent developments in echocardiography for valvular heart disease** Candidate would be allocated one or two patients/cases who are diagnosed with above (ischemic or valvular lesions) conditions, once in a week. They will be allowed to formulate the diagnostic question independently. The candidate will be analyzed by the faculty for the performance on the basis of diagnostic skill with the interpretation of the disease and looked for the knowledge on treatment modality. This will be followed by the brief discussion.

Textbooks and Reference Books:

1. Echocardiography by Feigenbaum (Latest Edition)
2. Echo manuals by Mayo Clinic Lecture notes.
3. Journal articles Cardiology by Braunwald and Hurst (Latest edition)

Clinical lab posting: 75 hours

Students will be posted in the echocardiographic laboratory for the observation and to develop practice in the cardiac investigation in ischemic and valvular heart disease by echocardiography.

Hands on practical work: 25hours

Students will be allowed to perform echocardiographic test independently under the supervision of the faculty to develop the skill and experience.

Second Year – Theory

Paper V: Paediatric Echocardiography

Total hours: 46Hrs

Unit No	Unit title	Unit objectives	Content	Hours	Method of evaluation
1	Orientation and introduction to the course			1	Sessional examination
2	Fetal cardiac Imaging		Indications for fetal cardiac evaluation Fetal physiology-Indications for fetal echocardiography	2	Sessional examination
3	Echo examination		A segmental approach to anatomy-Cardiac situs - Ventricular morphology -Great arterial connections	2	Sessional examination
4	Abnormalities of RV inflow			1	Sessional examination
5	Abnormalities of LV inflow		-Pulmonary veins - Left atrium-Mitral valve	2	Sessional examination
6	Abnormalities of RV outflow		- Right ventricle-Pulmonary Valve-Pulmonary artery	2	
7	Abnormalities of LV outflow		-Subvalvular Obstruction - Valvular aortic stenosis -Supravalvular aortic stenosis	2	Sessional examination
8	Coarctation of aorta			2	Sessional examination

9	Abnormalities of cardiac septation		Atrial septal defect- -Ventricular septal defect-Endocardial cushion defect	3	Sessional examination
10	Abnormal vascular connections and structures		Patent ductus arteriosus- Abnormal systemic venous connection Abnormalpulmonary venous connection-Abnormalities of the coronary circulation	2	Sessional examination
11	Cono truncal abnormalities		-Tetralogy of Fallot -Trans position of the great arteries,- Double outlet Right ventricle- Persistent truncus arteriosus- Aorto pulmonary window	3	Sessional examination
12	Abnormalities of ventricular development		Hypoplastic left heart syndrome -single ventricle- Tricuspid atresia	3	Sessional examination
13	M-mode and 2D in CHD		Basics of imaging and sequential segmental analysis - Left to right shunts -Atrio ventricular septal defect Congenital left ventricular and right vedntricular inflow anomalies -Left ventricular outflow tract obstruction. Echocardiographic anatomy of TOF with PS-Complete transposition of great arteries- AV/VA discordance- Pulmonary veins-Imaging of coronary anomalies and pulmonary arteries- Echocardiographic evaluation of aortic arch and its anomalies-Univentricular heart and heterotaxy syndrome.	10	Sessional examination
14	3D echo in CHD For quantification of ventricular volumes, Mass and function with CHD		LV volume, EF and Mass-RV volume, EF and Mass -Single ventricular volumes, EF and mass -3D analysis of regional wall motion, Synchrony and strain	3	Sessional examination
15	Echo in the evaluation of adults with CHD		Simple congenital heart defects in adults Valvular heart disease Complex congenital heart	2	

			defects		
16	Echo evaluation during and after surgery		Systemic artery to pulmonary artery shunts Pulmonary artery bands Fontan procedure -Right ventricle to pulmonary artery conduits	3	Sessional examination
17	Echo evaluation of acquired heart disease in childhood		IE-Modified DukeCriteria for the diagnosis of IE Echo findings in Complications of IE . RHD-Johns criteria. Kawasaki disease - Coronary ectasia and aneurysms	3	Sessional examination

Paper VI: Echocardiography in Myocardial, Pericardial, Aortic and Systemic Disorders & Non-Cardiac Diagnosis

Total hours: 47

Unit No	Unit title	Unit objectives	Content	Hours	Method of evaluation
1	Orientation and introduction to the course			1	Sessional examination
2 2A	Echo in cardiomyopathies Hypertrophic cardiomyopathy		Definition and types of hypertrophy -Mid LV hypertrophic cardiomyopathy -Differential Diagnosis Treatment strategies	12	Sessional examination
2B	Dilated cardiomyopathy		Secondary findings in DCM -Etiology of DCM-Doppler evaluation of systolic and diastolic function -Therapeutic decision		
2C	Infiltrative and Restrictive cardiomyopathy		Echo evaluation of RCM -Constrictive versus restrictive heart disease		
2D	Peripartum cardiomyopathy				
2E	Non-compaction LV/RV cardiomyopathy				
2F	Endocardial fibro				

	elastosis and hyper eosinophilic syndrome				
3	Echocardiographic Differentiation of ischemic and non ischemic cardiomyopathy		Echocardiographic assessment of ischemic and non ischemic cardiomyopathy -M-mode echocardiography -2D/3D /Doppler echocardiography - Distinction between ischemic and non ischemic dilated cardiomyopathy-Other non invasive imaging modalities	10	Sessional Examination
4	Pericardial disease		Acute pericarditis - Pericardial effusion , M-Mode and 2D echocardiography-Cardiac tamponade -Constrictive Pericarditis –Congenital anomalies-3D echo assessment in pericardial disease -2D versus 3D echocardiography	5	Sessional examination
5	Diseases of the Aorta		Echocardiographic Evaluation -Aortic dilatation and Aneurysm - Marfan' syndrome - Sinus of valsalva aneurysm - Aortic dissection -Aortic pseudo aneurysm, Aortic Trauma-Infections of the aorta- Aortic prosthesis thrombus -Takayasu arteritis	5	Sessional examination
6	Echo in systemic disease		Hypertension -DM-Connective tissue /auto immune disease-Chronic liver disease-COPD -Pulmonary hypertension	5	Sessional examination
7	Echocardiography in the Elderly		Aortic atherosclerosis and penetrating aortic Ulcer - Aortic valve Sclerosis - Aortic stenosis -Aortic	5	Sessional examination

			aneurysm- Aortic Dissection -LV Masses, Dimensions and function- Echocardiography in stroke patients -Mitral annular calcification- Prosthetic valves		
8	Echocardiographic assessment of Cardiac Tumors and Masses		Echocardiographic assessment of cardiac tumors and masses- Primary Benign cardiac tumors -Malignant primary cardiac tumors	4	Sessional examination

Paper VII: Recent advances

Total hours: 47

Unit No	Unit title	Unit objectives	Content	Hours	Method of evaluation
1	Orientation and introduction to the course			1	Sessional examination
2	Monitoring ventricular function in the operating room		LV filling -Global systolic Function, Regional wall motion abnormality-Use of TEE in operating room to monitor cardiac function in specific cardiac enteties	2	Sessional examination
3	Contrast ultrasound imaging, Method, Analysis and Application		Characteristics of microbubbles Ultrasonographic contrast agent, Ultrasonographic imaging technique-Method of analysis-Clinical applications of ultrasonographic contrast- Myocardial contrast echocardiography, Indications for use of ultrasound contrast- Safety of ultrasound contrast	3	Sessional examination
4	Myocardial perfusion echocardiography		Acute coronary syndromes Assessment of myocardial viability Chronic coronary artery disease	2	Sessional examination
5	Endothelial Dysfunction		Endothelial function and Dysfunction -Role of Acetylcholine -Shear stress and	3	Sessional examination

			flow mediated Dilatation-NO Release-Methodology for Assessing endothelial function-Analysis of shear stress and flow mediated dilatation response-Factors affecting the flow mediated dilatation-Limitations -Other non invasive methods to assess endothelial function		
6	3D- Transthorasic and TEE echo examination and performing		3D TEE Technology -Performing 3D TEE -Evaluation -Specific uses of 3D TEE	2	Sessional examination
6A	3D TEE to evaluate valvular heart disease.		3D echo image optimization-3D echo of the mitral valve -3D echo of the aortic valve-3D echo of the pulmonic valve -3D echo of the Tricuspid valve	2	
6B	3D TEE in operating room		Mitral Valve disease-Aortic valve disease-Tricuspid valve disease-Native valve endocarditis-Prosthetic valve dysfunction-Cardiac masses	2	
6C	3D guidance of Percutaneous procedures		Fluoroscopy versus echocardiography in guiding percutaneous interventions-Transseptal puncture, Device closure of cardiac shunts-Occlusion of the LA appendage- Guidance for electrophysiology procedures, Miscellaneous procedures	4	
7	Speckle tracking echocardiography; clinical usefulness		Cardiac muscular anatomy-what is strain-2D speckle tracking echocardiography -Image acquisition and processing - Clinical application of 2D STE-3D speckle tracking echocardiography - Clinical applications of 3D STE-Limitation	3	Sessional examination
8	Intra cardiac echocardiography		Equipment and the Catheters-Imaging specification-clinical	2	Sessional examination

			applications-intra cardiac echocardiography during EP intervention -During structural intervention		
9	Intravascular ultrasound imaging		Principles of Ultrasound - Technology-Image acquisition- Intravascular ultrasound examination Image interpretation -Utility of intravascular ultrasound in clinical practice	3	Sessional examination
10	Peripheral vascular ultrasound		Ultrasound diagnosis of carotid artery diseases Ultrasound diagnosis of Femoral access complications	2	Sessional examination
11	Advanced Non invasive Quantification Techniques in echocardiography		Clinical applications of advanced 3D echo quantification tools -RV quantification -Mitral valve assessment -Aortic valve assessment -Conclusion	3	Sessional examination
12	Echocardiography in Women		Structural heart disease:-MVP, Mitral stenosis, Mitral annular calcification -Ischemic heart disease -Stress echocardiography -Polycystic ovarian Syndrome -Takotsubo cardiomyopathy-CHD -Echocardiography in pregnancy-Peripartum cardiomyopathy-Fetal echocardiography	2	Sessional examination
13	Echo for the Electrophysiologist		Echocardiography in SVT-Left atrium Atrial septum-Pulmonary veins-Inferior venacava-Echocardiography in VT-Echocardiography in cardiac Implantable electronic devices	3	Sessional examination

14	Echo in life threatening conditions		Chest trauma-Penetrating chest trauma- Acute Mitral regurgitation Acute severe AR -Aortic dissection –Debakey classification -The Stanford classification Pulmonary thromboembolic Disease -Air embolism Hypovolemia -Large intracardiac thrombus	4	
15	A Primer on cardiac MRI for the Echo cardiographer		Quantitative left and right ventricular assessment -Strain assessment LV structure -Myocarditis and Sarcoidosis-cardiac hypertrophy,Cardiomyopathies -Velocity Mapping, Flow and shunt Assessment -Valvular heart disease and prosthetic valves	3	Sessional examination
16	Fetal echocardiography		Echocardiography in diagnosis of heart disease in pregnancy-Indication-Extra cardiac reasons and associations for fetal heart disease - Fundamentals of fetal cardiac imaging	2	Sessional examination

PRACTICALS

Paper - V: Paediatric Echocardiography 140 HRS

40 Hours

1. Paediatric echocardiography: Segmental approach, Assessing visceral and cardiac situs, veno-atrial connection, atrio-ventricular and ventriculo-great artery relation, Ventricular loop, Great artery position, Aortic arch visualization.
2. Abnormalities of right ventricular inflow
3. Abnormalities of left ventricular inflow: Pulmonary veins, left atrium, and mitral valve.
4. Abnormalities of right ventricular outflow: Right ventricle, pulmonary valve, pulmonary artery
5. Abnormalities of left ventricular inflow: sub-valvular obstruction, Valvular aortic stenosis, supravalvular aortic stenosis.

6. Coarctation of the aorta
7. Abnormalities of cardiac septation: Atrial septal defect, ventricular septal defect, endocardial cushion defect.
8. Abnormalities vascular connection and structures: patent ductus arteriosus, abnormal systemic venous connections, abnormal pulmonary venous connections, abnormalities of the coronary circulation.
9. Cono-truncal abnormalities: Tetralogy of Fallot, transposition of the great arteries, double outlet right ventricle, persistent truncus arteriosus and aortopulmonary window.

Candidate would be allocated one or two patients/cases who are diagnosed with above conditions, once in a week. They will be allowed to formulate the diagnostic questions independently. The candidate will be analyzed by the faculty for the performance on the basis of diagnostic skill with the interpretation of the disease and looked for the knowledge on treatment modality. This will be followed by the brief discussion.

Clinical lab posting: 75 hours

Students will be posted in the echocardiographic laboratory for the observation and to develop practice in the cardiac investigation of congenital heart disease by echocardiography.

Hands on practical work: 25hours

Students will be allowed to perform echocardiographic test independently under the supervision of the faculty to develop the skill and experience.

Paper - VI: Echocardiography in Myocardial, Pericardial, Aortic and Systemic Disorders & Non-Cardiac Diagnosis -125Hrs

25 Hours

1. **Hypertrophic Cardiomyopathy**: Morphological variants, diagnosis, haemodynamics, echocardiography evaluation of hypertrophic cardiomyopathy, assessing intracavitary and outflow tract gradients in obstructive cardiomyopathy, Mitral regurgitation in hypertrophic cardiomyopathy, other variants of hypertrophic cardiomyopathy, mid-cavity obstruction, conditions mimicking hypertrophic cardiomyopathy, therapeutic decision making and monitoring in hypertrophic cardiomyopathy, evaluation of therapy, pre and post-procedural evaluation.

2. **Idiopathic dilated cardiomyopathy:** Diagnosis and differentiation from other disorders such as IHD, Doppler evaluation of systolic and diastolic function, secondary findings in dilated cardiomyopathy, etiology of dilated cardiomyopathy, determination of prognosis in dilated cardiomyopathy, pre and post-procedural evaluation for cardiac re-synchronization therapy. Overview of cardiac transplantation.
3. **Restrictive Cardiomyopathy:** Diagnosis and haemodynamics, infiltrative cardiomyopathies, miscellaneous- myocardial diseases in neuromuscular disorders, infectious agents and toxins.

4. **Diseases of the pericardium:** Pericardial effusion: Detection of fluid, diagnosis-pleural versus pericardial fluid, quantitation, loculated effusions, cardiac tamponade-diagnosis, haemodynamics etiology, pericardiocentesis, Constrictive pericarditits: Diagnosis and haemodynamics. Differentiation from restrictive Cardiomyopathy, pre and post-surgical evaluation. Miscellaneous: acute pericarditis, pericardial thickening, pericardial cysts, absent pericardium.
5. **Diseases of the aorta:** Aortic dilatation and aneurysms, Aortic dissection-diagnosis and classification, false aneurysms, aneurysms of the aortic sinuses-rupture,haemodynamics, pre-and postsurgical evaluation.Miscellaneous-rauma, infections, aorta-left-ventricular tunnel, atherosclerosis, echocardiographic evaluation, aortic dilation and aneurysm, marfan syndrome, Sinus of valsalva aneurysm, aortic atheroma. Role of trans-esophageal echocardiography.
6. **Echocardiography in systemic disorders:** Diabetes hypertension, renal failure, neurological conditions, collagen vascular diseases and so on.
7. **Cardiac masses:** Tumors and source of embolus: Normal variants and artifacts, cardiac tumors; primary tumors, metastatic tumors of the heart, secondary effects, Masses, extra cardiac masses, intra cardiac thrombi, ultrasonic typing, man-made objects in the heart; Intra-cardiac thrombi: left ventricular thrombi, left atrial thrombi, right atrial thrombi, spontaneous echo contrast.
8. **Echo findings with altered electrical activation**: Normal and abnormal depolarization and conduction of the cardiac impulse, bundle branch blocks and Wolf-Parkinson-White syndrome, ectopic rhythm-ventricular and supra-ventricular, pacemakers.
9. **Recent developments in echocardiography in myocardial, pericardial, aortic and systemic disorders**
10. **Infective endocarditis.**

Candidate would be allocated one or two patients/cases who are diagnosed with above conditions, once in a two week. They will be allowed to formulate the diagnostic question independently. The candidate will be analyzed by the faculty for the performance on the basis of diagnostic skill with the interpretation of the disease and looked for the knowledge on treatment modality. This will be followed by the brief discussion.

Textbooks and Reference Books:

1. Echocardiography by Feigenbaum (Latest Edition)
2. Echo manuals by Mayo Clinic Lecture notes.
3. Journal articles Cardiology by Braunwald and Hurst (Latest edition)

Clinical lab posting: 75 hours

Students will be posted in the echocardiographic laboratory for the observation and to develop practice in the echocardiographic examination in myocardial, pericardial, aortic and systemic disorders.

Hands on practical work: 25hours

Students will be allowed to perform echocardiographic test independently under the supervision of the faculty to develop the skill and experience.

Paper- VII- Recent advances 125Hrs

25 Hours

1. **Tissue Doppler(TDI) and Deformation Imaging**
   Technical Principles of Tissue velocity, strain and strain rate imaging Introduction
   Tissue velocity imaging
   Pulsed wave tissue velocity imaging
   Color tissue velocity imaging Curved anatomical M-mode Concepts of strain and strain rate Definition of strain and Strain rate
   Estimation of strain and strain rate from ultrasound data
   Artifacts and methods to improve signal quality
2. **Principles and different technique for speckle tracking**
   Introduction
   Principles of speckle tracking Strain and strain rate assessment Torsion and twist
3. **Application of echocardiography in hemodynamic evaluation**
   Assessment of filling pressure at rest
   Heart failure and LV filling pressure
   Role of standard Echocardiography in Assessment of LV filling pressure Mitral inflow, Pulmonary venous flow
   Colour M-mode flow propagation velocity
   Role of TDI in Assessment of LV filling pressure
   Doppler estimation of LV filling pressure in AF
4. **Assessment of LV filling pressure with strain**
5. **Assessment of Systolic Heart failure**
   Introduction
   Regional systolic and long axis function
   Assessment of LV filling pressure
   Tissue Doppler imaging in heart failure with MR
   Tricuspid annular Velocities and RV function
6. **Assessment of Diastolic Heart failure**
   Introduction
   Differential diagnosis in a patient with Heart failure and Ejection fraction
   Echocardiography as a tool for Assessment of heart failure
7. **Assessment of cardiac dyssynchrony and its application**
   Introduction
   Methods of Assessment of cardiac dyssynchrony by myocardial imaging RV pacing -induced systolic dyssynchrony
   Role of cardiac dyssynchrony, Assessment in cardiac resynchronization therapy: Tissue Doppler imaging

8. **Ischemic heart disease**

   Experimental study on myocardial ischemia and viability using tissue Doppler and deformation

9. **Use of tissue velocity imaging during stress echocardiography**
10. **Tissue Doppler echocardiography in the assessment of Hypertensive heart disease**
11. **Constrictive Pericarditis versus Restrictive cardiomyopathy**
12. **Use of Myocardial imaging to identify and manage sub clinical heart disease in thyroid and other endocrine heart disease**
13. **Myocardial imaging in valvular heart disease** Myocardial imaging in mitral valve disease Myocardial imaging in Aortic valve disease
14. **Tissue Doppler Imaging and strain rate imaging to evaluate RV function.**
15. **3 D Echocardiography** Principles & Clinical Application
16. **Automated Functional Imaging**
17. **3D TEE**

    Clinical Applications & Instrumentation
18. **Cardiac resynchronization therapy**
19. **Contrast Echocardiography**
20. **Fetal Echocardiography.**

Candidates will be trained by the faculty in the echocardiographic lab to obtain technical skill on recent indices of Tissue Doppler imaging including strain and strain rate measurement. Periodically one or two hours per month, candidates will be subjected to random cases for which, the assessment will be carried out by applying all the Deformation techniques under the supervision of the faculty and then the appropriate discussion is recruited to reduce the means of error in the analysis.

Clinical lab posting: 75 hours

Students will be posted in the echocardiographic laboratory for the observation and to develop practice in the echocardiographic examination for diagnosing subtle changes in the myocardium in systemic, valvular, congenital heart diseases. Observing the echo guided CRT analysis to understand the prognostication and to identify the responders.

Hands on practical work: 25hours

Students will be allowed to perform echocardiographic test independently under the supervision of the faculty to develop the skill and experience

Section-III

Minimum requirement of infrastructure, laboratory facilities and staff:

(i) Basic Infrastructure:

Institute should have its own hospital with full-fledged cardiology unit with the following facilities:

- 25 bedded cardiology / cardiac surgery services
- Echocardiography laboratory with 4 echocardiography machines
- Class room with capacity for 30 students, measuring 500 sq.ft
- One departmental Seminar room measuring 250sq.ft for each branch with A.V aids – OHP, Slide projector and computer with accessories are compulsory. LCD Projector (optional) other infrastructure criteria- Principals room, students common room, staff room, Library, office room, Store room, preparation room etc will be as per minimum criteria. Norms of B.Sc-Cardio vascular/Cardiac Care Technology course.

(ii). Infrastructure subject wise

- Anatomy laboratory
- Physiology laboratory
- Echocardiography equipments
  i. Echocardiography machines – 4
  ii. Transoesophageal echocardiography probes –01
  iii. OPD case load for echocardiography – 50 / day
  iv. Cardiology OPD attendance – 100 / day
  v. Cardiology inpatient service minimum – 25 beds
  vi. Cardiac surgical case load – 01operations / day

Suggested Readings:

1. Feigenbaum Present / Latest edition
2. 'Otto' Text book of Echo 6th edition
3. Echo manual – Joe
4. Indian Text book of Echocardiograpy: Amuthan . V
5. Jaypee publishers : Text book of Echo : Navin C Nanda
6. 3D Echo : Dr Amuthan . V
7. Valvular Heart Disease : Dalen & Alpert
8. 'Otto' : 3 D TEE Primer
9. Echocardiography review Guide "Otto"
10. Atlas of 3 D Echo: Edward A. Gill
11. 3 D Echo: Takakhiro Shiota

SECTION- IV
MONITORING LEARNING PROGRESS

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment be done using checklists that assess various aspects. Model Checklists are given in this Chapter, which may be copied and used.

The learning out comes to be assessed should include:

i) ***Acquisition of Knowledge***: The methods used comprise of `Log Book' which records participation in various teaching / learning activities by the students. The number of activities attended and the number in which presentations are made are to be recorded. The logbook should periodically be validated by the supervisors. Some of the activities are listed. The list is not complete. Institutions may include additional activities, if so, desired.

Journal Review Meeting (Journal Club): The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting using a checklist (see Model Checklist – I, Section IV)

Seminars / Symposia: The topics should be assigned to the student well in advance to facilitate in depth study. The ability to do literature search, in depth study, presentation skills and use of audio- visual aids are to be assessed using a checklist (see Model Checklist-II, Section IV)

ii) Teaching skills: Candidates should be encouraged to teach undergraduate medical students and paramedical students, if any. This performance should be based on assessment by the faculty members of the department and from feedback from the undergraduate students (See Model checklist III, Section IV)

iii) Dissertation: Please see checklist IV and V in Section IV.

iv) Work diary / Log Book- Every candidate shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal,
reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of experiments or laboratory procedures, if any conducted by the candidate.

v) *Records:* Records, log books and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University.

<u>Log book:</u>

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

Format for the logbook for the different activities is given in Tables 1 and 2 of Section IV.
Copies may be made and used by the institutions.

Procedure for defaulters: Every department should have a committee to review such situations. The defaulting candidate is counseled by the guide and head of the department. In extreme cases of default the departmental committee may recommend that defaulting candidate be withheld from appearing the examination, if she/he fails to fulfill the requirements in spite of being given adequate chances to set himself or herself right. **Format of Model Checklists**

Checklist - I

Model Checklist for Evaluation of Journal Review Presentations

Name of the student:_____ Date:_____

Name of the faculty/ Observer:_____

Sl No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist - II

Model Check List for the Evaluation of the Seminar Presentations

Name of the student:_____Date:_____

Name of the faculty/ Observer:_____

Sl No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist – III

Model Check list for Evaluation of Teaching Skill

Name of the student:_____Date:_____

Name of the faculty/ Observer:_____

SL. No.		Strong Point	Weak point
1	Communication of the purpose of the talk		
2	Evokes audience interest in the subject		
3	The introduction		
4	The sequence of ideas		
5	The use of practical examples and /or illustrations		
6	Speaking style (enjoyable, monotonous, etc., specify)		
7	Summary of the main points at the end		
8	Ask questions		
9	Answer questions asked by the audience		
10	Rapport of speaker with his audience		
11	Effectiveness of the talk		
12	Uses of AV aids appropriately		

Checklist - IV

Model Check list for Dissertation / Project Work Presentations

Name of the student:_____ Date:_____

Name of the faculty/ Observer:_____

Sl No.	Points to be considered	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Checklist – V

Continuous Evaluation of dissertation / project work By
Guide/ Co-Guide
Name of the student: _____Date:_____
Name of the faculty/ Observer:_____

Sl No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Periodic consultation with guide/ co-guide					
2	Depth of Analysis/ Discussion					
3	Department presentation of findings					
4	Quality of final output					
5	Others					

	Total score					

Overall Assessment Sheet

Date:

Check list No.	**Name of the students**			
	A	**B**	**C**	**D**
1				
2				
3				

Course i/c **Signature of the HOD** **Signature of the Prof. i/c AHS**

The above overall assessment sheet used along with logbook should form the basis for certifying satisfactory completion of course of study, in addition to the attendance requirement.
KEY

Mean score: Is the sum all the scores of checklists 1 to 5

A, B, C: Name of the students

LOG BOOK

Table 1: Academic activities attended

Name:

Admission Year:

Date	**Type of activity, Specific Seminar, Journal club, presentation, UG teaching**	**Particulars**

LOG BOOK

Table-2: Academic presentations made by the student

Name:

Admission Year:

Date	**Topic**	**Type of activity, Specific Seminar, Journal club, presentation and UG teaching**

Management Information System Report

1. Name of the college imparting Echocardiography
2. Details of M.Sc.

Sl. No	**Name of the Branch & Teaching faculty**	**Sanctioned Strength**	**Admitted**	**Name of the subjects to be studied at 1st Year M.Sc.**	
1					
2					

3. No. of experiments/assignments conducted for 1st year M.Sc. Echocardiography students

Sl.No	**Branch**	**Subject**		**Assigned by SVIMS University**	**Conducted**	**%**	**Remarks**
1.		**No**	**Name**				
2							

4. No. of theory classes conducted for 1st year M.Sc. Echocardiography students

Sl.No	Branch	Subject		SVIMS University Norms(25)	Conducted	%	Remarks
1.		**No**	**Name**				
2.							
3.							

5. Number of theory and practical classes taken by 2nd year M.Sc. Echocardiography students for under graduate program (Optional).
6. No. of Journal clubs department wise for 1st year and 2nd year M.Sc. Echocardiography Students

Total No. of students Dept. Wise	Norms for half yearly Report	Achieved Number	% Achievement	Remarks
1st year M.Sc. Echocardiography No.=	2 per candidate per year			
2nd year M.Sc. Echocardiography No.=	2 per candidate per year			

7. Number of seminars for 1st year and 2nd year M.Sc. Echocardiography students

Total No. of students : 10	Norms for half yearly Report	Achieved Number	% Achievement	Remarks
1st year M.Sc. Echocardiography No.=10	2 per candidate			
2nd year M.Sc. Echocardiography No.= 08	2 per candidate			

8. Number of interdepartmental meetings

Norms for half yearly Report	Achieved Number	% Achievement	Remarks
	2	200%	Interactive and productive

9. Number of visits to pharmaceutical industry/research center/hospital for 1st year & 2nd year M.Sc. Echocardiography students.

Norms for half yearly Report	Achieved Number	% Achievement	Remarks
1	02	200	Educative & informative

10 Number of guest lectures for postgraduate Program

Norms for half yearly Report	Achieved Number	% Achievement	Remarks
2	03	150	Need focused and educative

11. Number of research papers published in the year in the college –

12. Any other additional information such as consultancy/collaboration/conducting Seminars & workshop or attending seminar & workshops or conference

Sl. No.	Subject	No. of Contact Hours	Code	Grade	Remarks
1.	Cardiac Embryology	20	C,L	P	
2.	Fetal and neonatal circulation	2	C,L	P	
3.	Ultrasound physics and instrumentation	146	C,L,P,PL	P	
4.	Clinical Cardiology	133	C,L,PL	P	
5.	Cardiovascular Pharmacology	10	C,L	P	
6.	Electrophysiology	4	C,L	P	
7.	Acute coronary syndrome	8	C,L	P	
8.	BLS/ACLS	10	C,L,P	P	
9.	Ischemic Heart Disease	17	L	P	
10.	Valvular Heart disease	32	L	P	
11.	Congenital Heart Disease	44	L	P	
12.	Cardiac surgery	10	L,C, PL	P	
13.	Echocardiography for lschemic Heart disease	70	C,P,PL	P	

14.	Echocardiography for Valvular heart disease	70	C,PL,P	P	
15.	Echocardiography for Congenital Heart disease	140	C,PL,P	P	
16.	Epedemiology and Biostastics	60	L	P	
18.	Ehocardiography of other heart diseases	25	PL, C,L,P	P	
19.	Myopericardial, Aortic, Systemic disorder & non cardiac diagnosis	137	C,L,P,PL	P	
20.	Recent Advances	168	C,L,PL,P	P	
21	Medical ethics	10	L	P	
22	Fetal Echocardiography	2	L,P	P	
23	Peripheral Ultrasound	2	L,P	P	
24	Seminar presentation	SS, I(G)	Classes for UG's		
25	Attending rounds with Cardiologists	10	C	P	

DESCRIPTION OF CODES

C : Clinical Teaching

D : Demonstration of Faculty

I : Independent Work by Student

I (G) : Independent Work by Student Guided by Faculty

L : Classroom Lectures by Faculty

P : Hands on Practical Work by Students

SD : Self Directed Study by Student

SD (E) : Self Directed Study by Student with Faculty Evaluation

SS : Student Conducted Seminars with Faculty Moderation and Evaluation by Peers and Faculty

PL : Practical / Clinical Lab Posting

Prof. & Course Incharge **Prof.& HOD** **Prof. i/c AHS**

CHECKLIST - I

Model Check List for Evaluation of Teaching Skill

SL. No.		Poor 0	Below average 1	Average 2	Good 3	Very good 4
1	Communication of the purpose of the talk					
2	Evokes audience interest in the subject					
3	The introduction					
4	The sequence of ideas					
5	The use of practical examples and /or illustrations					
6	Speaking style (enjoyable, monotonous, etc., specify)					
7	Summary of the main points at the end					
8	Ask questions					
9	Answer questions asked by the audience					
10	Rapport of speaker with his audience					
11	Effectiveness of the talk					
12	Uses of AV aids appropriately					

CHECKLIST - II

Model check list for Dissertation / Project Work Presentations

S. No.	Points to be considered	Poor 0	Below average 1	Average 2	Good 3	Very Good 4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Overall Assessment of the student by the clinical/Lab work:

Sl. No	Points to be considered	Poor 0	Below Average 1	Average 2	Good 3	Very Good 4	Excel lent 5
1	Attendance						
2	Punctuality						
3	Interaction with colleagues and support staff						
4	Maintenance of case records						
5	Topic Presentation						
7	Time sense						
8	Knowledge						
9	Rapport with patient.						
10	Overall quality of work						
	Total Score	- -	- -	- -			

MODEL QUESTION PAPER

THEORY

Each theory paper will have

1) Essay questions – 03 nos. carrying 10 marks each - 03 x 10 = 30
2) Short answer questions – 10 nos. carrying 05 marks each - 10 x 05 = 50

Total = 80

Internal assessment = 20

PRACTICAL

(a) Preliminary:

Internal assessment : 15

University examination : 60

Total = 75

(b) Viva = 25

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507

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

1st BOARD OF STUDIES MEETING

B.Sc. Radiotherapy Technology Course

19.02.2020

TIRUMALA TIRUPATI DEVASTHANAMS

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES, TIRUPATI

B.Sc. Radiotherapy Technology Course

1st BOARD OF STUDIES MEETING

List of Members

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

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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 31stDecember 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: Theduration of the course is 4 years, divided into 8 semesters. The 1st& 2nd semesters shall be common for all the specializations. The 3rd, 4th, 5th& 6th semesters involve theory, practice and handling of equipment in the respective speciality. During 7th& 8th semesters, the candidate will undergo internship in the speciality.

5) Syllabus : The syllabus is common during 1st and 2nd 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 3rd to 8th

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 1st 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 Sankranthi 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.

1. 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	-	-	-	-	-		-	-	-
	Total	**360**	**140**								

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%	-	-
	Total	**400**	**200**								

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.N0	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.N0	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 +Practal)
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

Sl.N0	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

Sl.N0	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 3rd Semester to 6th 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 theFaculty 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	-	-	-
	Total		**50**	**850**			

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.	**100**	**-**	IE	50	-	50%
2.	Internship & Project work		-	800	-	-	50	50%
	Total		**100**	**800**				

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, 1st 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, lymphatoid 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
TOTAL		**80**	**40**

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	
Total	**80**	**40**	**15**		**135**

No. of teaching hours :

	Theory	Practicals
1st 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 1st 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	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
TOTAL MARKS			**50**

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, giganitism, 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, surfactantsOxygen 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 :

		Theory	Practicals
1st 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 1st 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	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 visualacuity, 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+, Acids, Bases, Buffers :**
   Equilibrium constant, dissociation of water, H+ concentration, pH, acids-strong and weak, bases, titration behavior, Henderson-Hesselbach 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 supplimentation, 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 :

		Theory	Practicals
1st semester	-	80	40

Suggested Books :

1. Biochemistry by U. Sathyanrayana
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 1st 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	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 :

	Theory	Practicals
1st semester -	80	40

Examination pattern – Internal Exam
(At the end of 2nd semester)

S.No	Paper	Theory				
		Theory	Min. Pass	Int. Assmt. (IA)	Min. pass	Aggregate
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:

		Theory	Practicals
1st 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 1st 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
2nd 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 2nd 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 :

		Theory	Practicals
2nd semester	-	80	40

Suggested Books :

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

Examination pattern – University Exam
(At the end of 2nd 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
Total Hours		**80**

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
1st semester	-	80	40

Suggested Books :

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

Examination pattern – University Exam
(At the end of 2nd 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 HIMS
6. Telemedicine

III. Basics of computer networks :

1. Internet
    a) Define the Internet
    b) How the Internet woks
    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 2nd 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	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, polimyclitis.
    c. Disease control programmes : Tuberculosis, Malaria, Filaria, S.T.D, Goitre, Cholera and other diarrhoeal diseases and National Programme for preventation 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
1st semester	-	30	20

Suggested Books :

1. Park's text book of Preventive and social Medicine – 23rd 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 2nd 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 :

		Theory
1st semester	-	50
2nd 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 Grammer - 40 Marks

Examination pattern – University Exam

(At the end of 2nd 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, Intravasularbrachy 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 – Carousal - 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. Tumrs – 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, hypo pharynx, 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, uretur and penis
   h) CNS
   i) Retinoblastoma, wilms tumor and rhabdomyo sarcoma

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 - parametersofisodose 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 ultra – sound 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 –2nd 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, 2nd 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 myloma

• 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. Teletherapyand Brachytherapy Equipments:

1. Time, Distance and shielding measurement of HVT & TVT
2. Familiarization of radiation survey meters and their functional performace 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 treatmentonTeletherapy 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. Intracavitaryapplication 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 maintainingRecords /Log Bookby 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	-	-	-
	Total		**50**	**850**			

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%
	Total		**100**	**800**				

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 & Endo tracheal intubation
5. Advanced airway management skill (Use of bogie stellate, supraglottic devices)
6. Basic settings of a ventilator
7. Basic modes of ventilator
8. General case 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:

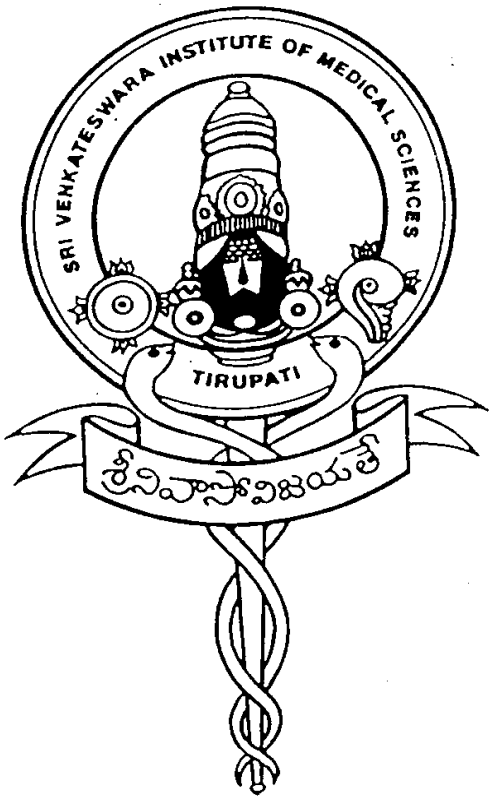
- Introduction to Biostatistics and Research Methods by Sunder Rao PSS Y Richard J . PHI publishers 2012.
- Biostatistics: A Foundation for Analysis of Health Sciences by Danial WW. John Wiley Publishers.
- Primer of Biostatistics by Galantz SA. McGraw Hill Press, 2011
- Essentials of Medical Statistics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

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

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)



REGULATIONS & SYLLABUS
2016-17

B. Sc Allied Health Sciences
(All Specialties)

TIRUMALA TIRUPATI DEVASTHANAMS

INDEX

1. GENERAL REGULATIONS

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

Historical Background:

The Paramedical courses were started in 1996-97 as PG Diploma with 2 year duration for Science Graduates. Subsequently, from 2009-10 onwards in place of PG Diploma, B.Sc Degree courses with 3 year duration were started in the all the specialities except Dialysis technology, Nuclear medicine technology and ECG & CVT technology with the course duration of 4 years (including 1 year internship).

W.e.f 2015-16 academic year onwards the duration of all the courses were increased to 4 years including 1 year internship. The course structure is re-designed from annual to semester pattern with 4 year duration having 8 semesters as per the revised UGC regulations. All the Paramedical courses are recognized by the A.P. Paramedical Board, Govt. of A.P.

1) Notification:

Notification shall be issued by the SVIMS University inviting applications from the eligible candidates who satisfy the Local or Non-local status in Andhra Pradesh / Telangana (Residence requirement) as laid down in Andhra Pradesh Education Institutions (Regulations of Admissions) Order, 1974 applicable to Non-statewide Universities and Educational Institutions. The admissions are subject to the procedure laid down in the G.O. Ms.No. 26, Dt: 22.03.2016 of HM & FW (E1), Dept. Govt. of A.P.

2) Programmes offered:

S.No	Name of the course	Eligibility	No. of seats	Duration
1	B.Sc Anaesthesia Technology (AT)	Inter Bi.PC or equivalent	12	**4 years**
2	B.Sc Medical Lab Technology (MLT)	-do-	20	
3	B.Sc Neurophysiology T echnology (EEG & ENMG)	-do-	2	
4	B.Sc Radiography & Imaging Technology (RIT)	-do-	9	
5	B.Sc Cardiac Pulmonary Perfusion Technology (CPPT)	-do-	2	
6	B.Sc ECG and Cardiovascular Technology (ECG & CVT)	-do-	6	
7	B.Sc Dialysis Technology (DT)	-do-	6	
8	B.Sc Emergency Medical Services Technology (EMST)	-do-	4	
9	B.Sc Nuclear Medicine Technology (NMT)	Inter MPC/ Bi.PC or equivalent	2	

3) Eligibility for admission:

i) The minimum age for admission shall be 17 years on 31st December of the year in which admission is sought.

ii) Minimum education:
10+2 class passed with Science subjects (Physics, Chemistry, Biology) & English Core/English Elective with aggregate of 45% marks from recognized board under AISSCE/CBSE/ICSE/SSCE/HSCE/NIOS or other equivalent Board. In case of SC/ST & Backward classes candidates, it shall be, not less than 40% of marks.

iii) Inter with optional subjects of MPC are also eligible for B.Sc (NMT) & DRT courses.

iv) The students who have passed intermediate vocational bridge course with Biology & Physical Sciences are also eligible for courses S.No. 1 to 8 subject to merit in the Bridge course in Physical & Biological sciences.

v) The following qualifications are also considered equivalent to be eligible for admission to the courses as mentioned against them even without qualifying bridge course :

a. Intermediate vocational (M.L.T.) - B.Sc (MLT)
b. Intermediate Vocational (Radiography) - B.Sc (RIT)

vi) Any other qualification awarded by the board of intermediate education equivalent to the specialization offered by the university at intermediate level are also eligible.

4) Method of Selection :

Admissions are made based on the common merit list prepared basing on marks secured in the qualifying examination in the subjects of Physics, Chemistry, Biology & English with less No. of attempts. In case of a tie, the order of preference to be followed in deciding the merit of the candidate, shall be :

i. Optional subjects (Group) marks secured in Physics, Chemistry & Biology
ii. Elder person based on the date of birth

Note: *1. The percentage of marks shall be calculated up to three decimal places*

2. The marks secured in the bridge course shall be considered for deciding merit, in case the candidate is opting for the course other than the specialty studied.

5) Course structure: The duration of the course is 4 years, divided into 8 semesters. The I & II semesters shall be common for all the specializations. The III, IV, V & VI semesters involves theory, practice and handling of equipment in the respective speciality. During VII & VIII semesters, the candidate will undergo internship in the speciality along with teaching & practice of certain common subjects.

6) Syllabus: The syllabus is common during I and II 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 III to VIII semesters will be discussed and approved by the Board of Studies (specialty wise) meetings by the dept. concerned.

7) Commencement of the Programme: The course will ordinarily commence from 1st August of the each academic year.

8) Medium of Instruction: English.

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

10) Uniform : All the students have to wear the uniform prescribed by the University. They should also wear white shoes.

11) Attendance : A candidate must have minimum of 80% attendance (irrespective of the kind of absence) in theory and practical in each subject for appearing for examination. A candidate must have 100% attendance in each of the practical areas before award of degree.

Participation in NCC, NSS, Sports and Games, educational tours, professional meetings and conferences or other Co-curricular activities representing the institution / university will not count as absence, provided the student is permitted by the University through proper channel. The shortage of attendance, if any, upto 10% shall only be condoned.

12) Internship : For B.Sc AHS : After successful completion of three years of course, student have to undergo internship training for a period of one year.

13) Holidays & Vacation : During I - VI semesters, 01 week holidays each during Dasara and Sankranthi and 15 days summer vacation shall be granted in the month of May, apart from public holidays declared by the University.

During internship (VII & VIII semesters), 15 days of leave, 15 days of summer vacation and institute declared holidays are permitted.

14) 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.

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

- ***These regulations and syllabus were come into force w.e.f. the admissions of 2015-16 batch onwards***

2. Teaching Hours & Examination Pattern (Common for all Courses)

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	80	40%	20	40%	50%	-	-
5	Basics in Medical Physics & Electronics	40	-	IE	40	40%	00	40%	50%	-	-
	English	50	-	-	-	-	-		-	-	-
	Total	**360**	**140**								

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	40	40%	10	40%	50%	-	-
11	English	50	-	UE	80	40%	20	40%	50%	-	-
	Total	**400**	**200**								

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.

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
24	Basic Life support & Trauma life support	Anesthesia & Emergency Medicine	20	10	IE	50	50%
25	Cardiac life support	Cardiology	15	10	IE	50	50%
26	Medical Ethics	Forensic Medicine	15	10	IE	50	50%
27	Internship	In the Speciality Dept.	-	820	-	-	-
	Total		**50**	**850**			

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	Practical Max. Marks	Mim. for Pass
28	Fundamentals in Research	In the Speciality Dept.	**100**	**-**	IE	50	-	50%
29	Internship & Project work		-	800	-	-	50	50%
	Total		**100**	**800**				

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

COMMON FOR ALL SPECIALITIES

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

Practicals : 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, 1st 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, lymphatoid organs **4 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
TOTAL		**80**	**40**

a. 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	
Total	**80**	**40**	**15**		**135**

No. of teaching hours :

		Theory	Practicals
1st 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 1st 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	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
TOTAL MARKS			**50**

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
Succus entericus 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, Hypothalamo hypophyseal inter relationship, Diabetes Insipidus
Anterior pituitary hormones and their functions
Dwarfism, giganitism, 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, surfactantsOxygen 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 :

		Theory	Practicals
1st 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 1st 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	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 visualacuity, 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+, Acids, Bases, Buffers :**
   Equilibrium constant, dissociation of water, H+ concentration, pH, acids-strong and weak, bases, titration behavior, Henderson-Hesselbach 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 supplimentation, 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 :

		Theory	Practicals
1st semester	-	80	40

Suggested Books :

1. Biochemistry by U. Sathyanrayana
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 1st 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	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 :

	Theory	Practicals
2nd semester -	80	40

Examination pattern – Internal Exam
(At the end of 2nd semester)

S.No	Paper	Theory				
		Theory	Min. Pass	Int. Assmt. (IA)	Min. pass	Aggregate
1	Elements of Health & Nursing Principles	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:

		Theory	Practicals
1st 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 1st 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
2nd semester -	80	40

Suggested Books :

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

Examination pattern – University Exam
(At the end of 2nd 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 :

	Theory	**Practicals**
2nd semester -	80	40

Suggested Books :

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

Examination pattern – University Exam
(At the end of 2nd 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
Total Hours		**80**

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
1st semester	-	80	40

Suggested Books :

1. Essence of Pharmacology by K.D. Tripathi
2. Phamacology and Pharmacotherapecutics by Sethoskar
3. Text book of Pharmacology for Allied Sciences – Padmaja Udaykumar

Examination pattern – University Exam
(At the end of 2nd 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 HIMS
6. Telemedicine

III. Basics of computer networks :

1. Internet
    a) Define the Internet
    b) How the Internet woks
    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 Balvir singh
3. MS OFFICE 2010
4. Electronic medical records for clinicians and administrators by Jerome h.carter

Examination Pattern – Internal Exam
(At the end of 2nd 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	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, polimyclitis.
    c. Disease control programmes : Tuberculosis, Malaria, Filaria, S.T.D, Goitre, Cholera and other diarrhoeal diseases and National Programme for preventation 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
1st semester	-	30	20

Suggested Books :

1. Park's text book of Preventive and social Medicine – 23rd 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 1st 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 Pre-dominat 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

IT : 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 :

		Theory
1st semester	-	50
2nd semester	-	50

Suggested Books :

Paths to skills in English" published by orient blackswan PVT LTD by Sundaravalli, AS. Kamalakar etal

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

Examination pattern – University Exam
(At the end of 2nd 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**

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES

TIRUPATI – 517 507

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

1. B.Sc Anaesthesia Technology (AT)

(Semester pattern)

w.e.f 2015-16 Batch

SPECIALITY PAPERS

III Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Applied Anatomy and Physiology related to Anesthesia Technology -I	80	120	IE	80	20	50%
13	Applied Anatomy and Physiology related to Anesthesia Technology -II	80	120	IE	80	20	50%
14	Pharmacology related to Anesthesia Technology	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester:

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+Practical)
15	History of Anesthesia	80	120	UE	80	40%	20	40%	50%	50	50%
16	Principles of Anaesthesia -I	80	120	UE	80	40%	20	40%	50%	50	50%
17	Principles of Anaesthesia -II	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

V Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
18	Anesthesia Techniques in Regional and General Anesthesia including complications	80	120	IE	80	20	50%
19	Medical diseases influencing choice of Anesthesia	80	120	IE	80	20	50%
20	Complications in Anesthesia	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	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)
21	Anaesthesia for specialities – I (Cardiac Anaesthesia, Thoracic Anaesthesia, Neuro Anaesthesia)	80	120	UE	80	40%	20	40%	50%	50	50%
22	Anaesthesia for specialities – I (Geriatric Anaesthesia, Obstetrics Anaesthesia & Paediatric naesthesia)	80	120	UE	80	40%	20	40%	50%	50	50%
23	Regional, Daycare & Outside OR	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

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 - ANAESTHESIA TECHNOLOGY

III Semester

The objective of this subject is to provide an outline of anatomy and physiology to improve the students understanding the technical and diagnostic procedures used, with special emphasis on applied aspects.

PAPER - 12

Applied Anatomy And Physiology Related To Anaesthesia Technology – I :

1. Respiratory System

1. Structure and function of the respiratory tract in relation to anesthesia.
2. Nose :Role in humidification
3. Pharynx: Obstruction in airways
4. Larynx: Movement of vocal cords, cord palsies, trachea & bronchial
1. Tree – vessels, nerve supply, respiratory tract, reflexes,
2. Bronchospasm.
5. Alveoli- Layers, surfactants.
6. Respiratory Physiology
7. Control of breathing.
8. Respiratory muscles - diaphragm, intercostals.
9. Lung volumes – dead space, vital capacity, FRC etc.
10. Pleural cavity – intra pleural pressure, pneumothorax.
11. Work of breathing – airway resistance, compliance.
12. Respiratory movements under anesthesia.
13. Tracheal tug – signs, hiccup.
14. Pulmonary Gas Exchange and acid base status :
15. Pulmonary circulation - Pulmonary oedema, Pulmonary hypertension,
16. Hypoxic pulmonary vasoconstriction.
17. Pulmonary function tests.
18. Transfer of gases – oxygen & carbon dioxide.
19. Acid base status, definitions, acidosis types, alkalosis types, buffers in the body.
20. Oxygen : Properties, storage, supply, hypoxia.
21. Respiratory failure, type, clinical features, causes.

2. Cardiovascular System

1. Anatomy – Chambers of the heart, major vasculature. Coronary supply, innervations. Conduction system.
2. Cardiac output- determinants, heart rate, rhythms, preload, after load. Coronary blood flow & myocardial oxygen supply electrophysiology.
3. ECG - arrhythmias cardiovascular response to anesthetic & surgical procedures.
4. Hypotension – causes, effects, management.
5. Cardio pulmonary resuscitation.
6. Myocardial infarction, hypertension.

PAPER - 13

Applied Anatomy And Physiology Related To Anaesthesia Technology: Part – II

1. Fluid and Electrolytes :

- Body fluids – Composition.
- Osmolaltiy.
- Water, sodium and potassium balance.
- I.V. Fluids – composition & administration.
- I.V. Cannulation

2. Blood Transfusion :

- Blood grouping, Cross matching.
- Transfusion indications, hazards.
- Blood products – storage, administration.
- Plasma volume expanders.

3. Nervous System :

Cerebro spinal fluid – circulation, composition, raised intracranial pressure, methods of reduction. Anatomy of spinal cord and vertebrae.

4. Reproductive System :

Physiological changes in pregnancy and labour.

5. Liver:

Anatomy, portal circulation, functions of liver.
Jaundice – types and clinical features.

6. Kidney :

Anatomy, functions, renal failure.

PAPER –14

Pharmacology related To Anaesthesia Technology :

The objective of this subject is to provide training in general pharmacology with special emphasis on common drugs used, routes of administration, types of formulations, dose and frequency of administration, side effects and toxicity, management of toxic effects, drug interactions, knowledge of chemical and trade names, importance of manufacturing and expiry dates and instructions for handling of drugs.

1. Antisialagogues
2. Atropine, Scopolamine, Glycophyrrolate.
3. Sedatives / Anxiolytics
4. Diazepam, Phenergan, Lorazepam, Chloropromazine, Droperidol.
5. Narcotics
6. Morphine, Pethidine, Antiemetics, Methoclopramide, Ondanseteron.
7. Antacids
8. Na citrate, Gelusil, Mucaine gel.
9. H2 Blockers:Cimetidine, Ranitidine, Famotidine
10. Induction Agents: Intravenous and Inhalational (Barbiturates, Benzodiazepines, Ketamine, Propofol, Etomidate, Halothane, Sevoflurane and Desflurane).
11. Muscle Relaxants :Depolarising and Non depolarising muscle relaxants

12. Narcotics – Morphine,Pethidine, Fentanyl, Sufentanyl, Alfentanyl, Fortwin.
13. Inhalational Gases: 02, N20, Air
14. Agents - Ether, Halothane, Isofluranes.
15. Reversal Agents :Physostigmine, Neostigmine, Atropine, Glysopyrrolate, Nalorphine, Naloxone, Flumazenil (Diazepam).
16. Local Anaesthetics :Xylocaine, Preparation, Local – Bupivacaine – Topical, Prilocaine – Jelly, Emla – Ointment, Etidocaine.
17. Emergency Drugs:

- Adrenaline : Mode of administration, dilution, dosage, effects, Isoprenaline.
- Atropine, bicarbonate, calcium, ephedrine, xylocard, other ionotropes: dopamine, dobutamine, amrinone.
- Aminophylline, hydrocortisone, antihistaminics, potassium.

A) Cardiovascular drugs.
   a. Antihypertensives
   b. Antiarrhythmics
   c. Beta – Blockers
   d. Ca – Channel blockers
   e. Vasodilators: nitroglycerin & sodium nitroprusside

B) Respiratory system -Bronchodilators, respiratory stimulants, Bronchiolytic agents.

C) Renal system -Diuretics, furosemide, mannitol

D) Obstetrics -Oxytocin, methergin

E) Miscellaneous: Antibiotics, pencillins, aminoglycosides, cephalosporins

F) IV fluids, various preparations: Crystalloids and Colloids

G) Heparin, protamine, insulin analgesics, NSAIDS.

IV Semester

The objective of this subject is to provide an introduction to the types of equipment used in Anesthesia, the purposes for which they are used and their maintenance.

PAPER – 15

History of Anaesthesia :

- First successful clinical demonstration
- Pre-historic (ether) era
- Inhalational anaesthetic era
- Regional anaesthetic era
- Intravenous anaesthetic era
- Modern anaesthetic era

1. Minimum standard of anaesthesia
2. Who should give anaesthesia ?
3. Ten golden rules of anaesthesia –
4. Assess & prepare, starve, check the drugs and equipment suction, keep the airway clear, be ready to control ventilation, have a vein open, monitor pulse & BP, have someone in the room to apply cricoid pressure – if needed.
5. Pre-op preparation :
6. Pre anaesthetic assessment, History –, Past history – disease / surgery / anaesth, Personal history – smoking / alcohol.
7. General physical assessment, Systemic examination – CVS, RS, CNS, P.A., Local examination.

Investigations :

1. **Routine**
   i. Haematological – their significance, ii. Urine, iii. E.C.G., iv. Chest & X-ray
2. **Special**
   i. Endcorine, hormonal assays, ii. Echocardiography, iii. Angiography, iv. Others
3. **Anesthesia risk standardization**- ASA grading – I, II, III, IV

PAPER – 16

Principles of Anaesthesia - I :

1. **Medical Gas Supply**
   Compressed gas cylinders
   Colour coding
   Cylinder valves; pin index.
   Gas piping system
   Recommendations for piping system
   Alarms & safety devices
2. **Anaesthesia Machine**
   Hanger and yoke system
   Cylinder pressure gauge
   Pressure regulator
   Flow meter assembly
   Vapourizers-types, hazards, maintenance, filling & draining, etc.
3. **Face Masks & Airway Laryngoscopes**
   Types, sizes
   Endotracheal tubes – Types, sizes,
   Cuff system
   Fixing, removing and inflating cuff, checking tube position, complications

PAPER – 17

Principles of Anaesthesia – II :

1. Breathing System
   - General considerations: humidity & heat
   - Common components – connectors, adaptors, reservoir bags
   - Capnography; etco2
   - Pulse oximetry
   - Methods of humidification
   - Classification of breathing system
   - Mapleson system – A, B, C, D, E, F.
   - Jackson rees system, Bain circuit
   - Non rebreathing valves – ambu valves
   - The circle system
   - Components
   - Soda lime, indicators
2. Monitoring – ECG, Temperature, Neuromuscular; Nerve stimulators; Invasive blood pressure and central venous pressure and cardiac output monitoring
3. Oxygen delivery devices; Suction; Ambu bag; Reservoir bag.
4. Electrical safety in theatres
5. Endotracheal suction, Suction devices; Ambu bag; Reservoir bag.

