

**REGULATIONS AND CURRICULUM
M.Sc – Medical Courses**

2016



JSS UNIVERSITY

(Established under section 3 of UGC Act, 1956)

**JSS Medical Institutions Campus,
Sri Shivarathreeshwara Nagara,
Mysore - 570 015, Karnataka, India**

**GOALS AND GENERAL OBJECTIVES OF POSTGRADUATE
MSc IN MEDICAL SCIENCE**

GOAL

The goal of postgraduate M.Sc in medical sciences is to produce well trained produce

1. Competent medical and paramedical teachers.
2. Individuals with research attitude
3. Skilled laboratory experts
4. Industry ready technical experts

GENERAL OBJECTIVES

At the end of the postgraduate training in the discipline concerned the student shall be able to;

- i. Demonstrate competence in basic concepts of research methodology and be able to critically analyze relevant published research literature.
- ii. Develop skills in using educational methods and techniques as applicable to the teaching of medical/nursing students and paramedical health workers.
- iii. Demonstrate competence in developing developing diagnostic and analysis tools

COMPONENTS OF THE COURSE CURRICULUM :

The major components of the Postgraduate curriculum shall be:

- Theoretical knowledge
- Practical skills
- Thesis skills.
- Attitudes including communication skills.
- Training in research methodology.

Regulations

1. Courses offered in M.Sc medical sciences:

- a) M.Sc in Anatomy
- b) M.Sc in Biochemistry,
- c) M.Sc in Microbiology
- d) M.Sc in Pharmacology
- e) M.Sc in Physiology

2. Eligibility for Admission

A candidate seeking admission to M.Sc medical science course should have a bachelor degree under recognized university.

3. Qualifications

The candidate must have passed B.Sc with at least one subject of biological Sciences or BAMS or MBBS or BHMS or BPT or B.Pharm or any other professional graduates from a recognized University.

4. Duration of the course:

Duration shall be for a period of 3 years.

5. Attendance

Candidates should have attended at least 80% of the total number of classes conducted in an academic year, from the date of commencement of the term to the last working day, as notified by the University, in each of the subjects prescribed for that year, separately in theory and practical, to be eligible to appear for the university examinations.

6. Monitoring Progress of Studies:

Periodic tests: The concerned departments conduct exams, from first year to third year. The tests may include written papers, practicals and viva voce. Records and marks obtained in such tests will be maintained by the Head of the Department and sent to the University, when called for.

Records: Records and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University.

7. Dissertation

Every candidate pursuing M.Sc degree course is required to carry out work on a selected research project under the guidance of a recognized post graduate teacher in their respective subjects in second and final year. The results of such a work shall be submitted in the form of a dissertation.

8. Schedule of Examination

The university examination for M.Sc courses shall be held at the end of first (Anatomy, Physiology and Biochemistry). At the end of third academic year individual papers for each courses will be held separately.

9. Scheme of Examination

1 year M.Sc (preliminary) exam:

INTERNAL ASSESSMENT: (50 marks in each subject)

Three tests, 1st IA at the end of 3rd month, 2nd internal at the end of 6 month, 3rd internal exam at the end of completing 1 year course. Average of best two is taken for internal assessment. A candidate should get minimum 35% IA marks to take the university exam.

UNIVERSITY EXAMINATION:

Theory – 3 hours paper, 100 marks each in Anatomy, Physiology and Biochemistry.

Pattern of theory question paper

	Theory		
Type of Questions	Number of Questions	Marks for each question	Total
Long Essay	2	10	20
Short Essay	10	5	50
Short Answer	10	3	30
Total Marks			100

NO PRACTICAL EXAMINATION FOR I YEAR M.Sc (medical) STUDENTS.

Criteria for declaring as pass in University Examination for 1st year: A candidate should get 50% marks in each subject (Theory including IA marks).

A candidate securing less than 50% of marks as described above shall be declared to have failed in the examination. Failed candidate may appear in subsequent examination upon payment of examination fee to the University.

A successful candidate is awarded pass class irrespective of percentage, as these marks will be considered while awarding the class at the end of final year.

Carry over system: A candidate who has failed in one or more subject in the **I year university examination** can be permitted to enter II year, **the candidate should clear all the I year subjects 6 months before taking the final year university exams.**

For the declaration of the class at the end of final year candidate must have passed all the subjects in first attempt. Otherwise the result will be declared as pass class.

Syllabus

Anatomy – 1st Year

Objectives:

1. Acquire in depth knowledge of structure of human body from the gross to the microscopic anatomy level, and correlate it with the functions.
2. Comprehend the principles underlying the structural organization of body and provide anatomical explanations for altered functions.
3. Acquire knowledge of basic principles of normal growth and differentiation. Understand the process of human growth and development of all the organ systems of body. Analyze the congenital malformations and etiological factors including genetic mechanisms involved in abnormal development.
4. Identify, locate and demonstrate surface marking of clinically important structures in the cadaver and correlate it with living anatomy
5. Competently Procure, Embalm and Preserve the human cadavers
6. Acquire mastery in tissue preparation, staining and museum specimens preparation
7. Develop an attitude of scientific enquiry and learn prevailing research methodologies.
8. Conduct research in bio-medical sciences

Course Outcomes:

After completing the course the postgraduate should:

1. Have acquired the competencies pertaining to the subject of Anatomy.
2. Competently carryout the Body Donation Program, Prepare histology slides and maintain the museum
3. Be oriented to the principles of research methodology
4. Have acquired skills in educating medical and paramedical professionals.
5. Have acquired skills in effectively communicating with the students and colleagues from various medical and paramedical fields.
6. Have acquired qualities of a good teacher capable of innovations in teaching & learning methodology

Syllabus

Distribution of theory and practical hours:

- 4 hours of theory/week.
- 2 hours of dissection/week for gross anatomy.
- 2 hours of practical's/ week for histology.

General Anatomy:

General anatomy includes introduction to anatomy, Skeleton system with classification, types of bone, features of long bone, ossification, blood supply, Joints – classification with examples, structure of typical synovial joints, Myology – classification with examples, types of skeletal muscles, tendon, aponeurosis, Nervous system – subdivisions, types of cells in CNS, neuron - structure, types, ganglia and plexuses.

