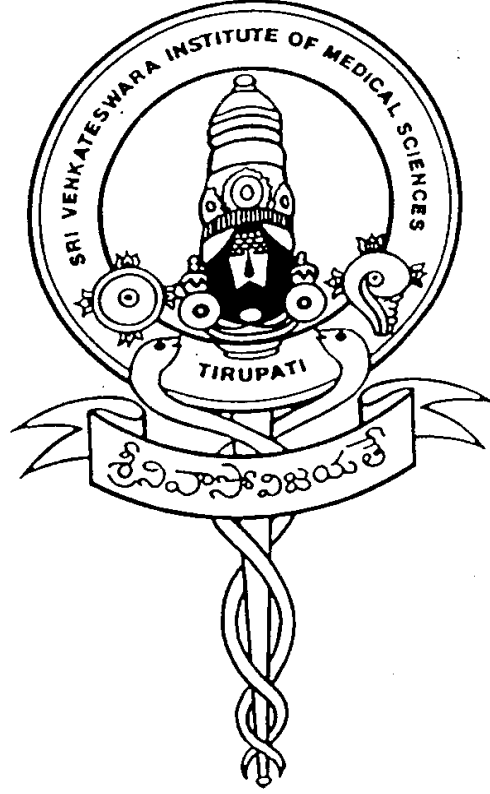


SRI VENKATESWARA INSTITUTE OF MEDICAL SCIENCES
TIRUPATI – 517 507
(A University established by an act of Andhra Pradesh State Legislature)



REGULATIONS & SYLLABUS
2016-17

B. Sc Allied Health Sciences
(All Specialties)

TIRUMALA TIRUPATI DEVASTHANAMS

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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".

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 Technology (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 speciality 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 Sankranti 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, 1stcarpo-metacarpal joint, Hip Joint, Knee Joint, Ankle Joint

Practicals : Illustrations- major bones, important muscles, joints **8 hrs**

Unit III - Nervous System

Learning objectives: **12 hrs**

Describe the

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

Practicals : Illustrations– Brain, spinal cord and their sections **6 hrs**

Unit IV - Circulatory System

Learning objectives: **10 hrs**

Describe the

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

Practicals: Illustrations -thoracic cavity, mediastinum, heart, major vessels, lymphoid organs **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
1 st 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)
		Theor y	Min. pass	Int. Assmt. (IA)	Min. pass	Aggregate		
1	Anatomy	80	40%	20	40%	50%	50	50%

a. Theory: Question paper pattern

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

b. Practical examination:

Proposed pattern			
Region	No of slides/ no of spotters	Marks allotted	Total marks
Histology	04	02	08
Abdomen, Thorax and Pelvis	08	02	16
Head and neck	01	02	02
Brain	01	02	02
Upper limb bones	02	02	04
Lower limb bones	02	02	04
Head, neck and Thorax bones	02	02	04
Record + IA Practical			10
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, gigantism, acromegaly
Thyroid hormones, biosynthesis and functions
Cretinism, Myxoedema, Goiter and Grave's disease
Parathyroid hormones, functions, tetany
Insulin, glucagons, actions and diabetes mellitus
Adrenal medullary hormones and their actions
Adrenal cortex hormones and their functions

8. Reproductive System

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

9. Respiratory System

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

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

Nervous and chemical regulation of respiration

Hypoxia, cyanosis and artificial respiration.

10. Cardiovascular System

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

Cardiac cycle

ECG, heart sounds

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

Regulation of B.P.

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

Effect of exercise on CVS & respiration

11. Nervous System

Structure of neurons

Properties of neurons (excitation and conduction)

Synapses and synaptic transmission, reflexes and properties of reflexes

Sensory endings and sensory mechanisms

Spinal cord-pathways in the spinal cord

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

Cerebrospinal fluid

Control of posture and control of voluntary motor activity

Autonomic nervous system

12 Special Senses

1. Vision

2. Audition, olfaction, gustation and vestibular apparatus

Practicals / Demonstration :

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

MODEL PAPER – I

Time: 3 hours

Max. Marks: 80

- Two essays out of four - 2x10 = 20
- Six short notes out of six - 6x5 = 30
- 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-Hasselbach equation, buffers, pH measurement, physiological buffers.