V Semester

PAPER – 18

Anaesthetic Techniques in Regional & General Anaesthesia Including Complications :

The objective of this subject is to cover techniques in general anaesthesia including preoperative preparation, intra operative management, complications in anaesthesia due to coexisting diseases and their management**.**

Pre-Anaesthetic Orders

Patient	-	Informed consent
	-	Npo
	-	Premedication – advantages, drugs used
	-	Special instructions – if any
Machine	-	Checking the machine
	-	02, N2O, suction apparatus Laryngoscopes, et tubes, airways
	-	Things for IV accessibility
	-	Other monitoring systems
Drugs	-	Emergency drugs
	-	Anaesthetic drugs

Intra-operative Management

1. Confirm the identification of the patient
2. Monitoring – minimum (ISA standards)
3. Noninvasive & Invasive monitoring
4. Induction – drugs used
5. Endotracheal intubation
6. Maintenance of anaesthesia
7. Positioning of the patient
8. Blood/Fluid & electrolyte balance
9. Reversal from anaesthesia – drugs used
10. Transferring the patient
11. Recovery room - set up
    i. things needed
    ii. problems
12. Post operative complications & management

PAPER – 19

Medical Diseases Influencing choice of Anesthesia :

This course will cover the concept of individualizing anesthetic technique in the presence of a comorbid condition in patients coming for routine and emergency surgical procedures. Upon completion of this course the students will be able to assist the anesthesiologist in selecting or modifying the anesthetic technique in presence of coexisting medical condition.

1. Ischemic Heart Disease
   Risk factors : Medications
   Acute MI
   Anaesthesia for IHD cases. Post op management
2. Valvular Heart Disease
   Mitral stenosis: Anaesthetic problems
   Mitral Regurgitation: Aortic stenosis. Aortic regurgitation.

3. Congenital Heart Disease
   ASD : VSD : Tetrology of fallot, PDA
4. Hypertension : Drugs
   Anaesthesia for hypertensives
   Hypertensive crises. Complications
5. Pericardial Disease: Pericardial Effusion;Cardiac Tamponade
6. Aneurysm Of Aorta; Types, Treatment
7. Chronic Obstructive Pulmonary Disease.
   Bronchiectasis.
8. Acute Respiratory Failure.
9. Diseases of Cns – Cerebral Oedema & Its Management
   Ocular Trauma.
10. Diseases of Liver And Bilary Tract
    Liver Functions.
    Liver Function Tests, Hepatitis
    Jaundice, Types; Cirrhosis; Hepatorenal Syndrome
11. Diseases of Git
    Peptic Ulcer : Gi Bleeding
    Oesophageal Varces
12. Renal Disease
    Functions of Kidney
    Kidney Function Tests
    Renal Failure
    Anaesthesia for renal failure patients.
13. Water Electrolyte & Acid Base Disturbances
    Distribution of Body Water, Dehydration
    Hyperkalemia, Hypokalemia. Sodium, Calcium
    Acid Base Disturbances – Types And Treatment.
14. Endocrine Disease :
    Diabetes Mellitus
    Thyroid Dysfunction – Thyrotoxicosis, Hypothyroidism
    Adrenal Gland Dysfunction
    Diabetes Insipedus.
15. Obesity
16. Anaemia.

PAPER – 20

Complications in Anaesthesia :

1. Minor Sequelae

- Nausea & vomiting
- Sore throat
- Laryngeal granuloma
- Neurological complications
- Awareness
- Vascular complications
- Trauma to teeth
- Headache
- Backache
- Ocular complications.
- Auditory complications

2. Major Catastrophes

- Mortality
- Causes of death
- Cerebral damage
- Prevention.

3. Intensive Care

- Monitoring and diagnostic procedures in ICU
- Central venous access
- ECG monitoring
- Invasive hemodynamic monitoring

4. General care of patient in ICU

- Eye, GI tract
- Bladder, skin
- Case of mechanically ventilated patient
- Tracheostomy, humidification
- Vascular lines – arterial, venous line
- Radiography
- Physiotherapy – chest physiotherapy

5. Regional Anaesthesia

- Introduction
- Indication
- Contraindication
- Check list
- Procedure
- Complications
- Management
- Spinal
- Epidural
- Nerve Block

6. Anaesthetic consideration in

a) Endocrine disease: Pheochromocytoma
b) Renal disease: Urolithiasis, TURP

VI Semester

PAPER – 21

Anaesthesia for specialities - I

This course will cover anaesthetic techniques for various specialities including cardiac anaesthesia, neuroanaesthesia, obstetric anaesthesia, thoracic anaesthesia, paediatric anaesthesia and anaesthesia for shock trauma. Upon completion of this course the students will be able to assist the anaesthetist in administration of anaesthesia required in various specialities.

Introduction: Importance of different specialities of anaesthesia:

I. Cardiac Anaesthesia :

1. NYHA classification
2. Arrhythmias
3. Angina
4. Dysponoea
5. Special investigations

- Echocardiography
- Angiography
- Premedication
- Setting up of monitoring system
- Monitoring – invasive and non-invasive
- Getting ready for the case
- Induction of cardiac patient, precautions to be taken
- Cardiopulmonary bypass
- Weaning of EPB
- Transferring the patient to ICU
- Care to be taken
- ICU management

II. Thoracic Anaesthesia :

1. Pulmonary function tests: Bedside and Laboratory spirometry (vitalograph)
2. Preoperative preparation
3. Premedication
4. Pre anaesthetic evaluation
5. Checklist
6. Induction/intubation
7. Double lumen tubes
8. Lop-monitoring
9. Pain management
10. Extubation
11. ICU management
12. Chest tube management

III. Neuro Anaesthesia :

1. Glasgow coma scale
2. Pre anaesthetic evaluation
3. Premedication
4. Special investigation –
   i. CT , ii. Angiography, iii. MRI
5. Check list
6. Induction of a patient armoured ett
7. Positioning in neuro surgery
8. I.C.P monitoring
9. Air embolism
10. Reversal of the patient
11. Transferring to I.C.U / ward

PAPER – 22

Anaesthesia For Specialities - II

I. Geriatric Anaesthesia :

1. Physiological changes in ageing
2. Diseases of aging
3. Pre anaesthetic evaluation
4. Nervous system
5. Geriatric pharmacodynamics/pharmacokinetics
6. Postoperative nervous system dysfunction
7. Anaesthesia for Trauma & Shock
8. Resuscitation
9. Preop investigation/assessment
10. Circulatory management
11. Management of anaesthesia

12. Rapid sequence induction
13. Lop monitoring
14. Other problems

II. Obstetric Anaesthesia :

1. Differences between a pregnant and a normal lady
2. Risks for anaesthesia
3. Precautions to be taken
4. Check list
5. Regional vs general anaesthesia
6. Induction / maintenance
7. Resuscitation of the new born, APGAR score
8. Reversal and extubation
9. Emergencies – Manual removal of placenta
    - A.P.H and P.P.H
    - Ruptured uterus
    - Ectopic pregnancy

III. Peadiatric Anaesthesia :

1. Theatre setting
2. Check list
3. Pae
4. Premedication – modes
5. Induction
6. Intubations-securing the ett
7. Lop-management monitoring
8. Reversal & extubation – problems
9. Transferring/IC management
10. Pain management

PAPER – 23

Regional, Daycare, Outside the OR :

I. Regional Anaesthesia :

1. History
2. Introduction
3. Contraindication
4. Check list
5. Procedure
6. Complications
7. Subarachnoid block
8. Epidural block
9. Nerve blocks

II. Day Care Anaesthesia :

1. Special features
2. Set up
3. Advantages/Disadvantages
4. Complications
5. Future

III. Anaesthesia Outside the O.R :

1. Situations
2. Cath lab
3. Radiology and Imaging Science Technology natural calamities
4. E.C.T
5. Features
6. Shortcomings and Complications

Reference Books :

1. Morgan and Mikhail's Clinical Anesthesiology
2. Dorsch and Dorsch's Understanding Anesthesia Equipment
3. Wylie Churchill-Davidson's A Practice of Anesthesia
4. Drugs & Equipment in Anesthetic Practice by A.K Paul
5. Step by Step Regional Anesthesia by A.K Paul
6. Essentials of Anaesthesiology by A.K Paul
7. Dorsch and Dorsch's Understanding Anesthesia Equipment

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
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(A University established by an act of Andhra Pradesh State Legislature)

2. CARDIAC PULMONARY PERFUSION TECHNOLOGY (CPPT) COURSE

(Semester pattern)

w.e.f 2015-16 Batch

SPECIALITY PAPERS

III Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical	Min. for Pass
12	Applied Anatomy of Cardiovascular System related to CPPT	**80**	**120**	IE	80	20	50%
13	Applied Physiology of Cardiovascular System related to CPPT	80	120	IE	80	20	50%
14	Applied Pharmacology related to cardiopulmonary tecchnology & Physiology of Blood and temperature regulation	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester:

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	UE /IE	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical	Min. for pass (Theory +Practic
15	Principles of Cardiopulmonary bypass I : History and Components	80	120	UE	80	40%	20	40%	50%	50	50%
16	Principles of Cardiopulmonary bypass II : Institution of CPB and Myocardial protection	80	120	UE	80	40%	20	40%	50%	50	50%
17	Principles of Cardiopulmonary bypass III : Complications and their Management , Advances in CP Perfusion	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

V Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical	Min. for Pass
18	Concepts of Cardiovascular Disease and outlines of clinical Evaluation related to Cardiovascular Technology	80	120	IE	80	20	50%
19	Advances in Cardiopulmonary bypass: Heart and heart lung transplantation	80	120	IE	80	20	50%
20	Non Cardiac uses of Cardiopulmonary bypass and assist Devices	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	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)
21	Intensive Care, Cardiopulmonary Resuscitation	80	120	UE	80	40%	20	40%	50%	50	50%
22	Engineering concept and clinical applications of various Cardiopulmonary perfusion devices	80	120	UE	80	40%	20	40%	50%	50	50%
23	Interventional Cardiology and Recent Advances in Cardiopulmonary perfusion	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

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 - CARDIAC PULMONARY PERFUSION TECHNOLOGY (CPPT)

III Semester

The objective of this subject is to provide the basic knowledge of anatomy and physiology to the various disease aspects and to also to provide training in all aspects of cardiopulmonary perfusion trechnology. At the end of the course the student under the supervision of a Surgeon and Chief Perfusionist shall be able to apply the knowledge to the cardiopulmonary perfusion and receive training to perfuse the patient who are undergoing 0020 open heart surgical procedure. They shall be able to calculate the basic need at the time of the cardiopulmonary bypass.

PAPER - 12

Applied Anatomy of Cardiovascular System related to CPPT :

I. Anatomy :

1. Anatomy of the Heart and great vessels.
   Gross anatomy and structural features of cardiac chambers.
   - Atrium
   - Ventricle.
   - AV junction
   - Heart valves.

II. Specialized conduction tissues:

- Sinus node.
- Internodal tracts.
- Av node.
- Bundles.

2. Innervations of the Heart.
   - Sympathetic.
   - Parasympathetic.
   - Sensory.
3. Coronary vascular system.
   - Coronary arteries.
   - Myocardial capillary bed.
   - Venous drainage.
   - Lymphatic drainage.
4. Pericardium.
5. Anatomy of Great vessels
6. Systemic Circulation.
   - Arterial system.
   - Venous system.
   - Lymphatic system.
   - Tissue perfusion and microcirculation
7. Pulmonary circulation.
   - Pulmonary artery.
   - Pulmonary veins.
   - Bronchial artery.
8. Anatomy of Respiratory system
   - Larynx, Trachea, Bronchi, Lungs
   - Histology of the respiratory system
   - Anatomy of the Chest wall
9. Anatomy of the renal system
10. Anatomy of the gastrointestinal and hepatobiliary system
11. Anatomy of the central nervous system

Books for study :

Test Book : 1. Medical Embryology Langmans, Inderbir Singh
2. Anatomy : Chaurasia

Reference Book : Gray's Anatomy

PAPER - 13

Applied Physiology of Cardiovascular System related to CPPT:

I. Physiology :

1. Over view of the cardiovascular system.
   - Function of CVS.
   - Circulation of blood.
   - Central control of cardio vascular system.
2. Cardiac cycle.
   - Mechanical events.
   - Arterial cycle and central venous pressure cycle.
   - Clinical aspects of human cardiac cycle.
3. Structure and Properties of Myocardium
4. Ultrastructure of Myocardium
5. Cardiac Excitation and contraction.
   - Mechanism of contraction.
   - Pacemaker of conduction system.
   - Nodal electricity.
   - Nervous control of the heart rate.
6. Basics of ECG:
   - Electrocardiography
   - The electrical field of heart.
   - The leads; standard limb leads; precordial leads; Augmented limb leads.
   - Basic ECG deflections, basic action of electrocardiograph.
   - Normal ECG
   - The Electrical Axis
   - Chamber Enlargement
   - Myocardial infarction.
   - Coronary insufficiency
   - Recognition of ECG pattern.
   - Bundle Branch Block: General principles. Right bundle branch block. Left bundle branch block. The hemi blocks (fasicualr blocks).
   - Coronary Artery Disease: Myocardial infarction, Coronary insufficiency, Recognition of ECG pattern.
   - Sinus Rhythm: Sinus arrhythmia. Sinus tachycardia and Bradycardia
   - Ectopic Arterial Rhythm : Atrial extra systoles. Paroxysmal atrial tachycardia. Atrial fibrillation and flutter.
   - Atrio Ventricular (Av) Nodal Rhythm
   - Ventricular Rhythm : Ventricular extra systoles.
   - Ventricular tachycardia.
   - Ventricular flutter / fibrillation.
   - Disorder of Impulse Conduction : Sinotrial (SA) nodal block. Atrioventricular (AV) nodal block. First degree AV block. Second degree AV block. Third degree AV block
7. Assessment of cardiac output.
   - Ficks principle.
   - Thermal dilution and indicator dilution methods.
   - Pulse Doppler method.

- Miscellaneous methods.

8. Control of stroke volume and cardiac output.
9. Hemodynamics.
    - Relationship between pressure, flow and resistance.
    - Hemodynamics derived from cardiac catheterisation
10. Solute transport between blood and tissues.
    - Circulation of fluid between plasma, interstitium and lymph.
11. Vascular smooth muscle.
    - Mechanism of contraction.
    - Pharmaco mechanical coupling, automaticity.
12. Control of Blood vessels.
    - Local Control mechanism.
    - Nervous control.
    - Hormonal Control.
13. Cardiovascular receptors, reflexes and central control.
14. Coordinated cardiovascular responses.
    - Posture.
    - Valsalva manoeuvre
    - Exercise.
    - Diving reflex.
15. Cardiovascular responses in pathological situations.
    - Shock and hemorrhage.
    - Syncope.
    - Essential Hypertension.
    - Chronic cardiac failure.
16. Physiology of the Respiratory system
    - Mechanism of Ventilation
    - Perfusion
    - Diffusion
    - Cellular respiration
    - O2 and CO2 transport
    - Physical Loss governing gases and circulation
    - Blood gas analysis and their interpretation
17. Physiology of the renal system
    - Principles of Glomerular filteration , reabsorption and secreations
    - Urine analysis and interpretation
18. Electrolytes
19. Cerebral circulation
20. Renal Circulation
21. Anatomy of respiratory system.
22. Specialization in individual circulation.
    - Coronary circulation.
    - Cerebral circulation.
    - Pulmonary circulation.
    - spleenic and renal ceirculation
    - Cutaneous circulation.
23 . Respiratory Physiology.
    - Mechanics of respiration.
    - Principles of gas exchange.
    - Regulation of respiration.

Books for study :

Test Book	:	1. Physiology - Ganong 2. ECG - Schamroth
Reference Book	:	Text book physiology – Guyton

PAPER – 14

Applied Pharmacology related to Cardiopulmonary Technology & Physiology of Blood and temperature regulation:

1. Physiology of the blood and blood components
2. Coagulation Cascade including the blood clotting factors
3. Structure of the RBC, WBC, platelets and plasma proteins
4. Components of plasma
5. Physiology and temperature regulation
   a) Intermediatory metabolism
      - Carbohydrates
      - Proteins
      - Lipids
      - Nutrition
      - Metabolic rate
   b) Basic Pharmacology of the crystalloid solution
      - Colloid preparation
      - Diuretics
6. Cardiovascular drugs: related to heart and respiratory system including inotropes.
7. Hematology and coagulation Physiology Blood Components.
      - Structure of RBC, WBC, platelets, Plasma proteins
      - Blood groups
      - Blood transfusions.
      - Hemostasis.
8. Hematology and coagulation Physiology
9. Anti Anginal Agents:

   a) Beta Blocking Agents - Propranolol, Atenolol, Metoprolol, Labetolol, Pindolol.
   b) Nitrates – Nitroglycerine, Isosorbide dinitrate, Isosorbide mononitrate, Transdermal nitrate patches.
   c) Calcium channel blockers – nifedipine, verapamil, diltiazem, new calcium channel blockers.
10. Anti-Failure Agents :
   a) Diuretics – Furosemide, Thiazide diuretics, other thiazide like agents, Potassium sparing diuretics, combination diuretics, special diuretic problems.
   b) Angiotensin converting enzyme (ACE) inhibitors, Types of ace inhibitors Captopril, Enalapril, ACE inhibitors for diabetics and hypertensive renal disease.
   c) Digitalis and acute ionotropes – Digoxin, Digitoxin, Doubutamine, Dopamine, Adrenaline, Nonadrenaline, Isoprenaline, Mixed ionotropic vasodilators Mibrinone.
11. Anti-Hypertensive Drugs :
   Diuretics, Beta Blockers, Ace inhibitors, ARBS, Calcium antagonists, direct vasodilators, centrally active and peripherally active vasodilators.
12. Anti-Arrhythmic Agents :
   Quinidine and related compounds, Procainamide, Lidocaine, Mexiletine, Phenytoin, Flecainide, Amiodarone, Bretylium, Combination therapy, Verapamil.
13. Antithrombotic Agents :
   a) Platelet inhibitors : Aspirin, Persantinem clopidogrel, Prasugrel
   b) Anticoagulants : Heparin, low molecular weight heparin. Warfarin
   c) Fibrinolytics: Streptokinase Urokinase, Combination therapy.
14. Lipid lowering and anti-atherosclerotic drugs.
15. Which drug for which condition?
16. Miscellaneous drugs – Adenosine. Protamine, Emergency drugs, Narcotics, Sedatives, Steroids, Antihistamines, Antibiotics.
17. Basic information on biocompatibility

Books for study :

Text Book : Gabriel Khan
Reference Book : Drugs for the heart – Opie

IV Semester

PAPER – 15

Principles of Cardiopulmonary bypass I : History and Components :

1. History of Cardiopulmonary bypass
2. Components/ equipments of Cardiopulmonary bypass circuit
3. Principles of oxygenator function
4. Engineering design of oxygenators
5. Cardiopulmonary bypass circuit
6. Material used in cardiopulmonary bypass, their structure and chemistry

Books for study :

Text Book : 1. Text Book on Cardiopulmonary bypass Principles and Practice
Author : Glen P. Gravalee, Richard F Davis, Alfred H Stammers and Ross M. Ungerleider

2. Cardiopulmonary bypass Principles and management
Edited by : Kanneth M. Taylor

PAPER – 16

Principles of Cardiopulmonary bypass II : Institution of CPB and Myocardial protection :

1. Cannulation techniques
2. Priming techniques
3. Anticoagulation techniques
4. Pathophysiology response to Cardiopulmonary bypass
5. Myocardial protection
6. Heart lung machine and technical problems
7. Principles of hypothermia and circulatory arrest
8. Clinical concept and monitoring of Cardiopulmonary bypass
9. Cardiopulmonary bypass techniques in peadiatric : Neonate and infants and children
10. Detail study of standard heart lung machine and their Engineering concept
11. Neutralization of anticoagulation
12. Cardioplegia devices

Books for study :

Text Book : 1. Text Book on Cardiopulmonary bypass Principles and Practice
Author : Glen P. Gravalee, Richard F Davis, Alfred H Stammers and Ross M. Ungerleider

2. Cardiopulmonary bypass Principles and management
Edited by : Kanneth M. Taylor

PAPER – 17

Principles of Cardiopulmonary bypass III : Complications and their Management , Advances in CP Perfusion :

1. Hazards in CPB
2. Embolic problems
3. Organ system function in cardiopulmonary bypass :Brain and kidney, Lung, Metabolic and coagulation cascade
4. Principles of extracorporeal membrane oxygenation (ECMO)
5. Counterpulsation : Intra aortic balloon pump
6. Left ventricular assist Devices
7. Pacemakers / defibrillator
8. Heart and lung transplantation
9. Centrifugal pump
10. Blood salvage techniques during CPB

Books for study :

Text Book : 1. Text Book on Cardiopulmonary bypass Principles and Practice
Author : Glen P. Gravalee, Richard F Davis, Alfred H Stammers and Ross M. Ungerleider

2. Cardiopulmonary bypass Principles and management
Edited by : Kanneth M. Taylor

V Semester

PAPER – 18

Concepts of Cardiovascular Disease and outlines of clinical Evaluation related to Cardiovascular Technology :

1. Structural and functional diagnosis of congenital heart diseases
2. Management of CPBin infants and children, DHCA, TCA
3. How does CPB management in an infant differ from adult
4. Myocardial Protection in Children
5. Pulmonary Vascular Disease
6. **Pathological states in patients:** Clinical presentations, pathophysiology and management
7. **Congenital Heart Disease:** PDA, ASD and Partial Anamoulous Venous Connection, VSD, Coarctation Of Aorta, Pulmonary Stenosis, Pulmonary Atresia with intact IVS &VSD, Single Pulmonary Artery, Pulmonary Artery Aneurysm Cor-Triatriatum , AV Canal Defects , Aortopulmonary Septal Defects, Double Inlet Ventricle, Tetrology Of Fallot, Transposition Of Great Arteries, Tricuspid Atresia, Total Anamolous Pulmonary Venous Connection, Ebsteins Anamoly, Double Outlet Right Ventricle, Congenital Abnormalities Of Aortic Valve And LVOT , Coronary Artery Anomalies
8. **Valvular heart disease**: Rheumatic heart disease, mitral stenosis, mitral regurgitation, aortic stenosis and regurgitation. Tricuspid regurgitation and tricuspid stenois and mixed valvualar lesions
9. **Coronary artery disease**
10. **Pericardial Disease**: Constriction, Effusion, Transponade
11. **Myocardial Disorders**: Ischemia and infarction, LV aneurysm, Cardiac tumors

Books for study :

Text Books : 1. Davidson's Principles and Practice of Medicine,
Edited by Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston.

2. Perloff's Clinical Recognition of Congenital Heart Disease.
Author: J K Perloff , Ariane J. Marelli

3. Valvular heart Disease
Author . Joseph S Alpert, James E Dalan and Shahbuddin H Rahimtoola

4. Cardiac Surgery
Authors: Kirklin / Barratt-Boyes

Reference Books **:** Text Book of Cardiology : Braunwald

PAPER – 19

Advances in Cardiopulmonary bypass : Heart and heart lung transplantation:

1. Heart transplantation
2. Lung transplantation single and double
3. Heart and lung transplantation
4. In each group
   - Donor selection
   - Recipient selection
   - Indications
   - Contraindications
   - Donor Management
5. Postoperative care of the patient
6. Immunosuppressant schedule
7. Prophylactic medications
8. Complications: Chronic rejections and infections, Organ retrieval

Books for study :

Textbooks
1. Cardiac Surgery
Authors: Kirklin / Barratt-Boyes
2. Text Book on Cardiopulmonary bypass Principles and Practice
Author: Glen P Gravalee, Richard F Davis, Alfred H Stammers and Ross M Ungerleider
3. Cardiopulmonary bypass Principles and management
Edited by: Kenneth M Taylor

PAPER – 20

Non Cardiac uses of Cardiopulmonary bypass and assist Devices :

1. Perfusion for Thoracic Aortic surgery
2. Left Heart bypass
3. Principles of extracorporeal membrane oxygenation (ECMO)
4. Counterpulsation : Intra aortic balloon pump
5. Left ventricular assist Devices
6. Pacemakers / defibrillator
7. Centrifugal pump
8. Blood salvage techniques during CPB

Books for study :

Text Books : 1. Text Book on Cardiopulmonary bypass Principles and Practice
Author: Glen P Gravalee, Richard F Davis, Alfred H Stammers and Ross M Ungerleider

2. Cardiopulmonary bypass Principles and management
Edited by: Kenneth M Taylor

Reference books : Cardiac Surgery
Authors: Kirklin / Barratt-Boyes

VI Semester

PAPER - 21

Intensive Care, Cardiopulmonary Resuscitation :

A. Intensive Care

1. Monitoring and diagnostic procedures in ICU.
   - Central venous access
   - ECG monitoring
   - Invasive hemodynamic monitoring.
   - Cardiac arrhythmia recognition.

2. General care of patient in ICU
   - Eye, GI tract and bladder system
   - Care of mechanically ventilated patient.
   - Tracheostomy, Humidification
   - Vascular line, arterial line, venous line.
   - Radiography
   - Chest physiotherapy

3. Intensive care management of myocardial infarction & unstable angina.

4. Fluid management and parenteral nutrition.
5. Infectious disease in ICU, antibiotics in ICU.

6. Respiratory failure
   - Oxygen therapy
   - Mechanical ventilation.
7. Acid base disorders electrolyte imbalance.
8. Cardio vascular failure
   - Plan of management
   - Inotropic support
   - Vasodilator drugs.
9. Renal failure and liver failure.
10. Head injury.
11. Principles of transfusion therapy.

B. Cardio Pulmonary Resuscitation and First Aid Techniques :

Introduction of this training is to ensure that each student learn and retain the knowledge and skill to manage patients through cardio pulmonary emergencies.

1. Basic Life Support
   - An Open Airway.
   - Adequate Breathing.
   - Sufficient Circulation.
2. Adult One-Rescuer CPR
   - Assess the victim's need for CPR.
   - Call for help.
   - Open Airway & checking breathing.
   - Mouth to mouth breathing.
   - Manual resuscitation bag and mask.
   - Determine pulselessness.
   - External chest compression.
3. Adult - Two Rescuer CPR
4. CPR Equipment
   - Manual resuscitator (Bag – value).
   - Mouth to valve mask resuscitator.
   - Patient assessment.

   a) Resuscitation For Children
   Artificial ventilation for children & babies under two External chest compression for children & babies.

   b) The Recovery Position - ACLS: (Advanced Cardiac Life Support).

   c) Skill Steps

   d) Station One : Basic Life Support
   - One rescuer CPR.
   - Two rescuer CPR.
   - Obstructed airway.

   e) Station Two : Airway Management
   - Mouth to mask ventilation.
   - EDA
   - Endo tracheal intubation.
   - Endotracheal intubation with DOA in place.

   f) Station Three: ECG And Treatment.
   - Modalities.
   - Statue ECG slip.
   - Case histories and ACLS.
   - Treatment modalities.

   g) Station Four : Mega Code
   - Serving as code leader.
   - Defibrillation.

   h) Lecture Topics : ACLS In Perspective
   - Myocardial infarction.
   - Adjunct for airway control.
   - Dysarhythmia therapy.
   - Electrical therapy.
   - Cardio vascular pharmacology.
   - Putting it all together.

   i) First Aid Techniques
   - AIM – First aid treatment given to a casualty.
   - To preserve life.

- To prevent the condition worsening.
- To promote recovery.

j) Action At Emergency
- Approach.
- Assessing the situation.
- Examination & diagnosis.
- Treatment.
- After treatment.
- Making a report.
- Removing clothing.
- Removing crash – helmets.

k) Asphyxia
- Suffocation (External obstruction).
- Hanging, stranging & throuting.
- Drowning.
- Smoke inhalation.
- Carbon monoxide poisoning.
- Choking.
- Blast injuries.
- Stove-in-chest
- Asthma
- Electrical injuries.
- Winging.
- Hiccups.

l) Wounds & Bleeding
- Types of wound.
- How the body responds to injury.
- Foreign external bleeding.
- Minor external bleeding.
- Internal bleeding.
- Infecting wounds.
- Special forms of bleeding.

Books for study :

Textbook	: Text Book of Anaesthesia Kaplan
Reference books	: Cardiac Surgery Authors: Kirklin / Barratt-Boyes Sabistons

PAPER – 22

Engineering concept and clinical applications of various Cardiopulmonary perfusion devices :

1. Heart lung machine
2. Oxygenators and types
3. Haemofilters
4. Bubble traps
5. Cardioplegia delivery system
6. Centrifugal pump
7. Biopump and other pumps
8. Counterpulsation : Intra aortic balloon pump
9. Left ventricular assist Devices
10. Radiofrequency ablator

Books for study :

Text Books : 1. Text Book on Cardiopulmonary bypass Principles and Practice
Author: Glen P Gravalee, Richard F Davis, Alfred H Stammers and Ross M Ungerleider
2. Cardiopulmonary bypass Principles and management
Edited by: Kenneth M Taylor

PAPER - 23

Interventional Cardiology and Recent Advances in Cardiopulmonary perfusion :

1. Pericardiocentesis
2. IABP
3. PCPS
4. End myocardial Biopsy
5. PBPV/PBAV
6. PTMC
7. Alcohol septal ablation
8. Electro Physiological studies.
9. RF Ablation
10. TPI
11. PPI
12. CRT
13. ICD

Books for study :

Text Books : Davidson's Principles and Practice of Medicine,
Edited by Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston.
Text Book of Cardiology by Braunwald

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

3. DIALYSIS TECHNOLOGY (DT)

(Semester pattern)

w.e.f 2015-16 Batch

SPECIALITY PAPERS

III Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Applied Anatomy and Physiology Related to Dialysis Technology	80	120	IE	80	20	50%
13	Concepts of Disease and Outlines of Clinical Evaluation related to Dialysis Technology	80	120	IE	80	20	50%
14	DT Directed Clinical Education - I	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester :

Paper No.	Paper	Hours of		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+ Practical)
15	Pharmacology related to Dialysis Technology	80	120	UE	80	40%	20	40%	50%	50	50%
16	Concepts of Disease and Outlines of Clinical Evaluation related to Dialysis Technology	80	120	UE	80	40%	20	40%	50%	50	50%
17	DT Directed Clinical Education – II	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

V Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
18	Applied Dialysis therapy Technology - Part I	80	120	IE	80	20	50%
19	Applied Dialysis therapy Technology - Part II	80	120	IE	80	20	50%
20	DT Directed Clinical Education - Part III	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	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)
21	Applied Dialysis therapy Technology Part III	80	120	UE	80	40%	20	40%	50%	50	50%
22	Applied Dialysis therapy Technology Part IV	80	120	UE	80	40%	20	40%	50%	50	50%
23	Renal Transplantation & Coordination	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

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 - DIALYSIS TECHNOLOGY COURSE

III Semester

PAPER - 12

Applied Anatomy And Physiology Related To Dialysis Technology :

Unit I: Gross structures of excretory system

- Structure of Kidney
- Structure of Ureter
- Structure of Urinary bladder
- Structure of Nephron, renal corpuscle, glomerular apparatus, proximal tubule, loop of Henle, distal tubule and collecting tubule.

Unit II: Vascular supply of kidney and Peritoneum

- Renal Artery
- Renal vein
- Veins used for dialysis (Jugular, Femoral and Sub clavian vein)
- Artery and Veins used for AV fistula and Graft
- Innervations of Kidney and Urinary bladder
- Peritoneum in general

Unit III: Physiology related to Dialysis technology- Mechanism of urine formation

- Glomerular filtration
- Factors affecting GFR
- Methods of estimating GFR
- Tubular Reabsorption
- Concentration
- Dilution and acidification

Unit IV: Functions of excretory system

- Excretory and regulatory functions of kidney
- Metabolic and Secretory functions of kidney
- Physiology of bladder function
- Renal function test
- Micturition
- Types of bladder dysfunction

Unit V: Regulatory functions of excretory system

- Role of Kidney in blood pressure regulation in health and diseases
- Role of peritoneum in peritoneal dialysis
- Mechanism of blood formation and regulation
- Role of kidney in bone formation
- Other endocrine functions of the kidney
- Body fluids and electrolytes and their regulation in health and disease
- Disorders of metabolism (Water, Potassium, Sodium, Phosphate, Calcium)
- Role of kidney in acid-base balance

Reference Books :

1. Hand book of Anatomy – P.Saraswathi
2. Human Anatomy – B.D.Chaurasia
3. Human physiology – A.K.Jain
4. Anatomy and physiology in health and illness – Ross and Willson
   Gray's anatomy for the students - Richard L.Drake

Practical's :

Gross Specimens / Spotters

1. Kidney
2. Ureter
3. Urinary bladder

Charts/Spotters :

1. Renal corpuscle
2. Glomerular apparatus
3. Nephron(proximal tubule, loop of Henle, distal tubule and collecting tubule)
4. Renal Artery, Renal vein, Subclavian vein, Femoral vein, Jugular vein, Radial artery,
5. Innervations of kidney and urinary bladder,
6. Peritoneum in general
7. Functions of excretory system(Excretory, regulatory, Metabolic and endocrine functions)
8. Renal function tests
9. Physiology of bladder function
10. Micturition
11. Types of bladder dysfunction
12. Mechanism of urine formation
13. Role of kidney in blood pressure regulation in health and diseases
14. Role of peritoneum in peritoneal dialysis
15. Mechanism of blood formation and regulation
16. Role of kidney in bone formation
17. Other endocrine functions of the kidney
18. Body fluids and electrolytes and their regulation in health and disease
19. Disorders of water metabolism (Potassium,Sodium,Phosphate,Calcium)
20. Role of kidney in acid-base balance.

PAPER – 13

Concepts Of Disease And Outlines Of Clinical Evaluation Related To Dialysis Technology - I

Unit I : Basic Renal disorders

1. Glomerular Diseases
2. Post infectious glomerulonephritis
3. Acute Kidney Injury (AKI)
4. Chronic kidney disease (CKD)

Unit II : Acid-Base, Fluids and Electrolyte Disorders

1. Metabolic Acidosis
2. Metabolic Alkalosis
3. Respiratory acidosis and alkalosis
4. Edema and the clinical use of diuretics
5. Disorders of sodium (Hyponatremia, Hypernatremia)
6. Disorders of potassium metabolism
7. Disorders of calcium, and Phosphorous Homeostasis

Unit III: The Kidney in systemic disease

1. Renal function in congestive heart failure
2. Renal function in liver disease
3. Renal involvement in systemic vasculitis
4. Renal manifestations in SLE and other rheumatic disorders

Unit IV: Diabetic nephropathy

1. Epidemiology
2. Stages and Pathogenesis
3. Diagnosis
4. Management
5. Prevention

Unit V: Renal Biopsy

1. Indications
2. Contraindications
3. Techniques of Renal Biopsy
4. Pre and post biopsy care
5. Complications of Renal Biopsy

Reference Books :

1. Primer on Kidney Disease – Arthur Greenburg
2. Text book of Pathology - Harsh Mohan
3. Basic pathology –pocket Robbins
4. Principles and practice of medicine – Davidson's
5. Principle of Internal Medicine – Harrison
6. Kidney diseases in primary care – K.Mandal ,Stanly

Practicals :

Specimens And Charts/Case Discussions :

1. Glomerular Diseases
2. Post infectious glomerulonephritis
3. Acute Renal Failure
4. Chronic renal Failure - chronic kidney disease (CKD)
5. Acid-Base, Fluids and Electrolyte Disorders
6. Renal function in congestive heart failure
7. Renal function in liver disease
8. Renal involvement in systemic vacuities
9. Renal manifestations in SLE and other rheumatic disorders

10. Diabetic nephropathy
11. Renal biposy

Urine Analysis :

1. Physical examination
2. Chemical examination
3. Microscopic examination

PAPER – 14

DT Directed Clinical Education - I :

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a nephrologist or senior Dialysis Therapy Technologist. Students are tested on intermediate clinical dialysis therapy technology skills.

IV Semester

PAPER – 15

Pharmacology Related To Dialysis Technology :

Course Objective

The course will cover general pharmacology with special emphasis on common drugs used, route of administration, type of formulations, dose and frequency of administration, side effects and toxicity, management of toxic effects, drug interactions, knowledge of chemical and trade names, importance of manufacturing and expiry dates and instruction about handling each drug.

Unit I: Common drugs used in renal medicine

1. I.V Fluids in renal patient
2. Diuretics
3. Anti-hypertensive Drugs
4. Bicarbonate
5. Potassium
6. Magnesium
7. Calcium
8. Vitamin-D analogs
9. Erythropoiesis stimulating agents (ESA)
10. Iron therapy in dialysis patients
11. Phosphate Binders including Sevelamer HCL, Lanthanum carbonate
12. Vaccines used in dialysis patients - Hepatitis B, Pneumococcal, Influenza etc
13. Antibiotics
14. Antihistamines used in Dialysis unit
15. Chemicals used in the dialysis room including composition and mechanism of action
16. Hemodialysis concentrates
17. Replacement fluids for CRRT
18. Chemicals used for sterilization including formaldehyde, Hydrogen peroxide, Sodium Hypochlorite, Peroxyacetic acid , Citrate and its mechanism of action

19. Peritoneal Dialysis Solutions including Icodextrin
20. Vitamins used in Dialysis patients
21. Calcimimetic Agents

Unit II: Cardio vascular drugs & inotropic drugs

1. Digoxin
2. Betablockers
3. Dopamine
4. Dobutamine
5. Adrenaline,
6. Isoprenaline
7. Lipid lowering Agents

Unit III: Vasodilators

1. Nitro-glycerine
2. Nitroprusside

Unit I V: Drugs affecting coagulation

1. Heparin
2. Low molecular weight heparin
3. Tri sodium citrate
4. Protamin sulphate
5. Heparinoids
6. Direct thrombin Inhibitors
7. Regional Citrate Anticoagulation

Unit V: Immunosuppressive agents

1. Calcineurin Inhibitors
2. mTOR Inhibitors
3. Steroids
4. Azathioprine
5. Cyclosphosphamide
6. Mycophenolate mofetil
7. Induction Immunosuppressive drugs

Reference Books :

Medical pharmacology : Padmaja Udaykumar
KD Tripathi : Essentials of Medical Pharmacology

Practicals :

Course Objective :

The course will cover general pharmacology with special emphasis on common drugs used, route of administration, type of formulations, dose and frequency of administration, side effects and toxicity, management of toxic effects, drug interactions, knowledge of chemical and trade names, importance of manufacturing and expiry dates and instruction about handling each drug.

Spotters and Charts :

1. I.V Fluids in renal patient
2. Diuretics
3. Antihypertensive drugs
4. Steroids
5. Azthioprine
6. Calcineurin Inhibitors, mTOR inhibitors and Cyclosphosphamide
7. Vit-D analogs
8. Erythropoietin
9. IV iron
10. Antibiotics
11. Chemicals used in the dialysis room including composition and mechanism of action
12. Hemodialysis concentrate
13. Peritoneal dialysis fluid
14. Replacement fluids for CRRT
15. Chemicals used for sterilization(Formaldehyde, Hydrogen peroxide ,Citrosterile,Renalin)
16. Vaccines used in dialysis patients - Hepatitis B etc
17. Fluids used in peritoneal dialysis
18. (Digoxin,Betablockers,Dopamine,Dobutamine,Adrenaline,Isoprenaline)
19. Vasodilators (Nitro-glycerine, Nitroprusside)
20. Anticoagulation
21. Protamine
22. Bicarbonate
23. Electrolytes(Potassium, Magnesium)
24. Antihistamine

PAPER – 16

Concepts Of Disease And Outlines Of Clinical Evaluation Related To Dialysis Technology - II

Unit I: Secondary diseases affecting the kidney

1. Amyloidosis
2. Hyperoxaluria
3. HUS / TTP
4. Hereditary renal disorders
5. Kidney disorders in pregnancy

Unit II: Obstructive Renal disorders

1. Obstructive uropathy
2. VUR and Reflux nephropathy
3. Nephrolithiasis

Unit III: Infectious Diseases

1. Renal diseases associated with HIV infection
2. UTI(Urinary tract infection)
3. Opportunistic infections in dialysis patients
4. Viral infections in dialysis and transplantation

Unit IV: Drugs and the kidney

1. Analgesics and the kidney
2. Principles of drug therapy in kidney failure

Unit V: Renal hypertension

1. Pathogenesis
2. Essential HTN
3. Renovascular HTN
4. Therapy of HTN

Reference Books :

1. Primer on Kidney Disease – Arthur Greenburg
2. Text book of Pathology - Harsh Mohan
3. Basic pathology –pocket Robbins
4. Principles and practice of medicine – Davidson's
5. Principle of Internal Medicine - Harrison
6. Kidney diseases in primary care – K.Mandal, Stanly

Practicals :

Specimens And Charts/Case Discussions :

1. Amyloidosis
2. Hyperoxaluria
3. HUS / TTP
4. Heriditary renal disorders
5. Kidney disorders in pregnancy
6. Obstructive uropathy
7. VUR and Reflux nephropathy
8. Nephrolithiasis
9. Renal diseases associated with HIV infection
10. UTI(urinary track infection)
11. Drugs and the kidney
12. Renal hypertension

Urine Analysis :

1. Physical examination
2. Chemical examination
3. Microscopic examination

PAPER – 17

DT Directed Clinical Education - II

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a Nephrologist or senior Dialysis Therapy Technologist. Students are tested on intermediate clinical dialysis therapy technology skills.

V Semester

PAPER – 18

Applied Dialysis Therapy Technology - I:

Unit I: Introduction to Hemo Dialysis

1. Dialysis Team (Doctors, Technologist, Nurses, Technician, Renal Dietician- rights, responsibilities and relationship with patients)
2. Basic chemistry of body fluids and Electrolytes
3. History of Hemodialysis
4. Principles of Hemodialysis
5. Indications for dialysis
6. Types of Hemodialysis

Unit II: Water Treatment

1. Purpose of water treatment
2. Filtration
3. Softener and carbon filtration
4. Deioniser
5. RO system
6. UV radiation
7. Ultrafiltration
8. AAMI and European standards
9. Ultrapure water

Unit III: Hemo Dialysis Equipment's and Assessment of dialysis

1. Components and function HD equipment
2. Dialyser membranes – Types and biocompatibility
3. Types of dialyser
4. Hemodialysis adequacy
5. Dialyser reprocessing and reuse of dialyzers

Unit IV: Vascular access

1. History
2. Types of access
3. Access care
4. Access complications and management
5. Vascular access recirculation

Unit V: Current research in hemodialysis

1. Hemodialysis therapies
2. Hemodialysis machines

Practical's :

Charts/Slides/Spotters :

1. Basic chemistry of body fluids and Electrolytes
2. History, principles and indications of Hemodialysis

3. IV fluids used in dialysis patients
4. Types of Hemo dialysis
5. Water Treatment system
6. Dialyser membranes – Types and biocompatibility
7. Types of dialyser
8. Hemodialysis adequacy
9. Anticoagulation
10. Composition of dialysate
11. Current research in hemodialysis

Case Study /Hemodialysis Procedures :

1. Preparing the concentration of the dialysate depending upon the situation
2. Priming
3. Vascular access assessment
4. Skin suturing
5. Temporary catheter care and its exit site dressing
6. Dialyser reprocessing and reuse of dialysers
7. AV fistula/AV graft cannulation
8. Initiation of dialysis through Central venous catheter
9. Termination (closing of dialysis)

PAPER – 19

Applied Dialysis Therapy Technology - II

Unit I: Hybrid and continuous therapies

1. Continuous hemofiltration
2. Continuous Hemodiafiltration
3. Continuous and Intermittent hemodialysis
4. Sustained low efficiency dialysis(SLED)
5. Slow continuous ultrafiltration(SCUF)
6. High flux and high efficiency dialysis

Unit II: Assessment of complications and its management in Hemodialysis patients

1. Patient assessment, management and prevention– General, pre, intra and post dialysis
2. Lab data analysis
3. Machine monitoring during hemodialysis
4. Acute complications during hemodialysis

Unit III Paediatric Hemodialysis

1. Hemodialysis in infants and children
2. CRRT in infants and childrens

Unit IV: Special procedures pertaining to dialysis technology

1. Plasmapheresis
2. Hemoperfusion
3. MARS

Unit V: Role of dialysis technologist in hemodialysis unit

1. Infection control and universal precautions
2. Psychosocial aspects of dialysis
3. Quality assurance in dialysis
4. Management of dialysis unit – supplies, equipment and accessories.

Reference Books :

1. Hand Book of Dialysis : J.T.Daugirdas
2. Dialysis therapy : Allen R.Nissenson,Richard N.Fine

Practical's :

Charts/Slides/Spotters :

1. Infection control and universal precautions
2. Psychosocial aspects of dialysis
3. Drugs and dialysis
4. Quality assurance in dialysis
5. High flux and high efficiency dialysis
6. Hemodialysis in infants and children
7. Acute complications in hemodialysis patients
8. CRRT (continuous renal replacement therapy)
9. Plasmapheresis
10. Hemoperfusion
11. MARS (molecular adsorbent re circulating system)
12. Nutrition management in hemodialysis patients
13. Hemodialysis associated reactions

Case Study /Hemodialysis Procedures :

1. Preparing the concentration of the dialysate depending upon the situation
2. Priming
3. Vascular access assessment
4. Skin suturing
5. Temporary catheter care and its exit site dressing
6. Dialyser reprocessing and reuse of dialysers
7. Patient assessment – General, pre, intra and post dialysis
8. Machine monitoring during hemodialysis/setting of dialysis machine
9. Sequential dialysis
10. Sodium profiling

PAPER – 20

BSc.DT Directed Clinical Education – III

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a nephrologist or senior Dialysis Therapy Technologist. Students are tested on intermediate clinical dialysis therapy technology skills.

VI Semester

PAPER – 21

Applied Dialysis Therapy Technology – III:

UNIT I: Introduction to peritoneal dialysis

1. History of peritoneal dialysis
2. Physiology of PD – Kinetics of PD,
3. Acute peritoneal dialysis
4. Indications and contraindications for chronic PD

UNIT II: PD apparatus

1. Solution
2. Transfer set,
3. Connectologies.
4. Access for PD
5. Catheter and Exit site care

UNIT III: PD process and evaluation of peritoneum

1. PD therapies – intermittent & continuous
2. Assessment of peritoneal membrane permeability
3. Adequacy of peritoneal dialysis

UNIT IV: PD complications & management

1. Non infectious complications of PD – Mechanical and metabolic
2. Infectious complications of PD,
3. Patient Education

UNIT V : Systemic diseases in dialysis patients

1. Nutrition in dialysis patient
2. Diabetes in dialysis patient
3. Hypertension in dialysis patient
4. Serum enzyme levels
5. Hematologic abnormalities.

Reference Books :

Hand Book of Dialysis – J.T.Daugirdas
Text Book of Peritoneal Dialysis – Ram Gokul

Practical's :

Charts/Slides/Spotters

1. History of peritoneal dialysis
2. Physiology of PD – Kinetics of PD
3. Acute peritoneal dialysis
4. PD solution
5. Transfer set
6. Adequacy of peritoneal dialysis

Case Study

1. Non infectious complications of PD – Mechanical and metabolic
2. Infectious complications of PD
3. Patient Education

PD Procedure :

1. PD Catheter and exit site care
2. Performance of PD exchanges manually
3. Setting up of automated PD equipments
4. First assessment in minor procedures
5. PET analysis

PAPER – 22

Applied Dialysis Therapy Technology - IV

UNIT I : Infectious diseases in dialysis patients

1. Infections in dialysis patients
2. Hepatitis B
3. Hepatitis C
4. HIV
5. Catheter related bacteraemia (CRBS)

UNIT II : Special problems

1. Endocrine disturbances
2. Bone disease
3. Aluminium toxicity
4. Sleep disorders
5. Musculoskeletal & rheumatologic diseases in CRF patients
6. Special problems pertaining to Heart & circulatory system in CRF patient,
7. Special problems pertaining to digestive tract in CRF patients
8. Special problems pertaining to genitourinary tract and male reproductive organs in CRF patient
9. Special problems pertaining to obstetrics & gynaecology in CRF patients
10. Special problems pertaining to nervous system in CRF patients.

UNIT III Urosurgical procedures

1. Common urosurgical procedures, instruments & their management
2. ESWL

UNIT IV Principles of ICU care

1. Ventilator mode
2. Basics of ECG
3. Basics of ICU dialysis

Reference Books :

1. Hand Book of Dialysis – J.T.Daugirdas
2. Text Book of Peritoneal Dialysis – Ram Gokul

Practical's :

Case Study

1. Types of renal donor & cadaver donor maintenance
2. Recipient and donor workup for renal transplantation
3. Principles of post transplant management and follow up
4. Diabetes in dialysis patient
5. Hypertension in dialysis patient
6. Serum enzyme levels
7. Hematologic abnormalities
8. Infections in dialysis patients
9. Endocrine disturbances
10. Bone disease
11. Aluminum toxicity
12. Nutrition management in peritoneal dialysis patients
    - Introduction to the science of nutrition
    - Definition
    - Food pattern and its relation to health
    - Factors influencing food habits
    - Selection of food stuffs
    - Food storage and preservation
13. Sleep disorders
14. ESWL
15. Principles of ICU care

CPR demonstration

PAPER – 23

Renal transplantation and Coordination

Unit I : Basics of Kidney Transplantation

1. History of Kidney Transplantation
2. Transplant Immunology
3. Histocompatibility Testing , Cross matching Techniques in Renal Transplantation
4. Immunosuppressive drugs used in Renal Transplantation
5. Nutrition in Kidney transplant recipients

Unit II : Evaluation of Donor and Recipient

1. Living Donor Kidney Transplantation and Donor Evaluation
2. Evaluation of Adult Kidney Transplant patients
3. Indication and Contraindications for Renal Transplantation
4. Indication and Contraindications for Kidney Donation

Unit III : Renal Transplantation Coordination

1. Human Organ Transplant Act and its Amendments
2. Role of Transplant Coordinator in Organ Transplantation
3. Ethical Aspects in Renal Transplantation
4. Psychosocial aspects in Renal Transplantation

Unit IV : Deceased Donor Transplantation

1. Brain Death
2. Diagnosis of Brain death
3. Deceased Donor Organ Donation
4. Deceased Donor Maintenance

Unit V : Renal Transplant Surgery and Complications of Renal Transplantation

1. Transplantation Surgery and Surgical complications
2. Post-Transplant Management – Short and Long Term
3. Medical Complications of Renal Transplantation
4. Infectious Complications of Renal Transplantation

Reference Books :

Handbook of Kidney Transplantation – Gabriel Danovitch

Practical's :

Charts/Slides/Spotters

1. History of Kidney Transplantation
2. Transplant Immunology
3. Histocompatibility Testing , Cross matching Techniques in Renal Transplantation

4. Transplantation Surgery and Surgical complications
5. Post-Transplant Management – Short and Long Term
6. Medical Complications of Renal Transplantation
7. Infectious Complications of Renal Transplantation
8. Human Organ Transplant Act and its Amendments
9. Role of Transplant Coordinator in Organ Transplantation

Case Study

1. Types of renal donor & cadaver donor maintenance
2. Recipient and donor workup for renal transplantation
3. Principles of post transplant management and follow up

Reference Books :

1. Anatomy and Physiology

Ross and Wilson by Anne Waugh, Allison grant
Hand book of Anatomy – P.Saraswathi
Human Anatomy – B.D.Chaurasia
Human physiology – A.K.Jain
Anatomy and physiology in health and illness – Ross and Willson
Gray's anatomy for the students - Richard L.Drake

2. Pharmacology

Medical pharmacology – Padmaja Udaykumar
KD Tripathi - Essentials of Medical Pharmacology

3. Concepts of Disease and Outline

Primer on Kidney Disease – Arthur Greenburg

Text book of Pathology - Harsh Mohan
Basic pathology –pocket Robbins
Principles and practice of medicine – Davidson's
Principle of Internal Medicine - Harrison
Kidney diseases in primary care – K.Mandal ,Stanly

4. Dialysis Technology - I & II

Hand Book of Dialysis – J.T.Daugirdas
Dialysis therapy – Allen R.Nissenson,Richard N.Fine
Text Book of Peritoneal Dialysis – Ram Gokul
Principle and Practice of Dialysis - Henrich

5. Renal Transplantation

Handbook of Kidney Transplantation – Gabriel Danovitch
Kidney Transplantation Principle and Practice – Peter Morris

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

4. B.Sc. ECG & CARDIOVASCULAR TECHNOLOGY (ECG & CVT)

(Semester pattern)

w.e.f 2015-16 Batch

SPECIALITY PAPERS

III Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Applied Anatomy & Physiology related to Cardiovascular Technology	80	120	IE	80	20	50%
13	Electro Cardiography	80	120	IE	80	20	50%
14	Exercise testing & Holter Analysis	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester:

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+ Practical)
15	Applied Pharmacology	80	120	UE	80	40%	20	40%	50%	50	50%
16	Echo Cardiography	80	120	UE	80	40%	20	40%	50%	50	50%
17	Doppler Echo Cardiography, TEE, Contrast Echo	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

V Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
17	Concepts of Cardiovascular Disease and outlines of clinical Evaluation related to cardiac technology	80	120	IE	80	20	50%
18	Invasive Cardiology	80	120	IE	80	20	50%
19	Angiography, EP studies	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours : 600

VI Semester:

Paper No.	Paper	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)
20	Intensive Care, Cardiopulmonary Resuscitation	80	120	UE	80	40%	20	40%	50%	50	50%
21	Interventional Cardiology (Coronary, Congenital)	80	120	UE	80	40%	20	40%	50%	50	50%
22	Interventional Cardiology (Non-Coronary, Electro Physiology)	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

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 - ECG & CARDIOVASCULAR TECHNOLOGY

III Semester

The objective of this subject is to provide training in all aspects of instrumentation and recording techniques for Electrocardiography, exercise stress testing, holter monitoring. At the end of the course the student under the supervision of a physician will be able to perform a 12 lead ECG, assist in Treadmill exercise testing, assist in Holter analysis.

PAPER – 12

Applied Anatomy & Physiology Related to Cardiovascular Technology:

I. Anatomy :

1. Anatomy of the Heart and great vessels.
   a) Gross anatomy and structural features of cardiac chambers.
      1. Atrium
      2. Ventricle.
      3. AV junction
      4. Heart valves.

   b) Specialized conduction tissues.
      1. Sinus node.
      2. Internodal tracts.
      3. Av node.
      4. Bundles.
2. Innervations of the Heart.
      1. Sympathetic.
      2. Parasympathetic.
      3. Sensory.
3. Coronary vascular system.
      1. Coronary arteries.
      2. Myocardial capillary bed.
      3. Venous drainage.
      4. Lymphatic drainage.
4. Pericardium.
5. Systemic Circulation.
      1. Arterial system.
      2. Venous system.
      3. Lymphatic system.
      4. Tissue perfusion and microcirculation
6. Pulmonary circulation.
      1. Pulmonary artery.
      2. Pulmonary veins.
      3. Bronchial artery.
7. Cerebral circulation
8. Renal Circulation
9. Anatomy of respiratory system.

II. Physiology :

1. Over view of the cardiovascular system.
      1. Function of CVS.
      2. Circulation of blood.
      3. Central control of cardio vascular system.