Gross Anatomy:

Head and Neck: Scalp, Muscles of Facial expression, Anterior Triangle of the Neck, Posterior Triangle of the Neck, Parotid Gland, Dural venous sinuses and Pituitary gland, Thyroid and parathyroid gland, Orbit and extra ocular muscles, Oral Cavity and Tongue, Nose and nasal cavity, Paranasal air sinuses, Pharynx, Larynx and Osteology of skull bone

Thorax:

Thoracic Wall, Mediastinum, Pleura, Lungs and bronchopulmonary segments, Pericardium, Heart, Blood and Nerve supply of Heart, Diaphragm, Oesophagus and Thoracic duct and Osteology of ribs, Sternum and thoracic vertebrae

Abdomen and pelvis:

Anterior abdominal wall, Posterior Abdominal Wall, Peritoneal cavity and Peritoneum, Inguinal Region, Stomach, Duodenum, Jejunum and Ileum, Cecum and Appendix, Rectum and Anal canal

Spleen, Kidney, Pancreas, Liver, Extra hepatic biliary apparatus, Portal venous system, Kidney

Supra renal gland, Urinary bladder, Pelvic diaphragm and Urogenital diaphragm, Perineum, Male and female reproductive system and Osteology of pelvis and lumbar vertebrae

Histology:

Microscopy, basic tissues, blood vessels, lymphoid tissue, salivary glands, tongue, oesophagus, stomach, small intestine, large intestine, pancreas, liver, gall bladder, trachea, lung, kidney, ureter, urinary bladder, testis, epididymis, vas deferens, prostate, ovary, uterus, fallopian tube, placenta, pituitary gland, thyroid and parathyroid glands, suprarenal gland, and skin.

Genetics:

Introduction, Chromosomes, Inheritance, Karyotyping & Chromosomal abnormalities.

Embryology:

General embryology includes Introduction, gametogenesis, structure of sperm, growth of ovarian follicles, uterine cycle, fertilization, implantation, bilaminar germ disc,

notochord formation, trilaminar germ disc, embryonic folds, fetal membranes, placenta, umbilical cord, amniotic cavity .

Systemic embryology includes CVS, digestive system, urogenital system, pharyngeal arches and pouches, development of face and palate, respiratory system along with congenital anomalies

Practical Syllabus:

Gross Anatomy: Demonstration of dissected specimens region wise - Thorax, Abdomen and pelvis, Head and Neck and Brain including osteolog.

Histology: Demonstration of general and systemic histology slides. A practical record of work done in histology has to be maintained by the candidate and duly scrutinized by the faculty incharge and certified by head of the department.

Assessment

Internal Assessment:

Theory: 50 marks & No practical examination

University examination:

Theory: 100 marks & No practical examination

Weight age of marks for theory paper:

Theory Paper	
Topics	Marks
Head & Neck	20
Brain, Spinal cord	10
Thorax including diaphragm	15
General Anatomy	05
Embryology	10
Histology	10
Abdomen	10
Pelvis	10
Perineum	05
Genetics	05
Total	100

RECOMMENDED TEXT BOOKS

Gross Anatomy:

1. Dutta A.K. Human Anatomy vol. I-III (V edition, VI edition IX Edition) Current publisher.
2. Dutta A.K. Principle of General Anatomy. Current Publisher.
3. Keith and Moore Clinical Oriented Anatomy. VII edition Lippincot Williams and Willkins.
4. Vishram Singh. Clinical and Surgical Anatomy. Elsevier. Vol I-III, II edition
5. Vishram Singh. Textbook of general anatomy. Elsevier.
6. Frank H. Netter. Atlas of Human Anatomy. Vth edition Saunders Elsevier.

Histology:

1. Difiore's. Atlas of histology with functional co-relation. 11th edition
2. Text book of histology Inderbir Singh VI edition

Genetics:

1. Medical genetics by SD GANGANE III edition

Embryology:

1. Human Embryology by INDERBIR SINGH 10th edition
2. Vishram singh Textbook of clinical Embryology 2nd edition

Neuroanatomy:

1. Vishram Singh. Clinical Neuroanatomy. II edition Elsevier.
2. A. K. Dutta. Essentials of Neuroanatomy. IV edition Current books international.

PHYSIOLOGY - 1st Year

OBJECTIVES:

At the end of the course a post graduate student in Physiology should be able to:-

1. Develop skills and understand general and systemic Physiology.
2. To understand physiological basis of health and disease affecting various organ systems.

COURSE OUTCOME :

After completing the First year course, the postgraduate should

1. Have understood the basic concepts in Physiology.
2. Be able to interact with allied departments and render services in advanced laboratory investigations.
3. Be oriented to the principles of research methodology.

THEORY :

I GENERAL PHYSIOLOGY

1. Organization of the cell & its functions
2. Structure of cell membrane, cell organelles
3. Intercellular communications
4. Transport across cell membrane
5. Membrane potentials
6. Body fluid compartments and changes in body fluid compartments oedema
And dehydration, osmolarity and osmolality
7. Homeostasis, concepts of physiological norms, range and variations.
8. Genetic control of protein synthesis, apoptosis. Programmed cell death.

II BLOOD

1. Composition and functions of blood
2. Plasma Proteins – Types, Normal values, Origin, Functions, Variation in health and diseases.
3. Red Blood cells – Erythropoiesis definition, sites and stages of erythropoiesis, Regulation.
4. Morphology of RBC, Functions, Normal values, Variations, PCV

- and ESR, Determination, Anemias & its Clinical significance.
5. Haemoglobin - Structure ,Functions, Types, Derivatives. Methods of estimation. Normal Values, Anemias, Types and features.
 6. Life span and destruction of RBC, RE system, Functions, Jaundice, Types.
 7. Leucocytes – Leucopoiesis, Sites of Granulopoiesis, Lymphopoiesis and Monocytopoiesis.
 8. Morphology of different types of leucocytes,functions, Variations, Immunity, Transplantation of tissues and organs.
 9. Platelets – thromopoiesis, sites, stages, morphology, functions, normal values & Variation.
 10. Hemostasis and blood coagulation – definition, clotting factors. Mechanism of clotting.
 11. Clot retraction, Fibrinolysis, bleeding disorders. Tests for clotting, anticoagulants, Actions and uses.
 12. Blood groups –ABO system and Rh factor.
 13. Blood transfusion – Indications, types, Reactions, lymph – origin. Circulation, functions of lymph and lymph nodes. Blood volume, Determination, Regulations.

III NERVE AND MUSCLE

1. Structure of a neuron and classification of nerve fibers, Properties, Potential in nerve fibers. Degeneration and regeneration of nerve fibers, Neuroglia.
2. Muscle : Types , Physiological anatomy of skeletal muscle.
3. Neuromuscular junction and myasthenia gravis and NMJ blocking drugs.
4. Mechanism of muscle contraction and its molecular basis. Types of contraction- isotonic and isometric contractions.
5. Energetics of muscle contraction– Rigor mortis.
6. Types and properties of muscle fiber.
7. Structure and types of smooth muscle.
8. Contraction of smooth muscle.

IV GASTROINTESTINAL SYSTEM

1. Introduction – Anatomy of G.I.tract, Salivary secretion, Types of salivary glands, Innervations, composition of saliva, regulation, functions.
2. Gastric secretion – Structure of gastric mucosa, Innervation, Origin, composition and function of gastric juice, Mechanism of secretion of HCL, Functions.
3. Regulation of gastric secretion, Methods of study, phases of gastric secretion, factors influencing gastric secretion, peptic ulcer.
4. Pancreatic secretion – structure of pancreas, Innervations, composition and functions of pancreatic juice. Mechanism of secretion, regulation, Tests for pancreatic exocrine function.