2. Membrane and Cell:

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

3. Chemistry of Carbohydrates:

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

4. Chemistry of lipids:

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

5. **Chemistry of amino acids, peptides, proteins:**
Structure of 20 amino acids, grouping isomerism, charge properties, ninhydrin reaction, peptide bond, examples of peptides, Proteins –classification, Structure-primary, secondary, tertiary and quaternary forms, denaturation.
6. **Chemistry of Nucleic Acids including protein synthesis :**
History, bases, nucleosides, nucleotides. DNA and gene. Types of RNAs, Nucleotides coenzymes.
7. **Haemoglobin :**
Structure and functions of haemoglobin, Hb derivatives, degradation of Hb, Jaundice, Haemoglobinopathies
8. **Enzymes:**
History, catalyst, classification, efficiency, specificity, basic account of mechanism of action. Factors affecting enzyme activity. Units of measurement, Inhibitors – competitive, non-competitive, examples. Coenzymes, proenzymes, isoenzymes, Clinical enzymology, normal values.
9. **Vitamins:**
History, Vitamins A, D, E and K. B-complex vitamins – thiamine, riboflavin, niacin, pyridoxine, folic acid, pantothenic acid, biotin, B-12, Vitamin C. Brief account of chemistry, source, requirements, deficiency diseases, biochemical functions, Hypervitaminosis.
10. **Mineral metabolism:**
Bulk and trace elements. Sodium, potassium, Calcium, Phosphorous, Iron. Brief account of iodine, magnesium, copper, zinc, fluoride, manganese, selenium and molybdenum.
11. **Energy Metabolism:**
Calorimetry, basal metabolism, specific dynamic action, energy requirements under different conditions. Hormonal influence.
12. **Nutrition:**
Distribution of energy in dietary factors, Nitrogen balance, Protein quality, Kwashiorkar and Marasmus. Protein supplementation, Recommended dietary allowance and diet planning.
13. **Immunology :**
BASICS : Innate & acquired immunity, humoral & cell mediated immunity, antigen & antibodies

Practicals:

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

No. of teaching hours :

1 st semester	-	Theory 80	Practicals 40
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Suggested Books :

- Biochemistry by U. Sathyanarayana
- Text book of Biochemistry for Medical students by D.M.Vasudevan
- 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)
		Theor y	Min. pass	Int. Assmt. (IA)	Min. pass	Aggrega te		
1	Biochemistry	80	40%	20	40%	50%	50	50%

Practicals:

- Qualitative Experiment - Identification of unknown carbohydrate solution - 15 M
- Qualitative Experiment - Identification of unknown Protein solution - 15 M
- Spotters - 5 M
- Viva - 10 M
- 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
2 nd 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

- i. One essay out of two
- ii. Three short notes out of three
- iii. Five questions – very brief answers out of five

Max. Marks: 40

- 1x10 = 10
- 3x5 = 15
- 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
1 st 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
2 nd 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 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
2 nd semester -	80	40

Suggested Books :

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

Examination pattern – University Exam (At the end of 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
1 st semester -	80	40

Suggested Books :

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

III. Basics of computer networks :

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

IV. MS Office 2010

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

Practicals :

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

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

III. Microsoft PowerPoint 2010

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

IV. Microsoft PowerPoint 2010

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

No. of teaching hours :

	Theory	Practicals
1st semester	30	40

Suggested Books :

1. Foundation of computer science by Ashok Arora ,Lakshmi Publications
2. PC Hardware by 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, poliomylitis.
 - c. Disease control programmes : Tuberculosis, Malaria, Filaria, S.T.D, Goitre, Cholera and other diarrhoeal diseases and National Programme for prevention of blindness including trachoma, vector bone disease.

11. Demography & Population control

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

12. Environmental sanitation

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

Teaching Learning Activities :

The course content in Community Medicine will be covered by:

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

No. of teaching hours :

	Theory	Practicals
1 st 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-dominant role in all aspects of 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
1 st semester -	50
2 nd 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 anaesthesia)	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.
- Osmolality.
- 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, Glycopyrrolate.
3. Sedatives / Anxiolytics
4. Diazepam, Phenergan, Lorazepam, Chlorpromazine, Droperidol.
5. Narcotics
6. Morphine, Pethidine, Antiemetics, Methoclopramide, Ondansetron.
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: O₂, N₂O, Air
14. Agents - Ether, Halothane, Isofluranes.
15. Reversal Agents : Physostigmine, Neostigmine, Atropine, Glycopyrrolate, 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, penicillins, 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. Endocrine, 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
	-	O ₂ , N ₂ O, 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 : Tetralogy 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 Biliary Tract
Liver Functions.
Liver Function Tests, Hepatitis
Jaundice, Types; Cirrhosis; Hepatorenal Syndrome
11. Diseases of Git
Peptic Ulcer : Gi Bleeding
Oesophageal Varices
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 Insipidus.
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. Dyspnoea
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. Lap-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 technology & 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 technology. 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 O20 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 (fascicular 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.
 - Pharmacomechanical 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 filtration , reabsorption and secretions
 - 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.
 - splenic and renal circulation
 - 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, Dobutamine, 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, Tetralogy Of Fallot, Transposition Of Great Arteries, Tricuspid Atresia, Total Anamoulous 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 stenosis and mixed valvular 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 – valve).
 - 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.
 - Dysrhythmia 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 & throttling.
 - 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