2. Cardiac cycle.
    1. Mechanical events.
    2. Arterial cycle and central venous pressure cycle.
    3. Clinical aspects of human cardiac cycle.

3. Cardiac Excitation and contraction.
    1. Mechanism of contraction.
    2. Pacemaker of conduction system.
    3. Nodal electricity.
    4. Nervous control of the heart rate.

4. Basics of ECG.

5. Assessment of cardiac output.
    1. Ficks principle.
    2. Thermal dilution and indicator dilution methods.
    3. Pulse Doppler method.
    4. Miscellaneous methods.

6. Control of stroke volume and cardiac output.

7. Hemodynamics.
   Relationship between pressure, flow and resistance.

8. Solute transport between blood and tissues.
   Circulation of fluid between plasma, interstitium and lymph.

9. Vascular smooth muscle.
    1. Mechanism of contraction.
    2. Pharmaco mechanical coupling, automaticity

10. Control of Blood vessels.
    1. Local Control mechanism.
    2. Nervous control.
    3. Hormonal Control.

11. Specialization in individual circulation.
    1. Coronary circulation.
    2. Cerebral circulation.
    3. Pulmonary circulation.
    4. Cutaneous circulation.

12. Cardiovascular receptors, reflexes and central control.

13. Coordinated cardiovascular responses.
    1. Posture.
    2. Valsalva manoeuvre
    3. Exercise.
    4. Diving reflex.

14. Cardiovascular responses in pathological situations.
    1. Shock and hemorrhage.
    2. Syncope.
    3. Essential Hypertension.
    4. Chronic cardiac failure.

15. Respiratory Physiology.
    1. Mechanics of respiration.
    2. Principles of gas exchange.
    3. Regulation of respiration.

16. Hematology and coagulation Physiology
    1. Blood Components.
    2. Blood groups
    3. Blood transfusion.
    4. Hemostasis.

PAPER – 13

Electrocardiography :

1. Basic Principles
    1. The electrocardiographic paper.
    2. Electrocardiography
    3. The electrical field of heart.
    4. The leads; standard limb leads; precordial leads;
    5. Augmented limb leads.
    6. Basic ECG deflections, basic action of electrocardiograph.
2. Normal ECG
    1. The P wave
    2. The qrs complex
    3. The genesis of the qrs complex
    4. The wave; the ST segment
    5. The Q wave
    6. Rate and rhythm
    7. Rotation of the heart
    8. The Q-T interval.
3. The Electrical Axis
4. Pre Cardial Pattern Of ECG
5. Chamber Enlargement
    1. Myocardial infarction.
    2. Coronary insufficiency
    3. Recognition of ECG pattern.
6. Bundle Branch Block
    1. General principles.
    2. Right bundle branch block.
    3. Left bundle branch block.
    4. The hemi blocks (fasicualr blocks).
7. Coronary Artery Disease
    1. Myocardial infarction.
    2. Coronary insufficiency.
    3. Recognition of ECG pattern.
8. Pericarditis, Myocarditis, Congestive Cardiomyopathy.
9. Systemic Hypertension And Rheumatic Heart Disease.
10. Corpulmonale, Acute, Pulmonary Embolism Emphysema.
11. Drugs And Electrolytes.
12. Congenital And Hereditary Heart Disease
    Wolf Parkinson white syndrome and related syndromes.
13. Sinus Rhythm
    1. Sinus arrhythmia

2. Sinus tachycardia and Bradycardia

14. Ectopic Arterial Rhythm
    1. Atrial extra systoles.
    2. Paroxysmal atrial tachycardia
    3. Atrial fibrillation and flutter.

15. Atrio Ventricular (Av) Nodal Rhythm

16. Ventricular Rhythm
    1. Ventricular extra systoles.
    2. Ventricular tachycardia.
    3. Ventricular flutter / fibrillation.

17. Disorder Of Impulse Conduction
    1. Sinotrial (SA) nodal block
    2. Atrioventricular (AV) nodal block
    3. First degree AV block
    4. Second degree AV block
    5. Third degree AV block

PAPER – 14

Exercise Testing & Holter Analysis

I. Exercise Stress Testing

a) Exercise Physiology
b) Exercise protocols
c) Electrocardiograph measurements.
d) Exercise testing.
e) Indication & techniques.

II. Holter Analysis

IV Semester

PAPER – 15

Applied Pharmacology :

The objective of this subject is to cover general pharmacology with special emphasis on common drugs used, route of administration, types of formulations, dose and frequency of administration, side effects and toxicity, management of toxic effects, drug interaction, knowledge of chemical and trade names, importance of manufacture and expiry dates and instructions about handling each drug.

1. Anti Anginal Agents:
    1. Beta Blocking Agents - Propranolol, Atenolol, Metoprolol, Labetolol, Pindolol.
    2. Nitrates – Nitroglycerine, Isosorbide dinitrate, Isosorbide mononitrate, Transdermal nitrate patches.
    3. Calcium channel blockers – nifedipine, verapamil, diltiazem, new calcium channel blockers.

2. Anti-Failure Agents :
    1. Diuretics – Furosemide, Thiazide diuretics, other thiazide like agents, Potassium sparing diuretics, combination diuretics, special diuretic problems.
    2. Angiotensin converting enzyme (ACE) inhibitors, Types of ace inhibitors Captopril, Enalapril, ACE inhibitors for diabetics and hypertensive renal disease.
    3. Digitalis and acute ionotropes – Digoxin, Digitoxin, Doubutamine, Dopamine, Adrenaline, Nonadrenaline, Isoprenaline, Mixed ionotropic vasodilators Mibrinone.

3. Anti-Hypertensive Drugs :

Diuretics, Beta Blockers, Ace inhibitors, ARBS, Calcium antagonists, direct vasodilators, centrally active and peripherally active vasodilators.

4. Anti-Arrhythmic Agents :

   Quinidine and related compounds, Procainamide, Lidocaine, Mexiletine, Phenytoin, Flecainide, Amiodarone, Bretylium, Combination therapy, Verapamil.

5. Antithrombotic Agents :

   1. Platelet inhibitors : Aspirin. Persantinem clopidogrel, Prasugrel
   2. Anticoagulants : Heparin, low molecular weight heparin, Warfarin
   3. Fibrinolytics
      - Streptokinase.
      - Urokinase
      - Combination therapy.

6. Lipid lowering and anti-atherosclerotic drugs.
7. Which drug for which condition?
8. Miscellaneous drugs – Adenosine.

   Protamine, Emergency drugs, Narcotics, Sedatives, Steroids, Antihistamines, Antibiotics.

PAPER – 16

Echocardiography :

The objective of this subject is to provide training in all aspects of instrumentation and recording techniques for echocardiography. At the end of the course the student under the supervision of a physician will be able to perform ultrasonography, perform echo cardiography using colour Doppler.

1. Principles of echo cardiography
   1. Basic principles of ultrasound
   2. M-mode echo cardiography
   3. Two dimensional echo cardiography
2. Instrumentation
   1. Basic pulse echo system
   2. Transducers
   3. Pulse generation
   4. Echo detection Echo discplays
   5. A mode; B mode; m-mode Display and recording.
3. Echo Cardiographic examination.
   1. Selecting transducers
   2. Position of the patient
   3. Placement of the transducer
   4. Setting controls
   5. M-mode labeling
   6. 2 D Echo
   7. Normal variants
   8. Terminology
   9. Identification of segments.
4. Echo Measurements – Ase Recommendation
5. Acquired Valvular Heart Disease.
   1. Mitral stenosis.
   2. Mitral regurgitation
   3. Mitral valve prolapse

4. Aortic stenosis
5. Aortic regurgitation
6. Tricuspid stenosis and regurgitation

6. Congenital Heart Disease
    1. Atrial septal defect.
    2. Ventricular septal defect
    3. Patent ducts arteriosis
    4. Tetralogy of fallot
    5. Transposition of great arteries
    6. Tricuspid atresia

7. Pericardial Disease
    1. Constriction, 2. Effusion, 3. Transponade

8. Myocardial Disorders
    1. Ischaemia, 2. Infarction, 3. Aneurysms, 4. L V Function assessment.
9. Evaluation Of Cardiomyopathy
10. Evaluation Of Tumors And Thrombi

PAPER - 17

Doppler Echo Cardiography, TEE, Contrast Echo :

I. Doppler Echocardiography

a. Introduction to Doppler echocardiography
    1. The Doppler principle.
    2. Doppler ultra sound techniques
    3. Colour Doppler flow imaging.
    4. Clinical Application of Doppler echocardiography.

b. Physical principles and instrumentation in spectral and colour Doppler flow imaging.
    1. Physical principles of the Doppler effect, the Doppler echocardiography system
    2. display.
    3. Blood flow pattern.
    4. Non laminar flow
    5. Doppler echo cardiograph modes
    6. Continuous wave Doppler system
    7. Pulsed Doppler system
    8. High pulse repetition frequency.
    9. Colour display.
    10. Problems of colour imaging.

II. Transesophageal echocardiography

III. Contrast echo

V Semester

PAPER – 18

Concepts Of Cardiovascular Disease And Outlines Of Clinical Evaluation Related To Cardiac Technology :

This subject in the course will cover common diseases and their casues, pertinent microbiology, pathology of the system involved, outline of major signs and symptoms and management of the disease including medical and surgical intervention.

1. Congenital Heart Disease In The Adult Anatomical Abnormalities
    1. Obstruction.
    2. Valvular regurgitation.
    3. Abnormal communication between chambers.
    4. Abnormal connection.
    5. Surgical treatment.

2. Valvular Heart Disease Anatomic Abnormalities:
    1. Congenital valvular heart disease.
    2. Rheumatic valvulitis.
    3. Aortic Valve Disease
        - Aortic Stenosis.
        - Aortic regurgitation.
    4. Mitral Valve Disease
        - Mitral stenosis
        - Mitral regurgitation
        - Mitral valve prolapse
        - Combined valvular disease

3. Coronary Artery Disease
    1. Patho physiology and clinical recognition.
    2. Silent myocardial ischaemia
    3. Angina pectoris
    4. Symptomatic venous and asymptomatic myocardial ischaemia.
    5. Types and locations of myocardial infarction.
    6. Thrombolytic therapy.
    7. Medical treatment.
    8. Other treatment modalities.
    9. Surgical treatment.
    10. Cardiac rehabilitation services.

4. Myocardial Diseases
    1. Dilated cardiomyopathy.
    2. Hypertrophic cardiomyopathy.
    3. Restrictive cardiomyopathy.
    4. Myocarditis.
    5. Heart failure.
    6. Surgical and medical treatment.
5. Pericardial Disease
6. Electrical Disturbances Of The Heart.
    1. Sinus node dysfunction.
    2. Arrhythmias.
    3. Surgical treatment.
7. Pulmonary Hypertension.
8. Tumours Of The Heart.

9. Congenital Heart Disease In Infancy And Childhood.
    a) Cyanotic Congenital Heart Disease:
        1. Tetralogy of fallot.
        2. Pulmonary stenosis with atrial septal defect.
        3. Transposition of great arteries.
        4. Double outlet right ventricle.
        5. Pulmonary atresia.
        6. Total anamolous pulmonary venous connection.
    b) Acyanotic Heart Disease Septal Defects:
        1. Atrial septal defects.
        2. Ventricular septal defects.
        3. Congenital valvular disease.
        4. Patent ductus arteriosus.
        5. Coarctation of aorta.
10. Hypertension.

PAPER - 19

Invasive Cardiology :

1. Cine angiographic imagiology
2. Radiation hazards in Cath lab
3. Contrast media
4. Cardiac catheterization standard practice
5. Cardiac catheterization complications
6. Pressure recording.
7. Oxymetry / shunt quantification
8. Vascular resistance
9. Calculation of cardiac output
10. Gorlins formula
11. Pressure wave forms – normal
12. Pulmonary arterial hypertension

PAPER – 20

Angiography, EP Studies :

1. Percutaneous approach in Cardiology
2. Cath findings in TOF
3. Cath findings in left to right shunt
4. Cath findings in HCM
5. Cath findings in valvular diseases.
6. Hemodynamics of constrictive pericarditis and restrictive cardiomyopathy.
7. Coronary angiography views
8. Classification of coronary artery stenosis
9. Peripheral angiography
10. IVUS
11. Sinus node function tests.
12. AV node function tests.

VI Semester

PAPER - 21

Intensive Care, Cardiopulmonary Resuscitation :

I. Intensive Care

1. Monitoring and diagnostic procedures in ICU.
    1. Central venous access
    2. ECG monitoring
    3. Invasive hemodynamic monitoring.
    4. Cardiac arrhythmia recognition.
2. General care of patient in ICU
    1. Eye, GI tract and bladder system
    2. Care of mechanically ventilated patient.
    3. Tracheostomy, Humidification
    4. Vascular line, arterial line, venous line.
    5. Radiography
    6. Chest physiotherapy
3. Intensive care management of myocardial infarction & unstable angina.
4. Fluid management and parenteral nutrition.
5. Infectious disease in ICU, antibiotics in ICU.
6. Respiratory failure
    1. Oxygen therapy
    2. Mechanical ventilation.
7. Acid base disorders electrolyte imbalance.
8. Cardio vascular failure
    1. Plan of management
    2. Inotropic support
    3. Vasodilator drugs.
9. Renal failure and liver failure.
10. Head injury.
11. Principles of transfusion therapy.

II. Cardio Pulmonary Resuscitation and First Aid Techniques :

Introduction of this training is to ensure that each student learn and retain the knowledge and skill to manage patients through cardio pulmonary emergencies.

1. Basic Life Support
    1. An Open Airway.
    2. Adequate Breathing.
    3. Sufficient Circulation.
2. Adult One-Rescuer CPR
    1. Assess the victim's need for CPR.
    2. Call for help.
    3. Open Airway & checking breathing.
    4. Mouth to mouth breathing.
    5. Manual resuscitation bag and mask.
    6. Determine pulselessness.
    7. External chest compression.
3. Adult - Two Rescuer CPR

4. CPR Equipment

    1. Manual resuscitator (Bag – value).
    2. Mouth to valve mask resuscitator.
    3. Patient assessment.

5. Resuscitation For Children

    Artificial ventilation for children & babies under two External chest compression for children & babies.

6. The Recovery Position

    ACLS: (Advanced Cardiac Life Support).

7. Skill Steps

8. Station One : Basic Life Support
    1. One rescuer CPR.
    2. Two rescuer CPR.
    3. Obstructed airway.

9. Station Two : Airway Management
    1. Mouth to mask ventilation.
    2. EDA
    3. Endo tracheal intubation.
    4. Endotracheal intubation with DOA in place.

10. Station Three: ECG and Treatment.
    1. Modalities.
    2. Statue ECG slip.
    3. Case histories and ACLS.
    4. Treatment modalities.

11. Station Four : Mega Code
    1. Serving as code leader.
    2. Defibrillation.

12. Lecture Topics : Acls In Perspective
    1. Myocardial infarction.
    2. Adjunct for airway control.
    3. Dysarhythmia therapy.
    4. Electrical therapy.
    5. Cardio vascular pharmacology.
    6. Putting it all together.

13. First Aid Techniques

14. Action at Emergency
    1. Approach.
    2. Assessing the situation.
    3. Examination & diagnosis.
    4. Treatment.
    5. After treatment.
    6. Making a report.
    7. Removing clothing.
    8. Removing crash – helmets.

15. Asphyxia
    1. Suffocation (External obstruction).
    2. Hanging, stranging & throuting.
    3. Drowning.
    4. Smoke inhalation.
    5. Carbon monoxide poisoning.

6. Choking.
7. Blast injuries.
8. Stove-in-chest
9. Asthma
10. Electrical injuries.
11. Winging.
12. Hiccups.

16. Wounds & Bleeding
    1. Types of wound.
    2. How the body responds to injury.
    3. Foreign external bleeding.
    4. Minor external bleeding.
    5. Internal bleeding.
    6. Infecting wounds.
    7. Special forms of bleeding.

PAPER - 22

Interventional Cardiology (Coronary, Congenital) :

1. PTCA techniques
2. Primary PTCA
3. Coronary stents
4. Drug coated stents
5. Advanced coronary interventions
6. Peripheral interventions
7. Trans catheter ASD closure
8. Trans catheter VSA closure
9. Tran catheter PDA closure
10. Coil Embolisation
11. Diagnosis & Treatment of coarctation of aorta
12. Balloon arterial septostomy.

PAPER - 23

Interventional Cardiology (Non- Coronary& Electro Physiology) :

14. IABP
15. PCPS
16. End myocardial Biopsy
17. PBPV/PBAV
18. PTMC
19. Alcohol septal ablation
20. Electro Physiological studies.
21. RF Ablation
22. TPI
23. PPI
24. CRT
25. ICD

Reference Books :

1) Anatomy : Chaurasia
2) Physiology : Ganong
3) Pharmacology : Gabriel Khan
4) ECG : Narasimhan's Indian Edition of Schamroth
5) Echo : Cathetre otto's text book of Echocardiography
6) TMT : Ellstead
7) Cath & Angio : Mortin Kern / Topol's hand book
8) Cardiology : From Davidson's text book of Medicine.

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5. B.Sc EMERGENCY MEDICAL SERVICES TECHNOLOGY (EMST)

(Semester pattern)

w.e.f 2015-16 Batch

TEACHING HOURS & EXAMINATION PATTERN

III Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Principles of Emergency Medicine	80	120	IE	80	20	50%
13	Gastro intestinal, Liver, Kidney Emergencies	80	120	IE	80	20	50%
14	Toxicology	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester:

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+ Practical)
15	Environmental Injuries & Endocrine Emergencies	80	120	UE	80	40%	20	40%	50%	50	50%
16	Paediatrics & Obtetrics and Gyenecological Emergencies	80	120	UE	80	40%	20	40%	50%	50	50%
17	Neurological Emergencies	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

V Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
18	Cardiac & Pulmonary Emergencies	80	120	IE	80	20	50%
19	Pharmacology related to Emergency Medicine	80	120	IE	80	20	50%
20	Basic & Advanced Life support management	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	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)
21	Trauma Care - I	80	120	UE	80	40%	20	40%	50%	50	50%
22	Trauma Care - II	80	120	UE	80	40%	20	40%	50%	50	50%
23	Disaster Management, Poly Trauma & Paediatric Trauma	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

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 - EMERGENCY MEDICAL SERVICES TECHNOLGY

III Semester

PAPER - 12

Principles of Emergency Medicine :

Course Objective : The objective of this subject is to provide an introduction to the types of equipment used in Emergency Medicine, the purposes for which they are used and their maintenance.

I. Breathing System

1. General considerations: humidity & heat
2. Capnography; etco2
3. Pulse oximetry
4. Methods of humidification
5. Classification of breathing system
6. Non rebreathing valves – Ambu valves
7. Components

II. Face Masks & Airway Laryngoscopes

1. Types, sizes
2. Endotracheal tubes – Types, sizes,
3. Cuff system
4. Fixing, removing and inflating cuff, checking tube position, complications.

Investigations :

Routine	-	Haematological – their significance
	-	Urine
	-	E.C.G.
	-	Chest & x-ray
Special	-	Endocrine, hormonal assays
	-	Echocardiography
	-	Angiography
	-	Others

PAPER –13

Gastro intestinal, Liver, Kidney Emergencies :

I. Gastrointestinal Emergencies :

1. Acute Abdominal pain
2. Nausea and Vomiting
3. Disorders presenting primarily with Diarrhea
4. Acute and chronic constipation
5. Upper Gastrointestinal Bleeding
6. Lower Gastrointestinal Bleeding
7. Esophageal Emergencies, Gastroesophageal Reflux Disease, and Swallowed Foreign Bodies
8. Peptic Ulcer Disease and Gastritis
9. Pancreatitis and Cholecystitis
10. Hepatic Disorders, Jaundice, and Hepatic Failure
11. Acute Appendictis
12. Diverticulitis

13. Bowel Obstruction and Volvulus
14. Gastrointestinal Procedures and Devices
15. Complications of General Surgical Procedures

II. Liver:

Anatomy of the Liver, portal circulation, functions of the liver.
Jaundice – types and clinical features.

III. Kidney:

Anatomy of the kidney, functions of the kidney, and renal failure.
AKI, CKD, Haemodialysis

PAPER – 14

Toxicology :

1. General Management of poisoned patients
2. Principles of Drug Interactions
3. Atypical Antidepressants, Serotonin Reuptake Inhibitors, and Serotonin Syndrome
4. Monoamine Oxidase Inhibitors
5. Lithium
6. Barbiturates
7. Benzodiazepine Sedatives
8. Opioids
9. Aspirin and Sallicylates
10. Acetaminophen
11. Nonsteroidal Anti-Inflammatory Drugs
12. Digitalis Glycosides
13. B-Blockers
14. Calcium Channel Blockers
15. Antihypertensive Agents
16. Hydrocarbons and Volatile Substances
17. Caustics
18. Pesticides
19. Anticholinergics
20. Industrial Toxins

IV Semester

PAPER - 15

Environmental Injuries & Endocrine Emergencies :

I. Environmental Injuries :

1. Frostbite and Other Localized Cold Injuries
2. Hypothermia
3. Heat Emergencies
4. Bites and stings
5. Trauma and Envenomations from Marine fauna
6. Thermal Burns
7. Chemical Burns

II. Endocrine Emergencies :

1. Type 1 Diabetes Mellitus
2. Type 2 Diabetes Mellitus
3. Diabetic Ketoacidosis
4. Thyroid Disorders: Hypothyroidism and Myxedema Crisis
5. Thyroid Disorders: Hyperthyroidism and Thyroid Storm

PAPER – 16

Pediatric & Obstetrics and Gyenocological Emergencies:

I. Pediatric Emergencies :

1. Emergency care of children
2. Neonatal Emergencies and common Neonatal problems
3. Fever and serious Bacterial Illness
4. Stridor and Drooling
5. Pediatric Heart Disease: Congenital Heart Defects
6. Pediatric Heart Disease: Acquired Heart Disease
7. Vomiting, Diarrhea, and Dehydration in Children
8. Acute Abdominal Pain in Children
9. Seizures and Status Epilepticus in Children

II. Obstetrics And Gynaecological Emergencies :

1. Vaginal Bleeding in the Nonpregnant patient
2. Abdominal and Pelvic pain in the Nonpregnant Female
3. Ectopic pregnancy and |Emergencies in the First 20 weeks of pregnancy
4. Normal pregnancy
5. Emergency Delivery

PAPER – 17

Neurological Emergencies :

1. The Neurologic Examination in the Emergency Setting
2. Headache and Facial Pain
3. Spontaneous Subarachnoid and Intracerebral Hemorrhage
4. Stroke, Transient Ischemic Attack, and Cervical Artery Dissection
5. Seizures and status Epilepticus in Adults
6. Traumatic brain injury
7. Interpretations of plain X-Ray, CT Scan, MRI
8. Positioning of Head Injury patient in prone & supine position
9. Glasgow – Coma score and its application
10. Aneurysm
11. Brain death
12. Organ Donation
13. Apnea test

V Semester

PAPER – 18

Cardiac & Pulmonary Emergencies :

I. Cardiac Emergencies:

1. M.I
2. Pulmonary Oedema
3. Angina
4. Hypertensive crisis
5. Interpretation of ECG
6. Interpretation of 2D echo
7. Holter analysis text
8. Shifting of a cardiac patient to Cath Lab
9. Bleeding disorders
10. Mitral stenosis
11. Cardiomyopathies

II. Pulmonary Emergencies :

1. Respiratory Distress
2. HEMOPTYSIS
3. Acute Bronchitis and Upper Respiratory Tract Infections
4. Community-Acquired Pneumonia, Aspiration Pneumonia, and Noninfectious Pulmonary Infiltrates
5. Empyema and Lung Abscess
6. Tuberculosis
7. Spontaneous and Iatrogenic Pneumothorax
8. Acute Asthma in Adults
9. Chronic Obstructive pulmonary Disease

PAPER – 19

Pharmacology related to Emergency Medicine :

1. Organophosporous compounds
2. Antidote
3. Oximes
4. Narcotic Abuse
5. Narcotics
6. Atropine
7. Medazolam
8. Thiopentone
9. Muscle relaxants
10. Dopomine
11. Dobutamine
12. Nor _ adrenaline
13. Adrenaline
14. Isoprenaline
15. Anti emitics
16. Phenytoin
17. Navalproate

18. Manitol
19. Lasix
20. Fluid Challenge
21. Analgesics
22. Antibiotics – 1st & 2nd gen. of cephalosporins & penicillines

PAPER – 20

Basic & Advanced Life support management :

1. BLS
2. Airway Assessment
3. Airway Equipment
4. Technique of Mask Ventilation & Endo tracheal intubation
5. Advanced airway management skill (Use of bogie stellate, supraglottic devices)
6. Basic settings of a ventilator
7. Basic modes of ventilator
8. General case of patient on ventilator including endotracheal suctioning
9. Classification and management of shock
10. Central and peripheral venous access
11. Defibrillators
12. ECPR

VI Semester

PAPER - 21

Trauma Care – I :

I. Traumatic Disorders :

i) Principles of care

ii) Prehospital trauma care

1. Triage
2. Resuscitation and stabilization
3. Hemorrhagic shock
4. Neurogenic shock
5. Role of emergency physician
6. Team response
7. Reassessment and monitoring
8. Diagnosis
9. Treatment
10. Disposition

iii) Cause of injury:

1. Homicide
2. Suicide
3. Family violence
4. Motor vehicle crashes
5. Falls
6. Drowning/near drowning
7. Poisoning
8. Burns and fire related injuries

9. Occupational injuries

iv) Radiological evaluation:
1. Plain radiography
2. Contrast radiography
3. CT scan
4. Angiography
5. MRI
6. Ultrasound

v) Spinal cord and peripheral nervous system trauma:
1. Complete spinal cord injuries
2. Incomplete cord injuries
3. Cauda equine injuries
4. Peripheral nerve injuries

vi) Injuries of the spine:
1. Fractures
2. Dislocations/subluxations

v) Facial fractures

vi) Soft tissue facial injuries
1. Complex lacerations
2. Avulsions

vii) Neck trauma

vii) Vascular injuries
1. Carotid artery
2. Internal and external jugular veins

PAPER - 22

Trauma Care – II :

I. Laryngotracheal injuries:
1. Lacerations
2. Crush injuries
3. Vocal cord avulsions/hematomas
4. Fracture larynx
5. Compression with hematomas

II. Chest Trauma:
1. Penetrating chest trauma
2. Rib fractures
3. Sterna fractures
4. Flail chest
5. Clavicle fracture/dislocation
6. Pulmonary contusion
7. Pericardial tamponade
8. Vascular injuries
9. Tracheo bronchial tree injuries
10. Pneumo thoraces
11. Hemothorax

III. Abdominal Trauma:
1. Penetrating abdominal trauma
2. Abdominal wall contusion
3. Solid-viscus injuries

4. Hollow viscus injuries
5. Vascular injuries
6. Diaphragmatic rupture
7. Mesenteric avulsion, hematoma
8. Bladder rupture, contusion
9. Renal injuries
10. Urethral injuries

IV. Upper extremity bony trauma:

Fractures (open and closed)

1. Forearm
2. Supra condylar
3. Humeral shaft and head
4. Scapula

V. Dislocations / subluxations /fracture dislocation

1. Shoulder
2. Elbow
3. Wrist
4. Hand

VI. Lower extremity bony Trauma:

Fractures (open and closed)

1. Phalangeal
2. Metatarsal
3. Tarsal
4. Ankle
5. Leg (tibia-fibula)
6. Patellar
7. Midshaft and distal femur
8. Proximal femur (hip)

VII. Pelvic fractures:

1. Public rami
2. Iliac crest

VIII. Dislocations / fracture dislocations:

1. Ankle
2. Knee
3. Hip

IX. Injuries of the genitalia:

1. Cutaneous injuries
2. Lacerations
3. Avulsions
4. Burns
5. Puncture wounds
6. Bite wounds

PAPER - 23

Disaster Management, Poly Trauma & Paediatric Trauma :

I. Disaster Management :

1. Disaster-Definition
2. Types of disasters
3. Different classifications of disaster
4. Characteristics of disaster
5. Disaster preparedness and hospital planning
6. Hospital community co-ordination
7. Field triage and medical care –START technique
8. Training and disaster drills

II. Poly trauma / Multiple skeletal injuries:

III. Special considerations for paediatric trauma victim:

1. Clinical assessment and management
2. Anatomic/physiologic differences from adults
3. Airways management
4. Fluid resuscitation
5. Recognition of child abuse
6. Head injury
7. Spinal injuries
8. Without radiological abnormality
9. Chest trauma
10. Abdominal trauma
11. Burns
12. Fractures
    i. Green stick
    ii. Torus

Text books to study :

1. Nancy Caroline – Paramedic text book
2. Tintinalli's Emergency Medicine. A comprehensive study Guide eighth edition by David cline; Garth Meckler; Judith E. Tintinalli.
3. Roberts and Hedge's clinical procedures in Emergency Medicine 6th edition by James R. Roberts.
4. Short Text books of Anaesthesia by Ajay Yadav 5th edition.
5. Lee synopsis of Anesthesia 13th edition by Davies.
6. Oxford Hand book of Emergency Medicine by Michael J. Clancy; Kerstin Hogg.

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6. B.Sc. MEDICAL LAB TECHNOLOGY (MLT)

(Semester pattern)

w.e.f 2015-16 Batch

Course co-ordinator :

The course co-ordinator shall be nominated for B.Sc MLT course in alphabetical order for each academic year i.e. for the year 2016-17, the course in-charge from the dept. of Biochemistry, 2017-18, the course in-charge dept. of Microbiology and 2018-19 the course in-charge from the dept. of Pathology and so on...

He / She will be responsible for taking attendance, maintaining internal assessment marks, clinical training postings and intimation to the HoD's concerned, Prof. i/c AHS and to the University.

TEACHING HOURS & EXAMINATION PATTERN

III Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Biochemistry-I	60	140	IE	80	20	50%
13	Microbiology-I	60	140	IE	80	20	50%
14	Pathology-I	60	140	IE	80	20	50%
	Total	**180**	**420**				

T600

Practical including Oral, Spotters & Record

IV Semester:

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+ Practical)
15	Biochemistry-II	60	140	UE	80	40%	20	40%	50%	50	50%
16	Microbiology-II	60	140	UE	80	40%	20	40%	50%	50	50%
17	Pathology-II	60	140	UE	80	40%	20	40%	50%	50	50%
	Total	**180**	**420**								

Total hours: 600

Practical including Oral, Spotters

V Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
18	Biochemistry -III	60	100	IE	80	20	50%
19	Microbiology -III	60	100	IE	80	20	50%
20	**Part A :** Pathology-III	60	100	IE	80	20	50%
	Part B : Transfusion Medicine - I	20	100	-	-	-	-
	Total	**200**	**400**				

Total hours: 600

Practical including Oral, Spotters

VI Semester:

Paper No.	Paper	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+
21	Biochemistry-IV	60	100	UE	80	40%	20	40%	50%	50	50%
22	Microbiology--IV	60	100	UE	80	40%	20	40%	50%	50	50%
23	Part-A : Pathology IV	60	100	UE	50	40%	15	40%	50%	30	50%
	Part-B: Transfusion Medicine -II	20	100	UE	30		5			20	
	Total	**200**	**400**								

Total hours: 600

Practical including Oral, Spotters

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 - MEDICAL LAB TECHNOLOGY COURSE

III Semester

PAPER – 12

Biochemistry-I :

1. **Biological Oxidation**:
   High energy compounds, Mitochondrial Electron transport. Inhibitors and uncouplers of oxidative Phosphorylation.

2. **Digestion And Absorption**:
   Digestion and absorption of carbohydrates, lipids, proteins

3. **Carbohydrate Metabolism**:
   Glycolysis, Pyruvate oxidation, TCA cycle, energetic of glucose oxidation. Glycogenesis, glycogenolysis, gluconeogenesis and their regulations. Glycogen storage disease, hormonal regulation of blood sugar. Brief account of Diabetes mellitus, GTT.

4. **Lipid Metabolism**:
   Beta oxidation, energetics of fatty acid oxidation, Fatty acid biosynthesis. Lipogenesis, ketosis. Basic idea on formation of bile salts and steroid hormones. Plasma lipoproteins. Starvation, obesity, fatty liver.

5. **Metabolism Of Amino Acids**:
   Deamination, decarboxyiation and trarisamination. Essential & non-essential amino acids. Metabolism of glycine, methionine and cysteine, phenylalanine, tyrosine

6. Radioactive Isotopes and their applications.

7. **General Laboratory Techniques & Procedures**:
   Water, reference materials, glassware & plastic ware, volumetric equipment, centrifuges, solutions, mixers & homogenizers, filtration & concentration, balances, units, buffers, safety

8. **Photometry**: Beer's law, colorimetry

Practicals :

1. Weighing of substances
2. Preparation of solutions- 1NHCl, 2/3NH2SO4, 0.9% Normal saline
3. End Point Assays : Total protein and albumin

PAPER – 13

Microbiology- I :

I. General Bacteriology :

1. History of Microbiology.
2. Classification of Micro organisms
3. Microscopes.
4. Structure of Bacterial cells.
5. Staining methods.
6. Growth & Nutrition of bacteria.
7. Culture media and culture methods – Aerobic, Anaerobic.

8. Biochemical Tests for identification.
9. Bacterial Metabolism.
10. Theory and practical aspects of sterilization, disinfection.
11. Bacterial genetics.
12. Molecular methods of Diagnosis : NAT.
13. Antimicrobial agents and resistance.
14. Antibiotic sensitivity tests.
15. Hospital waste management.
16. Quality control in Microbiology.
17. Laboratory safety.
18. Infection, source, Transmission.
19. Virulence factors and toxins.

II. Immunology:

1. Immunity : Types.
2. Innate Immunity.
3. Antigens and Antibodies.
4. Antigen – Antibody reaction : Agglutination, precipitation, CFT.
5. Specialized Techniques : RIA, ELISA, Immunofluorescence, Dot – Blot & Rapid assays.
6. Humoral Immune response and CMI.
7. Monoclonal antibody and hybridoma techniques.
8. Hypersensitivity reactions.
9. Autoimmunity, tumour immunity, transplantation.
10. Immunodeficiency: Primary, Secondary, AIDS.

PAPER – 14

Pathology - I :

Introduction to Pathology :

I. Histopathology :

1. Structure and functions of normal cell
2. Reception of specimens
3. Various fixatives – Mode of action, indications, preparation
4. Grossing- Preparation & Taking blocks
5. Steps of tissue processing and embedding
6. Use of microscopes – Light microscope, Polarizing microscope

II. Clinical Pathology :

1. Urine examination, physical, chemical and microscopic examination
2. Examination of Urine for occult blood

III. Haematology :

1. Blood collection
2. Anticoagulants used in hematology, Normal values in hematology
3. Basic hematological Techniques
4. RBC, HB, PCV, Red cell indices
5. Total and Differential counts absolute eosinophil count
6. Platelet count, ESR
7. Preparation of blood films stain used in hematology
8. Morphology of Red cells, leucocytes and Platelets
9. Preparation of Glass ware

IV. Cytology:

1. **Respiratory Tract**
   Anatomy, Histology and physiology of the respiratory Tract collections
   Characteristics of normal and malignant cytology
2. **Gastrointestinal Tract**
   Anatomy, Histology, Physiology of GIT
   Classification and preparation of samples
   Characteristics of normal and malignant cytology
3. **Urinary Tract**
   Anatomy, Histology and Physiology
   Collection and preparation of samples
   Urinary sediment cytology
   Body fluids(CSF, Pleural, Peritoneal)& cell counts
   Fixation and Fixatives in cytology
   Processing of samples in the laboratory
   Pap staining
   FNAC

IV Semester

PAPER – 15

Biochemistry – II :

1. **Non-protein Nitrogenous Compounds**:
   Urea, creatinine and uric acid - formation, excretion, normal value
2. **Iron, Porphyrins And Bile Pigments**:
   Chemistry of porphyrins, catabolism of heme. Disorders of porphyrin metabolism, hemoglobinopathies.
3. **Electrochemistry**:
   Potentiometery, voltammetry, amperometry, coulometry, conductometry, biosensors.
4. **Photometry**:
   Spectrophotometry, flame photometry, atomic absorption spectrophotometry
5. **Electrophoresis**:
   Definition, Principle, Basics, method, types, clinical applications including scrum protein electrophoresis, hemoglobin electrophoresis
6. **Function Tests** :
   Liver function tests, renal function tests, gastric function tests
7. **Toxicology**:
   Definitions, mechanisms of toxicity, factors influencing toxicity, detoxification, antidotes, drug interactions, medico legal aspects.

Practicals :

1. Measurement of Ph
2. Preparation of reagents- Benedicts, BCG, Jaffe's reagent, Phosphate buffer
3. End Point Assays : Urea, serum and urine creatinine, total & conjugated bilirubin, uric

acid.
4. Kinetic Assays : Alkaline phosphatase, Amylase
5. Normal urine analysis
6. Analysis of abnormal constituents in urine.
7. Serum protein electrophoresis, flame photometry : Demonstration

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Microbiology- II :

I. Systematic Bacteriology:

1. Gram positive cocci : Staphylococcus, streptococcus, Enterococcus.
2. Gram Negative cocci : Neisseria, Moraxella.
3. Gram positive bacilli : Corynelbacterium, Nocardia, Actinomyces, Bacillus, Listeria.
4. Gram Negative Bacilli : Enterobacteriaceae : E.coli, klelesiella, enterobacter, proteus pseuduomonas, vibrios, camphylobracter, brucella, haemophilus, bordetella, pasterella, francisella.
5. Anaerobic Bacteria : Clostridium, Gram negative bacilli.
6. Mycobacterium.
7. Spirochactes : Treponema, Borrelia, Leptospira.
8. Chalmydia, Mycoplasma, Rickettsia.

II. Bacterial Infections and Diagnosis:

1. Urinary Tract infection.
2. Respiratory tract infection.
3. Diarrhoeal diseases.
4. CNS Infections.
5. Wound Soft tissue and bone infections.
6. Blood stream infection.
7. Sexually transmitted infections.
8. Hospital acquired infections

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Pathology-II :

I. Histopathology :

1. Steps of tissue processing and embedding
2. Section Cutting
3. Mode of preparation and theory of H&E staining
4. Various aspects of mounting, staining the slides.
5. Theory of decalcification and various methods
6. Phase contrast microscope and Fluorescent microscope
7. Museum techniques
8. Quality control in Histopathology

II. Clinical Pathology :

1. Examination of body fluids(CSF, Pleural, Peritoneal), cell counts
2. Urine examination
3. Physical, chemical & microscopic examination
4. Semen analysis

III. Hematology:

1. Bone marrow: Technique of aspiration, preparation, staining, Bone marrow biopsy
2. Myeloperoxidase stain in bone marrow

3. Preparation of Buffy coat smears, Reticulocyte count, Toluidine blue stain for Reticulocyte
4. Laboratory methods used in the investigation of deficiency anemias
   a) B12 and Folate assay
   b) Schilling Test
   c) Serum Iron and Iron binding capacity
   Lab methods used in the investigation of Hemolytic anemias
   a) Osmotic fragility
   b) G6 P Deficiency
   c) Sickling Tests
5. HbF, Hb A2, Plasma hemoglobin, Haptoglobin,
6. Demonstration of Hemosiderin in Urine.
7. Hemoglobin electrophoresis
8. Test for auto immune hemolytic anemias
9. Abnormal Hb pigments
10. Automation in hematology
11. Organization and quality control in Hematology laboratory
12. QBC

IV. Cytology :

1. Bronchial aspiration and Brushing
2. Characteristics of normal, benign and malignant cytology

V. Gastrointestinal Tract :

1. Classification and preparation of samples
2. Characteristics of normal and malignant cytology
3. Urinary sediment cytology
4. Bladder irrigation cytology
5. Processing of samples in the laboratory
6. Pap staining
7. H& E Stain
8. MGG stain
9. Rapid staining for frozen & squash
10. Interventional Cytology
11. Imprint cytology
12. Sputum cytology
13. Crush / squash smear cytology
14. Biopsy sediment Cytology (cell block preparation)

V Semester

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Biochemistry- III :

1. Chromatography:
Definition, Principle, Basics, method, types, clinical applications.

2. Biostatist1cs:
Fundamental concepts, sampling distributions, measures of central tendencies and variation, regression and correlation, F-test, t-lest.

3. Photometry:
Flurometry, nephelometry, turbidimetry

4. Endocrine System:

Chemistry and classification of hormones, mechanism of action of hormones, hormones secreted by hypothalamic pituitary axis, thyroid, parathyroid, pancreas, adrenal, gonads, associated pathological conditions and function tests.

5. Water & Electrolyte Balance:

Body water compartments, osmotic pressure, regulation of body fluid osmolarity and volume, metabolism of water, sodium, potassium and chloride along with associated disorders

6. Acid Base Balance:

Acids, bases, oxygen and carbon dioxide homeostasis, acid base balance, acidosis, alkalosis

Practicals :

1. End Point Assays : Calcium, phosphorus
2. Kinetic Assays : LDH
3. Paper chromatography: Demonstration

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Microbiology- III :

I. Virology:

1. General Properties & Classification of Viruses
2. Replication of Virus
3. Lab : Diagnosis ofViral infections – Tissue culture, Cell culture
   Electron microscopy, Fluorescent tests
   Serology, PCR
4. Bacteriophage, phage typing
5. Viral vaccines, antiviral agents
6. Characteristics, mode of infection, spread, diseases and lab diagnosis of:
   a. Herpes viruses : HSV, VZV, EBV, CMV
   b. Adenovirus
   c. Papilloma virus
   d. Respiratory virus : Influenza, PIF, RSV, Rhinovirus, Mumps, Measles, Rubella
   e. Polio virus
   f. Rabies virus
   g. Important ambo viruses : Dengue, JEV, KFD, Chickunguniya
   h. HIV
   i. Hepatitis Viruses

II. Mycology:

1. Fungi – Characteristic, Classification, Lab Diagnosis
2. Cryptococcus
3. Dermatophytes
4. Subcutaneous Mycoses : Sporothrix, Mycetoma, Rhinosporidium
5. Dimorphic Fungi
6. Apergillus, Mycetoma

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Part A : Pathology – III :

I. Flow And Imaging Cytometry :

1. Methodology in Flow Cytometry
2. Imaging Cytometry – Principles, Equipment, Techniques of image analysis and evaluation.
3. Automated Cytology

II. Tissue Culture :

1. Equipment necessary for carrying out tissue culture studies
   i. Laminar Flow Equipment
   ii. Carbondioxide Incubator
   iii. Inverted tissue culture Microscope
2. Basic Procedure for preparation of glassware, Media etc. for tissue culture (Sterilization)
   i. Dry Heat sterilization
   ii. Autoclaving in an atmosphere of steam
   iii. Chemical sterilization
   iv. Fitter sterilization of liquid media etc.
3. Preparation of cell lines
   i. Enzymatic digestion of the tissue using Trypsin
   ii. Plating of cells in tissue culture media
   iii. Observation of cells in inverted Microscope
   iv. Subculturing and derivation of cell lines
4. Characterization of cell lines
   i. Determination of biochemical markers in cells
   ii. Chromosomal and DNA content of cells
   iii. Immunological properties of cells
5. Preservation of Immortalized cell lines
   i. Storage in glycerol in liquid nitrogen
   ii. Storage in Dimethyl sulfoxide in liquid nitrogen

III. Cytogenetics:

1. Human genetics: An introduction to the subject
2. Terminology, classifications and nomenclature of human chromosomes.
3. Methods for karyotypic analysis.
   a. Culture of one marrow, peripheral blood lymphocytes, solid tumours, skin fibroblasts etc.,
   b. Direct preparation from tumour material
4. Characterisation of human chromosomes by various banding techniques
5. Sex chromatin identification
6. Karyotyping and analysis of chromosomal abnormalities
7. Common chromosomal observations observed in cancer, mechanisms of their production and role of oncogenes
8. Photomicrography in cytogenetics.

IV. Frozen Sections And Cryostat :

1. Frozen Sections:
   a. Freezing Microtome
   b. Frozen Section Technique

2. Cryostat:
    a. Types
    b. Operation of cryostat
    c. Cryostat Cut sections

V. Instrumentation :

1. Freezing Microtome
2. Cryostat
3. Photographic equipment
4. Automation in pathology (Cell counters etc)
5. Application of Computers in Pathology

Part B : Transfusion Medicine – I :

Hemorrhagic Disorders:

1. Mechanism of coagulation
2. Collection and anticoagulants used in coagulation studies
3. Bleeding time and clotting time
4. Other coagulation studies PT, KPTT etc.
5. Assay of clotting factor
6. Test for blood fibrinolytic activity and detection of FDP
7. Platelet count
8. Platelet function tests.
9. LE Cell

VI Semester

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Biochemistry – IV :

1. **Osmometry**:
   Osmosis and osmometers
2. **Immunoassays**:
   Principle, Basics, ligand binding immunoassays including RIA, ELISA & CLIA.
3. **PCR**:
   Principle and applications of polymerase chain reaction (PCR).
4. **Analytical Goals**:
   Precision and accuracy, bias, sensitivity and specificity
5. **Method Evaluation**:
   Purpose, selection of method, laboratory evaluation, example/study.
6. **Total Quality Management**:
   Fundamental concepts, control of preanalytical, analytical and postanalytical variables, internal and external quality control programs.
7. **Automation**:
   Definition, instrumental concepts, auto analyzers, selection of instruments, trends in automation.
8. **Computers In Clinical Chemistry**:
   Laboratory information systems.

Practicals :

1. **End Point Assays**: Glucose, cholesterol, urinary proteins, CSF-protein and glucose.
2. **Kinetic Assays** : SGOT, SGPT, CPK, CPK-MB
3. **Immuno Assays**: Ferritin, PSA - Demonstration
4. **Method evaluation**: Within run precision for Glucose, Urea standard curve
5. **Spotters** : LJ charts, GTT, LFT, RFT, Reference ranges

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Microbiology- IV :

Parasitology:

1. Types of parasites, classification of protozoa and Helminths.
2. Collection, preservation and processing of stool specimen.
3. Examination of blood parasites : Methods.
4. Basic structure, Life history, forms seen in clinical specimen and Lab diagnosis of
   a. Protozoa: Entamoeba, Giardia, Trichomoras, B.Coli, Trypanosomes, Leishmania, Plasmodium, Toxoplasma, Isospora, Cryptosporidium, Microsporidium.
   b. Helminths : Ascaris, Hookworms, strongyloides, Trichinella, Enterobius, Trichuries, Filarial worms, Guinea worm, Taenia, Echinococcus, Hymenolepis, schistosona, Diphyllobothrium, paragonimus.
5. Roles of Arthropds in disease transmission.
6. Mosquito Borne Diseases, morphology of anopheles, culex, aedes mosquitoes.

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Part A : Pathology- IV :

I. Immuno Histochemistry & Immunocytochemistry :

1. Introduction
2. Overview of immuno histochemistry
3. Applications of Immuno histochemistry
4. Basic concepts of Immunohistochemistry
5. Monoclonal antibodies and their preparations
6. Fluorescent reactions
7. PAP Technique – principle, preparation of reagents and procedure
8. Immunocytochemical methods (immuno peroxidase and immune aniline phosphatase etc.)
9. In Situ Hybridization
10. Immunofluorescence

II. Special Stains :

1. Carbohydrate stains
2. Periodic Acid Schiff, ALPAS, Mucicarmine
3. Muscle stains
4. Massons Trichrome, PTAH
5. Neural stains
6. Luxol fast blue, Eriochrome cyanine, Glees stain
7. Connective tissue fibres stain

8. Jones, MSB, Van Gieson, Reticulin, Verhoeff's stain
9. Organisms
10. Zn stain, Fite Ferraco stain, Warthin Starry stain
11. Pigments, mineral
12. Schmorl's, Vonkossa, Melanin Bleach, DOPA, Massons fonata,
13. Perls Prussian blue stain
14. Fat stains
15. Sudan Black, Sudan III, Oil red O stain
16. Congo red stain

PART B : Transfusion Medicine – II :

Blood Transfusion and Immuno-Haematology :

1. ABO Blood Group System
2. Rh typing and weaker variants in Rh system
3. Subgroups and weaker variants of A and B Bombay Phenotype
4. Preparation and standardization of Anti Human Globulin reagent
5. Coombs test
6. Blood grouping and cross matching in blood bank
7. Investigations of transfusion reactions
8. Care and selection of donors
9. Role of Australia Antigen in Blood Transfusion
10. Screening for Australia Antigen
11. HLA Antigens and their significance in Blood transfusion
12. Preservation of blood, principles and its application in blood banking
13. Component therapy in clinical practice
14. Screening the blood for infective material
15. Blood Bank Administration

Reference Books :

I. Biochemistry:

1)Textbook of Biochemistry – U Satyanarayana
2) Clinical Chemistry – TEITZ
3) Chemical Chemistry – KAPLAN
4) Textbook of Laboratory Medicine – Praful Godkar
5) Varley's Clinical Chemistry – IV Edition

II. Microbiology:

1)Text book of Microbiology – Ananthanarayan & Panikar
2) Text book of Microbiology – Prof. C.P.Baveja
3) Text book of Medical Parasitology – CK Jayaram Panikar
4) Text Book of Practical Microbiology – Dr. S.C. Parija

III. Pathology:

1)Text Book of Pathology by Harsh Mohan
2) Practical Haematology by DACIE & LEWI'S
3) Haematology practice by Dr. Tejendra Singh
4) Histopathology Techniques by Bancraft
5) Clinical Diagnosis and laboratory methods by Todd & Sanfort

IV. Transfusion Medicine:

1) R.N. Makroo's compendium of Transfusion Medicine

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

7. B.Sc Nuclear Medicine Technology (NMT)

(Semester pattern)

w.e.f 2015-16 Batch

TEACHING HOURS & EXAMINATION PATTERN

III Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Nuclear Medicine physics & instrumentation-I	80	120	IE	80	20	50%
13	Radiopharmacy, Radiation Biology and Radiation Safety -I	80	120	IE	80	20	50%
14	Nuclear Medicine Techniques and procedures -I)	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester :

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+Practical)
15	Nuclear medicine physics and instrumentation -I I	80	120	UE	80	40%	20	40%	50%	50	50%
16	Radiopharmacy, Radiation Biology and Radiation Safety - II	80	120	UE	80	40%	20	40%	50%	50	50%
17	Nuclear Medicine Techniques and procedures -I I	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters, Records on Basic Recording of EEG, nerve conduction and evoked potential.

V Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
18	Nuclear medicine physics and instrumentation - III	80	120	IE	80	20	50%
19	Radiopharmacy, Radiation Biology and Radiation Safety - III	80	120	IE	80	20	50%
20	Nuclear medicine techniques and procedures - III	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	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)
21	Nuclear medicine physics and instrumentation - IV	80	120	UE	80	40%	20	40%	50%	50	50%
22	Radiopharmacy, Radiation Biology and Radiation Safety - IV	80	120	UE	80	40%	20	40%	50%	50	50%
23	Nuclear medicine techniques and procedures - IV	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters, Record on Advanced Recording of EEG, nerve conduction and evoked potential

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 - NUCLEAR MEDICINE TECHNOLOGY

III Semester

PAPER - 12

Nuclear Medicine Physics And Instrumentation - I :

Unit 01 : Basics for handling of computers in nuclear medicine

Personal computer and specialized computers/ workstations in Nuclear Medicine.
Hardware and software in work stations.
Input and output devices. Types of memories and storage devices.
Concept for nuclear medicine scintigraphy, image formation, matrix size, picture element, vox cell element, grey scale, color scale.
Nuclear Medicine image hard copies, glossy prints, paper prints etc.,
X-Ray films, types, basic film structure & quality, choosing films for different studies, film processing techniques: dry and wet processing, manual and automatic.
Wet film, processing solutions. Film processing rooms, film processing equipments.

Unit 02 :

Elementary introduction to structure of matter, elements, compounds and mixtures, molecules and atoms. Atomic & Nuclear structures, Atomic models, Periodic table, simple ideas of quantum mechanics, Mass energy equivalence, fluorescence, Phosphorescence, luminescence, electromagnetic spectrum.

Unit 03 :

Electricity, Magnetism and Electromagnetic induction: Electricity in ionized gases-electric charges-electric induction- Coloumb law-unit of charge-resistance-ohms law-electric power-Joules law. Magnetism-magnetic properties-electromagnetic effect-electrical instruments like Voltmeter, Ammeter & Multimeter. Transformer, transistor, rectifier, pre amplifier, pulse amplifier, power supply, circuits. Filters and their types.

Unit 04 :

Atomic structure, atomic number, mass number, isotopes, radioisotopes, radioactivity, specific activity, types of radioactive disintegrations, electron capture, characteristics of alpha, beta and gamma rays, energy ionizing radiation, half-life (Physical, Biological), effective half life, isomeric transitions, secular, transient and no-equilibrium, production of radioisotopes and X-rays (characteristic and Bremsstrahlung), neutron sources.

Discovery of radioactivity, Natural & Artificial Radioactivity, Isotopes and nuclides, binding forces between nuclear particles, types of radiation, alpha, beta particles and gamma radiation.

Unit 05:

Mechanisms of radioactive decay, decay scheme for important radio isotopes used in nuclear medicine. Interaction of X-rays & γ-rays with matter - Radiation intensity & exposure - radiation dose - Radiation quality – law of exponential attenuation – half value thickness, tenth value thickness – linear attenuation coefficient – Scattering – photoelectric effect – Compton-scattering – pair production – particle interactions – total attenuation coefficient-relative clinical importance.

Books for Study :

1. Physics in Nuclear Medicine – Simon Cherry, James Sorenson & Michael Phelps.
2. Basic Medical Radiation physics: Stanton
3. Medical Radiation Physics – William R. Hendee.
4. Basics of Computers and Image hard copy production in Nuclear Medicine.
5. Computers in Nuclear Medicine –A practical Approach – Kai.H.Lee
6. Computer Fundamentals-concepts, systems & Applications – D.P Nagpal
7. Effective use of computers in Nuclear Medicine: Michael J.Gelf and Stephen.RThomas.
8. Radiographic Latent Image Processing – W.E.J. McKinney
9. General principles of Hospital practice and care of patient
10. Anatomy & Physiology for nurses.
11. Ramesh Chandra; physics in Nuclear Medicine.

PAPER - 13

Radiopharmacy, Radiation Biology and Radiation Safety - I :

1. Basics of radiation chemistry :

(a) Atomic and molecular structure (b) Bonding: Electrovalent, covalent, Dative covalent bond and hydrogen bonds (c) Valency, Atomic wt., -Molecular wt -Normality and molarity of solution, (d) Acids and Bases - Hydrogen Ion concentration - pH value - The role of pH in the preparations of radiopharmaceuticals -(e) chemical reaction - solute - Solvents - Solubility - crystallization - (f) The chemical elements which are necessary for life (carbon - Hydrogen, oxygen and nitrogen, Phosphorous, Iron etc.). (g) Fundamental chemistry of carbohydrates and carbonyl groups (h) - Oxidation and Reduction (i) proteins and amino acids. Lipids and profiles. Enzymes - vitamins, Hormones.

2. Basic in Laboratory Techniques

(i) Laboratory glassware (ii) Washing and autoclaving of glassware for the use in Radio-pharmacy areas (iii) Correct use of Pipettes, Balance, Centrifuge, gloves, syringes, vacuum vials, saline bottles, elution vials etc. (iv) hot lab tools for safe handling of active vials and syringes.