5. Liver and gall bladder – Function of liver , Composition and functions of bile. Function of gall bladder, filling and emptying , Regulation, Cholecystectomy , Gall stones.
6. Small intestine – structure , Composition and functions of succus entericus , regulation. Large intestine – structure, functions, secretion.
7. Gastro – intestinal motility :- stages of degulation, Mechanism, Distrurbances, Types of movement, Gastric emptying regulation.
8. Movements of small intestine – Types, Regulation, Ileo-caecal valve. Functions, Movements of colon, Defecation
9. Gastro – intestinal hormones and their actions, Digestion of Carbohydrates, Proteins and fats.
10. Absorption of Carbohydrates, Proteins, fats, vitamins, water and electrolytes.

V KIDNEY, SKIN AND TEMPERATURE REGUALTION

1. Functional anatomy of kidney, renal blood flow , its determination, regulation and peculiarities.
2. G.F.R- Definition, Measurement, filtration membrane, forces involved. Control of GFR.
3. Tubular function – Reabsorption, secretion and concentration mechanism.
4. Nerve supply to urinary bladder, Micturition, Non excretory functions of kidney.
5. Renal function tests.
6. Skin & its functions and temperature.

VI RESPIRATION

1. Introduction – Functional anatomy of respiratory tract,
2. Pulmonary Ventilation – Mechanism of ventilation, Muscles, pressure changes, pressure volume inter relationship, compliance, Airway resistance.
3. Surfactant – source, chemical nature , functions , Lung volumes and capacities, definition, Determination, Normal Values , significance.
4. Alveolar ventilation – dead space, Significance, Pulmonary circulation, Ventilation Perfusion ratio & its significance.
5. Respiratory membrane, partial pressure of gases. Diffusion of gases, Diffusion capacity, factors affecting diffusion of gas.
6. Oxygen transport – Forms of transport, O₂ –Hb dissociation curve. Factors affecting it, Myoglobin.
7. CO₂ transport – Form of transport, CO₂ dissociation curve, Chloride shift. Haldane effect.
8. Regulation of respiration – Organization of respiratory centers. Non- chemical regulation, Respiration and Acid – Base balance.

9. Hypoxia -types , Effects, voluntary Hyperventilation, Periodic breathing.
10. Dyspnoea, Asphyxia, Cyanosis, Decompression sickness, Artificial respiratory methods.
11. Pulmonary function tests, Respiratory adjustments during muscular exercise.

VII CARDIO VASCULAR SYSTEM

1. Functional anatomy of heart, blood vessels conducting system , systemic and pulmonary circulation.
2. Innervation of the heart and blood vessels, VMC.
3. Haemodynamics.
4. Properties of cardiac muscles,
5. Cardiac cycle.
6. Heart rate and regulation of heart rate.
7. Cardiac output definitions, variations, Method of determination, Regulation .
8. Blood pressure.
9. Shock.
10. Regional circulation.
11. Cardio vascular changes during muscular exercises.

VIII ENDOCRINES

1. Introduction to endocrinology, classification, General properties and mechanism of action of hormones.
2. Pituitary gland:
 - a) Anterior pituitary hormones, their actions, control and disorders,
 - b) Actions, Control and disorders of posterior pituitary hormones.
3. Thyroid gland:
 - a) Synthesis, actions of iodine containing thyroid hormones.
 - b) Control of secretion, Thyroid function tests and disorders
4. Calcium - Functions, control - Parathormone, Calcitonin & Calcitriol Disorders.
5. Endocrine pancreas – Insulin & Glucagon.
 - a) Source b) Actions c) regulation d) Clinical disorders
6. Adrenal gland:
 - a) Adrenal cortex – Nomenclature, Actions, Control, Disorders.
 - b) Adrenal medullary hormones – Synthesis, actions and control.

IX REPRODUCTION

1. Introduction.
2. Male reproductive system
 - a) Physiological anatomy, spermatogenesis and its regulation

- b) Testicular hormones, composition of semen.
- 3. Female reproductive system
 - a) Menstrual cycle
 - b) Pregnancy and parturition
 - c) Lactation and family planning

X CENTRAL NERVOUS SYSTEM

1. Organization of central nervous system
2. Synapse : Transmission and properties, neurotransmitters
3. Receptors and properties
4. Sensory system: Primary sensations : ascending tracts and sensory cortex
5. Pain sensation and thalamus
6. Spinal cord: Reflexes.
7. Motor tracts, basal ganglia, vestibular apparatus, cerebellum, control of motor activity and postural reflexes.
8. Hypothalamus, ANS, Limbic system, prefrontal lobe.
9. Higher mental functions
10. Sleep and EEG
11. Learning and memory
12. Language and speech
13. CSF and blood brain barrier (BBB)

XI SPECIAL SENSES

Vision:- Functional anatomy of eye

1. Aqueous humor, IOP, Glaucoma.
2. Optics of eye.
3. Image forming mechanism.
4. visual activity.
5. Errors of refractions.
6. Retina – structure and electrical activity of photoreceptors.
7. Visual pathway and its lesion , visual cortex, depth perception
8. Accommodation, Dark adaptation, papillary reflexes,
9. Colour vision with applied aspect.

Hearing :- Functional anatomy of ear

1. Physics of sound .
2. Role of tympanic membrane, middle ear and cochlea in hearing.
3. Auditory pathway and auditory cortex.
4. Tests for hearing and deafness.

Taste and smell:- Modalities, receptors, pathways, cortical and limbic areas associated

with taste and smell, olfaction and memory.

PRACTICALS

1. Study of the microscope and Effect of different concentrations of Saline on RBC.
2. Hemoglobin estimation
3. Enumeration of Red Cell Count
4. Demonstration of Packed cell volume, ESR and Blood Indices
5. Total Leucocyte count
6. Differential leucocyte count
7. Absolute Eosinophil count
8. Bleeding time, clotting time
9. Clinical examination of Cardio vascular system
10. Clinical examination Respiratory system
11. Clinical examination of Cranial nerves
12. Demonstration of Human experiments

UNIVERSITY EXAMINATION :

THEORY : 100 Marks

Distribution of chapters for Physiology paper with weightage of marks for University examination

PAPER - I	
Subjects	Marks
General Physiology	03
Blood	10
Cardiovascular system	12
Respiratory system	10
Gastrointestinal system	09
Renal system	06
Endocrines	10
Special senses	09
Reproduction	06
Central Nerves system	14
Muscle – Nerve	08
Skin and Body Temperature	03

RECOMMENDED TEXT BOOKS :

1. A.K. Jain – Textbook of Medical Physiology. 6th edition 2015 Avichal publication.
2. Indu Khurana - Medical Physiology for Undergraduate students, 1st edition 2012, Elsevier.
3. Venkatesh D. Sudhakar H H – Textbook of Medical Physiology, 2nd Edition, Wolter's Kluwer.
4. Guyton & Hall – Text of Medical Physiology 12th Edition, 2011, Elsevier
5. Ganong's Review of Medical physiology, 23rd edition, 2010, Tata McGraw Hill.