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+I A)	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 biopsy

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. Cyclophosphamide
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 Cyclophosphamide
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. Hereditary 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+I A)	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+I A)	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, Dobutamine, 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. Prasugrel, 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 displays
 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 causes, 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 anomalous 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 – valve).
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. Dysarrhythmia 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, strangling & throttling.
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+I A)	Practical *	Min. for pass (Theory+ Practical)
15	Environmental Injuries & Endocrine Emergencies	80	120	UE	80	40%	20	40%	50%	50	50%
16	Paediatrics & Obstetrics and Gynecological 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 TECHNOLOGY

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 Appendicitis
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 Salicylates
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 Gynecological 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. Organophosphorous compounds
2. Antidote
3. Oximes
4. Narcotic Abuse
5. Narcotics
6. Atropine
7. Medazolam
8. Thiopentone
9. Muscle relaxants
10. Dopamine
11. Dobutamine
12. Nor _ adrenaline
13. Adrenaline
14. Isoprenaline
15. Anti emetics
16. Phenytoin
17. Naloxone

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

PAPER – 20

Basic & Advanced Life support management :

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

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

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.

**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+I A)	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+I A)	Practical *	Min. for pass (Theory+Practical)
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, decarboxylation and transamination. 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:

Potentiometry, voltammetry, amperometry, coulometry, conductometry, biosensors.

4. Photometry:

Spectrophotometry, flame photometry, atomic absorption spectrophotometry

5. Electrophoresis:

Definition, Principle, Basics, method, types, clinical applications including serum 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 : Corynebacterium, Nocardia, Actinomyces, Bacillus, Listeria.
4. Gram Negative Bacilli : Enterobacteriaceae : E.coli, klebsiella, enterobacter, proteus, pseudomonas, vibrios, camphylobacter, brucella, haemophilus, bordetella, pasterella, francisella.
5. Anaerobic Bacteria : Clostridium, Gram negative bacilli.
6. Mycobacterium.
7. Spirochetes : Treponema, Borrelia, Leptospira.
8. Chlamydia, 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. Biostatistics:

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

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 of Viral 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

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

PAPER – 21

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

PAPER - 22

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, Trichomonas, B.Coli, Trypanosomes, Leishmania, Plasmodium, Toxoplasma, Isospora, Cryptosporidium, Microsporidium.
 - b. Helminths : Ascaris, Hookworms, strongyloides, Trichinella, Enterobius, Trichurias, Filarial worms, Guinea worm, Taenia, Echinococcus, Hymenolepis, schistosoma, Diphyllbothrium, paragonimus.
5. Roles of Arthropods in disease transmission.
6. Mosquito Borne Diseases, morphology of anopheles, culex, aedes mosquitoes.

PAPER – 23

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, Gleys 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 & LEWIS
- 3) Haematology practice by Dr. Tejendra Singh
- 4) Histopathology Techniques by Bancraft
- 5) Clinical Diagnosis and laboratory methods by Todd & Sanford

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 Radiopharmacy 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. Hepatobiliary 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. ^{99m}Tc 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 particles 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.

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 ^{99m}Tc -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. ^{99m}Tc 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, Poisson, 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 Tortoise,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 - dyskinesia 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 ^{51}Cr , $^{99\text{m}}\text{Tc}$ - Red cell survival study.
- 4. Special procedures:** Dacryoscintigraphy, 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)

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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 Tortoise, 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 I131 - 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+I A)	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 complement and 2's complement.

- a) **Gates** : Universal gates OR. AND. Not. EXOR. EXNOR. Truth table and boolean 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.

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 limb.
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+ I A)	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+I A)	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, mastoids 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, retrograde pyelogram, MCU, AUG, Opposing Urethrogram, Dacrygraphy, 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, Practical 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. Kremkau, 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	Anesthesia	10	-	IE	50	50%
	b) Trauma life support	Emergency Medicine	10				
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 :

- 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.
- 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.