Radio isotope receipt, storage and log book entries in radio pharmacy laboratory. Radio active and non radio active waste, segregation active and non active waste in nuclear medicine laboratory, segregation of glass and plastic material, common methods of safe disposal of radio-active waste in nuclear medicine, permissible limits of waste disposal for various radio nuclides used in nuclear medicine. International symbols of radioactivity labels.

3.Tracer methods :

Behavior of radioactive tracers in biological process - characteristics of radio pharmaceuticals - Half life, Physical, Biological and effective half life. Dispensing of radio pharmaceuticals - Specific activity, Tracer dose preparation - Tracer dose administration etc.

4. Radiation Biology and safety:

Interaction of radiation with cell, direct and indirect interactions, mechanism of radiation damage in living cells, tissue/organ damage, pre-natal effects, radiation modifying factors.

5. Radiation Quantities and Units :

Activity(Becquerel/Curie), energy, exposure (C/kg/Roentgen), LET, charged particle equilibrium (CPE), air kerma, absorbed dose (Gray/Rad), radiation weighting factors(WR), tissue weighting factors (WT) equivalent dose (Sievert/Rem), effective dose(Sievert/Rem), Collective Effective dose (Person Sv), Annual Limit of intake {ALT} (Becquerel), Derived Air Concentration {DAC} (Becquerel/m3).

Books for study :

Textbooks :

1. The handbook of Radio pharmaceutical -Mohan Patel & Samij Sadack, Chapman & Hall Medicals, London.
2. Technetium 99m radiopharmaceuticals. Preparation and quality control by Ilse Zolle, Springer.

Reference books :

3. Fundamentals of Nuclear Pharmacy-Gopal B. Saha, Springer-Verlag, New York.
4. Nuclear Medicine Technology & Techniques-Donald R. Bernier , Paul E. Christian & James K. Langan Mosby.
5. Radiobiology for the radiologist. Eric J Hall. J B Lippincott company.

PAPER - 14

Nuclear Medicine Techniques and Procedures - I :

I. Techniques :

This section will emphasize the students to learn the special and necessary care to be taken for a patient who will come to the nuclear medicine investigation or therapy. After initial interaction he will learn the method to study the available records, drug history, previous investigations and treatment related details for executing the test with optimal preparation. He will also learn some of the tests performed for assay of hormones.

1. Ordering nuclear medicine procedure-

Checking relevant patient data in the request, scheduling the procedures by giving appointments, study based proper instructions, pre test preparation for the procedures to the out patients as well as the in patients through the written appointments.

2. Preparation of the patients before the procedure :

Identification of patient by checking data (Name, age, gender, unique hospital ID No, name of referring physician, Referring unit etc before take the patients for the nuclear medicine procedure. Precautions to avoid confusion in patient selection, misadministration etc.

3. Check the patients about their previous medications :

Related drug history, especially for thyroid studies, renal studies for patients with RAS problem. Patients (female) should be checked for early pregnancies before starting any radioactive procedure. Patients also should be checked for the sensitivity for any particular medicine or dye or any contra indication for the particular study. e.g. Pulmonary hypertension is contra indication for Lung perfusion studies.

4. Care of Patients :

During the Nuclear Medicine Procedure: regarding the care to be taken while Transferring the patients from the wheel chair or stretcher to the treatment couch especially the bone scan patients with spine metastasis and lung scan patients connected with oxygen cylinders, Post renal Tx patients with IV line and drain tubes. etc neuro patients under coma stage or with epileptic convulsions or children care regarding using the immobilizing devices etc. Build confidence to take all necessary steps before starting the NM procedures.

II. Procedures :

This section is intended to educate the students about the physiology of different system in human body in brief and also about the different pathological conditions occur in various systems and their indications for the need of Nuclear Medicine Procedures in an elaborate manner to the best of the ability.

1. Diagnostic – In vitro techniques:

Principles of Radio immunoassays (RIA) standard curve, data analysis, Quality Control (QC) and applications, Methods of receptor assays, hormones, drugs. IRMA Immuno-radiometric assay, ELISA, RIA, estimation, T3, T4, TSH, thyroid antibodies, and current applications using similar techniques.

2. In vivo techniques:

Non imaging procedures. General Principles and procedures of non-imaging techniques, Tracer dose, uptake studies, compartmental analysis in radio nuclide studies, volume dilution studies.

3. Urinary tract:

Anatomy and physiology, common pathological conditions affecting kidneys in pediatric and adults, Radio pharmaceutical, dosages, route of administration, patient preparation, data acquisition, processing, quantitative parameters GFR, ERPF, split function, T max, T half, types of renogram curves, pharmacological interventions. Native kidney Renogram study, Evaluation of Reno vascular hypertension, Transplant kidney scintigraphy. Radionuclide cystography, Radio pharmaceutical & imaging techniques. Scrotal scintigraphy: Radio pharmaceutical, dosimetry, methodology. Renal cortical imaging, procedure, RP doses, imaging protocol, common views, utility of pin hole and SPECT images.

4. Heptobiliary scintigraphy:

Anatomy and pathology. Radio pharmaceutical, patient preparation, dosimetry, dynamic flow, static imaging procedures, applications. Hepatic artery perfusion scintigraphy.

5. Liver, spleen scintigraphy:

Pathology, basis of scintigraphic localization – Patient dosage, Procedures, Patient preparation, applications. 99mTc Heat damaged - RBCs - basics of Tagging procedure dose administration - Imaging procedure.

Books for study :

1. Nuclear Medicine Technology & Techniques, -Donald R. Bernier, Paul E. Christian & James K. Langan Mosby
2. Care of the patient in diagnostic radiology, Chesney & Chesney Blackwell
3. Notes on radiological emergencies Ansell, Churchill
4. A guide to Oncological nursing Deeley Livingstone

5. First aid (Hamlyn) Haugher & Gardner, Hamlyn
6. Care of the injured, Ring Livingstone
7. Practical Nursing and first aid -Ross & Wilson, Livingstone
8. Hand book of Nuclear Medicine – Frederick L Datz and
9. Essentials of Nuclear Medicine Imaging – Fred A Mettler , Milton J Guiberteau.

IV Semester

PAPER – 15

Nuclear Medicine physics and instrumentation *- II :*

Unit 01 :

1. Interaction of Radiation with Matter

Interaction of charged particulars with matter, interaction of neutrons with matter, range of charged particles, interaction of photons with matter (photoelectric, Compton and pair production), absorption and attenuation of photons, Half Value Thickness (HVT) and Tenth Value Thickness (TVT).

2. Operational Limits

Introduction to natural background radiation, concept of occupational risk, philosophy of radiation protection, system of dose limitation, ALARA, dose limits to radiation workers and general public, AERB/CRP/ national regulatory guidelines, dose constraints for comforters of patients.

Unit 02 :

1. Basics of radiation detectors:

Construction and Principles of Operation – Ionization Chamber, Isotope calibrator – Proportional Counter – Geiger muller counter – Voltage calibration of a Geiger Mueller tube, optimum operating condition – Dead time correction – Uses of Gas – filled detectors – Semiconductor detectors.

2. Scintillation detector: Thallium activated Sodium Iodide crystal – Photo multiplier tube, electron multiplication, high voltage supply, Shielding, collimators, field of view. Well counter, construction, design of shielding. Signal output, Pre amplifier: reasons for use of Voltage amplifier, liquid scintillation detector.

Unit 03 :

Tools and techniques for demonstration and processing of Gamma rays signals:

1. Spectrometer:

Basic principles of Pulse – height analyzer single channel and Multi – channel analyzers. Optimum operating conditions, window settings – Determination of gamma energy spectrum, Integral and differential counting. Spectra of commonly used radio nuclides e.g I131, Tc99, Cr51, Cs137. Radiation measurements.

2. Gamma camera:

Camera head construction and principle of operation, Collimators: parallel hole, high resolution, high sensitivity, pin hole, diverging & converging hole, slant hole. Scintillation crystal, optical coupling, Photo multiplier tubes, per amplifiers. Pulse height analyzer, Timer, Data Processor and their function. Application of Cathode ray tube, persistence scope. Resolving time

characteristics, Gamma camera Uniformity and intrinsic resolution, Sensitivity, Total – system resolution, Spatial volume resolution saturation.

Unit 04 :

Radiation detection and working principle of Nuclear medicine equipments:

Principal of radiation detection, gas detector (ionizing chamber, proportional counter and GM counter), solid state detector (scintillator, semiconductor and Thermoluminescent Dosimeter {TLD}), liquid scintillation counting systems, radiation monitoring instruments, personnel monitoring, area monitoring, environmental monitoring, direct reading devices, calibration and response of radiation monitoring instruments. Working principle of isotope calibrators, Planar Gamma Camera, SPECT gamma camera.

Books for study :

1. Physics of Nuclear Medicine, - James A. Sorenson & Michael
2. Nuclear Medicine and PET CT, technology and techniques. By Paul E Christian and Kristen M. Waterstram, publisher (Mosby Elsevier)

Reference books :

1. Nuclear Radiation Detection – William J. Price, McGraw – Hill Book Company.
2. Principles of Nuclear Medicine – Henry N. Wagner, W.B. Saunders company, London.
3. Principles and practice of Nuclear Medicine, Paul J. Early, D. Bruce Sodes. C.V. Mosby company Princeton.
4. Instrumentation in Nuclear Medicine – Gerald J. Hine.
5. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.

Practicals :

1. Loading and development of x ray film.
2. Preparation of paper hard copy of a Nuclear procedure.
3. Preparation of CD of given image in JPEG format and DICOM format.
4. Handling of a radiation survey meter.
5. Identification of a dosimeter, specific applications, radiation/clinical importance and safe handling in Nuclear medicine.
6. Identification of a shielding device, specific application radiation/clinical importance and safe handling in nuclear medicine.
7. Identification of a non shielding protective device, specific application, radiation/clinical importance and safe handling in nuclear medicine.
8. Plateau of G M counter.
9. Dead time and resolving time of G M counter.
10. Radiation exposure: effect of time, distance and shielding.
11. Radiation survey of nuclear medicine lab.

PAPER – 16

Radiopharmacy, Radiation Biology and Radiation Safety-II :

1. Isotope generators:

Production of radio nuclides by artificial methods (b) Accelerator produced radio nuclide (c) Nuclear reactor produced radio nuclides, construction and Principles of generator systems - Ion Exchange system - Solvent extraction system - Parent - daughter relationship-growth of daughter product equilibrium with parent elements etc. Chemistry of Tc99m, Mo99-Tc99m generators Mo99 contamination check, Aluminum break through test etc (f) sterilization.

2. Radiopharmaceuticals:

Principles of cold kits & lyophilisation, importance of lyophilisation in preparation of cold kits. Common pharmaceutical cold kits, contents, pharmacological properties, physiological principle in use of a particular cold kit, pediatric and adult doses, route of injection, route of excretion, radiation exposure, critical organ for DTPA, GHA, DMSA, MDP, macro aggregated albumin, sulphur colloid, MIBI, Tetrofosmin, Mebrofenin, etc. (c) Labeling procedure of cold kits with required radio isotopes, Quality control tests: RC purity, RN purity, sterility check, Chromatography (Various methods) pyrogen test, bio distribution studies.

3. Radiation Biology and safety :

Chromosomal aberration, deterministic and stochastic effects, partial body and whole body exposures. Acute radiation syndrome. Radiation sensitizers. Radiation Protectors.

4. Radiation Hazard Evaluation and Control:

Internal and external radiation hazards and their perspective, evaluation and control of hazard due to external radiation, individual and workplace monitoring – time, distance and shielding, specific gamma ray constant, external radiation monitoring, survey meters, internal hazard evaluation and control, protective measures for handling unsealed sources(eg. fume-hood, glove box), air contamination monitoring, personnel contamination monitoring and decontamination procedures, surface decontamination procedures.

5. Radiation Accidents, Case Studies and Lessons Learned: Radiation accidents involving radioisotopes, orphan and vulnerable sources, handling of emergency situations resulting from spillage of radiopharmaceuticals / liquid radioisotopes, misadministration of radiopharmaceuticals and its consequences, general methods of prevention of accidents, loss of radioisotope, fire accidents and explosions; follow up actions through emergency response plans, case studies and mitigation, lessons learned.

Books for study :

Textbooks :

1. The handbook of Radio pharmaceutical -Mohan Patel & Samij Sadack, Chapman & Hall Medicals, London.
2. Technetium 99m radiopharmaceuticals. Preparation and quality control by Ilse Zolle, Springer.

Referencebooks :

3. Fundamentals of Nuclear Pharmacy-Gopal B. Saha, Springer-Verlag, New York.
4. Nuclear Medicine Technology & Techniques-Donald R. Bernier , Paul E. Christian & James K. Langan Mosby.

Practicals :

1. Elution techniques of generator (solvent extraction / column generator).
2. Determination of 99Mo breakthrough in a fresh eluted specimen of 99mTc -pertechnetate.
3. Determination of Half life of given radio isotopes.
4. Daughter and parent relationship of radioactive decay and radionuclide.
5. Gamma ray spectrometry calibration, spectrum, energy resolution, linearity.
6. Identification of unknown radionuclide and check the activity.
7. Preparation of different radio pharmaceuticals for Gamma camera Imaging.
8. Dispensing of low dose from bulk supply, radiation safety precautions.

PAPER - 17

Nuclear Medicine Techniques and procedures – II :

I. Techniques :

This section will emphasize the students to learn the special care of patient referred for nuclear cardiology test. Apart from this he will learn how to perform a scintigraphic test in a patient reported with intervention in the form of a catheter or drainage tube, without disturbing the same. Learn preparation of a renal transplant patients and thrombo embolic disorder patients.

1. Nuclear cardiology techniques and patient care:

In NM department, arrangement and operational use of TMT machine, ECG monitors, Defibrillator, emergency drugs, infusion pump etc. Preparation of patient, for cardiac study, flushing of IV lines, proper heparinization of I V canulae, quality check methods of I V fluids, safe techniques to prepare I V lines and fluids.

2. Preparation of the radioactive tracer for the study-

Selecting the appropriate tracer for the particular study should be assayed before use and to be properly labeled and to be kept within the lead shielded container. Usage of the gloves and over coats during the dispensing of the radio active tracer. Proper tray should be used during the transporting the tracer from the hot room to the injection room. And should be administered carefully and properly in the vein or required spot without causing any extra vasation and the management of the local hemorrhage and swelling.

3. Care of seriously ill patients:

In this student will understand the structure and function of inserted tube of clinical importance and perform the nuclear scintigraphy without disturbing it. Urinary catheters, surgical dressing, chest tube, PCN tube etc. and also learn to insert feeding tube and urinary catheter. Learn handling of patients referred with Cardiac monitors, central venous pressure line, with oxygen and other life support equipment. Assist in management of seizure patients, vaso vagal attack patient and cardiac arrest patients.

4.Speciman collection

in a safe manner and properly label them and store in a proper place for counting or sampling - safety precautions to be followed during the sampling of radio active specimen and precautions to be followed while disposing the same. Care regarding the disposal of contaminated swabs syringes and needles etc.

II. Procedures :

1. Endocrine system:

Thyroid: anatomy, physiology and different pathology. Radionuclide imaging of thyroid gland, patient preparation, drug interaction, radio pharmaceuticals, doses, precautions, indications and contraindications. Image acquisition, image processing, uptake studies procedure, interventions in thyroid imaging.

Imaging of thyroid cancer patients, patient preparation, important instructions, radio tracer administration, imaging protocols, data acquisition and processing, hard copy preparation. Parathyroid scintigraphy, adrenal cortical scintigraphy, principle, patient preparation, imaging protocol, imaging technique, data acquisition and processing.

2. Skeletal system:

Bone: Pathology of bone diseases, indications for scintigraphy -patient preparation-Radio active tracer doses and their administrations, Imaging techniques- whole body sweep, spot views, iso-count and iso-time studies, three phase & four phase bone scans - care to be taken while handling patients with bone fractures-applications. Bone marrow scintigraphy: Radio pharmaceutical used, technique Measurement of bone mineral density, technique & applications.

3. Respiratory system:

Pathology of respiratory diseases-Indication for scintigraphy.-Perfusion studies - Patients preparation - radio pharmaceuticals and dose administration-precautions to be followed and drugs to be kept for any anaphylactic reactions- contraindication for the procedure. Ventilation studies --Radio pharmaceuticals - Aerosols - inhalation procedures - Imaging procedures - precautions to be followed during inhalation of Aerosols.

4. Gastrointestinal tract:

Anatomy and pathology, Esophageal transit study- Radio pharmaceutical dosimetry, technique & analysis. Gastro esophageal reflux- Radio pharmaceutical dosimetry, technique & analysis. Gastric emptying- radio pharmaceutical dosimetry, technique & analysis. Gastrointestinal bleed scintigraphy: Radio pharmaceutical, dosimetry, methodology including RBC tagging procedures, Meckels' scintigraphy- Radio pharmaceutical, patient preparation. Pancreatic imaging: Radio pharmaceutical, dosimetry, methodology

5.Liver, spleen scintigraphy:

Pathology, basis of scintigraphic localization - Patient-Dosage- Procedures-Patient. Preparation, applications. 99mTc Heat damaged - RBCs - basics of - Tagging procedure dose administration - Imaging procedure.

Books for study :

1. Nuclear Medicine Technology & Techniques, -Donald R. Bernier, Paul E. Christian & James K. Langan Mosby
2. Care of the patient in diagnostic radiology, Chesney & Chesney Blackwell
3. Notes on radiological emergencies Ansell, Churchill
4. A guide to Oncological nursing Deeley Livingstone
5. First aid (Hamlyn) Haugher & Gardner, Hamlyn
6. Care of the injured, Ring Livingstone
7. Practical Nursing and first aid -Ross & Wilson, Livingstone
8. Hand book of Nuclear Medicine – Frederick L Datz and
9. Essentials of Nuclear Medicine Imaging – Fred A Mettler , Milton J Guiberteau.

Practicals :

1. Image acquisition and processing for a given dynamic /static study.
2. Gamma camera Patient positioning, Image acquisition and display (planar/ dynamic/whole body study) for a given patient.
3. Preparation, positioning, image acquisition and processing for MUGA scan.
4. Patient preparation, pharmaceutical administration, vital monitoring, precautions, image acquisition in a hypertens.

V Semester
PAPER - 18

Nuclear Medicine Physics And Instrumentation – III :

I. Mathematical application and counting statistics:

Basic mathematics covering integration, disintegration, vector, function, radioactivity calculations, use of various types of graphs to display or represent the radioactivity calculations (linear, semi log, logit-log, Log-Log etc).

Types of measurement error, Precision and Accuracy, Nuclear counting statistics, Mean, Mode, Median, Poison, Normal (Gaussian) distribution, Standard deviation, coefficient of variation, Probable error, confidence limits, Percent standard deviation, Statistical tests. – Chi – square test, Figure of Merit test, students " t" test.

II. Radiation dosimetry

Compartmental Model – single compartment model, two compartment model with and without back transference; in-vivo dosimetry using classical dosimetry mechanism, beta dosimetry, gamma dosimetry, geometrical factor, dosimetry of low energy electromagnetic radiation, MIRD formulation – cumulated activity, equilibrium absorbed dose constant, absorption factor, specific absorbed fraction and the dose reciprocity thereon, mean dose per cumulated activity, limitation of MIRD method; extremity dosimetry.

III. Quality assurance of Nuclear Medicine equipments & general maintenance of the department:

New equipment purchase and installation: Technical specification and selection process of equipment, site preparation and installation**,** Acceptance test during installation.

Routine daily checks for prevention of physical damage and malfunctioning of equipment by performing - checking of power line - Air conditioning efficiency - dust free atmosphere. Equipment Log book. Approach to resolve a detected technical / functional problem in system– Making the availability of service as and when required, procurement of comprehensive annual maintenance contract and preventive periodical maintenance. – importance of routine and periodical quality control study of different equipment.

Gamma Camera QC tests: concept, types of tests, recommendations, with reference to

Flood checks, linearity-uniformity, dead time, resolution. QC of dose calibrator at installation, routine and after major repair. Routine departmental survey for to document the level of radiation in restricted and un restricted areas. Periodic calibration schedule of important equipment.

Books for study :

Textbooks :

1. Quality Control of Nuclear Medicine Instruments, International Atomic Energy Agency
2. Physics of Nuclear Medicine, - James A. Sorenson & Michael
3. Nuclear Medicine and PET CT, technology and techniques. By Paul E Christian and Kristen M. Waterstram, publisher (Mosby Elsevier)

Referencebooks :

1. Principles and practice of Nuclear Medicine, Paul J. Early, D. Bruce Sodes. C.V. Mosby company Princeton.
2. Instrumentation in Nuclear Medicine – Gerald J. Hine.
3. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.
4. Quality Control of Gamma Cameras and Associated Computer Systems, The Institute of Physical Sciences in Medicine
5. Quality Control of Nuclear Medicine Instrumentation, The Institute of Physical Sciences in Medicine.
4. "Quality Control in diagnostic imaging"-J.E. GRAY, University Park Press.
5. "Processing and Quality Control "William, E.J. Mckinney.J.B. Lippincott Company.
6. "Concepts in Medical Radiographic imaging"Marianne Tortoice,W.B. Saunders Company.
7. "Quality assurance Management"G.E. Hayes Charger production.
8. Diagnostic Imaging: Quality Assurance M.M. Rehani, Jaypee Bros Medical Publishers.
9. IAEA TECDOC.
10. NEMA standards.

PAPER - 19

Radiopharmacy, Radiation Biology and Radiation Safety –III :

I. Radiopharmacy:

Basic concept of good manufacturing practice (GMP). Preparation of common radiopharmaceuticals (RP) used in Nuclear medicine department to perform thyroid, bone scan, renal, hepato-biliary tract, lymphoscintigraphy etc. Performance of routine tests to assess the quality of radiopharmaceutical prepared for radionuclide scintigraphy. Basic concept for physiological and biological localization of a radio pharmaceuticals in a organ system.

II. Radiation Biology:

Effect of radiation on Biological system, induction of Radiation injury, effect of dose fractionation on tissue repair, somatic and hereditary effects of radiation, effects of radiation on embryo, normal and abnormal human exposure to radiation, maximum permissible levels, Choice of Radiopharmaceutical for the clinical situation and the equipments.

III. Radiation Safety:

1. Radionuclide Therapy-Radiation Safety Aspects

Radionuclide administration techniques, pre-and post-therapy precautions, nursing care, patient monitoring and discharge criteria, optimization of radiation dose to non-target tissues, radiation safety consideration in treatment of Ca-thyroid, palliative bone metastases, and other therapeutic procedures such as radiation synovectomy, peptide therapy.

2. Emergency Response Plans and Preparedness

Normal and potential exposures, accident situations involving radioisotopes, elements of emergency planning and preparedness including procedures for notification and communication, emergency response accessories, responsibilities of employer, licensee, RSO, technologist and radioisotope / equipment supplier.

3. Disposal of Radioactive Waste

Origin and types of waste, classification of wastes and methods of disposal, disposal of short- lived solid, liquid and gaseous radioactive waste, disposal of animal carcasses and radioactive foliage, disposal limits for ground burial and sanitary sewage system, incineration, disposal of long-lived and in dispersible radioactive wastes.

Books for study :

Textbooks :

1. The handbook of Radio pharmaceutical -Mohan Patel & Samij Sadack, Chapman & Hall Medicals, London.
2. Technetium 99m radiopharmaceuticals. Preparation and quality control by Ilse Zolle, Springer.

Referencebooks :

3. Fundamentals of Nuclear Pharmacy-Gopal B. Saha, Springer-Verlag, New York.
4. Nuclear Medicine Technology & Techniques-Donald R. Bernier , Paul E. Christian & James K. Langan Mosby.

PAPER – 20

Nuclear Medicine Techniques and Procedures - III :

1. Central nervous system:

Brain: Anatomy and brief physiology, different pathology and indications for scintigraphy. Conventional brain scintigraphy- radio pharmaceuticals, dose & dosimetry, patients preparation, precaution to be taken with post operative patients, epileptic patients, brain secondaries. Cerebral perfusion imaging: radio pharmaceuticals, dose & dosimetry, patients preparation, Cisternography, indication, :radiopharmaceuticals dose & dosimetry, methodology. Scintigraphy for CSF leak.

2. Cardio vascular system:

Anatomy and pathological conditions, Indications for studies. Cardiac cycle, ECG, Terminology of cardiac cycle - diastole - systole - diastolic volume - stroke volume cardiac output, Ejection Fraction - Pulmonary Transit time, Hypokinesia - akinesia - diskinesia etc. Dynamic study-first pass study: Purpose - radio nuclide - dosage - Bolus Injection - computer settings - Image acquisition - processing etc.

Multi Gated Blood Pool Acquisition (MUGA) scan, patient preparation, In vitro and in vivo RBC labeling with radionuclide, indication, administration dosage, Imaging procedures, Processing - E.F. calculation - Global and Regional stroke volume - Histogram phase angle etc.

Myocardial perfusion scintigraphy, patient preparation, drug interaction, important instructions, selection of mode of stress, physical, pharmacological, preparation of patient for physical stress with tread mill machine, preparation of patient for pharmacological stress e.g. Dobutamine and Adenosine infusion, important precautions, emergency medicines, function and handling of

defibrillator. Scintigraphic protocols for myocardial perfusion scintigraphy, protocols for assessment of myocardium viability, with respect to SPECT and PET tracers.

Processing of myocardial scintigraphy, preparation of images and CD recording.

3. **Haematological studies**: Hematological disorders total blood volume. Estimation of RBC volume, Blood volume - using 51Cr, 99mTc - Red cell survival study.
4. **Special procedures**: Dacryascintigraphy, Lymphoscintigraphy: Radio pharmaceuticals, dosimetry, imaging techniques. Venography: Radio pharmaceuticals, imaging techniques. Protein loss studies: Radio pharmaceuticals, dosimetry, imaging techniques, precautions prior to imaging. Salivary gland imaging: Radio nuclide - dosage - Imaging procedures. Vitamin B12 absorption study: Folic acids study etc. Schilling test.

Books for study :

1. Nuclear Medicine Technology & Techniques, -Donald R. Bernier, Paul E. Christian & James K. Langan Mosby
2. Care of the patient in diagnostic radiology, Chesney & Chesney Blackwell
3. Notes on radiological emergencies Ansell, Churchill
4. A guide to Oncological nursing Deeley Livingstone
5. First aid (Hamlyn) Haugher & Gardner, Hamlyn
6. Care of the injured, Ring Livingstone
7. Practical Nursing and first aid -Ross & Wilson, Livingstone
8. Hand book of Nuclear Medicine – Frederick L Datz and
9. Essentials of Nuclear Medicine Imaging – Fred A Mettler , Milton J Guiberteau.

VI Semester

PAPER - 21

Nuclear Medicine Physics And Instrumentation – IV :

Unit 01 :

Computerized Tomography:

Basic principle of Computed Tomography, Generations of CT scanners. X-ray tube, performance of x ray tube, Filters, Collimators, CT detectors, Data Acquisition System (DAS), CT Image Quality, CT Dose Vs image quality. Image Formation in CT, Image Reconstruction, Hounsfield Unit, Windowing, image display, CT artifacts. Helical CT scan: Slip ring technology, Advantages, Multi Detector CT, Cone-beam geometry, Reconstruction of helical CT images, CT Fluoroscopy, HRCT, Post Processing Techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR. Contrast material, contrast reaction, contrast material doses and route of administration. Whole body CT acquisition.

Unit 02 :

Basic principle of SPECT, SPECT data acquisition techniques, SPECT reconstruction techniques, SPECT filters. QC of SPECT gamma camera. Artifacts in SPECT image, SPECT image correction techniques with reference to attenuation correction using software, radionuclide techniques and CT volume data. Historical developments in PET technology, basic principle of PET imaging, concept of PET CT hybrid imaging, construction of PET scanner, crystals and PMT in PET CT scanner, co-incidence circuit, PET CT attenuation correction technique. PET CT image reconstruction techniques, daily QC of PET CT scanner. Concept of MRI, types of MR sequences, concept of PET MRI fusion imaging. Patient safety precaution required in PET MR imaging.

Miscellaneous equipments:

Nuclear Medicine probes, thyroid probe, sentinel lymph node probe, H pylori probe, construction and principle of operation.

Utility of Modern technology for maintain digital images and patient management with reference to DICOM image format, PACS, LAN, telemedicine.

Record keeping:

Test procedure – maintenance-provisional appointment – Registration of the patients in the department, Register with proper ID number – Isotope Radio pharmaceuticals administration – dosage – Date – Time – mode of Administration etc. Details of Test done – storing of results – Hard copies like Films, Report forms etc. - Dispatch of the results to the respective departments – maintaining the records – maintaining original report copy in the department safely etc.

Equipment maintenance:

Calibration of radiation protection equipment - Date of installation – Defects raised service done on date and time – done by whom – service record. Periodical quality control study on equipment and their record keeping – Preventive maintenance service on periodical interval either by the engineers in the institution or engineers from the company. Stocking of important spares and PC boards for the rectification of the defects during the time of repair.

Books for study :

Textbooks :

1. Quality Control of Nuclear Medicine Instruments, International Atomic Energy Agency
2. Physics of Nuclear Medicine, - James A. Sorenson & Michael
3. Nuclear Medicine and PET CT, technology and techniques. By Paul E Christian and Kristen M. Waterstram, publisher (Mosby Elsevier)

Reference books :

1. Principles and practice of Nuclear Medicine, Paul J. Early, D. Bruce Sodes. C.V. Mosby Company Princeton.
2. Instrumentation in Nuclear Medicine – Gerald J. Hine.
3. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.
4. Quality Control of Gamma Cameras and Associated Computer Systems, The Institute of Physical Sciences in Medicine
5. Quality Control of Nuclear Medicine Instrumentation, The Institute of Physical Sciences in Medicine.
4. Quality Control in diagnostic imaging - J.E. GRAY, University Park Press.
5. Processing and Quality Control William, E.J. Mckinney. J.B. Lippincott Company.
6. Concepts in Medical Radiographic imaging Marianne Tortoice,W.B. Saunders Company.
7. Quality assurance Management G.E. Hayes Charger production.
8. Diagnostic Imaging: Quality Assurance M.M. Rehani, Jaypee Bros Medical Publishers.
9. IAEA TECDOC.
10. NEMA standards.

Practicals :

1. QC of dose calibrator.
2. Daily QC of Gamma Camera.
3. QC of SPECT scanner
4. Daily QC of PET CT scanner.
5. Contamination level and methods of decontamination in nuclear medicine laboratory.
6. Segregation & Disposal methods of solid and Liquid Radioactive wastes.

PAPER - 22

Radiopharmacy, Radiation Biology and Radiation Safety – IV :

I. Radiopharmacy:

Procedure of cell labeling and safety precaution in nuclear medicine with respect to biohazard while radionuclide ventriculography, GI bleed scintigraphy and infection imaging.

Procedure of ventilation and perfusion scintigraphy for detection of pulmonary embolism and safety precautions. Preparation of SPECT scan RP and labeling efficiency check for bone, brain and cardiac study.Procedure and safety precaution to perform elution from a generator system.

Preparation of F18 FDG and F18 Sodium fluoride patient doses for PET CT scan.
Nuclear reactor and Cyclotron produced radio nuclides.
Generators based PET tracers.
Procedure and precautions for a therapeutic radionuclide in nuclear medicine with reference to Iodine 131, Samarium-153 and other radionuclides.

II. Radiation Biology and Radiation Safety:

Acute radiation syndrome, methods of renal protection, methods of thyroid protection from radiation, Radiation protectors, radiation sensitizers. Radiation-hormesis theory.

1. Planning of Nuclear Medicine (NM) Laboratories

Classification and general features of NM Laboratories (site, typical floor plans, ventilation, surface, walls, floor and ceiling, work surfaces, containment systems, fume-hood, glove box etc.), planning of NM laboratories, such as diagnostic and high dose therapy, PET-CT and medical cyclotron installation, shielding evaluation of NM laboratories and medical cyclotron, model layouts of various NM laboratories.

2. Transport of Radioactive Material

Rules governing transport of radioactive material, types of packages, A1 and A2 values, category of packages, excepted limit, special form and other than special form, TREMCARD, procedure of packing, marking, labeling, transport documents, responsibilities of consignor and consignee, consignor's declaration, instruction to the carrier, transport of surface contaminated objects, off-normal situations during transport of radioactive material, handling of off-normal situations, emergency planning.

3. Regulatory Aspects for Nuclear Medicine Laboratories

Regulations with respect to nuclear medicine laboratories, relevant regulatory documents such as Act, Rules, Code, Standards and Guides, responsibilities of employer, licensee, Radiation Safety Officer (RSO), technologist and radioisotope supplier, safety and security of

radioactive sources, regulatory requirements for import/export, procurement, use, handling, transfer and disposal of radioisotopes, inventory control, Radiation Protection Program (RPP).

Books for study :

Text books:

1. The handbook of Radio pharmaceutical -Mohan Patel & Samij Sadack, Chapman & Hall Medicals, London.
2. Technetium 99m radiopharmaceuticals. Preparation and quality control by Ilse Zolle, Springer.

Reference books :

3. Fundamentals of Nuclear Pharmacy-Gopal B. Saha, Springer-Verlag, New York.
4. Nuclear Medicine Technology & Techniques-Donald R. Bernier , Paul E. Christian & James K. Langan Mosby.
5. Radiation Protection in Hospitals. Richard F.Mould

Practicals :

1. QC of generator elute in nuclear medicine hot lab.
2. Radio labeling and QC of RP for SPECT Imaging using paper chromatography.
3. Safe handling and preparation of pharmaceutical stress dose for a given nuclear cardiology test, method of infusion, dose calculation, pre and post test precautions.
4. Segregation & Disposal methods of solid and Liquid radioactive wastes.

PAPER - 23

Nuclear Medicine Techniques and Procedures - IV :

1.Infection and inflammation imaging:

Radio pharmaceuticals, dosimetry, data acquisition protocols, comparison of image, information obtained from different radio pharmaceuticals, leukocyte labeled studies- leukocyte labeling procedures, imaging techniques and applications, advantage and limitations.

2. Tumor imaging:

Gamma camera and SPECT imaging, common radio-pharmaceuticals, dosimetry, patient preparation, imaging protocols and techniques, applications. PET CT imaging, radio pharmaceuticals, dosimetry, patient preparation, imaging protocols and techniques, CT contrast protocols and techniques in PET CT.

3.Therapeutic application of radio nuclides:

General precaution regarding contamination and radiation dosage. Radio iodine therapy for Thyrotoxicosis: Dosage Administration - Precaution to be followed.

4. Radio iodine therapy for Thyroid malignancy:

Dosage. Administration - Precaution and care of patient during administration. mIBG I13l - Indications - Dosage - Administration - Precaution to be taken during administration. Post therapy in patient care, concept of barrier nursing, regular radiation survey procedure, and permissible limits for patient discharge from isolation ward. Contamination, decontamination, tools and techniques for decontamination.

5. **Palliative treatment for bone metastasis :**

common radio isotope and radio pharmaceuticals used for bone pain palliation, pre therapy investigations, medicine order, understanding of schedules from BRIT, external agency, dosage - Administration - Precaution to be followed during administration. Instructions for patient after therapy. Basic concept of Radio-immunotherapy and receptor therapy.

Books for study :

1. Nuclear Medicine Technology & Techniques, -Donald R. Bernier, Paul E. Christian & James K. Langan Mosby
2. Care of the patient in diagnostic radiology, Chesney & Chesney Blackwell
3. Notes on radiological emergencies Ansell, Churchill
4. A guide to Oncological nursing Deeley Livingstone
5. First aid (Hamlyn) Haugher & Gardner, Hamlyn
6. Care of the injured, Ring Livingstone
7. Practical Nursing and first aid -Ross & Wilson, Livingstone
8. Hand book of Nuclear Medicine – Frederick L Datz and
9. Essentials of Nuclear Medicine Imaging – Fred A Mettler , Milton J Guiberteau.

Practicals :

1. Patient preparation, positioning, image acquisition and processing for a SPECT study.
2. Patient preparation, TMT stress/ pharmaceutical stress procedure for cardiac patient, Pre and post test precautions.
3. Patient preparation, table positioning, image acquisition and display of PET CT scan in a Oncology patient.
4. Patient preparation, positioning, image acquisition processing and display of SPECT scan in neurology patient.
5. Patient preparation, positioning, image acquisition, processing and display of bone scan planar and SPECT in a cancer patient.
6. Low dose radio iodine therapy, patient preparation, dose dispensing and safety precautions.
7. Preparation and execution of a radionuclide therapy dose in a cancer patient, pre administration precautions, post administration precautions.

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

8. B.Sc NEUROPHYSIOLOGY TECHNOLOGY (NPT)

(Semester pattern)

w.e.f 2015-16 Batch

TEACHING HOURS & EXAMINATION PATTERN

III Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
12	Basic Neurosciences-I	**80**	**120**	IE	80	20	50%
13	Instrumentation & their Circuits-I	80	120	IE	80	20	50%
14	Clinical Neurology-I	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester:

Paper No.	Paper	Hours of Teaching		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+ Practical)
15	Basic Neurosciences-II	80	120	UE	80	40%	20	40%	50%	50	50%
16	Instrumentation & their Circuits-II	80	120	UE	80	40%	20	40%	50%	50	50%
17	Clinical Neurology-II	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

**** Practical including Oral, Spotters, Records on Basic Recording of EEG, nerve conduction and evoked potential.***

V Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical*	Min. for Pass
18	EEG & Telemetry-I	80	120	IE	80	20	50%
19	Electroneuromyography-I	80	120	IE	80	20	50%
20	Management of Patients & Machine	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	Hours of		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)
21	EEG & Telemetry-II	80	120	UE	80	40%	20	40%	50%	50	50%
22	Electroneuromyography-II	80	120	UE	80	40%	20	40%	50%	50	50%
23	Evoked potential studies and others	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters, Record, Advanced Recording of EEG, nerve conduction and evoked potential.

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 - NEUROPHYSIOLOGY TECHNOLOGY

III Semester

PAPER – 12

Basic Neurosciences – I :

Basic Neuroanatomy and Neurophysiology as applied to various electrophysiological procedures.

1. Neuro Anatomy :

a) Gross anatomy of brain and various areas.
b) Cranial nerves – visual system, auditory system.
c) Automatic nervous system.
d) Spinal cord.
e) Formation of plexus.
f) Peripheral nerves.
g) Muscles.
h) Myoneural junction.

2. Sub Divisions of Nervous System :

a) Central
b) Peripheral
c) Autonomic

PAPER - 13

Instrumentation and their circuits – I :

I. Electronics – Biomedical Department :

1. Electrical Concepts :

Definition and units of Basic electrical quantities: Voltage, current, charge, power, resistance, capacitance, inductance, impedance, reactance, Ac and Dc, power factor, RMS, average and maximum value of Ac.

a) Circuit Elements : Resistors, capacitors, inductors - types symbol, colour code representation series and parallel combination and their equivalent. Transformer – types and construction detail.

b) Circuit Laws : Ohm's law, Kirchoff's voltage law, Kirchoff's current law, Wheat stone bridge.

c) Motors : Types and Uses.

2. Elements of Electronics :

a) Atomic structures, material classification according to their conduction, electronic emission.
b) Semi conductors – intrinsic, extrinsic, P type, N type, diodes, transistors, characteristics, schematic representation.
c) Application of diodes as a switch and rectifier, HWR, FWR, bridge rectifier.
d) Application of transistor as an amplifier.
e) Power supply unit.
f) Introduction to integrated circuit.
g) Introduction to operational amplifiers – adder, subtractor multiplier, sine wave generator, square wave generator triangular generator, Schmitt trigger.

3. Digital Circuits :

Binary number system, bits, bytes, octal, hexadecimal, addition, subtraction, 1"s comprement and 2"s complement.

a) **Gates :** Universal gates OR. AND. Not. EXOR. EXNOR. Truth table and booleam expression.
b) A-D converter.

PAPER – 14

Clinical Neurology – I :

Concepts of Disease and outlines of Clinical Evaluation related to Neural Science :

1. Epilepsies
2. CNS Infections.
   - Meningitis
   - Encephalitis
3. Stroke
4. Parkinsonism

IV Semester

PAPER – 15

Basic Neurosciences – II :

1. Brain :

a) Lobes, functions – Dissection Hall
b) Gyri, Sulci, Cortical areas – Demonstration
c) Association commissural areas.
d) Brain stem, cerebellum
e) Sensory and motor pathways
f) Pyramidal system
g) Upper and lower motor neuron
h) Spinal cord
i) Peripheral nervous system
   i. Cranial nerves – origin, distribution, pathways.
   ii. Spinal cord and spinal nerves.
   iii. Formation of plexus.
   iv. Muscles – Origin, insertion nerve supply and action.
j) Concept of myotomes and dermatomes

2. Neuro Physiology :

a) Membrane potentials and action potentials.
b) Synapse and synaptic transmission.
c) Excitation and inhibition.
d) Dendrites and dendritic physiology.
e) EEG generators.
f) Physiology of Nerve conduction and Muscle contraction.
g) Commissural pathways and association areas.
h) Physiology of Neuromuscular Junction transmission.
i) Motor and sensory tracts.
j) Sensory receptors.

3. Pulmonary Resuscitation.

PAPER - 16

Instrumentation and their circuits – II :

1. Electrical Safety and Medical Equipments :

Physiological effect of electrical current, shock hazards from electrical equipment, methods of accident prevention.

Classification of medical equipments according to the

a. Type of protection.
b. Mode of protection.

2. Bioelectricity :

Biological potentials, ECG, EEG, EMG sources of Bio-electric potential, cell testing potential, action potential and their propagation, electrodes and transducers.

3. Transducers :

Their principle, active and passive transducer, transducer used in biomedical applications.

4. Electro Encephalogram :

a) Block diagram, EEG amplifier – preamplifier, differential amplifier, basic concept, input impedance, common mode rejection ratio, pen amplifier, buffer amplifier, driving amplifier, isolation amplifier.
b) Electrodes, types, surface or sub-dermal, ground reference electrode metal clip on the ear lobe.
c) Filters – low frequency filters, high frequency filters, 60 Hz or notch filters, frequency response curves and time constant.
d) Sensitivity and calibration of EEG amplifiers, paper speed, pen mechanism, other recording devices – CRO, principles of averaging, analogus section, digital section S/N ratio.

5. Principles Of Averaging :

a) Introduction to computers – Application of computers – Concepts of Data and Information – A typical computer system – Memory concepts – History of computers – Types of computers.
b) Input-output devices – Data storage devices –Software – the identification – the role of software – Housekeeping.
c) The computer internals – Typical PC configuration – Booting – virus, anti virus – Data compression techniques – on software – versions of software.
d) Number systems – Binary Arithmetic – Standard codes for unit of information.
e) Operating system – Definition – Classification – Introduction to windows – Features of windows – Desktop and Desktop icons – Starting programs – Browsing and managing windows explorer – setting – Taskbars and creating shortcuts.

Introduction to MS –DOS and WINDOWS.
MS Office – MS Word, PowerPoint, Access & Excel.
Introduction to Internet, Intranet and E-mail.

6. Instrumentation :

a) Grounding.
b) Electrodes – Surface electrodes, needle electrodes, dechloriding, microelectrodes, electrode – materials, application, 10-20 system referential system electrode paste.
c) Instrumentation in relation to
   i. EEG
   ii. Electrocardiogram.

iii. ENMG
iv. EPs
v. Polysomnography.
vi. Dop scan
vii. Brain mapping

Should be trained in identifying any defects and rectify them.

7. Basic Records of EEG, nerve conduction, evoked potentials.

PAPER - 17

Clinical Neurology – II :

1. Alzheimer Disease
2. Cerebellar ataxia (Fredrich's ataxia)
3. Peripheral Neuropathies.
4. Muscle Disorders.
5. Neuromuscular Junction Disorders.
6. Demyelinating disorders.

V Semester

PAPER - 18

EEG & Telemetry – I :

Recording Technique :

1. Electrodes :
a) Types, materials and characteristics.
b) Modes of application.
c) Impedance.
d) Effects on E.E.G.
2. The 10-20 system.
3. Reference and Bipolar Technique
4. Reference contamination.
5. Fields.
6. Montage and localization.
a) Cancellation and summation
b) Phase reversal.

PAPER - 19

Electroneuromyography – I :

1. Nerve conduction studies – Median, Ulnar, Radial, CP, Tibial, Femoral Sural etc.
2. H-Reflex and F-Wave.
3. Repetitive stimulation.

PAPER - 20

Management of Patients and Machine :

1. Cerebral vascular diseases.
2. Space occupied lesion.
3. Toxic, metabolic and endocrine conditions.
4. Infections, disease.
5. Psychiatric disorder.
6. Pediatric condition.
7. Drug effects on E.E.G.
8. Disorders of sleep.
9. Electro cerebral silence.

VI Semester

PAPER - 21

EEG & Telemetry– II :

1. Normal EEG patterns ;
   - Awake / Resting : Normal / Abnormal.
   - Sleep : Normal / Abnormal.
   - Activation procedures.
2. Artifacts and correction.
3. Seizures – Classification.
   - Clinical pattern.
   - EEG pattern.
4. EEG in toxic, metabolic, endocrine
5. EEG in space occupying lesion.
6. EEG in pediatric conditions.
7. Disorders of sleep.
8. Drug effects on EEG.
9. Telemetry – Principles of recording uses in clinical setting.
10. Signal analysis.
11. Sphenoid EEG recording :
    - Assisting in inserting leads.
    - Techniques of recording.
12. Epilepsy surgery :
    - Prolonged telemetry EEG.
    - Recording ictal period and reporting pre/ictal/postal phases.
    - Intraoperative recording (Corticogram)
13. Polysomnography
14. Magneto-encephalography
15. Advanced records of EEG, nerve conduction and evoked potential

PAPER - 22

Electroneuromyography – II :

1. Long loop reflexes.
2. Sympathetic skin response.
3. Refractory period.
4. Electromyography – Insertion activity, Spontaneous activity, Fibrillations, Fasciculation, Positive sharp waves, Myotonia, Pseudomyotonic discharges, interference patterns, single fibre EMG, Quantitative EMG
5. R-R Response

PAPER - 23

Evoked potential studies :

1. Definition of short term, Event related potentials.
   - Principle of varying.
   - Signal to noise ratio.
   - Frequency response
   - Different types of EPs
2. VEP (Visual Evoked Potential).
3. BAER (Brainstem Auditory Evoked Response).
4. SSEP (Somato Sensory Evoked Potential).
   - Upper limb
   - Lower limp.
5. Blink reflex.
6. Trans canal magnetic stimulation.
7. Trans cranial Doppler evaluation

Reference Books :

1. UK. Misra, J. Kalita : Clinical Neurophysiology, 3rd edition, India Elseiver,2014
2. UK. Misra, J. Kalita : Clinical Electro Encephalography, India Elseiver,2005
3. John.S.Ebersole, Thimothy A. Pedley : Current Practice of clinical Electro Encephalopathy, 3rd Edition, Lippincots, Willian & Wilkins
4. Donald L. Schomer Fernando M.Lotes Dasilva : Electro Encephalography 6th Edition Lippincots, William & Wilkins
5. Aminoff : Electrodiagnosis in clinical Neurology.
6. Elsevier Health Bookshop
7. Kimura : Electrodiagnosis in disease of Nerve & Muscle
8. Shin J Oh : Clinical Electromyography & Nerve conduction

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)

9. B.Sc RADIOGRAPHY & IMAGING TECHNOLOGY

(RIT)

(Semester pattern)

w.e.f 2015-16 Batch

TEACHING HOURS & EXAMINATION PATTERN

III Semester :

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical *	Min. for Pass
12	Radiological Physics & Dark Room Techniques	80	120	IE	80	20	50%
13	Radiological Equipments	80	120	IE	80	20	50%
14	Positioning in Radiography	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

IV Semester :

Paper No.	Paper	Hours of		Examination							
		Theory	Practical	Uni. Exam (UE) / Int. Exam(IE)	Theory Max. Marks	Min. for Pass	IA	Min. Pass	Aggregate (in Theory+IA)	Practical *	Min. for pass (Theory+ Practical)
15	Radiographic Procedures	80	120	UE	80	40%	20	40%	50%	50	50%
16	Basic and Advanced Ultrasound Imaging & Physics	80	120	UE	80	40%	20	40%	50%	50	50%
17	Techniques In Ultrasonography	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

V Semester:

Paper No.	Paper	Hours of Teaching		Examination			
		Theory	Practical	UE/ IE	Theory	Practical *	Min. for Pass
18	Basics & Advanced CT Imaging and Physics	80	120	IE	80	20	50%
19	Techniques in CT scan Imaging	80	120	IE	80	20	50%
20	Interventional Procedures and Angiography	80	120	IE	80	20	50%
	Total	**240**	**360**				

Total hours: 600

VI Semester:

Paper No.	Paper	Hours of		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)
21	Basic & Advanced MRI Imaging and Physics	80	120	UE	80	40%	20	40%	50%	50	50%
22	Techniques in MRI	80	120	UE	80	40%	20	40%	50%	50	50%
23	Care of Patients in Diagnostic Radiology	80	120	UE	80	40%	20	40%	50%	50	50%
	Total	**240**	**360**								

Total hours: 600

Practical including Oral, Spotters & Record

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 - RADIOGRAPHY & IMAGING TECHNOLOGY

III Semester

PAPER - 12

Radiological Physics & Dark Room Techniques :

I. X-rays - Generation, Properties and Interaction:

Electromagnetic radiation, spectrum and general properties: Wave and quanta concept, Processes of x-ray generation: General and characteristic radiation, X-ray spectrum, factors influencing the intensity of x-rays.

Basic interactions between diagnostic x-rays and matter: Coherent scattering, photo electric effect and Compton Effect – probability of occurrence and its applications in radiology. Biological effects of radiation. Attenuation: Linear and mass attenuation coefficients, Half Value Layer, Factors affecting attenuation, practical aspects of these phenomenon in Radiology, scatter radiation.

II. Radiation Protection & Measurements:

Radiation quantities and units, Radiation measuring instruments: Gas filled detectors: ionization chamber, proportional counter, Geiger-Muller counter, scintillation counter, solid state detector, Personal monitoring devices: Film, Thermo luminescent and Pocket dosimeters.

Aim of radiation protection, concept of As Low As Reasonably Achievable, International Commission on Radiation Protection (ICRP) and Atomic Energy Regulatory Board (AERB) recommendations, maximum permissible dose, Principles of protection in X-ray department for patient, personnel and public, Time-Distance-Shielding, protective devices, X-ray room design.

III. Radiographic photography:

X-ray films, Screen – film cassette, Characteristic curve, Radiographic Image Quality, Automatic Film Processor, Laser camera: Wet and Dry, Computed Radiography & Digital Radiography.

Construction of dark room, dry bench, wet bench, processing of film, developer, fixer, hangers, safelight

PAPER – 13

Radiological Equipments :

I. Electric Power & Transformers:

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.

II. X-Ray equipment & units :

Construction of diagnostic X-ray tube: Stationary and rotating anode type, Line – Focus principle, Heel effect, X-ray tube rating, Grid controlled and Metal - Ceramic X-ray tubes.
Mammography, Mobile X-ray unit, Dental x-ray unit, Dual Energy X-ray Absorptiometry.

III. X-ray generators:

Filament and High Voltage circuits, Single phase generators. Self, Half wave and Full wave rectified, Three 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.

IV. Accessories in Fluoroscopy :

X-ray beam restrictors, filters: Inherent, added, k-edge filters. Grids: Types, grid-ratio grid cut-off, moving grid. Air gap technique.

Basic principle, construction and working principle of image intensifier tube. Image characteristics, Image display and recording devices.

PAPER – 14

Positioning in Radiography :

Age, subject types and sex, anatomical landmarks-postural variations-erect and horizontal technique-respiratory movement and diaphragm level-regional densities-preparations-and immobilization of patient –pathological conditions-injuries, fractures and dislocations congenital, localized views-periodic examinations-use of dry bones-positioning terminology identification systems.

I. Positioning Radiography – I

Skeletal System

i) Upper Limb

Techniques for hand-fingers-thumb-wrist joint-forearm-elbow joint-humerus-shoulder joint and sterno-clavicular joint.

ii) Lower Limb

Techniques for foot-calcaneum-ankle joint-leg-knee joint-patella-and femur(lower two thirds)

iii) Pelvic Girdle

Techniques for pelvic-iliac fossa-ischium-and sacro iliac joint.

iv) Vertebral Column

Techniques for Atlanto-occipital articulation, cervical vertebrae, cervico-thoracic junction, thoracic vertebrae, lumbar vertebrae, lumbosacral articulation, sacrum

v) *Coccyx*

vi) Bones of Thorax

Techniques for sternum, ribs (upper and lower).

vii) Skull

Techniques for cranium, facial bones, sella turcica, temporal Bone, martoids and optic foraminae, sinuses, mandible and temporo mandible joint.

Viii) Chest

Chest X-Ray, PA, AP lateral, decubitus etc.

ix) Abdomen

Routine and radiographs in acute condition

Bedside radiography –techniques for acute chest conditions-intestinal obstruction, abdominal perforations-vertebral injuries-skull injuries-fractures immobilized.

Theatre radiography-introduction to C-arm image intensifier- exposure & training.

II. Soft tissue radiography

Neck, abdomen, skull, mammogram

Practicals :

1. X-ray beam alignment test
2. Determination of magnification by changing Source to Image Distance
3. Determination of magnification by changing Object to Image Distance
4. Radiation Protection Survey
5. Leakage radiation test
6. Positioning Radiography

IV Semester

PAPER - 15

Radiographic Procedures :

I. Contrast Media

Types, composition, uses, contraindications

II. Contrast Procedures - I

Barium swallow-Barium meal series-Barium enema-double contrast barium enema, small bowel enema, double and single contrast,
ERCP, PTBD, sinograms, fistulograms.

III. Contrast Procedures - II

IVU, retrogrde pyelogram, MCU, AUG, Opposing Urethrogram,
Dacrography, Sialogram, HSG,
T-Tube cholangiogram, operative cholangiogram (on table in theatre).

PAPER – 16

Basic and Advanced Ultrasound Imaging Physics :

I. Ultrasound - Generation, Properties and Interaction:

Basic Acoustics, Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity.

Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients.

Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, Construction and Working, Characteristics of US beam.

II. Image Formation, Display and Quality:

Ultrasound display modes: A, B, M, T-M mode, B-scan, Scan-converters: Analog and Digital, US Machine Controls, US focusing.

Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducers: mechanical and electronic arrays, Ultrasound Artifacts

III. Doppler Ultrasonography Physics :

Doppler Effect, Doppler ultrasound techniques: Continuous Wave Doppler, Pulsed Doppler, Duplex scanning, Doppler spectrum, Color Doppler, Power Doppler

PAPER - 17

Techniques In Ultrasonography :

Techniques for imaging different anatomic areas, Patient preparation for Doppler, Vascular sonography, Neurosonogram, Sonohysterography, Sonourethrography, Elastography, Musculoskeletal USG.

I. Techniques in Doppler Ultrasonography:

Doppler Effect, Doppler ultrasound techniques: Continuous Wave Doppler, Pulsed Doppler, Duplex scanning, Doppler spectrum, Color Doppler, Power Doppler

II. Recent Advances in Ultrasonography :

1. USG Contrast agents
2. Harmonic imaging
3. Extended FOV imaging
4. 3D US imaging: acquisition methods & reconstruction
5. 4D & 5D US imaging.

Practicals :

1. Basic Ultra sound techniques, Practicals based on theory
2. Contrast Procedures and Positioning Radiography.

V Semester

PAPER -18

Basics & Advances in CT Imaging Physics :

I. CT Imaging - Principle:

Basic principle of Computed Tomography, Comparison of CT with Conventional Radiography and Tomography, Generations of CT

II. Instrumentation:

Gantry, Patient couch, X-ray tube, Filters, Collimators, Detectors, Data Acquisition System (DAS).