Biochemistry – 1st Year

Objectives

MSc post-graduate in Biochemistry **should understand the theory and practical aspects of :**

1. The chemical and three dimensional structures of the various classes of biomolecules such as carbohydrates, proteins, lipids and nucleic acids as a prelude to understand the correlation between structure and function.
2. The metabolic pathways of the major classes of biomolecules, regulatory mechanisms, interactions, significance and alterations in disease states.
3. The Mechanism of energy release, conservation, utilization and derangements thereof.
4. The Role of micro and macro nutrients such as vitamins and minerals in health and the pathophysiology of nutritional disorders.
5. The Mechanism involved in the storage, transmission and expression of genetic information.
6. The physiological and pathological process affecting biochemical investigations.
7. LIS (Lab information system) and understand pre-analytical, analytical and post analytical procedures
8. Various research methodologies, analyse the data obtained.

Course outcomes:

After completing the three years of MSc in Medical Biochemistry, the postgraduate should be able to:

1. Become qualified technologists, medical teachers and PhD scholars
2. Carry out clinical lab investigations & instrument maintenance
3. Perform Quality control procedures in the lab

THEORY

I. Introduction

Importance and scope of medical biochemistry in prevention, diagnosis and therapeutics of diseases

II. Cell Biology

- a. Cell membrane – structure and composition
- b. Functions of cellular structures

- c. Transport across the cell membrane
 - i. Facilitated diffusion
 - ii. Passive transport
 - iii. Active transport
 - iv. Receptor mediation
 - v. Endocytosis and exocytosis

III. Chemistry of Carbohydrates

- a. Definition, classification and their biological importance
- b. Monosaccharides – structure, classification and properties (along with important derivatives of monosaccharides and reactions of carbohydrates)
- c. Isomerism and stereoisomerism
- d. Disaccharides & oligosaccharides-structure, properties & importance
- e. Polysaccharides – homo and heteropolysaccharides – structure, distribution and functions
- f. Dietary fibres

IV. Chemistry of amino acids, peptides and proteins

- a. Amino acids – Structure, types, various classifications and properties
- b. Peptides – structure and functions of biologically important peptides e.g. Glutathione, oxytocin and vasopressin, ANP and BNP
- c. Proteins – definition, classifications, functions, properties (physical and chemical), structural organization, structure- function relationship with reference to hemoglobin
- d. Separation techniques – electrophoresis and chromatography

V. Chemistry of lipids

- a. Definition, classification, properties and biological importance
- b. Simple lipids – Structure, distribution and functions
- c. Compound lipids – phospholipids, sphingolipids, glycolipids – composition, distribution and functions
- d. Derived lipids – fatty acids, steroids, eicosanoids – chemistry, distribution, classification and functions

VI. Chemistry of nucleic acids

- a. Purines and pyrimidines – structure, structural analogues and their clinical applications
- b. Nucleoside, nucleotide and other biologically important nucleotides
- c. Nucleic acids – definition, types
- d. DNA – structure, types of DNA and functions
- e. RNA – structure, types and functions

VII. Enzymology

- a. Definition, classification, properties
- b. Coenzymes and cofactors (apoenzyme, holoenzyme, cofactors and activators)
- c. Mechanism of enzyme action
- d. Factors affecting enzyme activity and K_m , its significance (derivation not required)
- e. Enzyme inhibition – types with Lineweaver-Burk plots and clinical importance
- f. Enzyme regulation – modes, mechanism and importance
- g. Isoenzymes – definition, chemistry, separation and clinical importance

- h. Diagnostic and therapeutic importance of enzymes
- i. Proenzymes, multienzyme complex and metalloenzymes
- j. RIA and ELISA

VIII. Vitamins

- a. Definition and classification
- b. Chemistry, sources, absorption and transport, biochemical role, RDA, and deficiency, antivitamins and hypervitaminosis of fat and water soluble vitamins

IX. Minerals

- a. Classification, sources, absorption, transport, fate, metabolism, biochemical functions, excretion, regulation, RDA, deficiency manifestations of the following: calcium, phosphorous, iron, copper, iodine, zinc, fluoride, magnesium, manganese, selenium, sodium, potassium and chloride.

X. Bioenergetics and Biological Oxidation

- a. Redox potential, concept of bioenergetics in relation to thermodynamics
- b. High energy compounds
- c. Enzymes involved with special reference to oxygenases
- d. Shuttle mechanisms
- e. Components and organization of respiratory chain in mitochondria
- f. Oxidative phosphorylation
- g. Formation of ATP and its regulation
- h. Inhibitors and uncouplers (Brown adipose tissue and thermogenesis)

XI. Digestion and absorption

- a. Carbohydrate
- b. Lipids
- c. Proteins
- d. Malabsorption syndromes and other related disorders

XII. Metabolism of carbohydrates

- a. Glucose transporters
- b. Glycolysis
- c. Oxidation of pyruvate
- d. TCA cycle
- e. Gluconeogenesis, Cori's cycle
- f. Metabolism of glycogen (glycogenesis, glycogenolysis, storage disorders)
- g. HMP shunt pathway
- h. Metabolism of fructose, galactose, uronic acid pathway, inborn errors associated with them
- i. Blood glucose regulation
- j. Diabetes Mellitus – etiology, metabolism in Diabetes Mellitus, biochemical basis of acute and chronic complications, laboratory diagnosis and monitoring (Glycated Hb, Fructosamine)
- k. Glucose tolerance test and glucose challenge test

XIII. Metabolism of amino acids and proteins

- a. Dynamic state of body proteins, protein turnover, nitrogen balance
- b. Cellular reactions of amino acids

- c. Formation, transport and disposal of ammonia (urea cycle)
- d. Metabolism of amino acids – glycine, serine, aromatic amino acids, sulphur containing amino acids, histidine, arginine, glutamic acid, branched chain amino acids (first three steps) and metabolic disorders associated with them along with laboratory diagnosis.
- e. Specialized products obtained from amino acid metabolism and their importance (Polyamines, creatine, nitric oxide)*

XIV. Metabolism of lipids

- a. oxidation of fatty acids – alpha, beta, omega – beta oxidation of odd chain and even chain fatty acids along with disorders
- b. Formation and utilization of ketone bodies and ketosis
- c. De novo synthesis of fatty acids, elongation and desaturation
- d. Phospholipids (lecithin and cephalin only) and triglycerides – formation and breakdown
- e. Lipid storage disorders
- f. Synthesis of cholesterol (only crucial intermediates), Fate of cholesterol and other compounds derived from cholesterol
- g. Lipoproteins – classification, metabolism, functions and disorders
- h. Atherosclerosis and role of PUFA in preventing atherosclerosis
- i. Eicosanoids
- j. Metabolism in adipose tissue, fatty liver and lipotropic factors

XV. Metabolism of nucleic acids

- a. Biosynthesis and breakdown of purine and pyrimidine nucleotides
- b. Salvage pathways and disorders

XVI. Intermediary metabolism

- a. Integration of carbohydrate, protein and lipid metabolism
- b. Regulation by hormones in starvation, well fed state and diabetes mellitus
- c. Methods of study of intermediary metabolism

XVII. Hemoglobin metabolism

- a. Biosynthesis of heme, regulation and porphyrias
- b. Degradation of hemoglobin
- c. Biochemical basis of jaundice and distinguishing features of different types of jaundice
- d. Hemoglobin variants and Hb derivatives
- e. Abnormal hemoglobins, hemoglobinopathies and thalassemia

XVIII. Genetics and Molecular biology

- a. DNA replication
- b. Transcription, post transcriptional modifications, reverse transcriptase
- c. Genetic code, translation, post translational modifications
- d. Regulation of gene expression, mutation, Polymerase Chain Reaction, recombinant DNA technology, gene therapy, blotting techniques, Restriction Fragment Length Polymorphism, DNA fingerprinting

XIX. Nutrition

- a. Nutrients, Calorific value of food, BMR, SDA, respiratory quotient and its applications
- b. Balanced diet based on age, sex and activity, biological value of proteins, nitrogen balance
- c. Protein energy malnutrition – kwashiorkor and marasmus

- d. Biochemistry of starvation and obesity
- e. Dietetics, Total parenteral nutrition, dietary fibres

XX. Acid base balance

- a. Basic concepts of acids, bases, buffers, pH, H ion concentration, derivation of Henderson – Hasselbach equation with its applications
- b. pH of blood and its regulation
- c. Anion gap and its importance
- d. Acidosis, alkalosis, assessment of acid-base status

XXI. Water and electrolyte balance

- a. Body water compartments, Donnan membrane equilibrium, osmolality, electrolytes concentration in body fluid compartments, water balance, regulation of water balance
- b. Electrolyte balance, regulation and its disorders

XXII. Function tests

- a. Liver function tests
- b. Renal function tests
- c. Thyroid function tests

XXIII. Endocrinology

Classification of hormones, mechanism of hormone action, Mechanism of action of insulin, glucagon, epinephrine and steroid hormones

XXIV. Plasma proteins

- a. Classification, site of synthesis, functions, electrophoretogram in health and disease
- b. Acute phase proteins

- c. Immunoglobulins – structure, types, functions and associated disorders

XXV. Metabolism of Xenobiotics

XXVI. Radioisotopes and their application in medicine

XXVII. Biochemistry of cancer

- a. Carcinogens
- b. Oncogenes
- c. Growth factors
- d. Tumor markers

XXVIII. Myocardial Infarction

- a. Causes
- b. Cardiac markers
- c. Lipid profile

XXIX. Free radical and antioxidants

XXX. Quality control

XXXI. Biomedical waste management

PRACTICALS SYLLABUS:

- I. Introduction
- II. Demonstration – reactions of carbohydrates
- III. Reactions of glucose, fructose and xylose
- IV. Reactions of lactose and maltose
- V. Reactions of sucrose and starch
- VI. Identification of unknown carbohydrate
- VII. Demonstration - Precipitation reactions of albumin and casein
- VIII. Precipitation reactions of albumin and casein
- IX. Demonstration – colour reactions of proteins
- X. Colour reactions of albumin
- XI. Colour reactions of casein
- XII. Identification of unknown protein
- XIII. Demonstration and practical – reactions of NPN substances
- XIV. Identification of substance of physiological importance
- XV. Demonstration - Analysis of normal urine
- XVI. Analysis of normal urine
- XVII. Demonstration – analysis of abnormal urine
- XVIII. Analysis of abnormal urine
- XIX. Spectroscopic examination of hemoglobin derivatives and preparation of hemin crystals
- XX. Spot test for Phenylketonuria, alkaptonuria, homocystinuria

- XXI. Spotters
- XXII. Estimation of blood glucose and interpretation
- XXIII. Estimation of blood urea and interpretation
- XXIV. Estimation of urinary creatinine and calculation of creatinine clearance and interpretation
- XXV. Estimation of serum inorganic phosphate and interpretation
- XXVI. Estimation of serum total protein, albumin and A/G ratio and interpretation
- XXVII. Interpretation of charts and case reports
- XXVIII. Principles of colorimetry
- XXIX. Paper chromatography
- XXX. Electrophoresis
- XXXI. GTT and OGCT
- XXXII. Determination of ALT and AST
- XXXIII. Estimation of serum cholesterol
- XXXIV. Principles of flame photometry and Ion Selective Electrode
- XXXV. Estimation of serum bilirubin
- XXXVI. Determination of glucose and proteins in CSF
- XXXVII. Estimation of albumin in urine and tests for Bence Jones proteins in urine

Weightage of marks in university examination

Sl. No	Topic	Weightage of Marks
1	Cell structure and function, sub cellular organdies, cell membranes, transport across the membranes	5
2	Chemistry, digestion, absorption and metabolism of Carbohydrates	10
3	Amino acids and protein chemistry, general reactions of amino acids, digestion and absorption, urea cycle and metabolism of amino acids	10
4	Chemistry, digestion, absorption and metabolism of lipids	10
5	Enzymes	5
6	Biological oxidation, integration of metabolism and regulation of metabolism	5
7	Detoxification and Xenobiotics	5
8	Free radicals and antioxidants	5
9	Endocrine function	5
10	Biochemistry of cancer, oncogenes and tumour markers	5
11	Bio-medical Waste	5
12	Nucleotides and nucleic acid chemistry	5
13	Nucleotides and Nucleic acid metabolism	10
14	Protein Biosynthesis, Molecular genetics, regulation of gene expression, recombinant DNA technology, PCR, Human Genome Project & gene therapy	10

15	Vitamins	15
16	Minerals	10
17	Water and Electrolyte balance, Acid - base balance	10
18	Nutrition and energy metabolism	10
19	Heme metabolism, normal and abnormal hemoglobins, Plasma proteins and immunoglobulins	10
20	Liver function tests	5
21	Kidney function tests, Thyroid Function tests	5
22	Radio-isotopes, Cardiac Markers	5
23	Clinical chemistry, SI Units, quality control, interpretation and reference values and analysis	5

RECOMMENDED TEXT BOOKS

1. *MURRAY (ROBERT.K.M)*, Harpers Illustrated Biochemistry. Published by Lange Medicals
2. *D.M.VASUDEVAN AND SREEKUMARI.S* Textbook of Biochemistry for Medical students, published by Jaypee Medical Publishers, New Delhi
3. *CHAMPE, HARVEY & FERRIER*. Lippincott's illustrated reviews of Biochemistry. Published by Lippincott, Williams and Wilkins
4. *U. SATYANARAYANA* Textbook of Biochemistry published by Books and Allied (P) ltd.
5. *DEBAJYOTI DAS* Biochemistry. Published by Academic publishers.