III. Advances in CT Imaging

1. Image Formation:

Image Formation in CT, CT Image Reconstruction, Hounsfield Unit, Windowing, CT image display, CT Image Quality, CT artifacts

2. Recent methods in CT Imaging:

Helical CT scan: Slip ring technology, Advantages, Multi Detector CT, Cone – Beam geometry, Reconstruction of helical CT images, CT Fluoroscopy, HRCT, Post Processing Techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose

PAPER – 19

Techniques In CT Scan Imaging :

Patient preparation, Imaging techniques and protocols for various parts of body,

i. CT contrast enhanced protocols
ii. CT angiography:
iii. Aortogram,
iv. Selective angiogram head, neck and peripheral,
v. Image documentation: Filing, Maintenance.

Practicals :

Practicals based on theory.

PAPER – 20

Interventional Procedures and Angiography :

I. Principle & Instrumentation:

Digital Subtraction Angiography: Instrumentation, Principle of Digital Subtraction Angiography, Various Digital Subtraction Techniques

II. Basics Of Invasive Radiology:

Procedure of image guided biopsies and drainage procedure.

III. Invasive Angiography & Venography

4 Vessel DSA, Aortogram, Selective Angiogram, Venogram

IV. Invasive Monitoring

Cardiac resuscitation measures, Management of shock.

V. Interventional Procedures & Angiography

Stenting, PTA + stenting, stent graft, Embolisation

VI. Neuro Interventional Procedures

Embolisation, GDC
Glue embolisation
Vertebroplasty

VII. Adult & Paediatric Invasive Cardiology:

Basics of cardiac catheterization Coronary angiogram

Practicals :

Practicals based on theory + Interventional procedures techniques

VI Semester

PAPER -21

Basic & Advanced MRI Imaging Physics :

I. MRI Imaging - Principle:

Basic principle and concepts of MRI, the need for MRI, Role of hydrogen in MR Imaging, Advantages and disadvantages of MRI, MR Contrast media.

II. Instrumentation:

MR architecture, magnet system and gradient system, patient screening before scanning, Safety aspects, types of magnets and RF coils,
Basic types of pulse sequence and advanced pulse sequences

III. Image Formation:

Fourier transformation, K space imaging, Image formation in MRI, Gating mechanism in MRI. MR artifacts , factors influencing image quality

PAPER -22

Techniques in MRI :

I. Protocols:

Protocols in MRI for whole Body

II. Advanced MRI techniques:

MR Angiography, (TOF, phase contrast and dynamic contrast MR angiography), Functional MRI, MR Spectroscopy, Recent advancement in MRI and open MRI, MRCP, DWI, SWI, perfusion etc.

PAPER -23

Care of Patients in Diagnostic Radiology :

Care of the Patient and Fundamentals of Nursing and Medical Emergencies

Unit - 01 :

Introduction To Patient Care:

Clinical Responsibility, Legal Responsibility, Hospital And The Radiographer.
General Patient Care:

A. Patient Transfer Technique
B. Turning The Patient (Patient Conditions, Mechanic Safety).
C. Restraint Techniques - Trauma, Paediatric, Geriatric, Physically Handicapped Emotionally Disturbed Patients, Anaesthetised Patient, Moving Chair And Stretcher Patients.
D. Specific Patient Conditions.
Tubes And Catheters, Nasogastric, Chest, Urinary, Intravenous, Oxygen And Other. (Cast Surgical And Cardiac) Alcoholic, Bed Pans And Urinals.
E. Security Of Patient Properties.
Out Patient, Inpatient.
F. General Comfort And Reassurance For The Patient.

Unit -02 :

I. Practical Nursing Procedures In Radiology :

Temperature, Pulse, Respiration, B.P., Laying Up A Sterile Trolley, Assisting At An Iv Injection, A Simple Sterile Dressing, O2 Therapy And Resuscitation, Giving A Patient Bed Pan, Giving An Enema, The Catheterized Patient, The Use Of A Sucker.

II. Preparation Of The Patient:

General Abdominal Preparation, Clothing Of The Patient.

Unit -03 :

I. Sterilization and sterile techniques:

Methods Of Sterilization, Central Sterile Supply, Preparation Of The Hands For Aseptic Procedures.

II. Drugs in the X-Ray department:

Poisons And Dangerous Drugs, Units Of Measurement, Drugs Used In Preparation Of The Patient, Contrast Agents Used In X Ray Examinations, Drugs Used In Resuscitation, Labeling And Issuing.

Unit -04 :

Infection Control :

A. Infections Pathogens, Communicable Disease
Nasocomial Infection, Other
B. Isolation Technique:
Category, Purpose, Procedure.
C. Infection Sources:
Bacteria Virus, Other.
D. Transmission Modes:
Aerobic, Contact, Other.
E. Procedures:
Institutional, Departmental
F. Physiological Considerations:
G. The Infection Patient In The X Ray Department.
The Infections Patient In The Ward.

Unit -05 :

Contrast Media:

A. Definitions:
I) Air, Gasses.
II) Radiopaque: Barium Compounds, Aqueous Iodine Compounds, Oily Iodine Compounds, Other.

B. Pharmacology:
Barium Compounds & Iodine Compounds : Patient History/Allergy, Chemical Composition,Patient Precautions, Patient Reactions, Emergency Care.

C. Methods of Administration:
I) Systemic: Oral, Rectal, Tube, Catheter, Inhalation.
II) Parental: Intravenous, Intra-Arterial, Intra Spinal.

D. Administration Technic: Oral (Spoon, Cup, Capcule),Tube/Catheter,

Nasogastric, Urinary, Enema, Other.

E. Intravenous : Syringe, Needle/Infusion Container, Catheter,Needle

Unit-06 :

I. Patient's Care During Investigation:

G.I. Tract, Renal Tract, Biliary Tract, Respiratory Tract, Gynecology, Cardiovascular, Lymphatic System, C N S.

II. First Aid In The X Ray Department:

Radiological Emergencies, Shock, Hemorrhage, Burns, Scalds, Cpr, Loss Of Consciousness, Asphyxia, Fractures, Electricshock.

III. Medico-Legal Aspects Of The Radiographers Work:

Breach Of Professional Confidence, Negligence, Procedure In The Event Of Accident, The Importance Of Records.

IV. The Patient And The Radiation Hazards:

The Nature Of The Risk, Significant Examinations And Protective Measures.

References:

1. Care Of Patients In Diagnostic Radiography – Chesney And Chesney
2. Guidelines On Patient Care In Radiography – C.Gunn & C.S.Jackson.
3. Hospital Infection Control For Nurses – Peter Meers.

Reference Books :

Text Books (Latest Edition):

1. Dark room procedures & Radiography - a text of Radiology for Technician by Latest edition of Satish K. Bhargava
2. Christensen's Physics of Diagnostic Radiology – Latest edition of Thomas S. Curry.
3. Step by step cross sectional Anatomy by D. Karthikeyan & Deepa Chegu.

I. Anatomy and Physiology-

Ross and Wilson by Anne Waugh, Allison grant

II. Radiological physics and radiological equipments -

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.

III. Positioning Radiography and Contrast Procedures

1. A guide to Radiological Procedures - 2nd edition, Stephan Chapman & Richard Nakielny, 1986.
2. Clark's Positioning in Radiography.
3. Merrill's atlas of radiographic positioning and radiologic procedures, 1,2 & 3 Volumes.
4. Diagnostic radiography: A concise practical manual, Glenda J. Bryan, Churchill Livingstone, 1987.

5. Handbook of Medical Radiography - C. Ram Mohan
6. Radiological Procedures (A guideline) – Bhushan N. Lakkar

IV. Basic and advanced ultrasound imaging

1. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.
2. The Essential Physics of Medical Imaging – 2nd edition, , 2001
3. Doppler Ultrasound: Principles & Instruments – 2nd edition, Frederick W. Kremkav, 1995.
4. Text book of Color Doppler Imaging – 2nd edition, Satish K. Bhargava, Jaypee Brothers Medical Publishers (P) Ltd., 2010.
5. Essentials of Ultrasound Physics, James A Zagzebski, Mosby, 1996.
6. Three Dimensional Ultrasound, Thomas R. Nelson, Donal B. Downey, Dolores H. Pretorius, Aaron Fenster, Lippincott Williams & Wilkins, 2009.
7. Diagnostic Radiology – recent advances and applied physics in imaging AIIMS, MAMC – PG I Imaging series

V. Basic and advanced CT Imaging

1. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.
2. Euclid Seeram Computed Tomography – Physical principles, Clinical applications and Quality Control, 3rd edition, Saunders Elsevier, 2009.
3. A Practical Guide to CT Technologist, C. Ramamohan, Paras Publishing, 2002.
4. High Resolution CT of the Lung – 4th edition, W.Richard Webb., Nestor L. Muller & David P. Naidich, Lippincott Williams & Wilkins, 2009.
5. Diagnostic Radiology – recent advances and applied physics in imaging AIIMS, MAMC – PG I Imaging series

VI. Basic and advanced MRI

1. MRI in Practice by Catherine Westbrook
2. MRI Physics for Radiologist by Alfred Horowitz
3. MRI made easy (for beginner) - Govind B. Chavhan
4. Diagnostic Radiology – recent advances and applied physics in imaging AIIMS, MAMC – PG I Imaging series

VII. Interventional procedures and angiography

1. Christensen's Physics of Diagnostic Radiology – 4th edition, Thomas S. Curry, 1990.
2. Applied Angiography for Radiographers, Laudicina & Wean, W.B. Saunders Company, 1994.
3. The Requisites: Vascular & Interventional Radiology, John A. Kaufman, Michael J.Lee, Mosby, 2004.

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
24	a) Basic Life support b)Trauma life support	Anesthesia Emergency Medicine	10 10	-	IE	50	50%
25	Cardiac life support	Cardiology	15	-	IE	50	50%
26	Medical Ethics	Forensic Medicine	15	-	IE	50	50%
	Internship	In the Specialty Dept.	-	850	-	-	-
	Total		**50**	**850**			

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	Practical Max. Marks	Mim. for Pass
27	Fundamentals in Research	In the Specialty Dept.	**100**	**-**	IE	50	-	50%
28	Internship & Project work		-	800	-	-	50	50%
	Total		**100**	**800**				

Total hours : 900

Note :

1. For B.Sc ECG & CVT Course, during the internship, the internees may be posted in OPD & IPD for clinical learning, to be able to take BP, Pulse and identify certain clinical conditions. BLS certification training may be given from an authorized agency.

2. For B.Sc MLT course, the internship posting for 12 months in the specialties of Biochemistry, 4M, Microbiology – 4M, Pathology - 3 M and Transfusion medicine – 1 M, students may be divided into 3 or 4 specialties as per the convenience of the course In-Charge / HoDs.

24. 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 & Endo tracheal intubation
5. Advanced airway management skill (Use of bogie stellate, supraglottic devices)
6. Basic settings of a ventilator
7. Basic modes of ventilator
8. General case 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

25. 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

26. 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

6. MODEL PAPER for III – VIII SEMESTERS

For all B.Sc PM courses except MLT

I. 80 Marks Paper

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

II. 50 Marks Paper

i. Two essays out of four	- 2x10 = 20
ii. Three short notes out of six	- 3x5 = 15
iii. Five questions- very brief answers out of eight	- 5x3 = 15

III. 40 Marks Paper

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

For MLT Course

I. 80 Marks Paper

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

II. 50 Marks Paper

i. Two essays out of four	- 2x10 = 20
ii. Three short notes out of six	- 3x5 = 15
iii. Five questions- very brief answers out of eight	- 5x3 = 15

III. 40 Marks Paper

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

IV. For VI Semester the model paper for Pathology & Transfusion Medicine is as given under :

A) For Pathology (50 marks)

i. Two essays out of four	- 2x10 = 20
ii. Three short notes out of six	- 3x5 = 15
iii. Five questions- very brief answers out of eight	- 5x3 = 15

B) For Transfusion Medicine (30 marks)

i. One essay out of two	- 1x10 = 10
ii. Four short notes out of six	- 4x5 = 20

Note:

i. *The duration of each theory paper for 80 marks - 3 hours, 50 marks - 2 ½ hours and 40 marks - 2 hours.*

ii. *The duration of each practical examination shall be 3 hours.*

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES

TIRUPATI – 517 507

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

PG Programme in Allied Health Sciences

M. Sc Clinical Virology

TIRUMALA TIRUPATIDEVASTHANAMS

INDEX

General Regulations

1. Title of the Course
   Master of Science degree in clinical virology
2. Duration of the Course
   The duration of the course shall be 2- years on full time basis
3. Eligibility for Admission-BSC – Microbiology/Biotechnology/Zoology/Botany
4. Selection Criteria
   a) All the PG (M.Sc) will have a common entrance exam
   b) The selection is based on the combined merit in the qualifying examination (degree) and marks secured in the entrance test conducted by the university (SVIMSPGCET) in the ratio of 80:20.
   c)The entrance test will be conducted on the subjects and weightage as mentioned below-
   English -30%, logical reasoning 30%, biology 20%, physical sciences 20% (+ 2 level) (intermediate).
   d) There are no qualifying marks in the entrance test. All the candidates appearing for the entrance test will be awarded ranks based on the marks secured.
5. Admission schedule:
   a) Commencement of Course: August every year
   b) The admissions are closed by 30th September or 60 days from the date of commencement of the programme.
6. Medium of instruction.
   English shall be the medium of instruction for the subjects of study as well as for the Examination.
7. Course of study
   - The course shall be pursued on full time basis. In the end of first year there shall be an examination. Students shall be posted to SVIMS and SPMC hospitals during the practical hours.
   - Subjects for study and teaching hours for first year and second year of the PG courses are shown below.
   -

Distribution of Teaching Hours

First Year

S. No	Main subject	Theory No. of Hours	Practical No. of Hours	Total
1.	**Basic- Microbiology and Virology**	100	30	130
2.	**Immunology and Medical Entomology**	60	30	90
3.	**Basic and Applied Viral Genetics**	80	30	110

4.	**Epidemiology and biostatics**	**50**	**-**	**50**
5.	**Dissertation**			**70**
	Total:	**290**	**90**	**450**

Second year

S. No.	Main subject	Theory No. of Hours	Practical No. of Hours	Total
6.	**Diagnostic Virology**	**110**	**30**	**140**
7.	**Applied Epidemiology, Applied Biostatistics & Applied Entomology**	**35**	**75**	**110**
8.	**Recent Advances in molecular virology**	**30**	**30**	**60**
9.	**Dissertation**			**140**
	Total:	**465**	**225**	**900**

8 a) Attendance:

A candidate is required to put in minimum 80% of attendance both in theory and practical separately of each paper before admission to the university examination. Participation in NCC, NSS, sports and games, educational tours, professional meetings and conference or other co-curricular activities representing the institution/university will not count as absence.

b) Condonation for lack of attendance:

The condonation of attendance on medical grounds or on absence under extraordinary circumstances to those who are having the attendance between 70% and 79% in each paper will be granted in genuine cases. The students who have shortage of attendance in the particular papers have to apply to the controller of examinations, indicating the reasons for shortage of attendance. The representation to be forwarded by the HOD & Prof. i/c AHS. If the reason is on the medical grounds, the relevant medical certificate has to be enclosed to the representation. If any student falls below the 70% of attendance, he/she will not be allowed to write the university examinations.

9. Scheme of examination

a) The examination for the degree shall consist of written papers, practical and oral.
b) There shall be two examinations viz. Preliminary and final. The preliminary

c) examination shall be taken at the end of the first year. The final examination shall be taken at the end of 2nd year.
d) The examination shall be conducted ordinarily twice a year, viz. July/August and January/February.

Preliminary Examination

This consists of theory, practical and oral. There will be separate papers for each specialization.

10. Examination fee structure: The examination fee shall be applicable as existing to the Other M.Sc. Courses (AHS).

11. University Examination and Distribution of marks.

First year

S. No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
1.	Basic- Microbiology and Virology	I	20	80	15	60	25	200
2.	Immunology and medical entomology	11	20	80	15	60	25	200
3.	Basic and Applied Viral Genetics	III	20	80	15	60	25	200
4.	Epidemiology and Biostatistics	IV	20	80	-	-	-	100
	Total		80	320	45	180	75	700

Second year

S. No	**Subjects**	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
5.	Diagnostic Virology	V	20	80	15	60	25	200
6.	Applied Epidemiology, Applied Biostatistics & Applied Entomology	VI	20	80	15	60	25	200
7.	Recent Advances in molecular virology	VII	20	80	15	60	25	200
8.	Dissertation		100(evaluation)				50	150
	Total							750

Dissertation

The student should submit dissertation one month before the final examination. Those students who have not submitted the dissertation shall not be allowed to appear for the final examination. The dissertation shall be confidentially assessed by an internal faculty other than the guide. At the time of practical university exam soft copy of the dissertation should be sent to the external examiner for proper evaluation and viva on the dissertation should be taken during orals at the time of practical examinations by all the examiners. The dissertation shall be written under the following headings:

Introduction; Aims or objectives of study; Review of literature; Materials and methods Results; Discussion; Conclusion; Summary; References; Tables; Annexure

The written text of dissertation shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should not be done. A declaration by the candidate that the work was done by him/her shall be included. The guide and head of the department shall certify the Bonafide of the dissertation.

Three copies of dissertation shall be submitted to the university through proper channel along with a soft copy (CD), one month before the final examinations.

Internal assessment (IA):

a) A student must secure at least 35% marks of the maximum marks fixed for internal assessment in a particular subject to be eligible to appear for the university examination of that subject.
b) There shall be three internal assessment tests and the average of these tests shall be considered for awarding final marks.
c) If the candidate is absent for any of the exams, the marks in that exam shall be taken as zero.
d) The computed internal assessment marks as per the regulation shall be sent to the controller of exams 15 days before the commencement of the University exam.
e) The internal assessment marks should be signed by the concerned teaching faculty or HOD and counter signed by the HOD before being forwarded to the Controller of Examinations.
f) For those who failed in internal assessment test/s, have to reappear as per the regulation 9 a) & b) before he/she appears for the university examination.
g) For those who want to improve their marks in internal assessment tests, they can

appear again as per the regulation 9 a) & b). For such students, the internal assessment marks of the student at the time of first appearance will be compared with the marks obtained at the present appearance and the higher of the two will be taken as his/her internal assessment marks.

12. Minimum for a pass

a) 35% in internal assessment of each theory paper and practical's / viva voce

b) 40% in each theory paper of university examination.

c) 50% on the total marks of theory university examination and internal assessment clubbed together, applicable to each paper.

d) Where, viva voce involved which is part of theory examination, 50% on the total marks of theory university examination, internal assessment and viva voce clubbed together, applicable to each paper.

e) Where there is no internal assessment marks, 50% on the total theory marks, 50% in practical's/viva voce applicable to each subject.

Note: For 2-year PG course, where any paper contains both theory and practical's/viva voce, the student has to pass both theory and practical's/viva voce, if any student pass in theory examination and fail in practical's/viva voce examination or vice versa, the student concerned has to appear again for both theory and practical's/viva voce examination.

13.Classification of successful candidates

Percentage of Marks for declaring Class:

Distinction	- 75% and above of the total marks.
First Class	- 65 - 74% of the total marks.
Second Class	- 50- 64% of the total marks.
Pass Class	- If the student does not pass all the subjects with in 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 attendance shortage, it will be taken into consideration as not completed within the duration of the course and the final results will be declared as "Pass".

14.Reappearance

The student has to pass both theory and practical's/via voce, if any student pass in theory examination and fail in practical's/viva voce examination or vice versa, the concerned student has to appear again for both theory and practical's/viva voce examination. Supplementary examination shall be conducted after 6 months of declaration of results.

15. Carry-over Provision

The students are permitted to complete the course period irrespective of their success in the preliminary part. However, the final results will be kept under "withheld" until he/she passes all the previous papers".

16. Maximum duration for completion of course

A candidate shall complete the course within four years from date of admission. Failing which, the candidate will be discharged.

17. Eligibility for award of degree

A candidate shall have passed in all the subjects of first and second year to be eligible for award of degree.

18. Panel of examiners:

a) There shall be a panel of four external examiners as advised by the Head of the department.

b) Theory paper setting to be done by the examiners locally, within the state or outside the state. For practical and viva-voce

c) No. of Examiners Required - Two
No. of Internal Examiner - One
No. of External Examiner – One

Eligibility for the examiner ship:

a) The examiner shall be a full-time teacher in the college or institution he or she is working.

b) Academic qualification and teaching/professional experience for examiners:

External / Internal Examiner: MD microbiology shall have not less than 5 years of teaching experience in the specialty concerned and working as Asst Prof. or above in a teaching hospital

First year

Course content (syllabus) Theory

Paper I: Basic- Microbiology and Virology

Unit no.	Unit title	Content	Hours	Method of evaluation
1.	Basic virology	1.History and principles of virology, virus taxonomy, introduction to replication strategies. 2. Virus structure and morphology. 3. Viruses of veterinary importance. 4. Principles of bio-safety, containment facilities, maintenance and handling of laboratory animals and requirements of virological laboratory. 5.Bacteriophages.	3 2 2 2	Sessional examination
2.	Tissue culture	1.Introduction to tissue culture Principles of tissue culture, applications, maintenance of sterility, use of antibiotics, mycoplasma and other contaminations 2. Cell environment. 3. In vitro cultures 4. Cell characterization 5. Large scale production 6. Quality assurance in animal tissue culture.	2 2 2 2 2 2	Sessional examination
3.	Cell biology	1.Microscopy 2. Cell ultra-structure and electron microscopy	1 3	Sessional examination

		3. Structure and function of cellular organelles 4. Cell division and cell cycle 5. Cell signalling 6. Cell growth and differentiation 7. Stem cells -adult and embryonic 8. Cell dynamics, cell death	2 2 2 2 2 2	
4.	Concepts of biosafety and biosecurity	1.Infectivity/Pathogenicity/Virulence, Routes of entry/exit, Modes of transmission, Secondary spread, Immune status of staff and immunization issues 2. Biosafety Levels and Risk group, Classification, Containment, Good microbiological practices, Disinfection, Decontamination and Sterilization 3. Primary Barriers and Secondary Barriers, different zoning and BSC] 4. Risk & Hazard Assessment 5. Safe laboratory Practices: Good microbiological practices, Good clinical practices (GCP), Good clinical and laboratory practices (GCLP), Good Laboratory practices (GLP)] 6. Decontamination procedures: Disinfection, Methods of sterilization, Decontamination Waste categories &Color coding of Bio-Medical Waste Containers/Bags, various types of Standards International norms & local government regulations 7. Regulatory Framework: [Code of conduct for scientists, Statuary roles of Department of Biotechnology (DBT), Indian Council of Medical Research (ICMR), Various types of committees for biosafety International Issues for Biosafety & Biosecurity, Laboratory certification, accreditation and standards, Commissioning, Certification &Validation, Accreditation, ISO, NABL,	2 2 2 1 2 2 3	Sessional examination

		8. Public health structure / system: [Disease surveillance and reporting, Disease control program	1	
5.	Bioethics	1.Ethics in Biomedical Research. 2. Ethical and regulatory issue in animal experiment. 3. Ethical issues in biotechnology. 4. Basics of Intellectual Property Rights. 5. Indian patenting system. 6. Issues related to Good Manufacturing Practices (GMP). 7. Issues related to Good Clinical Practices (GCP). 8. Issues related to Good Clinical Laboratory Practices (GCLP). 9. Development of consent document for clinical trials.	1 1 1 1 1 1 1 1 1	Sessional examination
6.	Virological Methods	1.In vivo, in vitro and in ovo systems for virus growth 2. Introduction to PCR 3. Fluorescence, confocal and electron microscopic techniques – principles and applications.	5 2 3	Sessional examination
7.	Analytical techniques	1.Characterization of biomolecules 2. Concentration of biomolecules 3. Electrophoresis of molecules from paper/gels. 4. Cell sorting and Flow cytometry: Principles and Applications. 5. Radioisotope techniques 6. Spectroscopy, Spectrophotometry, ORD and CD; Xray diffraction and Xray crystallography, surface plasmon resonance. 7. Micro array-based techniques 8. Introduction to Histological techniques 9. Detection of molecules in living	2 2 2 2 2 5 2 2 2	Sessional examination

		cells, in situ localization by techniques such as FISH and GISH		
8.	General Microbiology	1. Origin and evolution of microorganisms. 2. Cultivation of microorganisms hrs. 3. Isolation from different natural samples 4. Enumeration / measurement and preservation of growth of microorganism 5. Medical Microbiology: *Vibrio cholera, Salmonella typhii, S. pneumoniae*.	1 1 1 1 5	Sessional examination

Paper II: Immunology and medical entomology

Unit no.	Unit title	Content	Hours	Method of evaluation
1.	Immunology	1.Introduction and history; Primary and secondary organs of the immune system, Cells of the immune system. 2. Innate immune response & inflammation, complement system. 3. Hapten/antigen; antibody, structure & Function, Immunoglobulin classes. Antigen & antibody interaction, Antibody diversity. 4. Major histocompatibility complex, Polymorphism, Human leukocyte Antigen association with disease, Ontogeny, Positive and negative selection. 5. Antigen processing and presentation, Co-stimulation, T and B cell stimulation, Cytokines& Chemokines. 6.Cells and organs of the mucosal immune system. Mucosal effector	5 5 6 8 6 4	

		mechanisms. 7. Phagocytosis. Cytotoxic and T helper response. Natural killer and gamma delta cells. 8. Antigen-antibody, cytokine-mediated immune regulation. Complement mediated regulation. Hypersensitivity. Autoimmunity; immunodeficiency. Transplantation immunology.	4 7	
2.	**Vector Biology**	1.General entomology, insect morphology and classification of Insects and other arthropods of medical importance and their structures and functions. 2. Biology and life history of *Aedes, Culex* and *Anopheles* mosquitoes, their behaviour 3. Biology, morphology and disease relationship of sandflies, fleas, lice, ticks and mites in relation to viral infections prevalent in India 4. Vector virus relationship Xenodiagnosis- methods and application. 5. Vector Control, insecticide resistance mechanism and control dynamics	2 2 3 3 5	

Paper III- Basic and Applied Viral Genetics

Unit no.	Unit title	Content	Hours	Method of evaluation
1.	Molecular biology	1.Genomes: types, diversity in size, structure and organization in viruses, prokaryotes (nucleoid) and eukaryotes. Genome complexity and sequence components. Central dogma theory and flow of genetic information. 2. Genes: gene	4 1	Sessional examination

		structure and architecture, types of genes. 3. Plasmids 4. Mobile genetic elements 5. Gene transfer mechanisms and gene mapping in bacteria 6. Genetic recombination 7. Replication / perpetuation of nucleic acids: Concepts, definitions, and strategies / models for replication. 8. DNA damage and repair 9. Mutations: Types, causes and consequences of mutations 10. Transcription (RNA biosynthesis): Types of RNA and their role. Types of RNA polymerases. DNA foot printing. Promoters, enhancers, silencers, insulators. Events of transcription. Maturation and processing of different RNA transcripts capping, methylation, polyadenylation, splicing, RNA editing and modification of nucleosides in tRNAs. 11. Translation, post-translational modification of	1 1 1 2 3 1 2 4 4	

		proteins and their sorting and targeting. regulation of translation 12. Regulation of gene expression 13. Gene silencing mechanisms	 5 1	
2.	Recombinant DNA Technology	1.Scope and importance of recombinant DNA technology. 2. Tools for Recombinant DNA Technology 3. Cutting and joining of DNA molecules 4. Techniques for gene manipulation 5. Molecular diagnostics: Nucleic acid blotting and hybridization PCR, DNA profiling and DNA finger printing and their applications. 6. Site directed mutagenesis and protein engineering 7. Gene cloning strategies 8. Gene cloning & Expression in bacteria, yeast, plant and animal cells Insect cell system Construction of vectors 9. Phage display libraries, reverse genetics, viral replicons 10. Functional genomics – transcriptome and gene expression profiling	1 4 2 3 6 2 2 8 3 2 1	Sessional examination

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		11. Proteomics- proteome and analysis of protein expression.		
3.	Virus cell interactions	1.Definition, structure and methods of discovery of viral receptors (polio, herpes, VSV, HIV). Cellular interactions 2. Replication sites and their characterization, IRES, replicons, transport of viral proteins. 3. Host cell 'shut off', apoptosis, necrosis, stress response, alteration of signalling pathways, cellular basis of transformation, types of cenotaphic effects, ultrastructural cytopathology. 4. Cellular injury associated markers, mechanism of viral persistence and latency—	5 3 3 5	Sessional examination

Paper IV- Epidemiology and Biostatistics

Unit no.	Unit title	Content	Hours	Method of evaluation
1.	Basic epidemiology and biostatistics	1.History, evolution, definitions and concepts in Epidemiology. 2. Descriptive and analytical epidemiology 3. Sample size estimation and introduction to study designs	5 8 5	Sessional examination

		4. Introduction, types of data, tabular and graphical presentation of data. 5. Measures of central tendency. 6. Concept of probability. Concept of significance tests 7. Introduction to Sampling Methods 8.Types and methods of public health and infectious disease surveillance, establishing surveillance system. 9. Case control and cohort studies. 10. Needs and steps to be taken for outbreak investigations, collaboration with State and National health authorities. 11. Veterinary Epidemiology [2 hrs]	5 5 5 2 5 4 4 2	

Paper V- Diagnostic Virology

Unit no.	Unit title	Content	Hours	Method of evaluation
1.	Viral Enteric Diseases and Oncogenic viruses	1. Epidemiological scenario with respect to Viral Enteric Diseases at National And International level 2. Enteric viral infections: Clinical course, disease burden, risk factors, prevention, and treatment.	1 2	Sessional examination

		3. Rotavirus diversity, emerging strains, immunopathogenesis and vaccines under development. 4. Other viruses associated with diarrhoea and gastroenteritis: 5. Polio & Non-polio Enteroviruses 6. Viral oncogenesis, oncogenic viruses HPV, HTLV, Epstein Barr virus	2 6 3 2	
2.	Viral hepatitis	1.Physiology of Jaundice, clinical features and differential diagnosis, presentations of hepatitis caused by different hepatitis viruses. 2. Structure & genomic organization, replication, genotypes, serotypes of HAV, HBV, HCV & HEV. Mutations in hepatitis viruses. 3. Serological and molecular diagnosis of different hepatitis viruses. [3 hrs]. 4. Immunopathogenesis of different hepatitis viruses. Animal models and their uses. 5. types of hepatitis vaccines, vaccines presently used & vaccines of the future.	3 4 3 2 3	Sessional examination
3.	Viral respiratory diseases	1.Epidemiology of to respiratory diseases 2. History, clinical features, epidemiology, of	1 5	Sessional examination

		influenza, RSV and other respiratory diseases. 3. Biology and pathogenesis of SARS, Metapneumovirus, human rhino virus and Corona virus etc. 4. Differential diagnosis of different respiratory diseases. 5. Vaccines against different viral respiratory diseases.	3 3 4	
4.	Skin diseases	1.Epidemiology of Exanthematous diseases. 2. Viruses associated with Exanthematous Diseases 3. Measles, mumps, rubella, Parvovirus B-19, Chicken pox and other viral pox diseases. 4. Common features of viral pox diseases and case definitions. Para specific immunity due to pox vaccination, eradication and control programs.	1 5 7 3	Sessional examination
5.	Viral haemorrhagic fevers	1. Epidemiology of Viral Haemorrhagic Fevers 2. Common clinical features of Viral Haemorrhagic Fevers, History and Disease burden, Risk factors and geographical distribution of viruses associated with haemorrhagic fevers and their impact on global health. Clinical samples required,	1 3	Sessional examination

		choice of laboratory diagnostic tests and their interpretation for differential diagnosis. 3. Virus replication strategy, Pathogenesis, Prevention and treatment of Dengue. 4. Virus replication strategy, Pathogenesis, Prevention and treatment of Yellow Fever, Kyasanur forest disease, Chikungunya, Rift Valley Fever, Crimean Congo haemorrhagic fever, Hanta, Marburg and Ebola, and Rickettsial fevers.	 6 6	
6.	Viral encephalitis	1. Epidemiology of Viral Encephalitis 2. Viral Encephalitis, encephalopathy and meningitis, clinical symptoms and causative agents, treatment modalities, transmission, spread of an outbreak in relation to causative agent. Laboratory diagnosis of viral encephalitic agents, basic principles, preferred methods and problems. 3. Japanese encephalitis and West Nile viral infection 4. Chandipura encephalitis, other rhabdoviral neurotropic agents. 5. Encephalitis caused by measles, mumps	1 3 3 2 4	Sessional examination

		, alpha viruses, Nipah and Hendra virus, Herpes 6. Routes and modalities of infections of the nervous tissue, blood brain barrier, factors affecting the neurovirulence	3	
7.	HIV/ AIDS	1.Epidemiology of HIV/ AIDS, Introduction to retroviruses 2. Sexually transmitted diseases and their relation with HIV, opportunistic infections in HIV infected individuals. Social and behavioural aspects of prevention and control. Natural history. 3. Structure and replication of HIV, immunopathogenesis of infection, laboratory diagnosis of HIV infection. HIV isolation, characterization and viral load estimation. 4. Antiviral therapy and drug resistance, HIV vaccines. 5. Origin of HIV-1, HIV -2, SIV.	1 4 5 2 3	Sessional examination

Paper VI: Applied Epidemiology, Applied Biostatistics & Applied Entomology

Unit no.	Unit title	Content	Hours		
1.	**Applied epidemiology**	1.Types and methods of public health and infectious disease surveillance, establishing	5		

		surveillance system. 2. Case control and cohort studies. 3. Needs and steps to be taken for outbreak investigations, collaboration with State and National health authorities. [4 hrs.] 4. Veterinary Epidemiology 5. Medical surveillance: Medical first aid, Vaccination requirements, Accident reporting and investigation, post-exposure assessments & management, Hospital infection control 6. Preparedness and Response for emerging infections and outbreaks 7. Engineering and laboratory maintenance: general maintenance program of facility, environment controls, Laboratory AHUs, filters etc and other decontamination procedures, Various Alarms, Biosafety Cabinets, Autoclaves, keeping, Freezers, Incubators, Centrifuges etc.	4 4 2 1 2 2		
2.	**Bioinformatics**	1. search engines, sequence data	3		

		formats and submission tools, scoring matrices for sequence alignments, algorithms, database similarity searches—BLAST, FASTA. 2. Methods for sequence analysis: Multiple sequence alignment, phylogenetic analysis and tree building methods, data mining tools and applications 3. Structure based Approaches, homology based methods for protein tertiary structure prediction, visualization tools, structure evaluation and validation 4. Primer designing for PCR.	7 3 2		

Paper VII: Recent Advances in Molecular Virology

Unit no.	Unit title	Content	Hours	Method of evaluation
	Antivirals and Viral Vaccines	1.Conventional vaccines, immunomodulators (cytokines), vaccine delivery & adjuvants, large scale manufacturing-QA/QC issues. 2. Animal models and vaccine potency testing. 3. Vaccine induced	8 2 2	Sessional examination

		immune response and immune markers of protection 4. Interferons, designing and screening for antivirals, mechanisms of action, antiviral libraries, antiretrovirals- mechanism of action & drug resistance. 5. Anti-sense RNA, siRNA, miRNA, ribozymes, *in silico* approaches for drug designing.	10 8	

PRACTICALS

Paper 1: Basic- Microbiology, Virology -30 hours

Analytical methods (30 hours)
1. Preparation of reagents and buffers
2. Protein estimation by Lowry method
3. DNA estimation (spectrophotometric)
4. Polyacrylamide gel electrophoresis
5. Gel Filtration chromatography (Demonstration)

Tissue culture techniques (30 hours)
1. Glassware decontamination, washing, sterilization, packing and sterile handling.
2. Media and reagents preparation, sterility checks
3. Maintenance of cell cultures
4. Growth studies. cell count, mitotic index.
5. Preparation of primary cell culture (CEC)

Virus / Antigen detection (30 hours)
1. ELISA
2. Immunofluorescence assay
3. Heamagglutination
4. Agar gel diffusion
5. Polymerase chain reaction
6. Electron microscopy (Demonstration)

Propagation of viruses (15 hours)
1. Estimation of virus yields-- plaque assay & TCID50
2. Preparation virus stocks and determination of mouse LD50
3. Routes of inoculations in embryonated eggs
4. Handling of animals: Rules & Regulation

Paper II-Immunology and Entomology -30 hours

Entomological methods (15 hours)
1. Mosquito collection & taxonomy
2. Taxonomy of ticks and sandflies
3. Processing of arthropods
4. Mosquito inoculation &immunofluorescence
5. Insecticide testing
6. Water Sample Analysis (As Breeding Sources of Vector Mosquitoes)
7. Feeding Patterns of Mosquitoes & Houseflies & Mouthparts Dissection
8.Agar Gel Diffusion
9. Lymphocyte Separation
10.ELISA
11.IFA
12.Serodiagnosis of HCV, Serodiagnosis of HBV, Serodiagnosis of HIV
13.Water Sample Analysis (As Breeding Sources of Vector Mosquitoes)

Paper III- Basic and Applied Viral Genetics -30 hours

1. Nucleic Acid Extraction
2. Detection of DNA & RNA
3. Estimation of DNA & RNA
4. PCR
5. RT-PCR
6. Real Time PCR
7. Agarose Gel Electrophoresis
8. PAGE
9. Identification of PCR Amplified Products of Viral Antigens
10. Rt-PCR-Arbovirus
11. RT-PCR-Influenza

Paper IV- NO PRACTICALS

Paper V- Diagnostic Virology -30 hours

1. Sample collection
2. Sample processing for virus isolation and IFA
3. IFA
4. Virus isolation
5. HA test
6. HI test

Viral Exanthematous Diseases (15 hours)

1. Rubella (IgG, IgM) diagnosis
2. Measles (IgG, IgM) diagnosis
3. Measles PCR

Viral Hemorrhagic Fevers (Special reference to Dengue) (30 hours)

1. MAC-ELISA, Multiplex RT-PCR for serotyping
2. RNA extraction by Trizol method, Reverse transcription- PCR, agarose gel electrophoresis, interpretation
3. Hemagglutination inhibition assay

Viral Encephalitis ((15 hours)

1. Flavivirus neutralization tests for differential diagnosis
2. RT PCR of JE

HIV / AIDS ((15 hours)

1. HIV Diagnosis
2. HIV subtyping
3. CD4, CD8 counts

Paper VI: Applied Epidemiology, Applied Biostatistics & Applied Entomology-30 hours

Statistical software (EPI-Info)-

1: Introduction to the software
   Design data entry form
   Importing MS Excel data in Epi-Info
2: Basic commands in Epi-Info
   Recoding/transforming a variable
   Preparing frequency distributions/cross tables
   Computing descriptive statistics and interpretation
3: Graphical presentation of data:
   Bar diagram, Line diagram, Pie chart, Histogram, EpiCurve
   Interpretations
4: Computing correlation coefficient
   Comparing proportions using chi-square test
   Comparing means using t test
   Computing risk using univariate logistic regression
   Interpretations

1. Biological data banks.
2. Pairwise sequence alignments.
3. Phylogeny & tree building 1.
4. Phylogeny & tree building 2.
5. Secondary structure prediction.
6. Secondary databases – Motif, family searches, Epitope prediction(B-cell).
7. Epitope predictions (T-cell).
8. Biomolecular Structure visualization 1.
9. Biomolecular Structure visualization 2.
10. Primer designing.

Applied epidemiology

1. Laboratory emergency response issues: [Spills: laboratory simulation on Splashes/spills CIP protocol, Needle stick injury, Cuts, & Medical emergencies etc. Air & surfaces decontaminations of the facility based on incidents/accidents, Safeguarding against accidents in the facility, Ventilation failure and emergency protocols, Fire and other emergencies, Simulation fire alarm system, immediate remedial measures, emergency exit protocol, Safety measures & preparedness for Natural disasters & Terrorist threats].

2. Engineering requirements for Containment laboratory (BSL- II, III): Construction (Civil, Plumbing, drain line), HVAC & BMS, Electrical system (UPS, DG set), Access control system, Furniture, Communication, Fire alarm system, Definition of HEPA/ ULPA filter, Percentage (%) of penetration, In place testing, HEPA filters, Autoclave, BSC working & testing, Equipment's use in waste management: Incinerator & Shredder]

Paper VII: Recent Advances in Molecular Virology-30 hours

1. Biological Data Banks & Bioinformatics
2. NCBI, IVR, SWISSPROT & GISAID
3. Sequence Alignment Tools
4. Multiple Alignment
5. BLAST
6. Nucleic Acid to Translation
7. Sequence Assembly
8. Phylogeny Analysis
9. Software's : Mega & Bio Edit

Interdepartmental postings- 4 weeks

Students will be posted in the microbiology, biotechnology, bioinformatics for the observation and to develop expertise in various the diagnostic/ research methods.

Clinical Department Postings -4 weeks

Students will be posted on rotation basis to various clinical departments such as medicine, pediatrics, neurology and skin & VD.

Peripheral postings –2 weeks

Students will be posted in the microbiology department of veterinary college and virology department of SV university to gain experience in plant and animal diagnostic and research methods.

MONITORING LEARNING PROGRESS

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured, and assessment be done using checklists that assess various aspects. Model Checklists are given in this Chapter, which may be copied and used.
The learning out comes to be assessed should include:

i) *Acquisition of Knowledge*: The methods used comprise of `Log Book' which records participation in various teaching / learning activities by the students. The number of activities attended and the number in which presentations are made are to be recorded. The logbook should periodically be validated by the supervisors. Some of the activities are listed. The list is not complete. Institutions may include additional activities, if so, desired.

Journal Review Meeting (Journal Club): The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting using a checklist (see Model Checklist – I, Section IV)

Seminars / Symposia: The topics should be assigned to the student well in advance to facilitate in depth study. The ability to do literature search, in depth study, presentation skills and use of audio- visual aids are to be assessed using a checklist (See Model Checklist-II, Section IV)

ii) Teaching skills: Candidates should be encouraged to teach undergraduate medical students and paramedical students, if any. This performance should be based on assessment by the faculty members of the department and from feedback from the undergraduate students (See Model checklist III, Section IV)

ii) Dissertation: Please see checklist IV and V in Section IV.

iii) Work diary / Log Book- Every candidate shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal, reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of experiments or laboratory procedures, if any conducted by the candidate.

iv)*Records:* Records, log books and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University.

Log book:

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

Format for the logbook for the different activities is given in Tables 1 and 2 of Section IV. Copies may be made and used by the institutions.

Procedure for defaulters: Every department should have a committee to review such situations. The defaulting candidate is counseled by the guide and head of the department. In extreme cases of default, the departmental committee may recommend that defaulting candidate be withheld from appearing the examination, if she/he fails to fulfill the requirements in spite of being given adequate chances to set himself or herself right. Format of Model Checklists

Checklist - I

Model Checklist for Evaluation of Journal Review Presentations

Name of the student: _____ Date: _____

Name of the faculty/Observer: _____

Sl. No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist - II

Model Check List for the Evaluation of the Seminar Presentations

Name of the student: _____Date:_____

Name of the faculty/Observer: _____

Sl. No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist – III

Model Check list for Evaluation of Teaching Skill

Name of the student: _____Date: _____

Name of the faculty/Observer: _____

SL.No.		Strong Point	Weak point
1	Communication of the purpose of the talk		
2	Evokes audience interest in the subject		
3	The introduction		
4	The sequence of ideas		
5	The use of practical examples and /or illustrations		
6	Speaking style (enjoyable, monotonous, etc., specify)		
7	Summary of the main points at the end		
8	Ask questions		
9	Answer questions asked by the audience		
10	Rapport of speaker with his audience		
11	Effectiveness of the talk		
12	Uses of AV aids appropriately		

Checklist - IV

Model Check list for Dissertation / Project Work Presentations

Name of the student: _____Date: _____

Name of the faculty/Observer: _____

Sl. No.	Points to be considered	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Checklist – V

Continuous Evaluation of dissertation / project work Guide/ Co-Guide

Name of the student: _____Date: _____

Name of the faculty/Observer: _____

Sl. No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Periodic consultation with guide/ co-guide					
2	Depth of Analysis/ Discussion					
3	Department presentation of findings					
4	Quality of final output					
5	Others					
	Total score					

Overall Assessment Sheet

Date:

Check list No.	Name of the students			
	A	B	C	D
1				
2				
3				

Signature of the HOD Signature of the Prof. i/c AHS

The above overall assessment sheet used along with logbook should form the basis for certifying satisfactory completion of course of study, in addition to the attendance requirement.

KEY

Mean score: Is the sum all the scores of checklists 1 to 5

A, B, C: Name of the students

LOG BOOK

Table 1: Academic activities attended

Name: Admission

Year:

Date	Type of activity, Specific Seminar, Journal club, presentation, UG teaching	Particulars

Table-2: Academic presentations made by the student

Name:

Admission Year:

Date	Topic	Type of activity, Specific Seminar, Journal club, presentation and UG teaching

Management Information System Report

1. Name of the college imparting MSc clinical virology
2. Details of M.Sc.

Sl. No	**Name of the Branch & Teaching faculty**	**Sanctioned Strength**	**Admitted**	**Name of the subjects to be studied at 1st Year M.Sc.**	
1					
2					

3. No. of experiments/assignments conductedfor1st year M.Sc. clinical virology

Sl.No	Branch	Subject		Assigned by SVIMS University	Conducted	%	Remarks
1.		No	Name				
2							

4. No. of theory classes conducted for 1st year M.Sc. clinical virology

Sl.No	Branch	Subject		SVIMS University Norms (25)	Conducted	%	Remarks
1.		No	Name				
2.							

5. Number of theory and practical classes taken by 2nd year M.Sc. clinical virology students for undergraduate program (Optional).
6. No. of Journal club's department wise for 1st year and 2nd year M.Sc. Clinical virology students

Total No. of students Dept. Wise	Norms for half yearly Report	Achieved Number	% Achievement	Remarks
1st year M.Sc. Cardiac catheterization and Interventional Technology No.=	10 per candidate per year			
2nd year M.Sc. Cardiac catheterization and Interventional Technology No.=	10 per candidate per year			

7. Number of seminarsfor1st yearand2nd year M.Sc. Clinical virology students

Total No. of students: 10	Norms for half yearly Report	Achieved Number	% Achievement	Remarks
1st year M.Sc. Cardiac catheterization and Interventional Technology No.=10	10 per candidate			
2nd year M.Sc. Cardiac catheterization and Interventional Technology No.= 08	10 per candidate			

8. Number of inter departmental meetings

Norms for half yearly Report	**Achieved Number**	**% Achievement**	**Remarks**
6			

Overall Assessment of the student by the clinical/Lab work:

Sl. No	Points to be considered	Poor 0	Below Average 1	Average 2	Good 3	Very Good 4	Excel lent 5
1	Attendance						
2	Punctuality						
3	Interaction with colleagues and support staff						
4	Performance in the lab						
5	Topic Presentation						
7	Time sense						
8	Knowledge						
9.	Clinical orientation						
10	Overall quality of work						
	Total Score	- -	- -	- -			

MODEL QUESTION PAPER

THEORY

Each theory paper will have

1) Essay questions – 03 nos. carrying 10markseach - 03 x 10 =30
2) Short answer questions – 10 nos. carrying 05markseach - 10 x 05 =50

Total =80

Internal assessment =20

PRACTICAL

(a) Preliminary:

Internal assessment : 15
University examination : 60

Total =75

(b) Viva =25

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES

TIRUPATI – 517 507

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

1ST BOARD OF STUDIES MEETING

M.Sc. CARDIO-PULMONARY PERFUSION TECHNOLOGY COURSE

12/03/2021

TIRUMALA TIRUPATI DEVASTHANAMS

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES,TIRUPATI

BOS Members

1.	Dean, SVIMS	-	Chairman
2.	Registrar, SVIMS	-	Member
3.	Controller of Examinations, SVIMS	-	Member
4.	Dr K. Bhaskar Reddy Principal i/c, AHS, Dept. of Forensic Medicine, SVIMS	-	Member
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6.	Dr.T.Periyaswamy Professor & HOD Department of Cardio Thoracic Surgery Sri Ramachandra Institute of Higher Education and Research, Chennai	-	External Expert
7.	Sri Narsimhan Swaminathan Professor of Physiotherapy Vice Principal, Faculty of AHS Sri Ramachandra Institute of Higher Education and Research (Deemed to be University), Chennai	-	Member

CONTENTS

SECTION-I

AIMS AND OBJECTIVES

1. Aims and Objectives:

The main goals of postgraduate training in M.Sc Cardio Pulmonary Perfusion Technology are :

- The student should be thought full and have an understanding of the basic sciences relevant to respective department.
- He/ She should be able to acquire the detailed knowledge about the fundamentals and the upcoming advances in the respective field.
- He/ She should be able to critically analyse and evaluate various concepts and views and to adopt the one which is appropriate.
- He/ She should efficiently, effectively and skillfully practice cardio pulmonary perfusion which would be based on the scientific knowledge.
- The student should continue to strive and have keen interest in professional development both in teaching and in clinical practice.
- He / She should have a caring and a gentle attitude and would be empathic towards all,
- The student should be able to maintain high ethical standards.
- He/ She should be willing to share the knowledge and skills with the fresh learners, junior or a colleague.
- Medicine is a continuous processes of learning. Every second there is change in the technology and the techniques hence one needs to keep updated with the recent. This knowledge could only be acquired by self-study and by attending courses, conferences and seminars relevant to the speciality.
- He/ She should be able to undertake audit; use information and carryout research with the aim of publishing or presenting the work at various scientific gatherings**.**

The student should be able to acquire adequate skills and competence in performing various tasks as required.

- He or She should be able to adopt ethical principles in all aspects of the professional practice**.**
- He or She should be able to practice professional honesty and integrity.
- He or She should be able to carry out the duties irrespective of social status, caste, creed or religion of the patient.
- He or She should develop oral and written communication skills, which is very important for efficient functioning of the team.
- He or She should have leadership quality so as to get the best out of his or her team in a congenial working atmosphere.
- The student should be able to apply high moral and ethical standards while carrying out research related in its field.
- The student should be humble and accept the limitations in his or her knowledge and skill and should not hesitate to ask for help from colleagues when needed.

SECTION - II
GENERAL REGULATIONS

1. **Title of the Course**
   Master of Science degree in Cardio-Pulmonary Perfusion Technology
2. **Duration of the Course**
   The duration of the course shall be 2- years on full time basis
3. **Eligibility for Admission**
   a) B.Sc. in Cardio Pulmonary Perfusion Technology (B.Sc. CPPT)
   b) B,Sc. in Perfusion technology with an equivalent course / syllabus from a recognized University.
   c) B.Sc. Degree + 2 yrs. PG Diploma in CPPT.
   d) Candidates with Correspondence and Diploma courses in CPPT shall not be considered
   e) Candidates passing B.Sc. in Perfusion technology (Pertaining to dialysis Perfusion) shall not be eligible.
4. **Selection Criteria**
   Selection shall be based on the academic merit/entrance test conducted inthe qualifying exam.
5. **Admission schedule :**
   a) Commencement of Course: August every year
   b) The admissions are closed by 30th September or 60 days from the date of commencement of the programme.
6. **Yearly intake: 2 students per year.**
7. **Medium of instruction.**

   English shall be the medium of instruction for the subjects of study as well as for the Examination.

8. **Course of study**

   The course shall be pursued on full time basis. In the end of first year and second year there shall be an examination. Students shall be posted to SVIMS and SPMC hospitals during the practical hours.

   Subjects for study and teaching hours for first year and second year of the PG courses are shown below;

M.Sc.Cardio-Pulmonary Perfusion Technology

Table - I Distribution of Teaching Hours

First Year

S.No.	Main subject	Theory No. of Hours	Practical No. of Hours	Total
1.	Cardiology and Cardiac Surgery	80	60	140
2.	Introduction to OT& Cardio Pulmonary Perfusion Technology	80	60	140
3.	Equipments In Cardio Pulmonary Perfusion Technology & Physiology & Pathology Of Cardio Pulmonary Perfusion Pharmacology of Cardiovascular Drugs	80	60	140

4.	Epidemiology & Bio-statistics including Research Methodology	80	-	80
	Total:	**320**	**180**	**500**

Second year

S.No.	Branches	Theory No. of Hours	Practical No. of Hours	Total
5.	Clinical Applications Of Cardio Pulmonary Perfusion Technology	60	80	140
6.	Cardiac Surgery Without CPB Mechanical Circulatory Support & Robotic Cardiac Surgery.	60	80	140
7.	Organ Transplantation.	60	80	140
8.	Hematology as Relevant to Cardio Pulmonary Perfusion, Blood Transfusion and Blood Conservation	60	80	140
	Total:	**240**	**320**	**560**

9 a) Attendance:

A candidate is required to put in minimum 80% of attendance both in theory and practical separately of each paper before admission to the university examination. Participation in NCC, NSS, sports and games, educational tours, professional meetings and conferences or other co-curricular activities representing the institution/university will not count as absence.

b) Condonation for lack of attendance:

The condonation of attendance on medical grounds or on absence under extraordinary circumstances to those who are having the attendance between 70% and 79% in each paper will be granted in genuine cases. The students who have shortage of attendance in the particular papers have to apply to the controller of examinations, indicating the reasons for shortage of attendance. The representation to be forwarded by the HOD &Principal I/c,AHS. If the reason is on the medical grounds, the relevant medical certificate has to be enclosed to the representation. If any student falls below the 70% of attendance, he/she will not be allowed to write the university examinations.

10. Scheme of examination

a) The examination for the degree shall consist of written papers, practical and oral.
b) There shall be two examinations viz., Preliminary and final. The preliminary examination shall be taken at the end of the first year. The final examination shall be taken at the end of 2nd year.
c) The examination shall be conducted ordinarily twice a year, viz., July/August and January/February.

Preliminary Examination

This consists of theory, practical and oral.

Table - I. University Examination and Distribution of marks

First year

S.No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
1.	Cardiology and Cardiac Surgery	I	20	80	15	60	25	200
2.	Introduction to OT & Cardio Pulmonary Perfusion Technology	II	20	80	15	60	25	200
3.	Equipments In Cardio Pulmonary Perfusion Technology & Physiology & Pathology of Cardio Pulmonary Perfusion Pharmacology of Cardiovascular Drugs	III	20	80	15	60	25	200
4.	Epidemiology & Bio-statistics including Research Methodology	IV	20	80	-	-	-	100
	Total							**700**

Second year

S.No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
5.	Clinical Applications Of Cardio Pulmonary Perfusion Technology	V	20	80	15	60	25	200
6.	Cardiac Surgery without CPB Mechanical Circulatory Support & Robotic Cardiac Surgery.	VI	20	80	15	60	25	200
7.	Organ Transplantation	VII	20	80	15	60	25	200
8.	Hematology as Relevant to Cardio Pulmonary Perfusion, Blood Transfusion and Blood Conservation	VIII	20	80	15	60	25	200
9.	Dissertation					100	50	150
	Total							**950**

11. Dissertation:

The student should submit dissertation one month before the final examination. Those students who have not submitted the dissertation shall not be allowed to appear for the final examination. The dissertation shall be assessed at the time of orals by all the examiners.

The dissertation shall be written under the following headings:

Introduction; Aims or objectives of study; Review of literature; Materials and methods; Results; Discussion; Conclusion; Summary; References; Tables; Annexure

The Dissertation shall be reviewed in the form of a presentation every month by the Guide / HOD CVTS.

The written text of dissertation shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and other annexures. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should not be done. A declaration by the candidate that the work was done by him/her shall be included. The Guide and Head of the Department shall certify the bonafide of the dissertation.