M.Sc (MEDICAL) SECOND AND FINAL YEAR CURRICULUM AND SYLLABUS:

ANATOMY, PHYSIOLOGY, BIO-CHEMISTRY, PHARMACOLOGY AND MICROBIOLOGY.

TEACHING EXPOSURE:

1. In order to get the teaching experience, post-graduates are suppose to take practical classes for MBBS/ BPT/BDS and other allied health science students (Dissection and Histology).
2. Post-graduates should present seminars/Journal club at regular intervals.

DISSERTATION WORK:

During the course of study every candidate has to prepare a dissertation work on a selected topic under the guidance of a recognized post-graduate teacher.

The dissertation is aimed to train a post graduate student in research methods and techniques. It includes identification of a problem, formulation of a hypothesis, search and review of literature, getting acquainted with recent advances, designing of a research study, collection of data, critical analysis, and comparison of results and drawing conclusions.

Every candidate shall submit to the Controller of Examinations of the University in the prescribed proforma, a synopsis containing particulars of proposed dissertation work within six months from the date of commencement of the II year on or before the dates notified by the University. The synopsis shall be sent through the proper channel.

Such synopsis will be reviewed and the dissertation topic will be registered by the University. No change in the dissertation topic or guide shall be made without prior approval of the University.

The dissertation should be written under the following headings i. Introduction

ii. Aims or Objectives of study

iii. Review of Literature

iv. Material and Methods

- v. Results
- vi. Discussion
- vii. Conclusion
- viii. Summary
- ix. References
- x. Tables
- xi. Annexure

Six copies of dissertation thus prepared shall be submitted to the Controller of Examinations, six months before final examination on or before the dates notified by the University. The dissertation shall be valued by examiners appointed by the University. Approval of dissertation work is an essential precondition for a candidate to appear in the University examination.

A Co-guide may be included provided the work requires substantial contribution from a sister department or from another medical institution recognised for teaching/training by JSS University. The co-guide shall be a recognised postgraduate teacher of J.S.S University.

Change of guide: In the event of a registered guide leaving the college for any reason or in the event of death of guide, guide may be changed with prior permission from the university.

SCHEME OF EXAMINATION:

University examination:

Consists of Theory, Practical and Viva voce.

Theory: shall consist of three question papers, each of three hours duration. Each paper shall carry 100 marks. Each paper shall consist of two long essay questions each question carrying 20 marks and 4 short essay question each carrying 10 marks and 4 short

answers question carrying 5 marks. Total marks for each paper will be 100. Questions on recent advances may be asked in any or all the papers.

Practical Examination:

In case of practical examination, it should be aimed at assessing competence and skills of techniques and procedures as well as testing students ability to make relevant and valid observations, interpretations and inference of laboratory or experimental work relating to his/her subject.

The total marks for Practical examination shall be 200.

Viva Voce: Viva Voce Examination shall aim at assessing depth of knowledge, logical reasoning, confidence and oral communication skills. The total marks shall be 100 and

the distribution of marks shall be as under:

(i) For examination of all components of syllabus,

discussion of the dissertation topic	80 Marks
--------------------------------------	----------

(ii) For Pedagogy	20 Marks
-------------------	----------

Examiners: There shall be at least two examiners in each subject. Out of them one shall be external examiner and one shall be internal examiner.

Any professor with M.D degree with 10 years of teaching experience or professor with Ph.D degree in their respective subject with 5 years of teaching experience are eligible to become examiner.

Criteria for declaring as pass in University Examination: A candidate should get 50% marks in (1) Theory, (2) Practical and viva-voce examination separately.

A candidate securing less than 50% of marks as indicated above shall be declared to have failed in the examination. Failed candidate may appear in subsequent examination upon payment of examination fee to the University.

Declaration of distinction: A successful candidate passing the University examination in first attempt will be declared to have passed the examination with distinction, if the grand total aggregate mark is **75% and above**. And First class, if the grand total aggregate mark is **65% and above**.

Distinction and First class will not be awarded for candidates passing the examination in more than one attempt either in 1st year or in Final year or Both.

SYLLABUS FOR 2ND AND FINAL YEAR

M.Sc (Medical) ANATOMY

General anatomy:

Introduction, subdivisions of anatomy, anatomical position, anatomical planes, anatomical terms, Cell, cell division, Basic tissues, Skin, Superficial fascia and deep fascia, modifications of deep fascia, Skeleton system with classification, types of bone, features of long bone, ossification, blood supply, Joints – classification with examples, structure of typical synovial joints, Myology – classification with examples, types of skeletal muscles, tendon, aponeurosis, Nervous system – subdivisions, types of cells in CNS, neuron - structure, types, ganglia and nuclei, plexuses, Cardiovascular system – blood vessels, anastomosis, types of circulation, lymphatic system – components of the lymphatic system.

Gross Anatomy:

Upper limb: Introduction, bones of the upper limb, pectoral region, muscles, mammary gland, applied anatomy, Axilla – Boundaries and contents, Brachial plexus, applied anatomy, Back and scapular region - muscles, intermuscular spaces, anastomosis around the scapula, Arm – compartments, muscles, nerves and vessels, Cubital fossa, Forearm – compartments, muscles, nerves and vessels, flexor retinaculum, Hand – palmar aponeurosis, spaces of the palm, muscles, nerves and vessels of the palm, joints of the upper limb with osteology, surface marking and radiology.

Lower limb: Introduction, bones of the lower limb, front of thigh – femoral triangle, Adductor canal, applied anatomy, Gluteal region - muscles, nerves and vessels, Back of the thigh – Hamstrings, Popliteal fossa, Leg - compartments, muscles, nerves and vessels, Dorsum of foot, Sole - plantar aponeurosis, muscles, nerves and vessels of the sole, joints of the lower limb with osteology, surface marking and radiology.

Head and neck: Scalp – layers, blood supply, nerve supply, lymphatics and applied anatomy, Face – muscles of facial expression, nerve supply, blood supply, lymphatics, Deep fascia of neck, Triangles of neck, Parotid gland, Submandibular region, Cranial cavity, Orbit, Temporal fossa and Infratemporal fossa – muscles of mastication, maxillary artery, mandibular nerve and Temporomandibular joint, Deep dissection of neck – Thyroid gland, Deep structures of the neck, Nasal cavity, Para nasal air sinuses, Oral cavity – Tongue, Hard palate and Soft palate, Pharynx, Larynx, Ear, Eyeball, related applied anatomy, osteology, surface marking and radiology.