Three copies of dissertation shall be submitted to the university through proper channel along with a soft copy (CD), one month before the final examinations.

12. Internal assessment (IA):

a) A student must secure at least 35% marks of the maximum marks fixed for internal assessment in a particular subject, to be eligible to appear for the university examination of that subject.
b) There shall be three internal assessment tests and the average of these tests shall be considered for awarding final marks.
c) If the candidate is absent for any of the exams, the marks in that exam shall be taken as zero.
d) The computed internal assessment marks as per the regulation a & b shall be sent to the controller of exams 15 days before the commencement of the University exam.
e) The internal assessment marks should be signed by the concerned teaching faculty or HOD and counter signed by the HOD before being forwarded to the Controller of Examinations.
f) For those who failed in internal assessment test/s, have to reappear as per the regulations before he/she appears for the university examination.
g) For those who want to improve their marks in internal assessment tests, they can appear again as per the regulation. For such students, the internal assessment marks of the student at the time of first appearance will be compared with the marks obtained at the present appearance and the higher of the two will be taken as his/her internal assessment marks.

13. Examination fee structure : The examination fee shall be applicable as existing to the Other M.Sc. Courses (AHS).

14. Minimum for a pass:

a) 35% in internal assessment of each theory paper and practicals/viva voce
b) 40% in each theory paper of university examination.
c) 50% on the total marks of theory university examination and internal assessment clubbed together, applicable to each paper.
d) Where, viva voce involved which is part of theory examination, 50% on the total marks of theory university examination, internal assessment and viva voce clubbed together, applicable to each paper.
e) Where there is no internal assessment marks, 50% on the total theory marks, 50% in practicals/viva voce applicable to each subject.

15. Classification of successful candidates:

Percentage of Marks for declaring Class:

Distinction	- 75% and above of the total marks.
First Class	- 65 - 75% of the total marks.
Second Class	- 50- 64% of the total marks.
Pass Class	- If the student does not pass all the subjects withinthe 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 attendance shortage, it will be taken into consideration as not completed within the duration of the course and the final results will be declared as "Pass".

16. Panel of examiners:

a) There shall be a panel of four external examiners as advised by the Head of the department..
b) Theory paper setting to be done by the examiners locally, within the state or outside the state. For practical and viva-voce

c) No.of Examiners Required - Two
No.of Internal Examiner. - One
No.of External Examiner. - One

Eligibility for the examinership:

a) The examiner shall be a full time teacher in the college or institution he or she is working.

b) Academic qualification and teaching/professional experience for examiners:

- External / Internal Examiner: M.Sc in Cardio pulmonary Perfusion Technology / or equivalent syllabus for M.Sc Perfusion technology with minimum of five years of teaching / professional experience.
- External / Internal Examiner: M.Ch / DNB in Cardio Thoracic Surgery shall have not less than 5 years of teaching experience in the speciality concerned and working as Asst Prof. Or above in a teaching hospital.

17. Reappearance:

The student has to pass both theory and practicals/viva voce, if any student pass in theory examination and fail in practicals/viva voce examination or vice versa, the concerned student has to appear again for both theory and practicals/viva voce examination.

18. Carry-over Provision:

The students are permitted to complete the course period irrespective of their success in the preliminary part. However, the final results will be kept under "withheld" until he/she passes all the previous papers".

19. Maximum duration for completion of course:

A candidate shall complete the course within four years from date of admission. Failing which, the candidate will be discharged.

20. Eligibility for award of degree:

A candidate shall have passed in all the subjects of first and second year to be eligible for award of degree.

21. Model Question Paper:

(Common for all papers – 1st & 2nd year)

THEORY

Each theory paper will have

1) Essay questions – 03 nos. carrying 10 marks each	- 03 x 10	= 30
2) Short answer questions – 10 nos. carrying 05 marks each	- 10 x 05	= 50
Total		**= 80**
Internal assessment		= 20

PRACTICAL

(a) Internal assessment	:	15
University examination	:	60
Total	=	**75**
(b) Viva	=	25

22. Minimum Requirement of Infrastructure, Laboratory Facilities and Staff:

(i). Basic Infrastructure:

Institute should have its own hospital with full-fledged cardiac surgical service with the following facilities:

- 3 cardiac operating rooms
- Chief Perfusionist and 2 Assistant Perfusionist
- Class Room with capacity for 10 students
- One departmental Seminar room with capacity of 30 students with A.V aids – OHP, Slide projector and computer with accessories are compulsory. LCD Projector (optional)
- Institute should have the following infrastructure criteria- Principals room, students common room, staff room, Library, office room, Store room, preparation room etc will be as per minimum criteria.
- Minimum of 250 open-heart procedures per year.

(ii). Infrastructure subject wise

- Anatomy laboratory
- Physiology laboratory
- Perfusion equipments
    i. Heart Lung Machine and Accessories
    ii. Heater Cooler – one machine per patient
    iii. IABP - 2
    iv. A C T Machine - 2
    v. Blood Gas Analyzer - 2

(iii). Teaching staff requirement:

Teaching staff should be actively involved in imparting education in the particular subject:

- Professor – 1
- Associate Professor (5 years teaching experience) – 1
- Assistant Professor (3 years teaching experience) – 1
- Chief Perfusionist / Lecturer (B.Sc. Cardio Pulmonary Perfusion Technology) - 1
- Assistant Perfusionist / Tutor (B.Sc. / Diploma with experience of 5 years in Cardio pulmonary Perfusion Technology).

SECTION -III
Course content (Syllabus)

I YEAR THEORY

Paper –I: CARDIOLOGY and CARDIAC SURGERY 80 Hours

CARDIOLOGY

1. **The Electrical Activity of the Heart: the Electrocardiogram:** The cardiac action potential, the electrocardiogram.
2. **Diseases of the Coronary Arteries:** Causes, Pathology and Prevention, Coronary Heart Disease – Angina and Unstable Angina; Coronary Heart Disease – Myocardial Infarction: Treatment of acute infraction, complications of acute myocardial infarction and their management, late complications of infraction, risk stratification at hospital discharge, drug treatment at discharge, rehabilitation.
3. **Heart Failure:** The Pathophysiology of heart failure, clinical syndromes of heart failure, the management pf cardiac failure, acute circulatory failure (shock), cardiac transplantation.
4. **Disorders of Rate, Rhythm and Conduction:** Mechanisms of arrhythmias, disturbances of rate and rhythm, disorders of conduction, investigation of arrhythmias, management of arrhythmias.
5. **Rheumatic Fever and its Sequelae, Disorders of the Cardiac Valves:** Mitral valve disease, aortic valve disease, tricuspid valve disease, pulmonary valve disease, infective endocarditis.

6. Congenital Heart Disease: The varieties of congenital heart disease.

CARDIAC SURGERY

1. **Ischaemic Heart Disease:** Pathophysiology of ischaemic disease: Indications for CABG, Contraindication to CABG, Planning coronary artery surgery, Conduit, selection, Principles of saphenous vein harvest, Saphenous vein harvest, LIMA harvest, RIMA harvest, Alternative conduits, Distal anastomoses on bypass, Jump or sequential grafts, Endarterectomy, Positioning the heart in OPCAB , Proximal anastomoses to aorta, Redo coronary artery bypass surgery , Problem scenarios in redo surgery , Left ventricular aneurysm , LV aneurysmectomy ,Ischaemic ventriculoseptal defect (VSD), Ischaemic mitral regurgitation, Results of coronary artery bypass surgery.

2. **Valvular Heart Disease:** Pathophysiology of aortic stenosis, Pathophysiology of aortic regurgitation, Timing of surgery – aortic, Principles of aortic valve replacement, Aortic valve implantation, Stentless aortic valve replacement, Homograft aortic valve replacement, The Ross procedure, Aortic root replacement, Aortic root enlargement, Principles of valve sparing procedures, Results of aortic valve surgery, Pathophysiology of mitral stenosis, Pathophysiology of mitral regurgitation, Timing of surgery – mitral, Principles of mitral valve repair, Mitral Valvotomy, Principles of mitral valve repair, Mitral valve replacement, Tricuspid valve disease, Surgery for infective endocarditis, Combined Valvular procedures, Alternative approaches, Results of mitral and tricuspid valve surgery.

3. **Congenital heart disease:** Overview of congential heart surgery, Patent ductus arteriosus, Anomalous pulmonary venous connection, Coarctation of the aorta, Atrial septal defects, Ventricular septal defects, Atrioventricular septal defects, Truncus arteriosus, AV alignment abnormalities, Transposition of the arteries, Ebstein's anomaly , Tetralogy of Fallot ,

Hypoplastic left heart syndrome, Basic operative technique , Arterial switch (Jatene), Rastelli operation, Damus-kaye-stansel operation, Norwood operation, Glenn shunt and hemi – Fontan, Fontan operation, Pulmonary artery banding, Aortopulmonary shunts, Tetralogy of Fallot repair, Pulmonary valvotomy, Aortopulmonary window repair, Coarctation of the aorta repair, Interrupted aortic arch repair, LVOT obstruction repair.

4. **Diseases of the thoracic aorta**: Pathology of aortic dissection, Diagnosis of type A aortic dissection, Management of type A dissections, Set – up for repair of aortic dissection, Repair of Debakey type II dissection, Repair of Debakey type I dissection, Management of type B dissections, Other repair techniques, Pathology of aortic aneurysms, Diagnosis of aortic aneurysms, Management of aortic aneurysms, Surgery for ascending aneurysms, Valve sparing surgery techniques, Surgery for aortic arch aneurysms, Repair of descending aortic aneurysms, Bypass for descending aorta surgery, Traumatic aortic transaction.

5. **Minimal access surgery:** Incisions, Options for Cardiopulmonary bypass, LIMA harvest, Coronary artery bypass grafting (CABG), Valve surgery.

6. **Complications of cardiac surgery:** Normal postoperative course, Overview of complications, Hypotension and tamponade, Chest pain and ischemia, Late arrhythmias, Hypertension, Pericardial problems, Complications of valve surgery, Respiratory complications, Renal Complications, Gastrointestinal symptoms, Gastrointestinal complications, Hepatobiliary complications, Stroke, Management of stroke, Neurological complications, Wound infections, wound complications, Haematological complications.

7. **Cardiac Anaesthesia:** Basic Principles of anaesthesia, Conduct of anaesthesia, Pre-bypass anaesthetic management, Anaesthetic management of bypass, Anaesthetic management post – bypass, Anaesthesia for off – pump surgery.

PAPER - II INTRODUCTION TO – OT & CARDIO PULMONARY PERFUSION TECHNOLOGY: 80 Hours

1. **Introduction to the operating room environment & protocols:** General protocols followed in the operating room, Hand washing, Unsterile-substerile-sterile methods followed in the O R environment, Handling of Disposables in the O R, Handling &maintenance of equipments in the OR, Protocols followed in CCU

2. **Introduction to the various components of Cardiopulmonary bypass system**

3. **Introduction to the basics of CPB procedures**

4. **Basics of electricity & functioning of electro medical equipments.** Electric safety (Earthing) & care of apparatus. Electricity & electro medical equipments& safe guards Static electricity

5. **Sterilization – material & methods**

6. **Cardiopulmonary resuscitation:** Basic cardiac life support, Advanced cardiac life support

7. **Intensive coronary unit & recovery room concepts**

8. **Biomedical waste & its management**

Textbooks:

1. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis , Mark Kurusz& Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
2. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch

PAPER III : EQUIPMENTS IN CARDIO PULMONARY PERFUSION TECHNOLOGY & PHYSIOLOGY & PATHOLOGY OF CARDIO PULMONARY PERFUSION

PHARMACOLOGY OF CARDIOVASCULAR DRUGS 80 Hours

EQUIPMENTS IN CARDIO PULMONARY PERFUSION TECHNOLOGY

1. Blood Pumps, Principles of Oxygenator Function: Gas Exchange, Heat Transfer, and Operation
2. Circuitry and Cannulation Techniques, Cardiotomy Suction and Venting

PHYSIOLOGY & PATHOLOGY OF CARDIO PULMONARY PERFUSION

3. Blood – Surface Interface, Pulsatile Cardiopulmonary Bypass
4. Hemodilution and Priming Solutions, Hypothermia: Physiology and Clinical Use
5. Surgical Myocardial protection, Changes in the pharmacokinetics of Drugs Administered During Cardiopulmonary Bypass
6. Immune and Inflammatory responses after Cardiopulmonary Bypass, Embolic Events, Endocrine, Metabolic, and Electrolyte response
7. Cardiopulmonary Bypass and the Lung, Cardiopulmonary Bypass and the Kidney
8. Splanchnic, Hepatic, and Visceral effects, Neurologic Effects
9. Recent developments in equipments in cardio Pulmonary perfusion technology & physiology & pathology of Cardio Pulmonary perfusion

Textbooks:

1. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis, Mark Kurusz& Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
2. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch
3. Warm heart surgery, Tomas Antonio Salerno

PHARMACOLOGY OF CARDIOVASCULAR DRUGS

1. Anti-anginal agents: Beta-blocking antes, nitrates, calcium channel blockers

2. Anti-failure agents: Diuretics

3. Angiotensin – converting enzyme (ACE): inhibitors, angiotensin-II, Receptor Blockers (ARBs) and aldosterone antagonism

4. Digitalis: acute inotropes and inotropic dilators

5. Antihypertensive drugs:

6. Antiarrhythmic drugs

7. Antithrombotic agents: platelet inhibitors, anti coagulants and fibrinolytics

8. Lipid –lowering and antiatherosclerotic drugs

9. Recent developments in pharmacology of cardiovascular drugs

Textbooks:

Drugs for the heart, Lionel HOpie, Bernard J Gersh, 5th Edition

Paper – IV

Epidemiology & Bio-statistics including Research Methodology

Total hours: 80

Sl. No.	Topics	80 Hours
1	**Introduction** Introduction to Biostatistics& Research Methodology, types of variables & scales of measurements, measures of centraltendency and dispersion, Skewness and Kurtosis Rate, Ratio, proportion, incidence, prevalence and their meaning.	6
2	**Sampling** Random & non random sampling, various methods ofsampling-simple random, stratified, systematic, cluster andmultistage. Sampling and non sampling errors.	6
3	**Basic probability distribution and sampling distributions** Concept of probability distribution, normal, Poison andBinomial distributions, parameters and applications.Concept of sampling distributions. Standard error andconfidence intervals.	8
4	**Tests of Significance** Basics of testing of hypothesis – Null and alternate, hypothesis, type I and type II errors, level of significance and power of the test, p value. Tests of significance (parametric) T – test (paired & unpaired), Chi square test and test of proportion, one way analysis of variance. Repeated measures analysis of variance. Tests of significance (nonparametric) – Mann Whitney U Test,Wilcoxon Test, Kruskal – Wallis analysis of variance Friedmann's analysis of variance.	12
5	**Correlation and Regression** Simple correlation –Pearson'sand Separman's methods ;testing the significance of correlation co-efficient simple and multiple linear regression.	6
6	**Sample size determination** General concept Sample size for estimating means andproportion, testing of difference in means, proportions oftwo groups and more than two groups.	6

7	**Study Designs** Descriptive epidemiological methods – case series analysis and prevalence studies. Analytical epidemiological methods– case control and cohort studies, Clinical trials / inter ventionstudies, odds ratio and relative risk, stratified analysis.	12
8	**Multivariate analysis** Concept of multivariate analysis, introduction to logisticregression and survival analysis	8
9	**Reliability and validity evaluation of Diagnostic Tests** Cronbach's alpha and Test- retest methods	6
10	**Format of Scientific documents** Structure of Research protocol, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta analysis.	10

Suggested Reading

1. Surendar a Rao PSS and J Richard. Introduction Biostatics an Research Methods, Prentice Hall of India (2006).
2. AbhayaIndrayan and Rajeev Kumar Malhotra, Medical Biostatics, 4thEditiin, CRC Press (2017)
3. Indrayan and Satyanarayana, Biostatics for Medical, Nursing and pharmacy students, prentice Hall of India (2006)
4. Sarma K.V.S, Statistics made simple – do it yourself on PC, 2nd edition, Prentice Hall (2010)

PRACTICALS – I YEAR

Paper –I :

CARDIOLOGY AND CARDIAC SURGERY **60 Hours**

CARDIOLOGY

Clinical scenario given to the candidate for diagnosis and treatment of following disorders:

a. Unstable angina
b. Myocardial infarction
c. Left ventricular aneurysm
d. Congestive heart failure
e. Cardiac arrhythmia
f. Atrial septal defect
g. Ventricular septal defect
h. Tetralogy of Fallot
i. Hypertension

CARDIAC SURGERY

Brief description of surgical steps involved in:

a. Coronary artery bypass grafting (on pump CABG)
b. Mitral valve replacement
c. Aortic valve replacement
d. ASD closure
e. VSD closure
f. TOF repair
g. Redo sternotomy
h. Off-pump CABG

Recommended Reading and Reference books

Textbooks:

Cardiology:

1. Cardiology, 7th Edition, Desmond G. Julian, J. Campbell Cowan, James M. McLenachan

2. Davidson's Principles and Practice of Medicine, Edited by Nicki R.Colledge, Brian R.Walker, StuaratH.Ralston.

3. Pefloff's Clinical Recognition of Congenital Heart Disease. Author: JK Perloff, Ariane J.Marelli

4. Valvular heart Disease Author. Joseph S Alpert, James E Dalan and Shahbuddin H Rahimtoola

5. Text Book of Cardiology by Braunwald

Cardiac Surgery :

6. Cardiac Surgery: Oxford specialist handbook in surgery (Cardio thoracic surgery), Indian Edition, Joanna Chikwe, Emma Beddow, Brain Glenville.

7. Cardiac Surgery Author: Kirklin/ Barratt-Boyes

Cardio Pulmonary Perfusion:

8. Text Book on Cardiopulmonary bypass Principles and Practice Author: Glen P. Gravalee, Richard F Davis, Alfred H Stammers and Ross M.Ungerleider

9. Cardiopulmonary bypass Principles and management Edited by : Kanneth M. Taylor

Pharmacology:

10. Test Book of Pharmacology : . Gabriel Khan

11. Drugs for the heart – Opie

12. Text Book of Pharmacology by Satoskar

Anatomy

Test Book
1. Medical Embryology Langmans, Inderbir Singh
2. Anatomy : Chaurasia
3. Anatomy by Gray's Anatomy

ECG : Schamroth

Paper –II :

INTRODUCTION TO – OT & CARDIO PULMONARY PERFUSION TECHNOLOGY:

60 hours

- Practical aspects of the theory topics

Simlation:

Priming techniques
Assembly of a circuit
Leakage detection
Air bubble removal
Roller pump Caliberation
Wet runs
Monitoring parameters, Sampling and data Recording
Drug management
Equipment maintenance
Coordination with Surgeon and Anaesthetist

Paper –III:

EQUIPMENTS IN CARDIO PULMONARY PERFUSION TECHNOLOGY & PHYSIOLOGY & PATHOLOGY OF CARDIO PULMONARY PERFUSION PHARMACOLOGY OF CARDIOVASCULAR DRUGS:

60 hours

Equipments In Cardio Pulmonary Perfusion Technology & Physiology & Pathology of Cardio Pulmonary Perfusion:

1. The candidate should be able to recognize and describe the various parts of the following equipments:
   a. Integrated membrane Oxygenator system
   b. Roller pump.
   c. Centrifugal pump.
   d. Arterial line filter.
   e. Various types of connectors & tubing's.
   f. Various types of cannulae.
   g. Cardioplegia delivery system
2. Able to assemble an Adult Extra Corporeal Bypass Circuit..
3. Able to handle a Heart Lung machine with an Extra Corporeal circuit.
4. Priming and de-airing of an assembled Extra Corporeal Circuit.
5. Priming and de-airing of an Online Cardioplegia delivery system.
6. Determination of occlusion in a roller pump.
7. Method to calibrate the Heart Lung machine.
8. Should know about the Safety features of the Heart Lung machine.
9. Calculation PCV on CPB and amount of blood to be added to bring the PCV to the target PCV. Calculation body surface area of an individual, Systemic Vascular Resistance.

(1). Interpretation and correction of a given arterial blood gas report. (2). Interpretation and correction of a given electrolyte abnormality, (3). Performing and ACT estimation and interpretation of results (4). Other methods to monitor anti coagulation on CPB.

Pharmacology of Cardiovascular Drugs:

Common cardiovascular drugs and main actions & side effects:

a. Nitrates
b. β-Blockers
c. Calcium channel blockers
d. Digoxin
e. Angiotensin receptor antagonists
f. Angiotensin receptor blockers
g. Common anti-arrhythmic agents
h. Heparin
i. GP II b / III a blockers
j. Aspirin &clopidogrel

Second Year– Theory

Paper I : CLINICAL APPLICATIONS OF CARDIO PULMONARY PERFUSION TECHNOLOGY **60 Hours**

1. Conduct of cardiopulmonary bypass & termination of bypass
2. Management of unusual problems encountered in initiating and maintaining cardiopulmonary bypass.
3. Cardiopulmonary bypass in infants and children
4. Extra corporeal membrane oxygenation for respiratory or cardiac support
5. Extra corporeal cardiopulmonary support for resuscitation and invasive cardiology outside the suite
6. Non-cardiovascular applications of cardiopulmonary bypass
7. Perfusion for thoracic aortic surgery
8. Cardiopulmonary bypass for port – access cardiac surgery
9. Recent developments clinical applications of Cardio Pulmonary perfusion technology

Textbooks:

1. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis, Mark Kurusz& Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
2. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch
3. Warm heart surgery , Tomas Antonio Salerno

Paper II : CARDIAC SURGERY WITHOUT CPB
MECHANICAL CIRCULATORY SUPPORT &ROBOTIC CARDIAC SURGERY

60 Hours

Cardiac surgery without CPB

Patients selection for less invasive operations (MID CAB, OP-CABG), technical considerations in off-pump surgery, stabilizing devices, intra coronary stunts, primary off-pump CABG in impaired left ventricular function, alternative approaches to coronary artery disease, beating heart surgery supported by assist devices.

Mechanical circulatory support

1. IABP
2. Should have knowledge of Cardiac assist devices
   a. General aspects of mechanical support
   b. Extracorporeal devices
   c. Intracorporeal devices
   d. Future devices
3. Knowledge regarding the Devices used as bridge to transplantation
   a. Thoratec VAD
   b. Novacor LVAD
   c. Heart mate
   d. Totally artificial heart

Robotic cardiac surgery: The candidate should have knowledge regarding the following :
Cardio pulmonary bypass during port – access surgery and robotic surgery: endovascular catheter system, minimally invasive cardiac surgery, directs vision, micro-incision and video-assisted, and robotic operations.

Recent developments issues in Cardio Pulmonary perfusion

Textbooks:

1. Cardiac assists devices, Daniel J. Goldstein & Mehmet C.Oz, Futura Publishing Company, 2000
2. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis, Mark Kurusz& Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
3. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch

PAPER III: ORGAN TRANSPLANTATION 60 Hours

1. Heart transplantation

Basic transplant immunology, Patient and donor selection, Matching donor to recipient, Donor preparation, Orthotopic / heterotropic Cardiac transplantation, Intensive care management, Immunosuppression and rejection, Surgical complications and results.

2. Heart-lung transplantation

Recipient selection, donor selection and graft harvest, surgical procedure, Pathophysiology before / after transplantation, preoperative management.

3. Lung transplantation

Recipient selection, Donor selection and graft harvest, surgical procedures of lung transplantation (single-lung / double-lung transplantation) , Pathophysiology before / after transplantation, postoperative management.

4. Liver transplantation: role of perfusionist

5. Renal transplantation: role of perfusionist

6. Prosthetic heart valves (mechanical/ bioprosthetic) and the **annuloplasty rings**

Mechanical and bioprosthetic heart valves: ball & cage valve, tilting-disc valves (porcine, bovine and stent – less valves), Annuloplasty rings: Rigid rings, complete & partial rings, soft rings, bio-degradable sings.

7. Homografts

Grafts (Synthetic): synthetic grafts, pre-clotted grafts, collagen – coated grafts, bifurcatedgrafts:

Recommended Books for organ transplantation

Text Book: Cardiac Surgery Author: Kirklin/ Barratt-Boyes Sabistons

Reference books :

1. Clinical Guide to Heart Transplantation Editors: **Kobashigawa**, Jon (Ed.)
2. Lung And Heart - Lung Transplantation(Lung Biology In Health And Disease Vol. 217) by Joseph P Lynch and David J Ross, Taylor & Francis

3. Kaplan's Cardiac Anaesthesia, 5th Edition, Joel A Kaplan (Editor) Elsevier Saunders, Philadelphia 2006.

4. Oxford specialist handbook in surgery (Cardio thoracic surgery), Indian Edition, Joanna Chikwe, Emma Beddow, Brain Glenville.
5. Ventricular Assist Devices in Advanced-Stage Heart Failure Editors: **Kyo**, Shunei (Ed.)

Paper IV: HEMATOLOGY AS RELEVANT TO CARDIO PULMONARY PERFUSION, BLOOD TRANSFUSION AND BLOOD CONSERVATION 60 Hours

A.Hematology: Anticoagulation for cardiopulmonary bypass, Heparin neutralization, Hematologic effects of cardiopulmonary bypass, Management of coagulopathy associated with cardiopulmonary bypass. Coagulation Cascade and clotting factors

B.Blood transfusion: Transfusion practices, Transfusion algorithms Various transfusion reactions

C.Blood conservation: Autologous blood donation, acute perioperative normovolemichemodilution or "blood pooling", intraoperative blood salvage, postoperative autologous blood salvage, erythropoietion therapy to replace blood loss, Pathophysiology and epidemiology of hemostatic abnormalities, Topical agents for reducing blood loss.

Textbook

1. Cardiopulmonary bypass; Principles and practice, Glenn P. Gravelee, Richard F. Davis, Mark Kurusz& Joe R. Utley; 2nd edition; Lippincott Williams & Wilkins 2000.
2. Techniques in Extracorporeal circulation, Philip H. Kay & Christopher M. Munsch
3. Physiology - Ganong
4.Text book physiology – Gluyton

PRACTICALS – II YEAR

Paper –I :

CLINICAL APPLICATIONS OF CARDIO PULMONARY PERFUSION TECHNOLOGY

80 Hours

1. Able to assemble an ideal pediatricCPB circuit and should be able to describe the differences between adult and pediatric circuit.
2. Should be able to assemble an ECMO circuit and describe the components
3. Should be able to assemble ECMO circuit and prime it.
4. Should be able to design an ideal CPB circuit for an Aortic arch repair surgery and should know the advantages
5. Should know how to change an oxygenator during CPB
6. Should know how to change of pump loop
7. Management of massive air embolism during CPB.
8. Management of arterial pump failure
9. Should be able to deal with the catastrophic events which could occur during CPB like : Manage a simulated perfusion accident on a dummy CPB circuit including changing oxygenators when on CPB, managing falling/leaking reservoir levels, venous airlocks, air in the arterial line, cardioplegia delivery failure, increased arterial line pressure, recognition of a possible dissection, run away pump head, recognition of heat exchanger water leak into the CPB circuit, reaction time assessment etc.
10. Should be able to calculate vascular resistance on CPB and management of increased perfusion pressure on bypass.

Paper –II :

CARDIAC SURGERY WITHOUT CPB

MECHANICAL CIRCULATORY SUPPORT &ROBOTIC CARDIAC SURGERY

80- hours

1. Should know about the LVAD / RVAD circuit and be able to know the parts of the components
2. Should have knowledge of LVAD/RVAD circuit and prime.
3. Set up of an IABP; indentation the dicrotic notch, end diastolic point, unassited systole, and assisted systole.
4. Description of proper timing, timing errors, complications and contra indications of IABP therapy. Diagrammatic representation of picture of pressure wave of 1:2 assist.
5. Identification & use of octopus in off-pump CABG
6. Identification & use of star fish in off-pump CABG
7. Indications for use of IABP for off-pump procedures
8. Shunts used for systemic –pulmonary shunts in pediatric cardiac surgery and for aortic surgery.
9. Intra coronary shunts in off-pump CABG

Paper –III:

ORGAN TRANSPLANTATION **80- hours**

PRACTICALS

i). Should be able to identify
various mechanical and bioprosthetic heart valves
ball & cage valve, tilting-disc valves (porcine, bovine and stent – less valves),
Annuloplasty rings : Rigid rings , complete & partial rings , soft rings , bio-degradable sings.

ii). Should be able to identify various homografts specimens.
Describe the process of harvest, processing preservation and handling of homografts

iii).Should have knowledge and be able to identify various grafts (synthetic):
Desirable materials used for manufacture of synthetic grafts, pre-clotted grafts, collagen – coated grafts, bifurcated grafts:
Methods of sterilization of systemic grafts.
Difference between homografts and synthetic grafts.

Paper –IV

HEMATOLOGY AS RELEVANT TO CARDIO PULMONARY PERFUSION, BLOOD TRANSFUSION AND BLOOD CONSERVATION **80- hours**

1. Draw and discuss coagulation cascade
2. Describe action and uses of heparin
3. Describe action & side effects of protamine
4. Describe on heparin alternatives
5. Platelet dysfunction during CPB
6. Leukocyte depletion during CPB
7. Factors causing hemolysis during CPB
8. Monitoring of anti-coagulation during CPB

    a). ACT
    b). Heparin protration titration
    c). Heparin concentration
    d). Sonoclot
    e). Thromboelastography
9. Discuss coagulation disorder associated CPB
10. Draw and discussion on algorithm approach for hemostatic therapy in cardiac patients.
11. Draw and discussion on algorithm approach for postoperative red cell transfusion in cardiac surgical patients.
12. Cost effectiveness of autologous blood donation in cardiac surgery.

SECTION-IV
MONITORING LEARNING PROGRESS

It is essential to monitor the learning progress of each candidate through continuous appraisal and

regular assessment. It not only also helps teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment be done using checklists that assess various aspects. Model Checklists are given in this Chapter, which may be copied and used.
The learning out comes to be assessed should include:

i) ***Acquisition of Knowledge***: The methods used comprise of `Log Book' which records participation in various teaching / learning activities by the students. The number of activities attended and the number in which presentations are made are to be recorded. The logbook should periodically be validated by the supervisors. Some of the activities are listed. If the list is not complete, the department may include additional activities, if so, desired.

Journal Review Meeting (Journal Club): The ability to do literature search, in depth study,presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting using a checklist (see Model Checklist – I, Section IV)

Seminars / Symposia: The topics should be assigned to the student well in advance tofacilitate in depth study. The ability to do literature search, in depth study, presentation skills and use of audio- visual aids are to be assessed using a checklist (see Model Checklist-II, Section IV)

ii) Teaching skills: Candidates should be encouraged to teach undergraduate medicalstudents and paramedical students, if any. This performance should be based on assessment by the faculty members of the department and from feedback from the undergraduate students (See Model checklist III, Section IV)

iii) Dissertation: Please see checklist IV and V in Section IV.

iv) Work diary / Log Book- Every candidate shall maintain a work diary and record his/herparticipation in the training programmes conducted by the department such as journal, reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of experiments or laboratory procedures, if any conducted by the candidate.

v) *Records:* Records, log books and marks obtained in tests will be maintained by the Headof the Department and will be made available to the University.

Logbook:

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

Format for the logbook for the different activities is given in Tables 1 and 2 of Section IV.
Copies may be made and used by the department.

Procedure for defaulters: Every department should have a committee to review suchsituations. The defaulting candidate is counseled by the guide and head of the department. In extreme cases of default the departmental committee may recommend that defaulting candidate be withheld from appearing the examination, if she/he fails to fulfill the requirements in spite of being given adequate chances to set himself or herself right. **Format of Model Checklists**

SECTION - V

Checklist - I

Model Checklist for Evaluation of Journal Review Presentations

Name of the student:_____ Date:_____

Name of the faculty/ Observer:_____

Sl. No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist - II

Model Check List for the Evaluation of the Seminar Presentations

Name of the student:_____Date:_____

Name of the faculty/ Observer:_____

Sl. No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist – III

Model Check list for Evaluation of Teaching Skill

Name of the student:_____Date:_____

Name of the faculty/ Observer:_____

SL. No.		Strong Point	Weak point
1	Communication of the purpose of the talk		
2	Evokes audience interest in the subject		
3	The introduction		
4	The sequence of ideas		
5	The use of practical examples and /or illustrations		
6	Speaking style (enjoyable, monotonous, etc., specify)		
7	Summary of the main points at the end		
8	Ask questions		
9	Answer questions asked by the audience		
10	Rapport of speaker with his audience		
11	Effectiveness of the talk		
12	Uses of AV aids appropriately		

Checklist - IV

Model Check list for Dissertation / Project Work Presentations

Name of the student:_____ Date:_____

Name of the faculty/ Observer:_____

Sl. No.	Points to be considered	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Checklist – V

Continuous Evaluation of dissertation / project work By

Guide/ Co-Guide

Name of the student: _____Date:_____

Name of the faculty/ Observer:_____

Sl. No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Periodic consultation with guide/ co-guide					
2	Depth of Analysis/ Discussion					
3	Department presentation of findings					
4	Quality of final output					
5	Others					
	Total score					

Overall Assessment Sheet

Date:

Check list No.	Name of the students			
	A	**B**	**C**	**D**
1				
2				
3				

Course i/c **Signature of the HOD** **Signature of the Principal i/c AHS**

The above overall assessment sheet used along with logbook should form the basis for certifying satisfactory completion of course of study, in addition to the attendance requirement.

KEY

Mean score: Is the sum all the scores of checklists 1 to 5

A, B, C: Name of the students

LOG BOOK

Table 1: Academic activities attended

Name:

Admission Year:

College:

Date	**Type of activity, Specific Seminar, Journal club, presentation, UG teaching**	**Particulars**

LOG BOOK

Table-2: Academic presentations made by the student

Name:

Admission Year:

College:

Date	Topic	Type of activity, Specific Seminar, Journal club, presentation and UG teaching

SECTION-VI

ETHICS IN M.Sc. CARDIO PULMONARY PERFUSION TECHNOLOGY

(Should be taught to the 1st year students of M.Sc. Cardio Pulmonary Perfusion Technology)

Introduction: With the advances in science and technology and the increasing needs of the patient, their families and community, there is a concern for the health of the community as a whole. There is a shift to greater accountability to the society. It is therefore absolutely necessary for each and every one involved in the health care delivery to prepare themselves to deal with these problems. Technicians like the other professionals are confronted with many ethical problems.

Standards of professional conduct for technicians are necessary in the public interest to ensure an efficient laboratory service. Every technician should not only be willingly to play his part in giving such a service, but should also avoid any act or omission which would prejudice the giving of the services or impair confidence, in respect, for technician as a body.

To accomplish this and develop human values, it is desired that all the students undergo ethical sensitization by lectures or discussion on ethical issues.

Introduction to ethics-

What is ethics?
General introduction to Code of Laboratory Ethics
How to form a value system in one's personal and professional life?
International code of ethics

Ethics of the individual-
Technician relation to his job
Technician in relation to his trade
Technician in relation to medical profession
Technician in relation to his profession

Professional Ethics-
Code of conduct
Confidentiality
Fair trade practice
Handling of prescription
Mal practice and Negligence
Professional vigilance

Research Ethics-
Animal and experimental research/ humanness
Human experimentation
Human volunteer research - informed consent
Clinical trials
Gathering all scientific factors
Gathering all value factors
Identifying areas of value – conflict, setting priorities
Working out criteria towards decision

ICMR/ CPCSEA/ INSA Guidelines for human / animal experimentation

Recommended reading

- Francis C.M., Medical Ethics, I Edition, 1993, Jay pee Brothers, New Delhi p189.
- Good Clinical Practices: GOI Guidelines for clinical trials on Pharmaceutical Products in India (www.cdsco.nic.in)
- INSA Guidelines for care and use of Animals in Research – 2000.
- CPCSEA Guidelines 2001(www.cpcsea.org).
- Ethical Guidelines for Biomedical Research on Human Subjects, 2000, ICMR, New Delhi.
- ICMR Guidelines on animal use 2001, ICMR, New Delhi.

SECTION -VII

ANNEXURE-I

CATEGORIES OF BIO-MEDICAL WASTE

	Waste Category ** Type	Treatment a Disposal ** Options
Category No. 1	Human Anatomical Waste: (human tissues, organs, body parts)	Incineration deep burial
Category No. 2	Animal Waste: (animal tissues, organs, body parts, carcasses, blooding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge form hospitals, animal houses)	Incineration deep burial
Category No. 3	Microbiology & Biotechnology Waste: (wastes from laboratory cultures, stocks or specimens or micro-organisms live or attenuated vaccines, human and animal Cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins, dishes and devices used for transfer of cultures)	Local autoclaving / micro waving / incineration.
Category No. 4	Waste sharps: (Needles, syringes, scalpels, blades, glass, etc, that may cause puncture and cuts. This includes both used and unused sharps)	Disinfection (chemical treatment / autoclaving / micro –waving and mutilation / shredding
Category No. 5	Discarded Medicines and Cytotoxic drugs: (wastes comprising of outdated, contaminated and discarded medicines)	Incineration / destruction and drugs disposal in secured landfills.
Category No. 6	** Solid Waste: (Items contaminated with blood, and body fluids including cotton, dressings, soiled plaster casts, Eners, beddings, other material contaminated with blood)	Incineration Autoclaving / micro waving
Category No. 7	Solid Waste: (Wastes generated form disposable items other than the waste ** sharps such as tubings, catheters, intravenous sets, etc)	Disinfection by chemical treatment, autoclaving / micro-waving and mutilation / shredding
Category No. 8	Liquid Waste: (Waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)	Disinfection by chemical treatment and discharge into drains
Category No. 9	Incineration Ash: (Ash from incineration of any biomedical waste)	Disposal in municipal landfill

SECTION - VIII

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES

TIRUPATI – 517 507

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

TRANSCRIPT

Master of Science in Cardio-Pulmonary Perfusion Technology

We hereby certify that the person named here below was a bonafide post-graduate student of SVIMS University. Further, we certify that the contents herein are accurate and complete.

Name

University Reg. No.

Gender :

Date of Birth :

Nationality :

Permanent Address :

Mailing Address :

EDUCATION

School/University	Place	Years	Degree obtained

Sl. No.	Subject	No. of Contact Hours	Code	Grade	Remarks
1.	Cardiac Embryology	20	C,L	P	
2.	Fetal and neonatal circulation	2	C,L	P	
3.	Ultrasound physics and instrumentation	146	C,L,P,PL	P	
4.	Clinical Cardiology	133	C,L,PL	P	
5.	Cardiovascular Pharmacology	10	C,L	P	
6.	Electrophysiology	4	C,L	P	
7.	Acute coronary syndrome	8	C,L	P	
8.	BLS/ACLS	10	C,L,P	P	
9.	Ischemic Heart Disease	17	L	P	
10.	Valvular Heart disease	32	L	P	
11.	Congenital Heart Disease	44	L	P	
12.	Cardiac surgery	10	L,C, PL	P	
13.	Echocardiography for lschemic Heart disease	70	C,P,PL	P	
14.	Echocardiography for Valvular heart disease	70	C,PL,P	P	
15.	Echocardiography for Congenital Heart disease	140	C,PL,P	P	
16.	Epedemiology and Biostastics	60	L	P	
18.	Ehocardiography of other heart diseases	25	PL, C,L,P	P	
19.	Myopericardial, Aortic, Systemic disorder & non cardiac diagnosis	137	C,L,P,PL	P	
20.	Recent Advances	168	C,L,PL,P	P	
21.	Medical ethics	10	L	P	
22.	Fetal Echocardiography	2	L,P	P	
23.	Peripheral Ultrasound	2	L,P	P	
24.	Seminar presentation	SS, I(G)	Classes for UG's		
25.	Attending rounds with Cardiologists	10	C	P	

DESCRIPTION OF CODES

C : Clinical Teaching

D : Demonstration of Faculty

I : Independent Work by Student

I (G) : Independent Work by Student Guided by Faculty

L : Classroom Lectures by Faculty

P : Hands on Practical Work by Students

SD : Self Directed Study by Student

SD (E) : Self Directed Study by Student with Faculty Evaluation
SS : Student Conducted Seminars with Faculty Moderation and Evaluation by Peers and Faculty
PL : Practical / Clinical Lab Posting

Prof.& Course Incharge Prof.& HOD Principal I/c AHS

CHECKLIST - I
Model Check List for Evaluation of Teaching Skill

SL. No.		Poor 0	Below average 1	Average 2	Good 3	Very good 4
1	Communication of the purpose of the talk					
2	Evokes audience interest in thesubject					
3	The introduction					
4	The sequence of ideas					
5	The use of practical examples and /or illustrations					
6	Speaking style (enjoyable,monotonous, etc., specify)					
7	Summary of the main points at theend					
8	Ask questions					
9	Answer questions asked by the audience					
10	Rapport of speaker with his audience					
11	Effectiveness of the talk					
12	Uses of AV aids appropriately					

CHECKLIST - II

Model check list for Dissertation / Project Work Presentations

Sl. No.	Points to be considered	Poor 0	Below average 1	Average 2	Good 3	Very Good 4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Overall Assessment of the student by the clinical/Lab work:

Sl. No	Points to be considered	Poor 0	Below Average 1	Average 2	Good 3	Very Good 4	Excellent 5
1	Attendance						
2	Punctuality						
3	Interaction with colleagues and support staff						
4	Maintenance of case records						
5	Topic Presentation						
7	Time sense						
8	Knowledge						
9	Rapport with patient.						
10	Overall quality of work						
	Total Score	- -	- -	- -			

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES

TIRUPATI – 517 507

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

PG Programme in Allied Health Sciences

M.Sc DIALYSIS TECHNOLOGY COURSE

TIRUMALA TIRUPATI DEVASTHANAMS

INDEX

General Regulations

1. Title of the Course

Master of Science degree in Dialysis Technology(M.Sc – DT)

2. Duration of the Course

The duration of the course shall be 2- years on full time basis

3. Eligibility for Admission

B. Sc in Dialysis Technology (4 yrs duration including one year internship)

(or)

B. Sc in Dialysis Technology(3 yrs duration) with one year of experience in a teaching institute)

4. Selection Criteria

Selection shall be based on the academic merit/entrance test conducted in the qualifying exam.

5. **Admission schedule :**

a) Commencement of Course: In August during every year
b) The admissions are closed by 30th September or 60 days from the date of commencement of the programme.

6. Medium of instruction.

English shall be the medium of instruction for the subjects of study as well as for the Examination.

7. Course of study

The course shall be pursued on full time basis. In the end of first year, there shall be an examination. Students shall be posted in SVIMS and SPMC hospitals during the practical hours.

Subjects for study and teaching hours for first year and second year of the PG course is an shown below.

Distribution of Teaching Hours

FIRST YEAR – THEORY

S.No.	Main subject	Theory No. of Hours
1.	Basic Sciences in Nephrology *	200
2.	Clinical Nephrology	100
3.	Basic principles and overview of types of renal replacement therapies (HD & PD)	130
4.	Epidemiology & Biostatistics	60
5.	**Subsidiary subject:** Medical Ethics	10
	Total:	**500**

*The attendance for the speciality subject shall be maintained by the HOD's i.e. Anatomy, Physiology, Pathology etc. Both University Theory and Practical will be evaluated by the Nephrologist and the expert.

PRACTICALS

Sl. No.	Area of posting / Subject	Total no. of contact hours
1	Dialysis Room	430
2	Water treatment plant	50
3	Electronics, Plumbing , Computer	70
4	Management of Dialysis unit	50
5	ICU Side Dialysis	20
6	Peritoneal Dialysis	20
7	Special & advanced dialysis procedures	20
8	CPR Demo	10
9	Teaching Methodology	100
10	Groups Discussion	30
	Total :	**800**

SECOND YEAR – THEORY

S.No.	Branches	Theory No. of Hours
6.	Recent advances in HD Procedures & complications in renal disease patients, Dialysis patients & Renal Nutrition	220
7.	Management of Dialysis Unit & Biomedical Instrumentation , Biotechnology & Molecular Biology	140
8.	Emergency Medicine, ACL, Nephro – Radiological and imaging sciences, Nuclear Medicine and Nephro-psychiatry	60
	Total:	**400**

PRACTICALS

Sl. No.	Area of posting / Subject	Total no. of contact hours
1	Dialysis Room	400
2	Water treatment plant	20
3	Electronics, Plumbing , Computer	20
4	Management of Dialysis unit	100
5	ICU Side Dialysis	50
6	Peritoneal Dialysis	10
7	Special & advanced dialysis procedures	200
8	Teaching Methodology	300
9	Groups Discussion	20
10.	Machine Management	180
	Total :	**1300**

8 a) Attendance:

A candidate is required to put in minimum 80% of attendance both in theory and practical separately of each paper before admission to the university examination. Participation in NCC, NSS, sports and games, educational tours, professional meetings and conference or other co-curricular activities representing the institution/university will not count as absence.

b) Condonation for lack of attendance:

The condonation of attendance on medical grounds or on absence under extraordinary circumstances to those who are having the attendance between 70% and 79% in each paper will be granted in genuine cases. The students who have shortage of attendance in the particular papers have to apply to the controller of examinations, indicating the reasons for shortage of attendance. The representation to be forwarded by the HOD & Prof. i/c AHS. If the reason is on the medical grounds, the relevant medical certificate has to be enclosed to the representation. If any student falls below the 70% of attendance, he/she will not be allowed to write the university examinations.

9. Scheme of examination

a) The examination for the degree shall consist of written papers, practical and oral.
b) There shall be two examinations viz. Preliminary and final. The preliminary examination shall be taken at the end of the first year. The final examination shall be taken at the end of 2nd year.
c) The examination shall be conducted ordinarily twice a year, viz. July/August and January/February.

Preliminary Examination

This consists of theory, practical and oral. There will be separate papers for each specialization.

University Examination and Distribution of marks

FIRST YEAR

S.No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
1.	Basic Sciences in Nephrology	I	20	80	15	60	25	200
2.	Clinical Nephrology	II	20	80	15	60	25	200
3.	Basic principles and overview of types of renal replacement therapy (HD & PD)	III	20	80	15	60	25	200
4.	Epidemiology & biostatistics	IV	20	80		-	-	100
	Total							**700**

SECOND YEAR

S.No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
5.	Recent advance HD Procedures & complications in renal disease patients Dialysis patients & Renal Nutrition	V	20	80	15	60	25	200
6.	Management of Dialysis Unit & Biomedical Instrumentation	VI	20	80	15	60	25	200

	Biotechnology & Molecular Biology							
7.	Emergency Medicine / ACL Nephro – Radiological, Nuclear Medicine and imaging sciences Nephro-psychiatry	VII	20	80	15	60	25	200
8.	Dissertation					100	50	150
	Total							**750**

Dissertation

The student should submit dissertation one month before the final examination. Those students who have not submitted the dissertation shall not be allowed to appear for the final examination. The dissertation shall be assessed at the time of orals by all the examiners.

The dissertation shall be written under the following headings:

Introduction; Aims or objectives of study; Review of literature; Materials and methods Results; Discussion; Conclusion; Summary; References; Tables; Annexure

The written text of dissertation shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should not be done. A declaration by the candidate that the work was done by him/her shall be included. The guide and head of the department shall certify the bonafide of the dissertation.

Three copies of dissertation shall be submitted to the university through proper channel along with a soft copy (CD), one month before the final examinations.

10. Internal assessment (IA):

a) A student must secure at least 35% marks of the maximum marks fixed for internal assessment in a particular subject to be eligible to appear for the university examination of that subject.
b) There shall be three internal assessment tests and the average of these tests shall be considered for awarding final marks.
c) If the candidate is absent for any of the exams, the marks in that exam shall be taken as zero.
d) The computed internal assessment marks as per the regulation 10 a) & b) shall be sent to the controller of exams 15 days before the commencement of the University exam.
e) The internal assessment marks should be signed by the concerned teaching faculty or HOD and counter signed by the HOD before being forwarded to the Controller of Examinations.
f) For those who failed in internal assessment test/s, have to reappear as per the regulation 9 a) & b) before he/she appears for the university examination.
g) For those who want to improve their marks in internal assessment tests, they can appear again as per the regulation 9 a) & b). For such students, the internal assessment marks of the student at the time of first appearance will be compared with the marks obtained at the present appearance and the higher of the two will be taken as his/her internal assessment marks.

11.Minimum for a pass

a) 35% in internal assessment of each theory paper and practicals/viva voce
b) 40% in each theory paper of university examination.
c) 50% on the total marks of theory university examination and internal assessment clubbed together, applicable to each paper.

d) Where, viva voce involved which is part of theory examination, 50% on the total marks of theory university examination, internal assessment and viva voce clubbed together, applicable to each paper.
e) Where there is no internal assessment marks, 50% on the total theory marks, 50% in practicals/viva voce applicable to each subject.

Note: For 2 year PG course, where any paper contains both theory and practicals/viva voce, the student has to pass both theory and practicals/viva voce, if any student pass in theory examination and fail in practicals/viva voce examination or vice versa, the student concerned has to appear again for both theory and practicals/viva voce examination.

12. Classification of successful candidates

Percentage of Marks for declaring Class:

Distinction	- 75% and above of the total marks.
First Class	- 65 - 74% of the total marks.
Second Class	- 50- 64% 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 attendance shortage, it will be taken into consideration as not completed within the duration of the course and the final results will be declared as "Pass".

13. Reappearance

The student has to pass both theory and practicals/via voce, if any student pass in theory examination and fail in practicals/viva voce examination or vice versa, the concerned student has to appear again for both theory and practicals/viva voce examination.

14. Carry-over Provision

The students are permitted to complete the course period irrespective of their success in the preliminary part. However, the final results will be kept under "withheld" until he/she passes all the previous papers".

15. Maximum duration for completion of course

A candidate shall complete the course within four years from date of admission. Failing which, the candidate will be discharged.

16. Eligibility for award of degree

A candidate shall have passed in all the subjects of first and second year to be eligible for award of degree.

FIRST YEAR

Course content (Syllabus) Theory

Paper I: Basic Sciences in Nephrology

I. Anatomy of Urinary Tract & Kidney (30hrs)

1. Gross anatomy of the kidney **(6hrs)**

- Location of kidney
- Size
- Protection
- Structure of the kidney – gross structure blood supply, nerve supply, lymphatic flow, L.S of Kidney.

2. Basic anatomy of urinary system **(8hrs)**

- The Kidney (structural anatomy)
- The ureter
- The bladder
- The urethra
- Sphincters
- Prostate

3. Microscopic anatomy **(4hrs)**

- Nephron: Glomerular structure, tubules
- Interstitium
- Juxta Glomerular apparatus

4. Embryology and fetal development in brief **(2hrs)**

5. Anatomy of peritoneum **(4hrs)**

- Description
- Size
- Nature
- Blood supply
- Lymphatic drainage

6. Anatomy of Vascular system related to Hemodialysis. **(6hrs)**

- Upper limb vessels.
  (Course, distribution, branches, origin, and abnormalities)
- Neck vessels.
  (Course, distribution, branches, origin, and abnormalities)
- Femoral vessels.
  (Course, distribution, branches, origin, and abnormalities)

II. Physiology of Kidney: (30hrs)

1. Basic concepts **(6hrs)**

- Glomerular filtration

- renal auto regulation of blood supply & GFR
- clearance
- Tubular reabsorption
- Aldosterone, ADH & water homeostasis
- Tubular secretion
- Maximal tubular transport capacity

2. Summary of major functions of Nephron & its components in urine formation. **(4hrs)**
   - Glomerulus
   - PCT
   - Henley's loop (Descending limb & thick ascending limb)
   - DCT
   - Collecting duct: Cortical, Medullary.
3. Renal regulatory Mechanism **(4hrs)**
   - Water regulatory mechanism
   - Electrolyte regulation (Sodium, Potassium, Chloride, Calcium, Phosphate, Magnesium)
   - Regulation of acid – base balance (basic principles & abnormalities)
4. Renal hormones & vit D, erythropoietin, Renin, Prostaglandins **(2hrs)**
5. Physiological values **(2hrs)**
   - Urea, Creatinine, Electrolytes, Calcium, Phosphorus, uric acid, Magnesium, Glucose.
   - 24 hours urinary indices – urea, Creatinine, electrolytes Ca, M
6. Physiology of peritoneum during P.D **(2hrs)**

   Diffusion through the peritoneum.
   - Definition
   - Factors influencing solute transport

   i) Peritoneal permeability
   ii)Solute characteristics
   iii)Concentration gradient
   iv)Peritoneal blood flow
   v)Dialysis solution temperature
   vi)Available membrane area
7. Routes of solute transport. **(1hrs)**
   - Intracellular.
   - Extracellular.

8. Factors that enhance diffusion. **(1hrs)**
   - Increased dialysis solution flow.
   - Increased blood flow.
   - High concentration gradient.
   - Pre-warmed dialysis solution.
   - Osmotic pressure.
9. Osmosis through the peritoneal membrane. (**2hrs)**
   - Ultrafiltration.
   - Drug transport.
10. Composition and function of blood – Introduction **(4hrs)**
    - Red blood cells: Erythropoiesis, stages of differentiation function, count physiological variation.
    - Hemoglobin: structure, functions, concentration physiological variation methods of Estimation of Hb
    - White blood cells: Production, function, life span, count, differential count
    - Platelets: Origin, normal count, morphology functions.

- Plasma Proteins – Production, concentration, types, albumin, globulin, Fibrinogen, prothrombin functions.
- Hemostasis& Blood coagulation: Hemostasis: Definition, normal hemostasis, clotting factors, mechanism of clotting, disorders of clotting factors.
- Blood Bank :Blood groups –
  ABO system, Rh system
  Blood grouping & typing
  Cross matching: Rh system – Rh factor, Rh in compatibility.
- Blood transfusion – Indication, universal donor and recipient concept.
- Selection criteria of a blood donor. transfusion reactions Anticoagulants – Classification, examples and uses
- Anemia's: Classification – morphological and etiological. Effects of anemia on body
- Erythrocyte sedimentation Rate (ESR) and Packed cell volume
- Blood Volume :Normal value, determination of blood volume and regulation of blood
- Volume
- Body fluid: pH, normal value, regulation and variation
- Lymph: lymphoid tissue formation, circulation, composition and function of lymph

11. Hemostasis – basic principles **(2hrs)**
    - Coagulation cascade
    - Coagulation factors
    - Regulation of procoagulants & anticoagulants BT, CT, PT, PTT, thrombin time

III. Biochemistry (30hrs)

1. Biological oxidation oxidative reduction electron transport chain-bioenergetics system-high energy phosphate system.
2. Metabolism of carbohydrates- aerobic & anaerobic metabolic metabolism of glucose-Role of liver in carbohydrate metabolism-alternate aerobic pathway-Role of carbohydrate metabolism-Alternate aerobic pathway-pentose-muscle contraction-regulation of blood sugar-metabolism of other hexoses.
3. Lipid metabolism-Introduction-Blood lipids-absorption-oxidation of fatty acids-synthesis-energetic of fat metabolism-metabolism of cholesterol.
4. Proteinmetabolism-Absorption-storage-general pathway-nitrogen metabolism-anabolism-catabolism-Metabolism of amino acids
5. Water & Mineral Metabolism-Sodium – potassium- chloride-Sulphur-calcium-phosphorus-magnesium-Ion Iodine copper-Zinc etc.
6. Classification, mechanism of action of hormones regulating hormones calcium and phosphorous.
7. Regulation of pH of Blood and body fluids: Regulatory mechanisms, Renal Mechanism, Disturbances in acid-base balance, respiratory acidosis , respiratory alkalosis, metabolic acidosis, metabolic alkalosis, assessment of the acid- base balance, carbon-di-oxide combining power of blood, alkali reserve, anion gap, Evaluation of Acid –Base balance

8. Renal function Formation and composition of urine – Specific gravity and pH, solids and 24 hour urine, abnormal constituents of urine- Glycosuria - glycosuria, fructosuria, pentosuria, lactosuria, galactosuria. Proteinuria, Ketone bodies, Bile pigments and bile salts, Blood, porphyrins, Urinary lithiasis.
9. Function & Test of Liver.
10. Over view of estimation of serum creatinine, blood urea, serum electrolytes, 24 hrs. Urinary protein – Lab methods.

IV. Nephro pathology: (30hrs)

1. Renal histology.
2. Renal pathology
   - Glomerular diseases
   - Tubulo interstitial nephritis
   - Chronic renal failure
3. Allograft pathology
4. Hypertension and other vascular diseases
5. Hemogram
6. Peripheral blood smear
7. Urine analysis
   - Urine collection
   - Physical characteristics (Color, smell)
   - Specific gravity and osmolality
   - pH
   - Glucose
   - Ketones
   - Electrolytes
   - Protein & related substances
   - Sediments – cells, crystals, casts

V. Nephro-immunology (20hrs)

Nature of the Immune system

1. Historical concepts and introduction to serological testing:
   a. Immunity and immunization
   - Cellular verses humoral immunity
   - Antigens and haptens
   - Cells – mediated immunity

   b. The Age of serology
   c. Other historical developments
2. Natural Immunity:
   a. External defense system
   b. Internal defense system
   - cellular Defense mechanism
   - acute phase reactants
   - inflammation

   c. Summary
3. The lymphoid system:

a. Primary lymphoid organs
   - Bone marrow
   - Bursa of fabricius
   - Thymus

b. Secondary lymphoid organ
   - Spleen
   - Lymph nodes
   - Other secondary organs

c. Surface marker on lymphocytes

d. Stages in B-cell differentiation
   - Pro- B cells
   - Pre – B cells
   - Immature B cells
   - Mature B cells
   - Activated B cells
   - Plasma cells

e. T cells Differentiation
   - Double – negative stage
   - Double positive stage
   - Mature T cells
   - Antigen activation

f. Third population or natural killer
   - Mechanism of cyto toxicity
   - Antibody – Dependent cell

g. Laboratory identification of lymphocytes
   - Fluorescence Microscopy
   - Cell flow cytometry
   - Other methods

h. Summary

4. Nature of Antigens and the MHC Complex
   a. Factors influencing the immune response
   b. Traits of Immunogens
   c. Nature of epitopes
   d. Haptens
   e. Relationship of antigens to the Host
   f. Adjuvants
   g. Major Histocompatibility Complex
      - Genes coding for the HLA antigens
      - Class I Antigens
      - Class II antigens
      - Antigen presentation
      - MHC and Autoimmunity
5. Antibody structure and Function:
   a. Tetra peptide structure of immunoglobulin
      - Cleavage with papain
      - Pepsin digestion
   b. The Nature of Light Chains
   c. Heavy chain sequencing
   d. Antigen recognition unit
   e. Hings region

f. IgG
g. IgM
h. IgA
i. IgD
j. IgE
k. Theories of antibody diversity
l. Genes coding for immunoglobin
m. Monoclonal antibody
n. Summary

6. Cell-Mediated Immunity:
   a. Activation of T Helper cells
      - Adhesion Molecules
      - Specific Antigen recognition
      - Function of Interleukin-2
      - Triggering of Interleukin-1
      - T- Helper subsets
   b. Stimulation of B cells
   c. Activation of cytotoxic T cells
      - Role of cytokines in the inflammatory response
      - I-1, I-2, I-3, I-4, I-5, I-6, Other I , Interferon's, TNF, other factors
   d. Laboratory determination of T lymphocyte function
      - Summary
7. Complement:
   a. The classic pathway
      - The recognition unit
      - The activation unit
      - The membrane attack
   b. The alternative pathway
   c. System controls
      - fluid phase regulators
      - cell – bound regulators
   d. Other cell membrane Receptors
   e. Biologic manifestation of complement activation
   f. Complement and Diseases states
   g. Complement Deficiencies
      - Paroxysmal Nocturnal Hemoglobinuria
      - Other complement
        - Laboratory detection of complement abnormalities
        - summary
8. Transplantation:
   a. Review of MHC
   b. Transplantation
      - Descriptive terms
      - Graft rejection
      - Tissue matching
      - Types of tissues and organs transplanted
      - Prevention and treatment of rejections

VI. Microbiology Related To Dialysis **(40hrs)**

1. Morphology **2 hours**
   Classification of microorganisms, size, shape and structure of bacteria
2. Bacterial growth and nutrition **2 hours**
   Nutrition, growth and multiplications of bacteria
3. Sterilisation and Disinfection **2 hours**
   Principles and use of equipments of sterilization
4. Immunology **2 hours**
   Immunity, Vaccines and immunization
5. Systematic Bacteriology **15 hours**
   Morphology, cultivation, diseases caused and laboratory diagnosis (Staphyloccci, Streptococci, Pneumococci, Gonococci, Menigococci, *C. diphtheriae*, Mycobacteria, Clostridia, Bacillus, Shigella, Salmonella, *E. coli*, Klebsiella, Proteus, *vibrio cholerae*, Pseudomonas & Spirochetes)
6. Parasitology **5 hours**
   Morphology, life cycle, laboratory diagnosis of following parasites *E.histolytica*, Plasmodium, Tape worms, Intestinal nematodes
7. Mycology **3 hours**
   Morphology, diseases caused and lab diagnosis of Candida, Cryptococcus and opportunistic fungi
8. Virology **4 hours**
   General properties of viruses, diseases caused lab diagnosis and prevention of Hepatitis and HIV viruses
9. Hospital infection **3 hours**
   Causative agents, transmission methods, investigation, prevention and control
10. Biomedical waste management **2 hours**

VII. Pharmacology **(20hrs)**

1. Medications commonly used by patient with renal failure **(8hrs)**
   - Antacids and phosphate binders
   - Anti anemic drugs
   - Anticoagulants
   - Antihypertensives
   - Antimicrobials
   - Antipruritis
   - Cardiovascular drugs
   - Chelating agents
   - Electrolytes
   - Laxatives and
   - Local anesthetics
   - Potassium ion exchange resin
   - Thrombolytic agents
   - Vitamins
2. Pharmacology related to Renal disease, Hemodialysis and Peritoneal dialysis **(12hrs)**
   - Pharmaco kinetic and Pharmaco Dynamic principles
   - IV fluid therapy with special emphasis in renal disease.
   - Diuretics–Classification, actions, dosage, side effects & contraindications

- Antihypertensive–Classification, action, dosage, side effects & contraindications, special reference during dialysis, vasopressors
- Drugs used in hypotension.
- Drugs & Dialysis–Dose & duration of administration of drugs
- Dialysable drugs–Phenobarbitone, Lithium, Methanol etc
- Vit D & its analogues, phosphate binders, iron, folic acid & other vitamins of therapeutic value
- Erythropoietin in detail.
- Heparin including low molecular weight heparin
- Protamine sulphate.
- Gluteraldehyde, sodium hypochlorite, hydrogen peroxide role as disinfectants & adverse effects of residual particles applicable to gluteraldehyde
- Haemodialysis concentrates – composition & dilution (Acetate & bicarbonates)
- PD fluid in particular hypertonic solutions composition (Dextrose, icodextrin solutions)
- Potassium exchange resins with special emphasis on mode of administration.

Paper II: Clinical Nephrology (100hrs)

I. Kidney disease (60 hrs)

Basic concepts related to renal failure (**2hrs)**
Classification of renal disease –Acute Kidney Injury, Chronic Kidney Disease **(2hrs)**
(Diagnosis, Precaution, Management)
A. Acute Kidney Injury **(10hrs)**
Classification

- Pre renal uremia (Etiology, pathophysiology, assessment, management)
- Intra-renal uremia (Etiology, pathophysiology, assessment, management
- Post renal uremia (Etiology, pathophysiology, assessment, management)

Clinical course o AKI

- Initiating stage
- Oliguric stage
- Diuretic stage
- Recovery stage

B. Chronic Kidney Disease **(26hrs)**

1. (Includes causes, signs and symptoms, treatment)
    - Developmental/congenital disorder
    - Cystic disorder
    - Tubular disorder
    - Neoplasms
    - Infectious disease
    - Glomerulonephritis
    - Obstructive disorders
2. Renal problem and systemic disease
    - Diabetes mellitus (DM)
    - Diabetes insipidus (DI)
    - Primary hyperparathyroidism
    - Hepatorenal syndrome
    - Gout
    - Amyloidosis
    - Scleroderma or progressive systemic sclerosis
    - Good pasture syndrome

- SLE (Systemic lupus Erythromatosis)
- HUS
- Nephrotic syndrome
- Hypertensive nephropathy

C. Renal problem in pregnancy

D. Stages of renal dysfunction **(2hrs)**

Stages	Creatinine clearance ($ml/min/1.73m^2$)	Metabolic consequences
I. Stage Normal	>90	---
II. Stage Early Renal insufficiency	60-89	Increased serum PTH
III. C.K.D	30-59	Increased calcium absorption Anemia
IV. Pre-end stage failure	15-29	Increased TD, PO_4, K^+ acidosis
V. ESRD	<15	Uremic

E. Complications of chronic renal failure

- Anemia
- Polyneuritis
- Pericarditis
- Renal osteodystrophy
- Uremic carbohydrate intolerance
- Gynecomastia
- Infection
- Prurites

Approach to Patient with Renal Failure **(10hrs)**

F. Manifestations of renal failure:

- Systemic consequence of renal failure Alterations in following including signs, symptoms etiology & management.
- Uremia
- Fluid balance
- Electrolyte and ion balance (sodium, potassium, calcium, phosphate, Magnesium, hydrogen, bicarbonate, aluminium)
- Acid – base balance (Metabolic acidosis)
- Cardiovascular system (Hyperkalemia, Hypertension, Pericarditis, Pericardial effusion, Pericardial tamponade)
- Respiratory system
- Gastrointestinal system
- Hematological system (Anemia, Platelet dysfunction)
- Endocrine function
- Neuromuscular function & sleep problems
- Skeletal system
- Psycho-social function
- Dermatological manifestations

G. Patient history

H. Physical assessment of the renal system

I. Blood analysis

- Plasma Creatinine
- Blood urea nitrogen
- Plasma electrolytes
- Erythropoietin

- Plasma Renin
- Plasma substances (Antibodies & component with immunologic renal disorders like C3/C4 ANA

J. Clearance tests

- Creatinine clearance test, urea clearance.

K. Treatment **(5hrs)**

3 basic stages

a) Pressure reduction in remaining nephrons
b) Conservative treatment of uremic syndrome
c) Dialysis and transplantation

Indications of dialysis in AKI
Indications of dialysis in CKD

L. Contraindications for Dialysis (Including PD) **(3hrs)**

- Alzheimer's Disease
- Multi-infract denaturation
- Hepatorenal syndrome
- Advanced cirrhosis with encephalopathy
- Advanced malignancy etc

II. Renal transplantation **(40hrs)**

1. History and statistics
   - Historical events
   - Statistics
   - Data sources of renal replacement therapies
2. Immunological aspects
   - Functions of the immune system
   - Innate system
   - Acquired (lymphoid) immune system
   - Major histocompatibility complex
3. Evaluation of Potential Kidney transplant recipient & Donor
4. Storage & transplant of Kidneys
5. Pre/ Peri/Post-operative issues
6. Complications of renal transplant
7. Long term concerns
8. Commonly prescribed medications
9. Diagnosis of acute rejection
10. Other causes of sudden loss of renal function
11. The case with good initial renal function
12. The case with poor initial function
13. Uncontrollable rejection
14. Transplants in diabetes
15. Long term follow up
16. Late complications
17. Long term prognosis

Paper III: Basic Principles and overview of Types of Renal Replacement Therapy (HD & PD) (130hrs)

I. Renal Replacement Therapy **(30hrs)**

1. Indications **(10hrs)**

Most common cited clinical indications are

- Fluid overload
- Severe hypertension
- Hyperkalemia
- Metabolic acidosis
- Uremia

2. Indications for starting dialysis **(10hrs)**

- Oliguria (urine output < 200ml/12hr)
- Anurial/extreme oliguria
- Hyperkalemia ([K] >6.5mEg/l)
- Severe acidemia (pH<7.1)
- Azotemia ([urea] > 30mg/dl)
- Clinically significant organ (especially pulmonary) edema
- Uremic encephalopathy
- Uremic pericarditis
- Uremic neuropathy/myopathy
- Severe dysnatremia ([Na] <115 or > 160 meg/L)
- Hyperthermia
- Drug overdose with dialyzable toxin

3. Management of renal failure patients: **(10hrs)**

- Nutritional management in Renal failure (CKD, HD, CAPD, TRANSPLANT) (protein, calories, malnutrition).
- Anemia management in renal failure
- Medication for renal failure
- Investigation for renal failure
- Renal failure in children and pregnancy and its management

II. Concepts and principles of HD & PD and its application to patient care. (100hrs)

A. History & Types of Dialysis **(2hrs)**

- Hemodialysis
- Peritoneal dialysis
- Hemofiltration

Principles of Dialysis **(2hrs)**

- Reviewed basic knowledge

Basic Concepts Related To Dialysis **(6hrs)**

1. Basic chemistry concepts **(3hrs)**

A. Review

- an atom & atomic weight
- Molecules & molecular weight
- Mole
- Ions
- Density

B. Basic chemistry of Dialysate

- Blood electrolytes Vs dialysate composition
- Mixing ratios
- Dilution factors
- Concentrate composition
- Concentrate alteration
- Bicarbonate precipitation

2. Dialysis related Physics **(1hrs)**

- Fluid Dynamics
- Thermodynamics
- Temperature measurement

3. Dialysis & Electronics **(1hrs)**

- Electricity
- Conductivity
- Electrical leakage
- isolation transformer
- Electronic components- (Resistors, capacitors, Diodes, thermostats, transistors, integrated circuits, voltage regulators, microprocessors, memory, resistors color code)

4. Scientific terms used in Dialysis **(1hrs)**

- Solution
- Semipermeable membranes
- Diffusion (factors effecting diffusion)
- Filtration and ultrafiltration
- Fluid dynamics

B. Concepts and Principles of Hemodialysis **(90hrs)**

1. Applying scientific principles to dialysis **(3hrs)**
   - Fluid dynamics in dialysate (Diffusion in dialysis)
   - Ultrafiltration in dialysis
   - Osmosis in dialysis
   - convection in dialysis
2. Applying dialysis principles to the dialysis prescription **(3hrs)**
   - Dialyser, blood flow, rate, Dialysate flow rate, dialysis time, dialysate composition, anticoagulation
3. Dialysis and normal kidney (A comparison) **(2hrs)**
4. Hemodialysis Apparatus **(4hrs)**

A. Dialysers

a. Functions & Components

- Membranes
- Membrane materials
- Membrane manufacturing process
- Membrane characteristics
- Membrane permeability, Description.

b. Dialyser characteristics

- Biocompatibility
- Surface area
- Molecular weight cutoff
- UF coefficient
- Clearance
- Diffusion

- Connection
- Adsorption

c. Dialyser categories
- Convectional dialyser
- High efficiency dialyser
- High Flux dialyser

d. Dialyser types depending on their design and their comparative studies. (Hollow fibre, coiled, parallel plate)

e. Measuring Dialyser efficiency
- Determining Dialyser clearance

$$k \text{ ---------- x } Qb = \frac{CBi - CBo}{CBi}$$

- Determining UF rate --- Kuf

B. Dialysate

Purpose

Composition of dialysate

Sodium, Potassium, Magnesium, calcium, chloride, Glucose, Bicarbonate, Acetate

Dialysate delivery system.

i. Proportioning system

ii. Monitoring system

Conductivity, Temperature, flow rate, Dialysate pressure, TMP blood leak detection, pH.

5. Water treatment Plant (6hrs)

A. Purpose
- Preventing harm to Pt
- Preventing harm to equipments

B. How water become impure?

C. Types of contaminants and effects on Pts
- Micro – organisms
- Solid impurities
- Chemical impurities

D. Components of water treatment plant & their arrangement (Feed water components, R.O process)

E. Monitoring water treatment plant
- Continuous
- Periodic monitoring
- Microbiological testing
- Chemical monitoring (Chloramines, Na+, K+)
- Patient monitoring
  (Routine blood chemistries, Monitoring Pt. Symptoms)

F. Disinfection.

6. Dialysis Machine (5hrs)
- Types
- Function

Dialysate circuit

Blood circuit Delivery and monitoring Delivery and monitoring

Alarm function
- Equipment Dysfunction

- Maintenance & repair

7. Vascular access **(15hrs)**

- Historic forms of vascular access
  External A.V shunt
  Single needle devices
  Button devices
- Development of vascular access surgery
- Patient assessment and planning for vascular access surgery
- Anaesthesia for surgery of vascular access
- Surgical anatomy for HD access

Physiology of types of vascular access and clinical consideration

- Physiology of Arteriovenous fistula, Arteriovenous graft, Tunnelled Hemodialysis catheters
- Temporary type (IJC, S.C, F.C)
- Semi permanent
- Permanent Type

a) Types of catheter
b) Choice of device
c) Catheter placement
d) Placement techniques
e) Cut down techniques

- External jugular vein
- Internal jugular vein
- Femoral vein

f) Placement under radiographic guidance

- Ultrasound Complications
- Infectious complications
- Mechanical complications
- Thrombotic complications

Acute complications of central venous catheter

Thoracic

- Pneumothoracic
- Tension thoracic
- Subcutaneous emphysema

Hemothorax

- Hemomediastinum
- Hydro mediastinum
- Tracheal perforation

Arterial

- Subcutaneous hematoma
- Arterial laceration
- Arteriovenous fistula
- Pseudo aneurysm

Venous

- Venous laceration

- Air embolism
- Catheter embolism

Lymphatic
- Thoracic duct laceration

Cardiac
- Right ventricular interaction
- Arrhythmia
- Perforation and tamponade

Neurologic
- Brachial plexus
- Stellate ganglion
- Phrenic nerve
- Vegus nerve
- Recurrent laryngeal nerve

Catheter misplacement

Late complications

Thoracic
- Hydrothorax
- Hydro mediastinum

Venous
- Air embolism
- Central vein thrombosis
- Superior venacava syndrome
- Hepatic vein thrombosis

Cardiac
- Arrhythmia
- Perforation and tamponade
- Coronary sinus thrombosis

Lymphatic
- Lymphatic fistula
- Chylothorax

Septic
- Catheter sepsis
- Septic thrombosis
- Supperative thrombophlebitis
- Catheter performance and care
- Expected performances
- Complication , Prevention, Treatment
- Assessment and intervention for A.V.F maturation
- Non surgical methods for salvaging failed dialysis access
- Revisional surgery for failed access
- Nursing care for patient with dialysis access.
- New synthetic grafts and early access
- Biological properties of venous access devices.
- Complication of vascular access
- Infection in vascular access procedures
- Access in the neonatal and pediatric patients
- Improving vascular access outcomes

Continuous quality improvement (CQI) Clinical practice guidelines

8. Dialysis prescription (5hrs)

Duration, Dialysate, UF, Heparin, Investigation, Medication usually given during HD in the following cases,

- For acute renal failures
- For chronic renal failure
- First HD
- Regular HD
- HD & Surgery
- HD for transplant recipients
- HD for poisoning case
- Phlasmaphersis

9. Anticoagulation (7hrs)

a. Purpose
b. Anticoagulant requirement depending on
- Patient Characteristics
- Medical characteristics (Fever, infection, uremic etc)
- Dialyzer system characteristics
- Drug characteristics

c. Administration of Heparin during dialysis
d. Methodology
- Continuous
- Intermittent (Periodic)
- low dose (tight)
- Systemic
- Regional
- Baseline
- Controlled

e. Anticoagulation tests
- Whole blood clotting time
- Whole blood activated clotting time
- Whole blood partial thromboplastin time

f. Principles of anticoagulation
g. Heparinisation based on Pt's wt
h. Complications of Heparin therapy
i. Inadequate heparinisation
j. Heparin free dialysis
k. Other anticoagulants
l. Regional citrate anticoagulation
- Advantage
- Disadvantage

10. Adequacy of Dialysis (10hrs)

- Urea reduction ration (URR)
- Urea kinetic Modelling (UKM)
- K t/v

Factors affecting dialysis treatment
- Clearance factor

- Time factor
- Blood flow
- Dialysate flow & type
- Dialysis
- Vascular access
- Patient

Dialyser (reprocessing)

- History
- Purpose
- Safety
- Advantage
- Disadvantage
- Steps
- Methods of reprocess
- Disinfectants
- Fiber bundle volume
- Fiber integrity test

Concepts & Principles of Peritoneal Dialysis **(20hrs)**

A. PD Apparatus

- PD Catheter access
- Solution

B. Pt. selection
C. P.D Process
D. Modalities
E. Prescription
F. Type of PD
G. Adequacy of PD

Dialysis in Special Situations **(12hrs)**

- Pt's with congestive cardiac failure
- Advanced liver disease
- Pts positive for HIV, HCV, HBSAg
- Failed transplant
- Poisoning cases
- Pregnancy
- Dialysis infants & children and care of pediatric patients.
- ICU cases and patient care.

Special Dialysis Procedure **(5hrs)**

- Continuous Therapies in HD
- Haemodiafiltration
- Haemoperfusion
- SLED
- MARS
- Plasmapheresis **(3hrs)**

Paper IV: Epidemiology & Biostatics

(60 hours)

Unit 1: **Introduction:**

Introduction to bio statistics and research methodology, types of variables and scales of measurements, measures of central tendency and dispersion, Skewness and Kurtosis rate, ratio, proportion, Incidence and prevalence.

(4hrs)

Unit 2: **Sampling**:

Random and non-random sampling, various methods of sampling —simple random, stratified, systematic, cluster and multistage. Sampling and non-sampling errors and methods of minimizing these errors.

(4hrs)

Unit 3: **Basic probability distributions and sampling distributions**:

Concept of probability and probability distribution. Normal, Poisson and Binomial distributions, parameters and application. Concept of sampling distributions. Standard error and confidence intervals.

(6hrs)

Unit 4: **Tests of significance**:

- Basics of testing of hypothesis — Null and alternate hypothesis, type I and type II errors, level of significance and power of the test, p value.
- Tests of significance (parametric)- t — test (paired and unpaired),Chi square test and test of proportion, one way analysis of variance. Repeated measures analysis of variance.
- Tests of significance (non-parametric)-Mann-Whitney u test, Wilcoxon test, Kruskal-Wallis analysis of variance. Friedmann's analysis of variance. **(10hrs)**

Unit 5: **Correlation and regression**:

Simple correlation — Pearson's and Spearman's; testing the significance of correlation coefficient linear and multiple regression. **(4hrs)**

Unit 6: **Sample size determination**:

General concept, sample size for estimating mean and proportion, testing of difference in means and proportions of two groups **(4hrs)**

Unit 7: **Study designs**:

- Descriptive epidemiological methods — case series analysis and prevalence studies.
- Analytical epidemiological methods — case control and cohortstudies.
- Clinical trials/intervention studies, Odds ratio and relative risk, stratified analysis.

(10hrs)

Unit 8: **Multivariate analysis**:

Concept of multivariate analysis, introduction to logistic regression and survival Analysis

(6hrs)

Unit 9: **Reliability and validity evaluation of diagnostic tests**. **(4hrs)**

Cronbach's alpha and test – retest methods

Unit 10: **Format of scientific documents**.

Structure of research protocol, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta-analysis. **(8hrs)**

SECOND YEAR - THEORY

Paper V: Recent advances HD Procedures & Complications in renal disease patient Dialysis patients & Renal disease patients Dialysis patients & Renal Nutrition (220hrs)

1. Advanced HD procedures **(30hrs)**

1. Nocturnal Dialysis
2. Online dialysis
3. Daily dialysis
4. Telemedicine in Dialysis Practice
5. Peadiatric Dialysis

2. **Complications of renal disease patients, dialysis patients and Dialysis equipments.** **(110hrs)**

Clinical considerations in the Evaluation of Dialysis Patients

a. Hypertension in Dialysis Patients
b. Left Ventricular Dysfunction in Dialysis Subjects
c. Coronary Artery Disease in End-Stage Renal Disease
d. Autonomic Function and hemodynamic stability in End- Stage Renal Disease Patients
e. Infection and immunity in End-stage Renal Disease
f. B2-Microglobulin- Associated Amyloidosis of End-Stage Renal Disease
g. Renal Osteodystrophy
h. Dyslipidemias of End-Stage Renal Disease
i. Selection of Therapy for Patients with End-stage Renal Disease
j. Malnutrition and Intradialytic Parenteral Nutrition in ESRD Subjects
k. Disorders of Hemostasis in Dialysis Patients
l. Treatment of Anemia in Dialysis Subjects
m. Acquired Cystic Kidney Disease
n. Geriatric Dialysis Patients
o. Diabetic Dialysis Patients
p. Hemodialysis and Hemoperfusion for poisoning
q. Dialysis considerations in the patient with Acute Renal Failure
r. Infections in patients on Continuous Ambulatory Peritoneal Dialysis
s. Balancing outcomes in Dialysis with Economic Realities

3. Recent Advance in Dialysis and Nephrology (**10hrs)**

4. Cyber Nephrology **(10hrs)**

5. C**alculators** **(20hrs)**

- IV rate and dose
- Access recirculation
- URR
- Concentration
- GFR Adult/Pedi
- Kt/V (different formulas)
- Access recirculation
- Urea volume distribution
- Creatinine Clearance
- BMI
- Weight and measures (Length, volume, weight , Fahrenheit, Celsius etc)

6. Renal Nutrition **(40hrs)**
(30hrs)

Part I: Nutrition

1. Energy (Calories)
2. Protein
3. Lipid (Fats& Cholesterol)
4. Carbohydrates
5. Thiamine vitamin B1, aneurine
6. Riboflavin
7. Vitamin B6 (pyridoxine, adermin)
8. Nicotinic acid (Niacin, nicotinamide)
9. Folic acid (folate, folacin, pteroylglutamic acid)
10. Vitamin b12 (cobalamin)
11. Pantothenic acid(filtrate factor)
12. Choline, biotin
13. Ascorbic acid (vitamin C)
14. Vitamin A
15. Vitamin D
16. Vitamin E
17. Vitamin K
18. Bioflavonoid (vitamin P)
19. Sodium
20. Potassium
22. Iron
23. Calcium
24. Phosphate
25. Magnesium
26. Manganese
27. Iodine
28. Copper
29. Cobalt
30. Chloride
31. Fluoride
32. trace elements
33. Dietary Fibers
34. Water

Part II: Foods

1. Wheat
2. Rice
3. Pulses
4. Soya beans
5. Maize
6. Millets
7. Milk
8. Egg
9. Meats
10. Nuts & Dried Fruits
11. Sweet foods & sweetening agents
12. Fish
13. Vegetables
14. Fruits
15. Spices
16. Beverage

17. Alcohol

Part III: (A) Menu Planning (B) Dietary modifications

Part IV: Clinical dietetics

1. Diet Prescription
2. Peptic ulcer
3. Flatulence
4. Constipation
5. Diarrhea & dysentery
6. Protein- Energy malnutrition
7. Anemic
8. Under weight
9. Obesity
10. Diabetes mellitus
11. Kidney disease
12. Renal failure
13. Kidney stones
14. Coronary Heart Diseases and atherosclerosis
15. High BP
16. Congestive cardiac failure
17. Tube feeding

Part V: Principles of Nutritional Assessment

1. Introduction
    a. Nutritional assessment system
    b. Methods used in nutritional assessment
    c. The design of nutritional assessment system
    d. Evaluation of nutritional assessment indices
        Reference distribution
        Reference limits
        Cutoff points
2. Food consumption of Individual
    a. Methods
    b. New development in measuring food consumption
    c. Selecting an appropriate method
    d. Summary
3. Evaluation of nutrient intake data
    a. Tables of recommended nutrient intakes
    b. Evaluating Nutrient intakes of individuals
    c. Evaluating the nutrient intakes of population groups
    d. Probability approach to evaluating nutrient intakes
4. Anthropometric assessment
    a. Advantages and limitations of anthropometric assessment
    b. Sources of error in nutritional anthropometry
    c. Evaluation of anthropometric indices
5. Anthropometric assessment of growth
    a. Growth measurement
    b. Indices derived from growth measurements

VI: Bed side rounds & practices **(10 hrs)**

Paper VI: Basics of Hospital Administration and Management of Dialysis Unit & Biomedical Instrumentation Biotechnology & Molecular Biology (140hrs)

1. Patient education & health patient with rrt (30hrs)

- Patient Education
- Communication
- Patient communication problems
- Explanation of examinations
- Interacting with terminally ill patient
- Informed Consent
- Patient counselling on
  - Living with CKD
  - Life with HD and CAPD
  - Living with a transplanted kidney.

2. Basics of Management of health care organization include administrative aspects of dialysis unit

A. Hospital Structure (10hrs)

Basics of

- Intensive care units
- Hospital administration
- Resource management (personnel, material & finance)
- Quality management & infection control systems

B. Management of Healthcare Organizations (40hrs)

Management functions

- Planning
- MBO
- Decision making
- Organizing
- Staffing
- Controlling

Management and Economics

- Demand & Supply
- Nature of Costs
- Marginal cost and breakeven analysis
- Market structure: Business & Government
- Role of Government

Organizational Behavior

- Significance
- Structure & theories
- Individual & group behavior
- Leadership
- Motivation
- Organizational development
- Managing creativity and stress

Accounting for Hospital Management

- Budgeting & Budgetary control
- Difference between forecast & budgeting_ Preparation of budget

- Classification of budget
- Capital Budgeting

Concept of Hospital

- Departmentation in Hospital
- Clinical services management
- Organizing of support services
- Management of utility services
- Evaluation of Hospital services
- Issues related to Healthcare technology
- Present trend in healthcare technology
- Problems & constraints
- Planning & adopting appropriate technology in healthcare
- Evaluation method of health technology

Evolution of Quality management

- Quality assurance methods
- Patient satisfaction
- Standard operating procedure
- Quality certification
- Accreditation to national agencies

3. Biomedical Instrumentation (20hrs)

1. Introduction to Biomedical Instrumentation
    a. The Age of Biomedical Engineering
    b. Development of BM instrumentation
    c. Biometrics
    d. Introduction to the man-instrument system
    e. Components of the man-instrument system
    f. physiological systems of the body
    g. Problems encountered in measuring a living system.
2. Basic Transducer principles:
    a. The transducer and transduction principles
    b. Active transducers
    c. Passive transducers
    d. Transducers for Biomedical applications
3. Sources of Bioelectric potentials:
    a. Resting and action potentials
    b. Propagation of Action potentials
    c. The Bioelectric potentials
4. Electrodes
    a. Electrode theory
    b. Biopotential electrodes
    c. Biochemical transducers
5. The computer in Biomedical Instrumentation:
    a. The digital computer - Computer Hardware, Computer software
    b. Microprocessors - Types of microprocessors, Microprocessors in Biomedical Instrumentation- Calibration , Table lookup , Averaging , Formatting and printout
    c. Interfacing the computer and medical instrumentation and other equipment.- Digital interfacing requirement , Analog-to-digital and Digital-to-Analog conversion
    d. Biomedical computer application - Data acquisition, storage and retrieval, data reduction and transformation, mathematical operation, pattern recognition, limit detection, statistical analysis of data, data presentation ,control function - Computer

analysis of the ECG, the digital computer in the clinical chemistry laboratory, digital computerized in hemodialysis machine, other computer application

6. Electrical safety of Medical Equipment.
    a. Physiological effects of electrical current.
    b. Shock hazards from electrical equipment.
    c. Methods of accident prevention
    - Grounding
    - Double insulation
    - Protection by low voltage
    - Ground – fault circuit interrupter
    - Isolation of patient – connected parts
    - Isolated power distribution systems
7. Patient care and monitoring:
    a. The elements of intensive – care monitoring
    - Patient monitoring displays
    b. Diagnosis, calibration and repairability of patient – monitoring equipment
    c. Other instrumentation for monitoring patients
    d. The organization of the hospital for patient care monitoring
    e. Defibrillator
8. Description of Machine self test
9. Technical safety checks and maintenance
    a. General notes
    b. Technical safety checks and maintenance procedures
    c. maintenance checklist
10. Adjustment
    a. Overview of the Dip switches
    b. Calibration mode
    c. Hydraulics
    d. Dir detector
11. Calibration Program
12. Diagnostics Program
    a. General notes
13. Setup Menu
    a. Overview
    b. Main menu
14. Circuit diagram and circuit description
    a. Block diagram
    b. level detector control (LD)
    g. BLD
    h. Mother board
    i. CPU
    j. Input / output board
    k. Display board
    l. Power supply
    m. Hep - Module

4. **Molecular biology and biotechnology** **(40hrs)**
    1. Introduction to molecular Biology
    2. Concept
    3. Basic principles of Biotechnology
    4. Molecular Biology
        - Identification of the genetic materials

- Chemical nature of genetic materials
- Replication of DNA
- Non-genetic ribonucleic Acid (RNA) and transcription
- Genetic code
- Protein synthesis
- Regulation of gene action

5. Recombinant DNA technology
    - Biology & classification of Cloning strategies & Vectors.
    - Introduction of genes into the cell
    - DNA modifying enzymes and DNA synthesis
    - Genetic Recombination and Gene Transfer (Bacterial Conjugation, Transformation, Transduction, Episomes and Plasmids)
    - Genetic Engineering (Isolation, sequencing, Synthesis of Gene and DNA Fingerprinting)
    - Site Directed Mutagenesis.
    - Antisense Technology
    - Gene theraphy
6. Immunology
    - Antibody antigen reaction,
    - Hybridoma technology
    - Vaccines production (Principles)
7. Stem cell research: principles and application

Paper VII: Emergency Medicine /ACL Nephro-Radiological Nuclear Medicine and imaging sciences and Nephrophyshiatric (60hrs)

1. Emergency medicine/ACLS /renal nutrition (20hrs)

A. BLS (10hrs)

1. BLS in perspective
    a. The need for Medical interventions
    b. The ultimate Coronary Care Unit
    c. Emergency Cardiac Care
    d. The chain of Survival
    e. Role of the American Heart Association
2. Cardio Pulmonary Function and actions for survival
    a. The Cardiovascular and Respiratory system
    b. Action for survival
3. Risk factors and prudent Heart living
    a. Risk factors for Heart Attack
    b. Prudent Heart Living
    c. Summary: The role of Prevention
4. Adult BLS
    a. Citizen response to Cardio-pulmonary Emergency
    b. Indication for BLS
    c. The sequence of BLS; Assessment, EMS activations and the ABC of CPR
    d. CPR performed by one rescuer and two rescuers
    e. Foreign – Body airway obstruction Management
    f. CPR: The Human Dimension
    g. BLS Research Initiative

5. Special Resuscitation Situation
    a. Stroke
    b. Hypothermia
    c. Near – Drowning
    d. Cardiac arrest associated with Trauma
    e. Electric shock and lightning stroke
    f. Pregnancy
    g. Asphyseration
    h. Special techniques and pitfalls and complication
    i. Unique situation
6. Pediatric BLS
    a. Epidemiology
    b. Injury prevention
    c. Prehospital care
    d. The sequence of Pediatric BLS - the ABC of CPR
    e. Activation of the EMS system obstructive
    f. Foreign Body airway
    g. BLS in Trauma
7. Ethical and Legal considerations
    a. Values in Decision Making
    b. Instituting and Discontinuing CPR
    c. Legal mandates
    d. Conclusions
8. Safety during CPR Training and actual rescue
    a. Disease transmission during CPR Training
    b. Disease transmission during actual performance of CPR
9. Automated External Defibrillation
    a. Importance of Automated External Defibrillation
    b. Overview of Automated External Defibrillation
    c. Advantage and Disadvantage of Automated External Defibrillation
    d. Use of Automated External Defibrillation during Resuscitation attempts
    e. Automated External Defibrillation treatment algorithm
    f. Post resuscitation care
    g. Training
    h. Maintenance of Skills
    i. Medical control
    j. Quality assurance

B. ACLS **(10hrs)**

1. Cardiopulmonary Resuscitation and Advanced Cardiac Life Support
    a. Basic Life Support
    b. General Considerations of Advanced Cardiac Life Support: Arrhythmia recognition and defibrillation-ventilation and airway management-route of drug administration-IV fluids-diagnose and correct the underlying cause of the arrest-internal cardiac compression-initiation and discontinuation of resuscitation.
    c. Specific Arrest Sequences in Advanced Cardiac Life Support : VF and Pulseless VT – Systole-Bradycardia-Pulseless electrical activity(PEA)-Tachycardias
    d. Post resuscitation Management
    e. Common Medications Used in Advanced Cardiac Life Support : Epinephrine-Atropine sulfate-Lidocaine-Procainamide hydrochloride-Bretyliumtosylate-magnesium sulfate-adenosine-Diltiazem or verapamil-Isoproterenol-Sodium bicarbonate-Calcium

2. Critical Care
    a. Respiratory Failure: General considerations-pathophysiology-Blood gas analysis
    b. Oxygen therapy: Nasal prongs-venturi masks-Nonrebreathing masks-A continuous positive airway pressure mask-Bilevel positive airway pressure
    c. Airway Management and Tracheal Intubation: Airway Management-Endotracheal intubation-Surgical airways
    d. Mechanical Ventilation: Indications-Initiation of mechanical ventilation-Management of problems and complications-Weaning from mechanical ventilation-Drugs commonly used during endotracheal intubation and mechanical ventilation
    e. Shock: Resuscitative Principles-Individual shock states
    f. Hemodynamic Monitoring and Pulmonary Artery Catheterization: Indications-obtaining a pulmonary capillary wedge tracing-acceptance of PAOP readings-transmural pressure-Cardiac output-Interpretation of hemodynamic readings
3. Cardiac Arrhythmias
    a. Recognition and Management: Clinical diagnosis of arrhythmias-Electrocardiographic data-Bradyarrhythmias-premature complexes-Tachycardia-
    b. Antiarrhythmic Drug Therapy: General Principles-Antiarrhythmic agents
    c. Related Topics: Syncope-Electro-cardioversion-Cardiac pacing-Anti-tachycardia devices

2. Nephro-radiological and imaging sciences and nuclear medicine (20hrs)

3. Radiological and Imaging Sciences (15hrs)

1. Ultrasound Sonographic imaging characteristics
2. Doppler ultrasound – scanning techniques (ultrasound of the normal kidney – acute renal failure – surgical – medical renal disease – renal masses – cysts- solid renal masses – calculi – intrarenal hematomas – renal transplant evaluation – rejection – renal infections) Doppler ultrasound in evaluation of renal vascular disease and Transplant kidney evaluation.
3. Computed Tomography Of The Kidney: Anatomy – renal masses – cystic masses – solid renal masses – tumors of the renal pelvis – renal calculi – obstructive uropathy – infarction – acute renal cortical necrosis – renal vein thrombosis – renal artery stenosis – acute pyelonephritis – renal and perinephric abscess – emphysematous pyelonephritis – pylonephrosis – xanthogranulomatous pyelonephritis – tuberculous pyelonephritis – congenital anomalies – renal trauma – transplant kidneys
4. Urography: intravenous urography – indications – contra indications – interpretation.
5. Magnetic Resonance Imaging: normal kidney – congenital anomalies – obstruction – injection – renal parenchymal disease– hypertension and renal vascular disease – renal cysts – benign neoplasm's – malignancies of kidney.
6. Renal Angiography: Indications – relative contraindications.
7. Renal Biopsy

4. Nuclear Medicine (5hrs)

1. Basic of nuclear medicine.
2. DTPA, DMSA.
3. Peritoneal scintigrephy.
4. Reflex scintigrephy.
5. Transplant renal scintigrephy.

5. Nephropsychiatry (20hrs)

1. Psychiatric Assessment
   a. Introduction to clinical assessment
   b. The Psychiatric interview
   c. The mental status Exam
   d. Physical Exam and laboratory evaluation
   e. Intelligence testing and neuropsychological assessment
   f. Personality assessment
2. Psychiatric Aspects of Renal Care
   a. Introduction
   b. Psychiatric problems: uncooperativeness-cause of uncooperativeness
   c. Depression and Suicide, anxiety, rehabilitation problems, sexual problems
   d. Psychiatric fitness for Transplantation
   e. Treatment of psychiatric problems-preventive therapy-group therapies-environmental Manipulations-psychotherapy-pharmacotherapy-behavioral sexual techniques
3. Rehabilitation and Psychosocial Issues
   a. Endurance Exercise training in hemodialysis patients
   b. Psychosocial rehabilitation of Adult dialysis patients
   c. Ethical Dilemmas in Dialysis: To initiate or withdraw Therapy
4. Mental Disorders
   a. Diagnosis and classification in psychiatry
   b. Psychiatry history and examination
   c. Organic(Including Symptomatic) mental disorders
   d. Psychoactive substance use disorders
   e. Schizophrenia
   f. Mood Disorders, Anxiety and personality
   g. Other psychotic Disorders
   h. Neurotic, stress-related and somatoform disorders
   i. Disorders of Adult personality and behaviour
   j. Sexual disorders
   l. Sleep disorders
   m. Behavioural syndromes associated with psychological disturbances and physiological factors
   n. Mental retardation
   o. Child psychiatry
   p. Psychopharmacology
   q. Biological methods of treatment
   r. Psychoanalysis
   s. Psycho treatment
   t. Emergency psychiatry
   u. Legal and ethical issues in psychiatry
   v. Common psychiatry

PRACTICALS

(2100hrs)

1. Patient Care **(400hrs)**

A. Assessment

Collect & evaluate patient data

- Access Patency
- Apical pulse
- Blood pressure
- Breath sound
- Heart Sound
- Jugular vein distension
- Peripheral edema
- Pulse
- Respiration
- Signs of infection
- Temperature
- Weight
- Communication with patient

B. Pre dialysis procedures

a. Following HD orders and treatment plan

b. Equipment preparation procedures

- Preparing dialysate according
- Assembling the extracorporeal circuit
- Priming the dialyser & extracorporeal circuit
- Pre – initiation check

C. Initiation of Dialysis

a. Fluid removal procedures

- Calculating amount of fluid to be removed
- Predicting UF
- Calculating TMP
- Calculating UF rate
- Fluid replacement
- Isolated ultra filtration

b. Venipuncture procedure

- Needle insertion in a fistula or graft
- Initiating dialysis treatment
- Clean & dress access site (venous cannulation) using appropriate technique

c. Monitoring during dialysis

- Patient monitoring procedures
  - Taking vital signs
  - Monitoring general patient condition
  - Providing comfort and diversion during dialysis
- Technical monitoring
  - Monitoring devices
  - Equipment safety checks
  - Extracorporeal circuit
- Blood pump settings
- Adjust arterial & venous pressures

- Adjust fluid removal
- Monitor the dialysate delivery system
- Heparinisation during dialysis
- Recognize complications occurring during dialysis & their management
    - Chills
    - Cramps
    - Fever
    - Shock
- Recognize and management of complication due to operator & equipment error
    - Air embolism
    - Bleach or formaldehyde reaction
    - Chemical pyrogen reaction
    - Hemolysis and water quality
- Recognize problem regarding heparinisation (Coagulation, hemorrhage, hemostasis)
- Recognize access complication in patients (Clotting, infection, recirculation)
- Recognize blood leaks
- Recognize complication with administration of medication (Antihypertensive, Erythropoietin, iron dextran.

D. Post Dialysis Procedures

- Completing dialysis treatment procedures
- Discontinuing dialysis
- Post dialysis pt. check
- Taking vital signs and weight
- Documentation
- Equipment clearing / disinfection

E. Medications, solutions and laboratory test

a. Medications and solution procedures

- drawing solution
- Using I.V solutions

b. Laboratory tests procedures

- Drawing blood specimen
- Blood sampling pre & cost dialysis (Bun measurements)
- Monitoring of anemia
- determining R.B.S
- Determining Kt/V, recirculation, URR, Aluminum level, blood chemistry, culture, hematocrits, hepatitis study, iron study.
- Perform coagulation studies to determine Heparinisation

c. Documenting patient care

- Treatment record

2. Hemodialysis Catheterization Under Guidance (100hrs)

- Types of catheter
- Choice of device
- Catheter placement
- Placement techniques
- Cut down techniques
- External jugular vein
- Internal jugular vein
- Femoral vein
- Placement under radiographic guidance
- Ultrasound

3. Machine Technology **(400hrs)**

Maintenance of system:

- Clean & disinfect dialysis equipments as per unit policy (Protocol)
- Develop preventive maintenance schedules for all dialysis equipment and maintain record
- Document all dialysis equipment repair work performed
- Maintain emergency equipment in proper working condition for immediate use
- Maintain / verify the calibration of HD machines
- Order supplies & equipment for dialysis unit perform repairs to equipment
- Perform electrical leakage tests for all dialysis equipments
- Verify blood & dialysate flow rate.

Machine set up:

A. Assemble dialysis equipment for operation

B. Perform residual chemical checks

C. Perform required safety checks

- Conductivity
- pH
- Pressure holding test
- Temperature

D. Perform safety checks

- ABD (Air Bubble Detector)
- Arterial pressure gauge
- Blood leak alarm
- Blood pump
- Dialysis fluid
- Heparin pump
- Venous pressure gauge
- Dialysis check

E. Prepare bicarb solution

F. Prepare dialysis machine

- Rinse
- Prime
- Caliberate alarm
- Set monitor
- Fluid delivery system
- Connection

G. Perform Disinfection procedure of dialysis machine

4. Water Treatment Plant **(250hrs)**

A. Continuous monitoring

- Temperature, pressure, flow rate, conductivity resistivity, total dissolved solids (TDS)

B. Periodic monitoring

- Softener regeneration
- Hardness test
- total chlorine, chloramines test
- chemical analysis
- pH
- Others

Microbiological tests

- Disinfection
- Culture
- Record maintenance

Dialyser processing **(30hrs)**

- Process dialyser according to protocol
- Maintain processing record
- Perform reuse test
  - Bacterial culture
  - Presence of disinfectant
  - Pressure testing
  - Visual inspection

Electronics **(30hrs)**

- Components
- Relationship – voltage, amperage, resistance
- Basic multimeter skills
- Concepts
  - Transformer
  - Relays

- Reading wiring diagram / schematics
- Electrical safety
- Handing P.C boards
- Soldering skills

Computers **(20hrs)**

- Cabling
- Operating system
- Computer components

Plumbing **(20hrs)**

- Fittings
- Sizes
- Materials

Management of dialysis unit **(50hrs)**
Special and advanced dialysis procedures **(100hrs)**
Peritonial dialysis **(90hrs)**
Cpr demo **(10hrs)**
Teaching methodology **(600hrs)**
Distribution of marks for the first year

Subsidiary Subject

Ethics - 10 Hrs

(Should be taught to the 1st year students)

Introduction: With the advances in science and technology and the increasing needs of the patient, their families and community, there is a concern for the health of the community as a whole. There is a shift to greater accountability to the society. It is therefore absolutely necessary for each and every one involved in the health care delivery to prepare them to deal with these problems. Other professionals are confronted with many ethical problems.

Standards of professional conduct are necessary in the public interest to ensure an efficient laboratory service. Every sinologists or sonographer should not only be willingly to play his part in

giving such a service, but should also avoid any act or omission which would prejudice the giving of the services or impair confidence, in respect, for sinologists or sonographer as a body.

To accomplish this and develop human values, it is desired that all the students undergo ethical sensitization by lectures or discussion on ethical issues.

Introduction to ethics-

What is ethics?
General introduction to Code of Laboratory Ethics
How to form a value system in one's personal and professional life?
International code of ethics

Professional Ethics-
Code of conduct
Confidentiality
Fair trade practice
Handling of prescription
Mal practice and Negligence
Professional vigilance

Research Ethics-
Animal and experimental research/ humanness Human experimentation
Human volunteer research - informed consent Clinical trials
Gathering all scientific factors
Gathering all value factors
Identifying areas of value – conflict, setting priorities
Working out criteria towards decision
ICMR/ CPCSEA/ INSA Guidelines for human / animal experimentation

Suggested Readings :

1. Human Anatomy - B.D. Chaurasia
2. Gray's Anatomy for the students – Richard L.Drake
3. Human Physiology - A.K. Jain
4. Anatomy and physiology in health and illness – Ross and Willson
5. Text Book of Pathology - Harsh Mohan
6. Basic Pathology – pocket Robbins
7. Medical Pharmacology – Padmaja Uday Kumar
8. KD Tripathi – Essentials of Medical Pharmacology
9. The Kidney – By Barry Brenner, Floyd
10. Clinical Dialysis, Dialysis Therapy- By Nissenson, Fine
11. Complications of dialysis- By Norbert Lemeire, Ravindra Mehta
12. Dialysis technology- By Jim Curtis , Philip Varughese
13. Hand book of dialysis – By Daugirdas, Peter Gerard Blake
14. Renal Nursing – By Nicola Thomas
15. Review of HD – By C.F. Butch, Martha H Stoner, Anna L. Corea

16. Some are from internet sources.
17. Lwanga SK and Cho-YookTye (Editors). Teaching Health Statistics, Twenty lessons and seminar outlines, World Health Organization, Geneva.
18. Mahajan BK. Methods in Biostatistics for medical students and research workers. 6th Edition, Jaypee Brothers Medical Publishers, New Delhi, 1997.
19. Kothari CR. Research Methodology: Methods and Techniques. Wiley Eastern Ltd, New Delhi.
20. Sundar Rao P55 and Richard J. Introduction to Biostatistics: A Manual for Students in Health Sciences. Prentic-Hall of India Pvt. Ltd, New Delhi.
21. Park E. Park's Text book of Preventive and Social Medicine, M/S Banarasidas Bhanot, Jabalpur.
22. Nair S K. Essential Research Methodology, Epidemiology and Biostatistics. In: ShobhaTandon, editor. Text Book of Pedodontics, 2~ ed. Hyderabad: Paras Publishing; 2001 p 687-96.
23. Armitage P, Berry G. Statistical methods in medical research, 3rd ed. London: Blackwell Scientific Publications; 1994.
24. Daniel W W. Biostatistics: A foundation for analysis in health sciences, 2nd ed. New York; John Wiley and Sons, 1987.
25. Principles of Management by Koonz 'o' Donnel
26. Hospital planning Administration by B.M. Shakar

19. MODEL QUESTION PAPER

(Common for both specialities – 1st & 2nd year)

THEORY

Each theory paper will have

1) Essay questions – 03 nos. carrying 10 marks each - 03 x 10 = 30
2) Short answer questions – 10 nos. carrying 05 marks each - 10 x 05 = 50

Total = 80
Internal assessment = 20

PRACTICAL

(a) Preliminary:
Internal assessment : 15
University examination : 60

Total = 75
(b) Viva = 25

SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES

TIRUPATI – 517 507

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

PG Programme in Allied Health Sciences

M.Sc Echocardiography

TIRUMALA TIRUPATI DEVASTHANAMS

INDEX

General Regulations

1. **Title of the Course**
   Master of Science degree in Echocardiography
2. **Duration of the Course**
   The duration of the course shall be 2- years on full time basis
3. **Eligibility for Admission**

   a) B. Sc in Cardiovascular Technology (3 yrs)
   (or)

   b) B.Sc Degree + 2 years PG diploma in ECG & CVT + 3 years Experience. Three years of Experience post 2 years Diploma in cardiovascular technology. Post general B.Sc. Degree from reputed institution on regular basis. correspondence course will not be considered.
4. **Selection Criteria**
   Selection shall be based on the academic merit/entrance test conducted in the qualifying exam.
5. **Admission schedule :**
   a) Commencement of Course: August every year
   b) The admissions are closed by 30th September or 60 days from the date of commencement of the programme.

5. Medium of instruction.

English shall be the medium of instruction for the subjects of study as well as for the Examination.

6. Course of study

The course shall be pursued on full time basis. In the end of first year there shall be an examination. Students shall be posted to SVIMS and SPMC hospitals during the practical hours.

Subjects for study and teaching hours for first year and second year of the PG courses are shown below.

Distribution of Teaching Hours
First Year

S.No.	Main subject	Theory No. of Hours	Practical No. of Hours	Total
1.	Embryology & Ultrasound Physics	46	120	166
2.	Clinical Cardiology	47	120	167
3.	Echocardiography for Ischemic/Valvular Heart Disease	57	140	197
4.	Epidemiology & Biostatistics	60	-	60
5.	Subsidiary subject: Medical Ethics	10	-	10
	Total:	220	380	600

Second year

S.No.	Branches	Theory No. of Hours	Practical No. of Hours	Total
6.	Paediatric Echocardiography	46	140	186
7.	Echocardiography in Myocardial, Pericardial, Aortic and Systemic Disorders& Non Cardiac Diagnosis	47	125	172
8.	Recent Advances	47	125	173
	Total:	140	390	530

8 a) Attendance:

A candidate is required to put in minimum 80% of attendance both in theory and practical separately of each paper before admission to the university examination. Participation in NCC, NSS, sports and games, educational tours, professional meetings and conference or other co-curricular activities representing the institution/university will not count as absence.

b) Condonation for lack of attendance:

The condonation of attendance on medical grounds or on absence under extraordinary circumstances to those who are having the attendance between 70% and 79% in each paper will be granted in genuine cases. The students who have shortage of attendance in the particular papers have to apply to the controller of examinations, indicating the reasons for shortage of attendance. The representation to be forwarded by the HOD & Prof. i/c AHS. If the reason is on the medical grounds, the relevant medical certificate has to be enclosed to the representation. If any student falls below the 70% of attendance, he/she will not be allowed to write the university examinations.

9. Scheme of examination

a) The examination for the degree shall consist of written papers, practical and oral.
b) There shall be two examinations viz. Preliminary and final. The preliminary examination shall be taken at the end of the first year. The final examination shall be taken at the end of 2^{nd} year.
c) The examination shall be conducted ordinarily twice a year, viz. July/August and January/February.

Preliminary Examination

This consists of theory, practical and oral. There will be separate papers for each specialization.

University Examination and Distribution of marks

First year

S.No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
1.	Embryology & Ultrasound physics	I	20	80	15	60	25	200
2.	Clinical cardiology	II	20	80	15	60	25	200
3.	Echocardiography Ischemic/valvular heart disease	III	20	80	15	60	25	200
4.	Epidemiology & biostatistics	IV	20	80		-	-	100
	Total							700

Second year

S.No	Subjects	Paper	Theory		Practical (Marks)		Viva	Grand Total
			IA	UE	IA	UE		
5.	Pediatric Echocardiography	V	20	80	15	60	25	200
6.	Echocardiography in Myocardial, Pericardial, Aortic and Systmic Disorders & Non cardiac Diagnosis	VI	20	80	15	60	25	200
7.	Recent advances	VII	20	80	15	60	25	200
8.	Dissertation					100	50	150
	Total							750

Dissertation

The student should submit dissertation one month before the final examination. Those students who have not submitted the dissertation shall not be allowed to appear for the final examination. The dissertation shall be assessed at the time of orals by all the examiners.

The dissertation shall be written under the following headings:

Introduction; Aims or objectives of study; Review of literature; Materials and methods Results; Discussion; Conclusion; Summary; References; Tables; Annexure

The written text of dissertation shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should not be done. A declaration by the candidate that the work was done by him/her

shall be included. The guide and head of the department shall certify the bonafide of the dissertation.

Three copies of dissertation shall be submitted to the university through proper channel along with a soft copy (CD), one month before the final examinations.