Neuroanatomy: Introduction, Parts of brain, Spinal cord, Forebrain – Cerebral hemispheres, Diencephalon, Midbrain, Hind brain – Pons, Medulla oblongata, cerebellum, Ventricles of brain and CSF – formation and circulation, white matter of cerebrum – corpus callosum and internal capsule in detail, Basal nuclei, corpus striatum, with clinical correlations, radiology, surface marking and applied anatomy.

Thorax: Thoracic cage, Bones, Inlet of thorax and outlet of thorax – Diaphragm, Thoracic wall – Intercostal spaces with muscles, vessels and intercostals nerves, Pleura and Lungs, Medistinum – boundaries, subdivisions and contents, Pericardium, Heart – chambers, blood supply, nerve supply, veins of thorax, Trachea, oesophagus, thoracic duct, related applied anatomy, osteology, surface marking and radiology.

Abdomen and pelvis: Anterior abdominal wall - muscles, vessels and nerves, Inguinal canal, Rectus sheath, Male external genital organs – Testis in detail, Peritoneum, Stomach Duodenum and Pancreas, Portal vein, Large intestine, Liver, Extra hepatic biliary apparatus, Spleen, Kidney, Suprarenal glands, Ureter, Pelvic viscera, Perineum, Pelvic diaphragm with related applied anatomy , osteology, surface marking and radiology.

Genetics: Introduction, chromosomes, inheritance, karyotyping, chromosomal abnormalities, inborn errors of metabolism and genetic counselling.

Embryology:

General Embryology: Introduction, gametogenesis, structure of sperm, growth of ovarian follicles, uterine cycle, fertilization, implantation, First week of development, Second week of development, bilaminar germ disc, notochord formation, trilaminar germ disc, embryonic folds, fetal membranes, placenta, umbilical cord, amniotic cavity, twinning, teratology and prenatal diagnosis.

Systemic embryology: includes musculoskeletal system, body cavities. Development of CVS – formation of heart tube, cardiac loop, interatrial septum and interventricular septum, vascular development, clinical correlates, circulation before birth and after birth, clinical correlates. Development of Respiratory system – formation of lung bud, maturation of lungs, clinical correlates. Development of digestive system – divisions of gut tube, foregut, midgut rotation and derivatives of mid gut, hind gut, cloaca and its subdivisions and derivatives, clinical correlates. Development of Urogenital system – kidney, ureter and urinary bladder, mesonephric and paramesonephric ducts and their derivatives, clinical correlates. Head and Neck - pharyngeal arches and pouches, Pharyngeal clefts, development of face, palate, Tongue, thyroid gland, Nasal cavity development and clinical correlates. Development of CNS, special senses, skin along with congenital anomalies.

Histology:

Microscopy, microtome, tissue collection, embedding and paraffin blocks preparation, serial section cutting, staining techniques, mounting the sections. Along with this museum and embalming techniques. Histology of basic tissues, blood vessels, lymphoid tissue, salivary glands, tongue, oesophagus, stomach, small intestine, large intestine, pancreas, liver, gall bladder, trachea, lung, kidney, ureter, urinary bladder, testis, epididymis, vas deferens, prostate, seminal vesicle, penis, ovary, uterus, fallopian tube, mammary gland, placenta, umbilical cord, pituitary

gland, thyroid and parathyroid glands, suprarenal gland, cerebrum, cerebellum, spinal cord, retina, cornea and skin.

Practical schedule:

1. **Gross Anatomy:** Dissect and demonstrate the entire human cadaver
2. Embalm and maintain the record of embalming work done.
3. **Histology section:**
 - Collection of tissues, fixing, block making, section cutting; use of different types of microtomes and preparation of general and systemic slides.
 - Haematoxylin & Eosin - (i) Preparation of stains. (ii) Staining techniques.
 - Knowledge of light microscope and electron microscope.
 - Detailed microscopic study of all the tissues (General and Systemic slides).
4. **Log Book:** Every student should maintain a logbook in which a record of the practical exercises completed, Seminars & journal clubs details, Conferences/ workshops/ CME details, teaching learning activities etc should be entered. The Log books shall be checked and assessed periodically by the faculty members imparting the training. Duly scrutinized and certified by the head of the department and to be submitted to the external examiner during the final examination.
5. **Record Book:** A practical record of work done in histology and gross anatomy with an emphasis on cross sectional anatomy has to be maintained by the candidate and duly scrutinized and certified by the head of the department and to be submitted to the external examiner during the final examination.
6. **Research/Dissertation:**
 - During the course of study every candidate has to prepare a dissertation individually, on a selected topic under the direct guidance and supervision of a recognized postgraduate teacher as per JSSU regulations.
 - Hands on Workshop on synopsis & dissertation writing, paper & poster presentation skills & writing research papers.

Assessment

Formative assessment: Periodical examinations during the course of training. Assessment should be frequent, cover all domains of learning and provide feedback to improve learning; it should also cover professionalism and communication skills.

The Internal Assessment in theory and practical/clinical examination during 1st, 2nd and 3rd year.

Summative assessment:

University Examination pattern:

MD (Anatomy) Examination	Theory	Practical	Viva-voce (Pedagogy & Thesis discussion)	Total
Maximum marks	300	200	100	600

Theory: 300 Marks

The written examination consists of three papers, with maximum marks of 100 for each paper. Each paper will be of three hours duration.

Paper I: General Anatomy, Gross Anatomy and applied Anatomy

Paper II: Embryology with teratology, Histology, Comparative anatomy and Anthropology

Paper III: Neuroanatomy, Histological technique, Museum and embalming techniques including Medicolegal aspects and Human Genetics.

Each Theory paper consists of:

SI No	Type of Question	Marks
1	Long Essay (2)	2 X 20= 40
2	Short Essay (4)	4 X 10= 40
3	Short Answers (4)	4 X 5= 20
Total		100 marks

Practicals: 200 marks (Gross Anatomy - 100 marks, Histology - 100 marks) Spread over a minimum of 2 days

A. Gross Anatomy:

Dissection of the topic allotted on a human cadaver and display for discussion. Time allotted will be 03 hrs.

Distribution of Marks:

SI NO	Topics	Marks
1	Surface Anatomy	10
2	Dissection	40
3	Discussion	50
Total		100

Histology:

Identification and discussion of 10 stained sections which includes neuroanatomy, embryology and human genetics. Preparation of paraffin blocks, serial section cutting of the given block and staining the given slide with H and E stain, followed with discussion.