10. Internal assessment (IA):

a) A student must secure at least 35% marks of the maximum marks fixed for internal assessment in a particular subject to be eligible to appear for the university examination of that subject.
b) There shall be three internal assessment tests and the average of these tests shall be considered for awarding final marks.
c) If the candidate is absent for any of the exams, the marks in that exam shall be taken as zero.
d) The computed internal assessment marks as per the regulation 10 a) & b) shall be sent to the controller of exams 15 days before the commencement of the University exam.
e) The internal assessment marks should be signed by the concerned teaching faculty or HOD and counter signed by the HOD before being forwarded to the Controller of Examinations.
f) For those who failed in internal assessment test/s, have to reappear as per the regulation 9 a) & b) before he/she appears for the university examination.
g) For those who want to improve their marks in internal assessment tests, they can appear again as per the regulation 9 a) & b). For such students, the internal assessment marks of the student at the time of first appearance will be compared with the marks obtained at the present appearance and the higher of the two will be taken as his/her internal assessment marks.

11.Minimum for a pass

a) 35% in internal assessment of each theory paper and practicals/viva voce
b) 40% in each theory paper of university examination.
c) 50% on the total marks of theory university examination and internal assessment clubbed together, applicable to each paper.
d) Where, viva voce involved which is part of theory examination, 50% on the total marks of theory university examination, internal assessment and viva voce clubbed together, applicable to each paper.
e) Where there is no internal assessment marks, 50% on the total theory marks, 50% in practicals/viva voce applicable to each subject.

Note: For 2 year PG course, where any paper contains both theory and practicals/viva voce, the student has to pass both theory and practicals/viva voce, if any student pass in theory examination and fail in practicals/viva voce examination or vice versa, the student concerned has to appear again for both theory and practicals/viva voce examination.

12. Classification of successful candidates

Percentage of Marks for declaring Class:

Distinction	- 75% and above of the total marks.
First Class	- 65 - 74% of the total marks.
Second Class	- 50- 64% 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 attendance shortage, it will be taken into consideration as not completed within the duration of the course and the final results will be declared as “Pass”.

13. Reappearance

The student has to pass both theory and practicals/via voce, if any student pass in theory examination and fail in practicals/viva voce examination or vice versa, the concerned student has to appear again for both theory and practicals/viva voce examination.

14. Carry-over Provision

The students are permitted to complete the course period irrespective of their success in the preliminary part. However, the final results will be kept under “withheld” until he/she passes all the previous papers”.

15. Maximum duration for completion of course

A candidate shall complete the course within four years from date of admission.

Failing which, the candidate will be discharged.

16. Eligibility for award of degree

A candidate shall have passed in all the subjects of first and second year to be eligible for award of degree.

M.Sc. ECHOCARDIOGRAPHY

FIRST YEAR

Course content (Syllabus) Theory

Paper I: Embryology and ultrasound Physics **Total hours: 47Hrs**

Unit No	Unit title	Unit objectives	Content	Hours	Method of evaluation
	Orientation and introduction to the course			1	-
1	Early development of embryo		mitosis, -meosis -Oogenesis -spermatogenesis -fertilization-formation of germ layers-formation of embryonic disc-placental formation	8	Sessional examination
2	Early blood vessel formation		Intra embryonic blood vessel - extra embryonic blood vessel	2	Sessional examination
3	Development of the heart		Heart tube formation -cardiac loop formation -interatrial septum formation, -interventricular septum formation -atrial formation -ventricular formation -formation of the cardiac valves -formation of the great systemic veins-aortic arch formation	10	
4	Basics of ultrasound	Ultrasound physics and instrumentation	Physical principles, -The transducer, Imaging by ultrasound –Image optimization & equipments -Signal processing -Tissue harmonic imaging-Artifacts	3	Sessional examination
5	Doppler Echocardiography		Principles of Doppler ultrasound -Doppler formats -CF imaging -Doppler artifacts-Tissue Doppler imaging-Doppler	10	Sessional examination

			application -Speckle tracking -Tissue characterization -The digital echo Lab –Storage & retrieval of echo Images, Post study processing and approaches to AFI,-Biological Effects of US		
6	Specialized Echocardiographic Techniques and methods		Hemodynamics, Use of echo to assess cardiac hemodynamics and guide therapy -Evaluation of 3D Echo, Transducer technology,	6	Sessional examination
6A	Basics of 3D US		Beam forming and rendering 3d quantification, 3d examination protocol and approach		
6B	TEE		Instrumentation and Examination-TEE views-complication and safety consideration		
7	Echocardiographic examinations	Cardiac chambers	LV systolic Function, LV diastolic Function, LA, RA RV Function, Echo in ICU, operative, pre-operative application	7	Sessional examination
		Stress Echocardiography	Methodology -Pharmacological stress echo-Interpretation -Stress echocardiography in valvular heart Disease		

Paper II: Clinical cardiology

Total hours: 47

Unit No	Unit Title	Unit Contents	Hours	Method of Evaluation
1	Introduction and basics	-	1	Sessional examination
2	Basic anatomy and physiology of the heart	Anatomy of the heart -Lymphatic system ,Arterial and venous supply of the heart -Conduction system and basic electrophysiology	3	Sessional examination
3	History and symptoms	Importance of history taking. -Causes of cardinal symptoms(Cardiovascular and non cardiovascular)- Assessment:-NYHA functional Classification -CCS functional classification -Specific activity scale -Chest Pain, Dyspnea, Shortness of breath, Palpitation, Fatigue, Syncope, Other symptoms: Hemoptysis, Hoarseness, Cyanosis, Fever	10	Sessional examination
4	General Examination	Facial appearance -Gesture and signs - Oral cavity-Skin, Extremities-Peripheral edema	4	Sessional examination
5	Arterial pulse	Definition –Genesis -Wave pattern-Examination of arterial pulse-Characteristic features of pulse in common clinical conditions	3	Sessional examination
6	Measurement of Blood pressure	Definition -Components and determinants of arterial blood pressure -Hypertension –Cause, mechanism and complications	2	Sessional Examination
7	Jugular venous pressure	Examination -Analysis-Abnormalities	2	Sessional Examination
8	Cardiovascular system examination	Inspection and palpation of the Precordium, Percussion	2	Sessional examination
9 Cardiac auscultation		Principle and Techniques First Heart sound Second heart sound Diastolic and systolic sounds Prosthetic valve sounds Extra cardiac sounds	4	Sessional examination
9A	Heart sounds			
9B	Heart Murmurs	Definition -Mechanism Characteristics -Systolic murmur		

		Diastolic murmur -Continuous murmur		
10 10A 10B	Basic investigation Chest X-ray Evaluating chest X-ray in heart disease:	 Normal chest X-ray Lung and Pulmonary vasculature Cardiac size Abnormal Densities and lucency Cardiac malposition Lungs and pulmonary vasculature Cardiac chambers Great vessels Pleura and pericardium Implantable devices and other post surgical findings	3	Sessional Examination
11	Clinical Electrocardiogram	Advanced ECG- ECG findings in Various cardiac Diseases -Clinical issues in ECG interpretation	4	Sessional examination
12	Cardiovascular pharmacology	Mechanism of action-Indications, Dosage -Precautions of cardiovascular Drugs, Atropine- Lidocaine - Procainamide- Verapamil and diltizem-Adenosine-Magnesium-Sodium Bicarbonate, Morphine-Calcium chloride -Dopamine- Dobutamine-Isoproterenol - Amrinone Sodium Nitroprusside -B- blockers: propranolol, Metoprolol, Atenolol-Diuretics -Thrombolytic agents: Streptokinase,Urokinase	10	Sessional examination

Paper III: Echocardiography for Ischemic and valvular heart disease

Total hours: 57hrs

Unit No	Unit title	Unit objectives	Content	Hours	Method of evaluation
1	Orientation and introduction to the course			1	Sessional examination
2	Ischemic Heart Disease	Echo cardiography and Coronary artery disease	Understanding Coronary circulation, -Pathophysiology of coronary artery syndrome -wall motion scoring,-Detection and quantification of RWMA -Global ventricular function,-myocardial infarction	3	Sessional examination
2A	Echo assessment Coronary arteries		Morphology and coronary flow reserve by TTE and TEE -Visualization of coronary arteries-Distal coronary Flow and coronary flow reserve	3	Sessional examination
2B	Congenital abnormalities		Anomalies and echo detection -Kawasaki Disease.	2	Sessional examination
2C	Echo in IHD		Detection of Ischemia -Role in acute coronary syndrome -Role in ischemic cardiomyopathy	3	Sessional examination
2D	Chronic coronary artery disease		LV aneurysm -Pseudo aneurysm, Chronic remodeling, Mural thrombus -MR –Ischemic cardiomyopathy	2	
2E	Echo in CCU		Management of acute MI – Pathophysiology and Echocardiographic correlation-Detecting and assessing MI,-correlation with coronary anatomy,-Prognostication following MI,-Complications of MI	3	Sessional examination
2F	Stress echocardiography		Fundamentals, Types of Stress Echo-Interpretation of stress Echo-Technical aspects of non exercise test -Protocol, reversible ischemia detection, inducible ischemia/-viability and sensitivity and specificity -Assessment of disease significance and prognostic evaluation	3	Sessional examination
2G	Echocardiography		Approach and clinical	2	Sessional

	evaluation of coronary blood flow		applications-Doppler evaluation of coronary flow -Technical aspects and detection-assessment and clinical application		examination
2H	Newer techniques and their application for IHD		TDI, Strain, Strain rate, vector imaging, -Myocardial contrast Echo	2	Sessional examination
2 I	Surgical aspects of IHD		Role of Echo cardiographer- pre and post operative evaluation for CABG, Ischemic MR-repair vs replacement -Coronary anomalies echo aspects Dorr's procedure	2	Sessional examination
3	Valvular Heart Disease	Valve anatomy	Mitral valve anatomy, -Mitral valve anatomy in surgeons view-Scallops of mitral valve in different echo views -Aortic valve anatomy -Tricuspid valve anatomy -Pulmonary valve anatomy	5	Sessional examination
3A	Echo in RF		Acute vs chronic RF and valvular involvement	2	Sessional examination
3B	Mitral valve disease		MVP, -Mitral regurgitation-etiology Mechanism, Severity assessment -Sequential Evaluation. Chronic asymptomatic MR-Indication and Timing of Intervention for chronic valvular regurgitation-Assessment of Mitral stenosis -Etiology,-Severity assessment, Indication and valve assessment for Mitral Intervention	6	Sessional examination
3C	Aortic valve		Aortic regurgitation -Etiology-Quantification of AR –severity - Timing of surgery -Aortic stenosis -Etiology, Valvular, subvalvular and supra valvular stenosis. -Severity assessment, Use of stress Echo and strain in evaluation of AS , Low gradient severe AS with depressed and preserved EF, Myocardial response to chronic AS.	4	Sessional examination
3D	Tricuspid valve		TR-etiology, Severity assessment, TS –etiology and severity assessment	2	
3E	Pulmonary valve		Pulmonary stenosis- valvular, supravalvular, Infundibular, Peripheral stenosis	4	

			Pulmonary regurgitation - Etiology and severity assessment, Ross procedure		
3F	Pulmonary hypertension		Etiology, PA pressure assessment by various methods	2	
3G	Infective Endocarditic		Dukes criteria Organisms, culture, Involvement of Valves, Indication for Echo, Prognostic stratification	3	
3H	Prosthetic valves		Types of prosthetic valves, Echo assessment in various valves, Prosthetic valve dysfunction, Prosthetic valve IE, Pannus formation and dehiscence, Fluid dynamics of PV, Recognition and quantification of PV Dysfunction , 3DE and TEE evaluation		

Paper IV: Epidemiology &Biostatistics

Total hours: 60

Sl. No.	Topics	60 Hours
1	**Introduction** Introduction to Biostatistics & Research Methodology, types of variables & scales of measurements, measures of central tendency and dispersion, Skewness and Kurtosis Rate, Ratio, proportion, incidence, prevalence and their meaning.	4
2	**Sampling** Random & non random sampling, various methods of sampling-simple random, stratified, systematic, cluster and multistage. Sampling and non sampling errors.	4
3	**Basic probability distribution and sampling distributions** Concept of probability distribution, normal, Poison and Binomial distributions, parameters and applications. Concept of sampling distributions. Standard error and confidence intervals.	6
4	**Tests of Significance** Basics of testing of hypothesis – Null and alternate, hypothesis, type I and type II errors, level of significance and power of the test, p value. Tests of significance (parametric) T – test (paired & unpaired), Chi square test and test of proportion, one way analysis of variance. Repeated measures analysis of variance. Tests of	10

	significance (nonparametric) – Mann Whitney U Test, Wilcoxon Test, Kruskal – Wallis analysis of variance Friedmann's analysis of variance.	
5	**Correlation and Regression** Simple correlation – Pearson's and Separman's methods ; testing the significance of correlation co-efficient simple and multiple linear regression.	4
6	**Sample size determination** General concept Sample size for estimating means and proportion, testing of difference in means, proportions of two groups and more than two groups.	4
7	**Study Designs** Descriptive epidemiological methods – case series analysis and prevalence studies. Analytical epidemiological methods – case control and cohort studies, Clinical trials / intervention studies, odds ratio and relative risk, stratified analysis.	10
8	**Multivariate analysis** Concept of multivariate analysis, introduction to logistic regression and survival analysis	6
9	**Reliability and validity evaluation of Diagnostic Tests** Cronbach's alpha and Test- retest methods	4
10	**Format of Scientific documents** Structure of Research protocol, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta analysis.	8

Suggested Reading

1. Surendar a Rao PSS and J Richard. Introduction Biostatics an Research Methods, Prentice Hall of India (2006).
2. Abhaya Indrayan and Rajeev Kumar Malhotra, Medical Biostatics, 4th Editiin, CRC Press (2017)
3. Indrayan and Satyanarayana, Biostatics for Medical, Nursing and pharmacy students, prentice Hall of India (2006)
4. Sarma K.V.S, Statistics made simple – do it yourself on PC, 2nd edition, Prentice Hall (2010)

Subsidiary Subject

Ethics in Echocardiography: 10 HRS

(Should be taught to the 1st year students of M.Sc. Echocardiography)

Introduction: With the advances in science and technology and the increasing needs of the patient, their families and community, there is a concern for the health of the community as a whole. There is a shift to greater accountability to the society. It is therefore absolutely necessary for each and every one involved in the health care delivery to prepare them to deal with these problems. Other professionals are confronted with many ethical problems.

Standards of professional conduct are necessary in the public interest to ensure an efficient laboratory service. Every sinologists or sonographer should not only be willingly to play his part in giving such a service, but should also avoid any act or omission which would prejudice the giving of the services or impair confidence, in respect, for sinologists or sonographer as a body.

To accomplish this and develop human values, it is desired that all the students undergo ethical sensitization by lectures or discussion on ethical issues.

Introduction to ethics-
What is ethics?
General introduction to Code of Laboratory Ethics
How to form a value system in one's personal and professional life?
International code of ethics

Professional Ethics-
Code of conduct
Confidentiality
Fair trade practice
Handling of prescription
Mal practice and Negligence
Professional vigilance

Research Ethics-
Animal and experimental research/ humanness Human experimentation
Human volunteer research - informed consent Clinical trials
Gathering all scientific factors
Gathering all value factors
Identifying areas of value – conflict, setting priorities
Working out criteria towards decision
ICMR/ CPCSEA/ INSA Guidelines for human / animal experimentation

Recommended reading

Francis C.M., Medical Ethics, I Edition, 1993, Jay pee Brothers, New Delhi p189.

Good Clinical Practices: GOI Guidelines for clinical trials on Pharmaceutical Products in India (www.cdsco.nic.in)

INSA Guidelines for care and use of Animals in Research – 2000.

CPCSEA Guidelines 2001(www.cpcsea.org).

Ethical Guidelines for Biomedical Research on Human Subjects, 2000, ICMR, New Delhi.

ICMR Guidelines on animal use 2001, ICMR, New Delhi.

PRACTICALS

Paper –I: Embryology and ultrasound physics - 120 Hours

1. **Echocardiographic demonstration: 5Hours**

Candidate will be allocated equipment for demonstration of procedure of maintenance,

Will be required to accompany service engineers and biomedical engineers during service visits and prepare at least six analyses of error and corrective actions taken

Candidate will be required to perform rapid studies during OP peak hours under supervision and will participate in subsequent debriefing

Will assist consultant in quality control exercise on a weekly basis.

2. Basic Echocardiographic principles: 5 Hours

Transducer selection

Reduction of artifacts

Obtaining optimal gray scale images

Gain and depth controls

Use of M-mode for temporal analysis of cardiac events and obtaining measurements

Use of modalities to optimize colour flow such as colour maps, gain and scale

Adjustments related to Doppler such as scale, PRF, sweep, angle correction

Use of specialized techniques such as Tissue Doppler

3. Echocardiographic examination (10 Hours)

Will be required to perform calculations such as left ventricular mass and cardiac output, Calculation of cardiac mass,

Doppler equations, stroke distance, converting velocity to flow, flow to volumes, cardiac output, shunt ratios, modified Bernoulli equation and intra-vascular pressures, assessment of left ventricular, left atrial, right ventricular, right atrial pressures

Candidate would be required to store and retrieve studies of diagnostic quality-clinician satisfaction will be taken as a yardstick for performance

Applications of principles to obtaining, storing and retrieving optimal images.

Clinical lab posting: 75 hours

Students will be posted in the echocardiographic laboratory for the observation and to develop practice in the routine cardiac investigation by echocardiography.

Hands on practical work: 25hours

Students will be allowed to perform echocardiographic test independently under the supervision of the faculty to develop the skill and experience.

Paper-II : Clinical cardiology 120 hours

Clinical scenario given to the candidate for diagnosis and treatment of following disorders:

150 Hr

a. Unstable angina
b. Myocardial infarction
c. Left ventricular aneurysm
d. Congestive heart failure
e. Cardiac arrhythmia
f. Atrial septal defect
g. Ventricular septal defect
h. Tetralogy of Fallot
i. Hypertension

Cardiac Surgery

5 Hours

Brief description of surgical steps involved in:

a. Coronary artery bypass grafting (on pump CABG)
b. Mitral valve replacement
c. Aortic valve replacement
d. ASD closure
e. VSD closure
f. Off-pump CABG

Clinical lab posting: 75 hours

Students will be posted in the echocardiographic lab, for the observation and to identify the correlation of clinical diagnosis with the echo findings with the help of clinical features, blood investigations, ECG, X-RAY etc.

Students will be recruited to the operation theater for the observation of the cardiac surgeries and to understand various technics.

Students will be allowed to attend ward rounds with the cardiologists.

Students will be demonstrated for ACLS and BLS, and posted clinically in ICCU for the observation and experience.

Hands on practical work: 25hours

Students will be allowed to read ECG and report X-RAY, perform echocardiographic test independently under the supervision of the faculty.

Paper –III : Echocardiography for Ischemic valvular heart disease - 140 Hrs

Ischemic and valvular heart disease, Echocardiography for ischemic heart disease

20 Hours

1. **Understanding coronary circulation:** Coronary anatomy and physiology, pathogenesis of atherosclerotic plaques, abnormalities of coronary perfusion, wall thickening
2. **Wall motion scoring:** Regional left ventricular function, relationship to vascular supply, use of tissue Doppler where indicated, Segmental analysis for wall motion defects, coronary artery territories, detection and quantitation of Ischaemic muscle-wall motion scoring,
3. **Global ventricular function:** Linear measurements: indirect M-Mode markers of left ventricular function; Assessing global LV function; Evaluation of diastolic function: Methods for evaluating diastolic function, Doppler evaluation of diastolic function, Evaluation of mitral inflow, determination of isovolumic relaxation time, Evaluation of pulmonary vein flow, Doppler tissue imaging, Assessment of overall performance of the Ischemic left ventricle-systolic and diastolic function, estimating volumes rule of disks.
4. **Myocardial infarction:** Detecting and assessing MI, co-relation with coronary anatomy, prognostication following MI.
5. **Complications of MI**: Aneurysm, pseudo aneurysm, Ventricular Septal Defect, thrombi-embolic potential, right ventricular involvement.
6. **Stress echocardiography:** Protocols for stress echocardiography, detection of reversible Ischemic, detecting inducible ischemia/viability, specificity and sensitivity
7. **Newer techniques and their applications for IHD:** Tissue Doppler, strain, strain rate and velocity vector imaging, studying myocardial perfusion using contrast echocardiography.
8. **Surgical aspects of IHD-role of echo cardiographer:** Pre and postoperative evaluation for Coronary Artery Bypass Grafting (CABG), Linear endo-ventricular patchplasty (Dorr's procedure), Mitral regurgitation- morbid anatomy repair versus replacement decision/post-operative, coronary anomalies-echocardiographic aspects.
9. **Recent developments in echocardiography for ischemic heart disease Textbooks and Reference Books:**
    1. Echocardiography by Feigenbaum (Latest Edition)
    2. Echo manuals by Mayo Clinic Lecture notes.
    3. Journal articles
    4. Cardiology by Braunwald and Hurst (Latest edition)

Echocardiography for valvular heart disease **20 Hrs.**

1. **Hemodynamic information derived from echocardiography:** Aortic flow, pulmonary flow, mitral flow, left atrial flow, tricuspid valve flow, cardiac output, regurgitant fraction shunt ratios, echocardiographic detection of stagnant blood flow, modified Bernoulli equation and intravascular pressures, echocardiographic findings with elevated left ventricular diastolic pressure, elevated left atrial pressures, pulmonary hypertension, right ventricular pressure, right atrial pressure.

2. **Mitral stenosis:** Etiopathogeneisis, pathophysiology and hemodynamics, two-dimensional echocardiography in rheumatic mitral stenosis, congenital mitral stenosis, M-model echocardiographic appearance, transoesophageal echocardiography, three dimensional echo assessment for severity, anatomic determination of severity, exercise gradients, secondary features of mitral stenosis, Atrial fibrillation, secondary pulmonary hypertension, decision making regarding intervention; assessment for balloon mitral valvotomy-transesophageal echocardiography and its uses, post-procedural assessment,open mitral valvotomy versus mitral valve replacement- pre and post-operative assessment.

3. **Mitral regurgitation:** Doppler evaluation of mitral regurgitation, determination of mitral regurgitation, severity, Mitral valve prolapse and analysis of segments, Haemodynamics of MR, diagnosis of MR, assessing severity and secondary effects, pre-op, intra-op and post-operative, assessment for mitral valve repair, use of three dimensional echocardiography for mitral valve surgery, flail mitral valve, papillary muscle dysfunction. mitral annular calcium
4. **Tricuspid valve disease:** Anatomy and physiology of the healthy valve structural and functional changes in various disease states organic and functional involvement, tricuspid stenosis, tricuspid regurgitation and assessment of severity, approach to pulmonary artery hypertension.
5. **Aortic stenosis:** Etiopathogenesis and haemodynamics, sub-valvular, valvular and supravalvar lesions, cuspal morphology, diagnosis and assessment of secondary effects, time course and prognostication, pre-operative and post-operative assessment; Diagnosis, assessing mechanism and severity, assessing site, possible etiology, secondary effects such as LV function, impact on associated lesions and therapeutic approach
6. **Aortic regurgitation**: Etiopathogenesis and haemodynamics, secondary effects, establishing a diagnosis, evaluating the severity of aortic regurgitation, acute versus chronic aortic regurgitation, relevant aspects of left ventricular function, timing of surgery, pre-operative and post-operative assessment.
7. **Pulmonary valve disease:** Embryology, morphology, infundibular, valvular, supra valvular and peripheral pulmonic stenosis, evaluation of the right ventricular outflow tract, miscellaneous abnormalities of the pulmonary valve assessing severity of pulmonic stenosis, pre and post procedural assessment for pulmonary valvuloplasty, pulmonary regurgitation.
8. **Prosthetic valves:** Types and normal function of mechanical valves, stenosis regurgitation, use of tranesophageal echo for prosthetic valves, endocarditis: and its sequelae in native and prosthetic heart valves.

9. **Recent developments in echocardiography for valvular heart disease** Candidate would be allocated one or two patients/cases who are diagnosed with above (ischemic or valvular lesions) conditions, once in a week. They will be allowed to formulate the diagnostic question independently. The candidate will be analyzed by the faculty for the performance on the basis of diagnostic skill with the interpretation of the disease and looked for the knowledge on treatment modality. This will be followed by the brief discussion.

Textbooks and Reference Books:

1. Echocardiography by Feigenbaum (Latest Edition)
2. Echo manuals by Mayo Clinic Lecture notes.
3. Journal articles Cardiology by Braunwald and Hurst (Latest edition)

Clinical lab posting: 75 hours

Students will be posted in the echocardiographic laboratory for the observation and to develop practice in the cardiac investigation in ischemic and valvular heart disease by echocardiography.

Hands on practical work: 25hours

Students will be allowed to perform echocardiographic test independently under the supervision of the faculty to develop the skill and experience.

Second Year – Theory

Paper V: Paediatric Echocardiography

Total hours: 46Hrs

Unit No	Unit title	Unit objectives	Content	Hours	Method of evaluation
1	Orientation and introduction to the course			1	Sessional examination
2	Fetal cardiac Imaging		Indications for fetal cardiac evaluation Fetal physiology-Indications for fetal echocardiography	2	Sessional examination
3	Echo examination		A segmental approach to anatomy-Cardiac situs - Ventricular morphology -Great arterial connections	2	Sessional examination
4	Abnormalities of RV inflow			1	Sessional examination
5	Abnormalities of LV inflow		-Pulmonary veins - Left atrium-Mitral valve	2	Sessional examination
6	Abnormalities of RV outflow		- Right ventricle-Pulmonary Valve-Pulmonary artery	2	
7	Abnormalities of LV outflow		-Subvalvular Obstruction - Valvular aortic stenosis -Supravalvular aortic stenosis	2	Sessional examination
8	Coarctation of aorta			2	Sessional examination

9	Abnormalities of cardiac septation		Atrial septal defect- -Ventricular septal defect-Endocardial cushion defect	3	Sessional examination
10	Abnormal vascular connections and structures		Patent ductus arteriosus- Abnormal systemic venous connection Abnormalpulmonary venous connection-Abnormalities of the coronary circulation	2	Sessional examination
11	Cono truncal abnormalities		-Tetralogy of Fallot -Trans position of the great arteries,- Double outlet Right ventricle- Persistent truncus arteriosus- Aorto pulmonary window	3	Sessional examination
12	Abnormalities of ventricular development		Hypoplastic left heart syndrome -single ventricle- Tricuspid atresia	3	Sessional examination
13	M-mode and 2D in CHD		Basics of imaging and sequential segmental analysis - Left to right shunts -Atrio ventricular septal defect Congenital left ventricular and right vedntricular inflow anomalies -Left ventricular outflow tract obstruction. Echocardiographic anatomy of TOF with PS-Complete transposition of great arteries- AV/VA discordance- Pulmonary veins-Imaging of coronary anomalies and pulmonary arteries- Echocardiographic evaluation of aortic arch and its anomalies-Univentricular heart and heterotaxy syndrome.	10	Sessional examination
14	3D echo in CHD For quantification of ventricular volumes, Mass and function with CHD		LV volume, EF and Mass-RV volume, EF and Mass -Single ventricular volumes, EF and mass -3D analysis of regional wall motion, Synchrony and strain	3	Sessional examination
15	Echo in the evaluation of adults with CHD		Simple congenital heart defects in adults Valvular heart disease Complex congenital heart	2	

			defects		
16	Echo evaluation during and after surgery		Systemic artery to pulmonary artery shunts Pulmonary artery bands Fontan procedure -Right ventricle to pulmonary artery conduits	3	Sessional examination
17	Echo evaluation of acquired heart disease in childhood		IE-Modified DukeCriteria for the diagnosis of IE Echo findings in Complications of IE . RHD-Johns criteria. Kawasaki disease - Coronary ectasia and aneurysms	3	Sessional examination

Paper VI: Echocardiography in Myocardial, Pericardial, Aortic and Systemic Disorders & Non-Cardiac Diagnosis

Total hours: 47

Unit No	Unit title	Unit objectives	Content	Hours	Method of evaluation
1	Orientation and introduction to the course			1	Sessional examination
2 2A	Echo in cardiomyopathies Hypertrophic cardiomyopathy		Definition and types of hypertrophy -Mid LV hypertrophic cardiomyopathy -Differential Diagnosis Treatment strategies	12	Sessional examination
2B	Dilated cardiomyopathy		Secondary findings in DCM -Etiology of DCM-Doppler evaluation of systolic and diastolic function -Therapeutic decision		
2C	Infiltrative and Restrictive cardiomyopathy		Echo evaluation of RCM -Constrictive versus restrictive heart disease		
2D	Peripartum cardiomyopathy				
2E	Non-compaction LV/RV cardiomyopathy				
2F	Endocardial fibro				

	elastosis and hyper eosinophilic syndrome				
3	Echocardiographic Differentiation of ischemic and non ischemic cardiomyopathy		Echocardiographic assessment of ischemic and non ischemic cardiomyopathy -M-mode echocardiography -2D/3D /Doppler echocardiography - Distinction between ischemic and non ischemic dilated cardiomyopathy-Other non invasive imaging modalities	10	Sessional Examination
4	Pericardial disease		Acute pericarditis - Pericardial effusion , M-Mode and 2D echocardiography-Cardiac tamponade -Constrictive Pericarditis –Congenital anomalies-3D echo assessment in pericardial disease -2D versus 3D echocardiography	5	Sessional examination
5	Diseases of the Aorta		Echocardiographic Evaluation -Aortic dilatation and Aneurysm - Marfan' syndrome - Sinus of valsalva aneurysm - Aortic dissection -Aortic pseudo aneurysm, Aortic Trauma-Infections of the aorta- Aortic prosthesis thrombus -Takayasu arteritis	5	Sessional examination
6	Echo in systemic disease		Hypertension -DM-Connective tissue /auto immune disease-Chronic liver disease-COPD -Pulmonary hypertension	5	Sessional examination
7	Echocardiography in the Elderly		Aortic atherosclerosis and penetrating aortic Ulcer - Aortic valve Sclerosis - Aortic stenosis -Aortic	5	Sessional examination

			aneurysm- Aortic Dissection -LV Masses, Dimensions and function- Echocardiography in stroke patients -Mitral annular calcification- Prosthetic valves		
8	Echocardiographic assessment of Cardiac Tumors and Masses		Echocardiographic assessment of cardiac tumors and masses- Primary Benign cardiac tumors -Malignant primary cardiac tumors	4	Sessional examination

Paper VII: Recent advances

Total hours: 47

Unit No	Unit title	Unit objectives	Content	Hours	Method of evaluation
1	Orientation and introduction to the course			1	Sessional examination
2	Monitoring ventricular function in the operating room		LV filling -Global systolic Function, Regional wall motion abnormality-Use of TEE in operating room to monitor cardiac function in specific cardiac enteties	2	Sessional examination
3	Contrast ultrasound imaging, Method, Analysis and Application		Characteristics of microbubbles Ultrasonographic contrast agent, Ultrasonographic imaging technique-Method of analysis-Clinical applications of ultrasonographic contrast- Myocardial contrast echocardiography, Indications for use of ultrasound contrast- Safety of ultrasound contrast	3	Sessional examination
4	Myocardial perfusion echocardiography		Acute coronary syndromes Assessment of myocardial viability Chronic coronary artery disease	2	Sessional examination
5	Endothelial Dysfunction		Endothelial function and Dysfunction -Role of Acetylcholine -Shear stress and	3	Sessional examination

			flow mediated Dilatation-NO Release-Methodology for Assessing endothelial function-Analysis of shear stress and flow mediated dilatation response-Factors affecting the flow mediated dilatation-Limitations -Other non invasive methods to assess endothelial function		
6	3D- Transthorasic and TEE echo examination and performing		3D TEE Technology -Performing 3D TEE -Evaluation -Specific uses of 3D TEE	2	Sessional examination
6A	3D TEE to evaluate valvular heart disease.		3D echo image optimization-3D echo of the mitral valve -3D echo of the aortic valve-3D echo of the pulmonic valve -3D echo of the Tricuspid valve	2	
6B	3D TEE in operating room		Mitral Valve disease-Aortic valve disease-Tricuspid valve disease-Native valve endocarditis-Prosthetic valve dysfunction-Cardiac masses	2	
6C	3D guidance of Percutaneous procedures		Fluoroscopy versus echocardiography in guiding percutaneous interventions-Transseptal puncture, Device closure of cardiac shunts-Occlusion of the LA appendage- Guidance for electrophysiology procedures, Miscellaneous procedures	4	
7	Speckle tracking echocardiography; clinical usefulness		Cardiac muscular anatomy-what is strain-2D speckle tracking echocardiography -Image acquisition and processing - Clinical application of 2D STE-3D speckle tracking echocardiography - Clinical applications of 3D STE-Limitation	3	Sessional examination
8	Intra cardiac echocardiography		Equipment and the Catheters-Imaging specification-clinical	2	Sessional examination

			applications-intra cardiac echocardiography during EP intervention -During structural intervention		
9	Intravascular ultrasound imaging		Principles of Ultrasound - Technology-Image acquisition- Intravascular ultrasound examination Image interpretation -Utility of intravascular ultrasound in clinical practice	3	Sessional examination
10	Peripheral vascular ultrasound		Ultrasound diagnosis of carotid artery diseases Ultrasound diagnosis of Femoral access complications	2	Sessional examination
11	Advanced Non invasive Quantification Techniques in echocardiography		Clinical applications of advanced 3D echo quantification tools -RV quantification -Mitral valve assessment -Aortic valve assessment -Conclusion	3	Sessional examination
12	Echocardiography in Women		Structural heart disease:-MVP, Mitral stenosis, Mitral annular calcification -Ischemic heart disease -Stress echocardiography -Polycystic ovarian Syndrome -Takotsubo cardiomyopathy-CHD -Echocardiography in pregnancy-Peripartum cardiomyopathy-Fetal echocardiography	2	Sessional examination
13	Echo for the Electrophysiologist		Echocardiography in SVT-Left atrium Atrial septum-Pulmonary veins-Inferior venacava-Echocardiography in VT-Echocardiography in cardiac Implantable electronic devices	3	Sessional examination

14	Echo in life threatening conditions		Chest trauma-Penetrating chest trauma- Acute Mitral regurgitation Acute severe AR -Aortic dissection –Debakey classification -The Stanford classification Pulmonary thromboembolic Disease -Air embolism Hypovolemia -Large intracardiac thrombus	4	
15	A Primer on cardiac MRI for the Echo cardiographer		Quantitative left and right ventricular assessment -Strain assessment LV structure -Myocarditis and Sarcoidosis-cardiac hypertrophy,Cardiomyopathies -Velocity Mapping, Flow and shunt Assessment -Valvular heart disease and prosthetic valves	3	Sessional examination
16	Fetal echocardiography		Echocardiography in diagnosis of heart disease in pregnancy-Indication-Extra cardiac reasons and associations for fetal heart disease - Fundamentals of fetal cardiac imaging	2	Sessional examination

PRACTICALS

Paper - V: Paediatric Echocardiography 140 HRS

40 Hours

1. Paediatric echocardiography: Segmental approach, Assessing visceral and cardiac situs, veno-atrial connection, atrio-ventricular and ventriculo-great artery relation, Ventricular loop, Great artery position, Aortic arch visualization.
2. Abnormalities of right ventricular inflow
3. Abnormalities of left ventricular inflow: Pulmonary veins, left atrium, and mitral valve.
4. Abnormalities of right ventricular outflow: Right ventricle, pulmonary valve, pulmonary artery
5. Abnormalities of left ventricular inflow: sub-valvular obstruction, Valvular aortic stenosis, supravalvular aortic stenosis.

6. Coarctation of the aorta
7. Abnormalities of cardiac septation: Atrial septal defect, ventricular septal defect, endocardial cushion defect.
8. Abnormalities vascular connection and structures: patent ductus arteriosus, abnormal systemic venous connections, abnormal pulmonary venous connections, abnormalities of the coronary circulation.
9. Cono-truncal abnormalities: Tetralogy of Fallot, transposition of the great arteries, double outlet right ventricle, persistent truncus arteriosus and aortopulmonary window.

Candidate would be allocated one or two patients/cases who are diagnosed with above conditions, once in a week. They will be allowed to formulate the diagnostic questions independently. The candidate will be analyzed by the faculty for the performance on the basis of diagnostic skill with the interpretation of the disease and looked for the knowledge on treatment modality. This will be followed by the brief discussion.

Clinical lab posting: 75 hours

Students will be posted in the echocardiographic laboratory for the observation and to develop practice in the cardiac investigation of congenital heart disease by echocardiography.

Hands on practical work: 25hours

Students will be allowed to perform echocardiographic test independently under the supervision of the faculty to develop the skill and experience.

Paper - VI: Echocardiography in Myocardial, Pericardial, Aortic and Systemic Disorders & Non-Cardiac Diagnosis -125Hrs

25 Hours

1. **Hypertrophic Cardiomyopathy**: Morphological variants, diagnosis, haemodynamics, echocardiography evaluation of hypertrophic cardiomyopathy, assessing intracavitary and outflow tract gradients in obstructive cardiomyopathy, Mitral regurgitation in hypertrophic cardiomyopathy, other variants of hypertrophic cardiomyopathy, mid-cavity obstruction, conditions mimicking hypertrophic cardiomyopathy, therapeutic decision making and monitoring in hypertrophic cardiomyopathy, evaluation of therapy, pre and post-procedural evaluation.

2. **Idiopathic dilated cardiomyopathy:** Diagnosis and differentiation from other disorders such as IHD, Doppler evaluation of systolic and diastolic function, secondary findings in dilated cardiomyopathy, etiology of dilated cardiomyopathy, determination of prognosis in dilated cardiomyopathy, pre and post-procedural evaluation for cardiac re-synchronization therapy. Overview of cardiac transplantation.
3. **Restrictive Cardiomyopathy:** Diagnosis and haemodynamics, infiltrative cardiomyopathies, miscellaneous- myocardial diseases in neuromuscular disorders, infectious agents and toxins.

4. **Diseases of the pericardium:** Pericardial effusion: Detection of fluid, diagnosis-pleural versus pericardial fluid, quantitation, loculated effusions, cardiac tamponade-diagnosis, haemodynamics etiology, pericardiocentesis, Constrictive pericarditits: Diagnosis and haemodynamics. Differentiation from restrictive Cardiomyopathy, pre and post-surgical evaluation. Miscellaneous: acute pericarditis, pericardial thickening, pericardial cysts, absent pericardium.
5. **Diseases of the aorta:** Aortic dilatation and aneurysms, Aortic dissection-diagnosis and classification, false aneurysms, aneurysms of the aortic sinuses-rupture,haemodynamics, pre-and postsurgical evaluation.Miscellaneous-rauma, infections, aorta-left-ventricular tunnel, atherosclerosis, echocardiographic evaluation, aortic dilation and aneurysm, marfan syndrome, Sinus of valsalva aneurysm, aortic atheroma. Role of trans-esophageal echocardiography.
6. **Echocardiography in systemic disorders:** Diabetes hypertension, renal failure, neurological conditions, collagen vascular diseases and so on.
7. **Cardiac masses:** Tumors and source of embolus: Normal variants and artifacts, cardiac tumors; primary tumors, metastatic tumors of the heart, secondary effects, Masses, extra cardiac masses, intra cardiac thrombi, ultrasonic typing, man-made objects in the heart; Intra-cardiac thrombi: left ventricular thrombi, left atrial thrombi, right atrial thrombi, spontaneous echo contrast.
8. **Echo findings with altered electrical activation**: Normal and abnormal depolarization and conduction of the cardiac impulse, bundle branch blocks and Wolf-Parkinson-White syndrome, ectopic rhythm-ventricular and supra-ventricular, pacemakers.
9. **Recent developments in echocardiography in myocardial, pericardial, aortic and systemic disorders**
10. **Infective endocarditis.**

Candidate would be allocated one or two patients/cases who are diagnosed with above conditions, once in a two week. They will be allowed to formulate the diagnostic question independently. The candidate will be analyzed by the faculty for the performance on the basis of diagnostic skill with the interpretation of the disease and looked for the knowledge on treatment modality. This will be followed by the brief discussion.

Textbooks and Reference Books:

1. Echocardiography by Feigenbaum (Latest Edition)
2. Echo manuals by Mayo Clinic Lecture notes.
3. Journal articles Cardiology by Braunwald and Hurst (Latest edition)

Clinical lab posting: 75 hours

Students will be posted in the echocardiographic laboratory for the observation and to develop practice in the echocardiographic examination in myocardial, pericardial, aortic and systemic disorders.

Hands on practical work: 25hours

Students will be allowed to perform echocardiographic test independently under the supervision of the faculty to develop the skill and experience.

Paper- VII- Recent advances 125Hrs

25 Hours

1. **Tissue Doppler(TDI) and Deformation Imaging**
   Technical Principles of Tissue velocity, strain and strain rate imaging Introduction
   Tissue velocity imaging
   Pulsed wave tissue velocity imaging
   Color tissue velocity imaging Curved anatomical M-mode Concepts of strain and strain rate Definition of strain and Strain rate
   Estimation of strain and strain rate from ultrasound data
   Artifacts and methods to improve signal quality
2. **Principles and different technique for speckle tracking**
   Introduction
   Principles of speckle tracking Strain and strain rate assessment Torsion and twist
3. **Application of echocardiography in hemodynamic evaluation**
   Assessment of filling pressure at rest
   Heart failure and LV filling pressure
   Role of standard Echocardiography in Assessment of LV filling pressure Mitral inflow, Pulmonary venous flow
   Colour M-mode flow propagation velocity
   Role of TDI in Assessment of LV filling pressure
   Doppler estimation of LV filling pressure in AF
4. **Assessment of LV filling pressure with strain**
5. **Assessment of Systolic Heart failure**
   Introduction
   Regional systolic and long axis function
   Assessment of LV filling pressure
   Tissue Doppler imaging in heart failure with MR
   Tricuspid annular Velocities and RV function
6. **Assessment of Diastolic Heart failure**
   Introduction
   Differential diagnosis in a patient with Heart failure and Ejection fraction
   Echocardiography as a tool for Assessment of heart failure
7. **Assessment of cardiac dyssynchrony and its application**
   Introduction
   Methods of Assessment of cardiac dyssynchrony by myocardial imaging RV pacing -induced systolic dyssynchrony
   Role of cardiac dyssynchrony, Assessment in cardiac resynchronization therapy: Tissue Doppler imaging

8. **Ischemic heart disease**

   Experimental study on myocardial ischemia and viability using tissue Doppler and deformation

9. **Use of tissue velocity imaging during stress echocardiography**
10. **Tissue Doppler echocardiography in the assessment of Hypertensive heart disease**
11. **Constrictive Pericarditis versus Restrictive cardiomyopathy**
12. **Use of Myocardial imaging to identify and manage sub clinical heart disease in thyroid and other endocrine heart disease**
13. **Myocardial imaging in valvular heart disease** Myocardial imaging in mitral valve disease Myocardial imaging in Aortic valve disease
14. **Tissue Doppler Imaging and strain rate imaging to evaluate RV function.**
15. **3 D Echocardiography** Principles & Clinical Application
16. **Automated Functional Imaging**
17. **3D TEE**

    Clinical Applications & Instrumentation
18. **Cardiac resynchronization therapy**
19. **Contrast Echocardiography**
20. **Fetal Echocardiography.**

Candidates will be trained by the faculty in the echocardiographic lab to obtain technical skill on recent indices of Tissue Doppler imaging including strain and strain rate measurement. Periodically one or two hours per month, candidates will be subjected to random cases for which, the assessment will be carried out by applying all the Deformation techniques under the supervision of the faculty and then the appropriate discussion is recruited to reduce the means of error in the analysis.

Clinical lab posting: 75 hours

Students will be posted in the echocardiographic laboratory for the observation and to develop practice in the echocardiographic examination for diagnosing subtle changes in the myocardium in systemic, valvular, congenital heart diseases. Observing the echo guided CRT analysis to understand the prognostication and to identify the responders.

Hands on practical work: 25hours

Students will be allowed to perform echocardiographic test independently under the supervision of the faculty to develop the skill and experience

Section-III

Minimum requirement of infrastructure, laboratory facilities and staff:

(i) Basic Infrastructure:

Institute should have its own hospital with full-fledged cardiology unit with the following facilities:

- 25 bedded cardiology / cardiac surgery services
- Echocardiography laboratory with 4 echocardiography machines
- Class room with capacity for 30 students, measuring 500 sq.ft
- One departmental Seminar room measuring 250sq.ft for each branch with A.V aids – OHP, Slide projector and computer with accessories are compulsory. LCD Projector (optional) other infrastructure criteria- Principals room, students common room, staff room, Library, office room, Store room, preparation room etc will be as per minimum criteria. Norms of B.Sc-Cardio vascular/Cardiac Care Technology course.

(ii). Infrastructure subject wise

- Anatomy laboratory
- Physiology laboratory
- Echocardiography equipments
  i. Echocardiography machines – 4
  ii. Transoesophageal echocardiography probes –01
  iii. OPD case load for echocardiography – 50 / day
  iv. Cardiology OPD attendance – 100 / day
  v. Cardiology inpatient service minimum – 25 beds
  vi. Cardiac surgical case load – 01operations / day

Suggested Readings:

1. Feigenbaum Present / Latest edition
2. 'Otto' Text book of Echo 6th edition
3. Echo manual – Joe
4. Indian Text book of Echocardiograpy: Amuthan . V
5. Jaypee publishers : Text book of Echo : Navin C Nanda
6. 3D Echo : Dr Amuthan . V
7. Valvular Heart Disease : Dalen & Alpert
8. 'Otto' : 3 D TEE Primer
9. Echocardiography review Guide "Otto"
10. Atlas of 3 D Echo: Edward A. Gill
11. 3 D Echo: Takakhiro Shiota

SECTION- IV
MONITORING LEARNING PROGRESS

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment be done using checklists that assess various aspects. Model Checklists are given in this Chapter, which may be copied and used.

The learning out comes to be assessed should include:

i) ***Acquisition of Knowledge***: The methods used comprise of `Log Book' which records participation in various teaching / learning activities by the students. The number of activities attended and the number in which presentations are made are to be recorded. The logbook should periodically be validated by the supervisors. Some of the activities are listed. The list is not complete. Institutions may include additional activities, if so, desired.

Journal Review Meeting (Journal Club): The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting using a checklist (see Model Checklist – I, Section IV)

Seminars / Symposia: The topics should be assigned to the student well in advance to facilitate in depth study. The ability to do literature search, in depth study, presentation skills and use of audio- visual aids are to be assessed using a checklist (see Model Checklist-II, Section IV)

ii) Teaching skills: Candidates should be encouraged to teach undergraduate medical students and paramedical students, if any. This performance should be based on assessment by the faculty members of the department and from feedback from the undergraduate students (See Model checklist III, Section IV)

iii) Dissertation: Please see checklist IV and V in Section IV.

iv) Work diary / Log Book- Every candidate shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal,
reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of experiments or laboratory procedures, if any conducted by the candidate.

v) *Records:* Records, log books and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University.

<u>Log book:</u>

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

Format for the logbook for the different activities is given in Tables 1 and 2 of Section IV.
Copies may be made and used by the institutions.

Procedure for defaulters: Every department should have a committee to review such situations. The defaulting candidate is counseled by the guide and head of the department. In extreme cases of default the departmental committee may recommend that defaulting candidate be withheld from appearing the examination, if she/he fails to fulfill the requirements in spite of being given adequate chances to set himself or herself right. **Format of Model Checklists**

Checklist - I

Model Checklist for Evaluation of Journal Review Presentations

Name of the student:_____ Date:_____

Name of the faculty/ Observer:_____

Sl No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist - II

Model Check List for the Evaluation of the Seminar Presentations

Name of the student:_____Date:_____

Name of the faculty/ Observer:_____

Sl No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist – III

Model Check list for Evaluation of Teaching Skill

Name of the student:_____Date:_____

Name of the faculty/ Observer:_____

SL. No.		Strong Point	Weak point
1	Communication of the purpose of the talk		
2	Evokes audience interest in the subject		
3	The introduction		
4	The sequence of ideas		
5	The use of practical examples and /or illustrations		
6	Speaking style (enjoyable, monotonous, etc., specify)		
7	Summary of the main points at the end		
8	Ask questions		
9	Answer questions asked by the audience		
10	Rapport of speaker with his audience		
11	Effectiveness of the talk		
12	Uses of AV aids appropriately		

Checklist - IV

Model Check list for Dissertation / Project Work Presentations

Name of the student:_____ Date:_____

Name of the faculty/ Observer:_____

Sl No.	Points to be considered	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Checklist – V

Continuous Evaluation of dissertation / project work By
Guide/ Co-Guide
Name of the student: _____Date:_____
Name of the faculty/ Observer:_____

Sl No.	Items for observation during presentation	Poor	Below average	Average	Good	Very Good
		0	1	2	3	4
1	Periodic consultation with guide/ co-guide					
2	Depth of Analysis/ Discussion					
3	Department presentation of findings					
4	Quality of final output					
5	Others					

	Total score					

Overall Assessment Sheet

Date:

Check list No.	**Name of the students**			
	A	**B**	**C**	**D**
1				
2				
3				

Course i/c **Signature of the HOD** **Signature of the Prof. i/c AHS**

The above overall assessment sheet used along with logbook should form the basis for certifying satisfactory completion of course of study, in addition to the attendance requirement.
KEY

Mean score: Is the sum all the scores of checklists 1 to 5

A, B, C: Name of the students

LOG BOOK

Table 1: Academic activities attended

Name:

Admission Year:

Date	**Type of activity, Specific Seminar, Journal club, presentation, UG teaching**	**Particulars**

LOG BOOK

Table-2: Academic presentations made by the student

Name:

Admission Year:

Date	**Topic**	**Type of activity, Specific Seminar, Journal club, presentation and UG teaching**

Management Information System Report

1. Name of the college imparting Echocardiography
2. Details of M.Sc.

Sl. No	**Name of the Branch & Teaching faculty**	**Sanctioned Strength**	**Admitted**	**Name of the subjects to be studied at 1st Year M.Sc.**	
1					
2					

3. No. of experiments/assignments conducted for 1st year M.Sc. Echocardiography students

Sl.No	**Branch**	**Subject**		**Assigned by SVIMS University**	**Conducted**	**%**	**Remarks**
1.		**No**	**Name**				
2							

4. No. of theory classes conducted for 1st year M.Sc. Echocardiography students

Sl.No	Branch	Subject		SVIMS University Norms(25)	Conducted	%	Remarks
1.		**No**	**Name**				
2.							
3.							

5. Number of theory and practical classes taken by 2nd year M.Sc. Echocardiography students for under graduate program (Optional).
6. No. of Journal clubs department wise for 1st year and 2nd year M.Sc. Echocardiography Students

Total No. of students Dept. Wise	Norms for half yearly Report	Achieved Number	% Achievement	Remarks
1st year M.Sc. Echocardiography No.=	2 per candidate per year			
2nd year M.Sc. Echocardiography No.=	2 per candidate per year			

7. Number of seminars for 1st year and 2nd year M.Sc. Echocardiography students

Total No. of students : 10	Norms for half yearly Report	Achieved Number	% Achievement	Remarks
1st year M.Sc. Echocardiography No.=10	2 per candidate			
2nd year M.Sc. Echocardiography No.= 08	2 per candidate			

8. Number of interdepartmental meetings

Norms for half yearly Report	Achieved Number	% Achievement	Remarks
	2	200%	Interactive and productive

9. Number of visits to pharmaceutical industry/research center/hospital for 1st year & 2nd year M.Sc. Echocardiography students.

Norms for half yearly Report	Achieved Number	% Achievement	Remarks
1	02	200	Educative & informative

10 Number of guest lectures for postgraduate Program

Norms for half yearly Report	Achieved Number	% Achievement	Remarks
2	03	150	Need focused and educative

11. Number of research papers published in the year in the college –

12. Any other additional information such as consultancy/collaboration/conducting Seminars & workshop or attending seminar & workshops or conference

Sl. No.	Subject	No. of Contact Hours	Code	Grade	Remarks
1.	Cardiac Embryology	20	C,L	P	
2.	Fetal and neonatal circulation	2	C,L	P	
3.	Ultrasound physics and instrumentation	146	C,L,P,PL	P	
4.	Clinical Cardiology	133	C,L,PL	P	
5.	Cardiovascular Pharmacology	10	C,L	P	
6.	Electrophysiology	4	C,L	P	
7.	Acute coronary syndrome	8	C,L	P	
8.	BLS/ACLS	10	C,L,P	P	
9.	Ischemic Heart Disease	17	L	P	
10.	Valvular Heart disease	32	L	P	
11.	Congenital Heart Disease	44	L	P	
12.	Cardiac surgery	10	L,C, PL	P	
13.	Echocardiography for lschemic Heart disease	70	C,P,PL	P	

14.	Echocardiography for Valvular heart disease	70	C,PL,P	P	
15.	Echocardiography for Congenital Heart disease	140	C,PL,P	P	
16.	Epedemiology and Biostastics	60	L	P	
18.	Ehocardiography of other heart diseases	25	PL, C,L,P	P	
19.	Myopericardial, Aortic, Systemic disorder & non cardiac diagnosis	137	C,L,P,PL	P	
20.	Recent Advances	168	C,L,PL,P	P	
21	Medical ethics	10	L	P	
22	Fetal Echocardiography	2	L,P	P	
23	Peripheral Ultrasound	2	L,P	P	
24	Seminar presentation	SS, I(G)	Classes for UG's		
25	Attending rounds with Cardiologists	10	C	P	

DESCRIPTION OF CODES

C : Clinical Teaching

D : Demonstration of Faculty

I : Independent Work by Student

I (G) : Independent Work by Student Guided by Faculty

L : Classroom Lectures by Faculty

P : Hands on Practical Work by Students

SD : Self Directed Study by Student

SD (E) : Self Directed Study by Student with Faculty Evaluation

SS : Student Conducted Seminars with Faculty Moderation and Evaluation by Peers and Faculty

PL : Practical / Clinical Lab Posting

Prof. & Course Incharge **Prof.& HOD** **Prof. i/c AHS**

CHECKLIST - I

Model Check List for Evaluation of Teaching Skill

SL. No.		Poor 0	Below average 1	Average 2	Good 3	Very good 4
1	Communication of the purpose of the talk					
2	Evokes audience interest in the subject					
3	The introduction					
4	The sequence of ideas					
5	The use of practical examples and /or illustrations					
6	Speaking style (enjoyable, monotonous, etc., specify)					
7	Summary of the main points at the end					
8	Ask questions					
9	Answer questions asked by the audience					
10	Rapport of speaker with his audience					
11	Effectiveness of the talk					
12	Uses of AV aids appropriately					

CHECKLIST - II

Model check list for Dissertation / Project Work Presentations

S. No.	Points to be considered	Poor 0	Below average 1	Average 2	Good 3	Very Good 4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Overall Assessment of the student by the clinical/Lab work:

Sl. No	Points to be considered	Poor 0	Below Average 1	Average 2	Good 3	Very Good 4	Excel lent 5
1	Attendance						
2	Punctuality						
3	Interaction with colleagues and support staff						
4	Maintenance of case records						
5	Topic Presentation						
7	Time sense						
8	Knowledge						
9	Rapport with patient.						
10	Overall quality of work						
	Total Score	- -	- -	- -			

MODEL QUESTION PAPER

THEORY

Each theory paper will have

1) Essay questions – 03 nos. carrying 10 marks each - 03 x 10 = 30
2) Short answer questions – 10 nos. carrying 05 marks each - 10 x 05 = 50

Total = 80

Internal assessment = 20

PRACTICAL

(a) Preliminary:

Internal assessment : 15

University examination : 60

Total = 75

(b) Viva = 25