SI NO	Topics	Marks
1	Identification and discussion of 10 slides	20
2	Preparation of a paraffin block	10
3	Taking serial sections from blocks provided	10
4	Staining of the given section with H & E and Discussion	20
5	Discussion on histological techniques	40
Total		100

B. Viva –Voce & Pedagogy: 100 marks

Viva Voce(80 Marks): Grand Viva of all the components of the syllabus along with specimens, skiagrams including newer imaging techniques, bones and embryology models. Including discussion on dissertation topic.

Pedagogy(20 Marks): Demonstration of teaching skill / techniques. Microteaching of a short topic to assess teaching skills.

Recommended Books

Gross Anatomy:

1. Susan Stranding: Gray's Anatomy: The anatomical basis of clinical practice, Churchill Livingstone Elsevier. 41nd edition
2. Dutta A.K. Human Anatomy vol. I-III (V edition, VI edition IX Edition) Current publisher.
3. Dutta A.K. Principle of General Anatomy. Current Publisher.
4. Romanes. Cunningham's Manual of Practical Anatomy vol. I-III, 16th edition Oxford.
5. Keith and Moore Clinical Oriented Anatomy. VII edition Lippincot Williams and Wilkins.
6. R.S Snell. Clinical Anatomy by regions. 9th edition Lippincot Williams and Wilkins.
7. R.J. Last. Anatomy Regional and Applied. 11th edition Churchill Livingston.
8. Lee McGregor's Synopsis of Surgical Anatomy, 12 edition Varghese Publishing House.
9. Snell. Clinical anatomy by regions. VIII edition Lippincotts, Williams and Wilkins.
10. Hollinshed W Henry. Anatomy for surgeons. Vol. I-III Lippincotts, Williams and Wilkins.
11. Vishram Singh. Clinical and Surgical Anatomy. Elsevier. Vol I-III, II edition
12. Vishram Singh. Textbook of general anatomy. Elsevier.
13. Frank H. Netter. Atlas of Human Anatomy. Vth edition Saunders Elsevier.

Histology:

1. Young B. and Heath J. Wheater's Functional Histology. VI edition Churchill Livingstone.
2. M.H. E Ross. Histology: A textbook and atlas. VI edition Williams and Wilkins.
3. Difiore's. Atlas of histology with functional co-relation. 11th edition
4. Junqueira Basic histology - Text book and Atlas XIV edition
5. Bloom and Fawcett. Text book of histology. XII edition
6. Carlton's. Histology Technique.
7. E.C. Clayden. Practical of section cutting and staining.
8. D W Cormack. Ham's Histology. IX edition Lippincotts, Williams and Wilikins.

Genetics:

1. Medical genetics by SD GANGANE III edition
2. J.S Thompson and Thompson . Genetics in medicine. VII edition W.B. Saunders and Co. Philadelphia, London.
3. George Fraser and Oliver Mayo. Text book of Human Genetics. Blackwell Scientific Publications London, Oxford Edinburg, Melbourne.

Embryology:

1. Hamilton, Boyd. And Mossman. Human Embryology. IV edition
2. TW Sadler. Langman's Medical Embryology. Lippincotts, Williams and Wilikins. 12th edition
3. Keith L Moore and T.V.N. Persaud. The Developing Human. VII edition Saunders.
4. Larsen's Human embryology Schoenwolf, Bleyl, Brauer, Francis-West 7th edition
5. AK Datta Essentials of Human embryology 7th edition
6. Vishram singh Textbook of clinical Embryology 2nd edition

Neuroanatomy:

1. Richard S. Snell. Clinical Neuroanatomy for Medical Students. VII edition Williams and Wilkins.
2. Vishram Singh. Clinical Neuroanatomy. II edition Elsevier.
3. A. K. Dutta. Essentials of Neuroanatomy. IV edition Current books international.
4. John A. Kiernan. Barr's the human nervous system, Lippincott, Williams and Wilkins.

Radiology:

1. J.B. Walter et.al. Basic Atlas of Sectional Anatomy with correlated imaging. Saunders Elsevier.

Surface anatomy:

1. A. Halim. and A.C. Das. Surface Anatomy Lucknow. ASI, KGMC.

2ND AND FINAL YEAR SYLLABUS - MEDICAL PHYSIOLOGY

A. THEORY :

1. General physiology

1. History of Medicine with special reference to physiology
2. Cell physiology – Cell cycle, organization and physical structure of cell, apoptosis
3. Homeostasis: Internal environment, Control systems of body
4. Body fluids compartments and measurements, oedema and dehydration
5. Transport across cell membrane
6. Membrane potentials and its measurements
7. Genetics: Genetic code, its expression and regulation of gene expression
8. Biophysical principles

2. Blood

1. Blood: composition and functions, Blood volume and its measurements
2. Plasma proteins: types, properties and functions
3. RBC's: formation, functions
4. Haemoglobin – structure, synthesis, types – normal & abnormal,
5. Fate of RBC's and haemoglobin, jaundice, Anemia's and Polycythemia
6. WBC's: Types, formation, structure and functions of each type
7. Leukocytosis, leucopenia and leukemia
8. Immunity: Reticuloendothelial system, Cell mediated, Humoral immunity and immune reactions
9. Platelet's: structure, formation, functions
10. Haemostasis: Definition and Steps, coagulation, fibrinolytic system, anticoagulants
And coagulation tests
11. Blood groups: Major and minor blood group systems
12. Blood transfusion and its hazards
13. Lymph: formation and functions

3. Nerve Muscle physiology

1. Neuron, Neuroglia and Nerve fibres – Classification & properties
2. Degeneration and regeneration of nerve fibres, nerve growth factors
3. Neuromuscular transmission and its disorder, Drugs acting at Neuromuscular junction.
4. Skeletal muscle: Structure, Excitation and contraction coupling, molecular basis of contraction, Types of contraction Muscle types and properties and energy sources
5. EMG and Muscle disorders
6. Smooth muscle: Types, electrical activity and molecular basis of contraction
Properties of smooth muscle
7. Cardiac muscle: Structure, properties, molecular basis of contraction

4. Gastrointestinal physiology

1. General overview of GI system - Organization of Gastrointestinal wall,

Innervation of GIT

2. Oral Cavity: Mastication and digestion in mouth and its importance.
Salivary secretion: mechanism, composition, functions and regulation.
3. Physiology of deglutition : Definition, stages, neural control and applied aspects.
4. Stomach : Overview of functions, gastric secretion – mechanism, composition, Function and regulation. Experimental procedures to elucidate and phases of gastric secretion.
5. Gastric motility – characteristics and control, gastric emptying and antral pump mechanism, peptic ulcer.
6. Pancreatic secretions: Composition, mechanism, functions and regulation.
7. Liver: Functions, Bile formation, secretion and regulation, Entero hepatic circulation,
8. Gall bladder: Functions, Mechanism and regulation of gall bladder contraction
9. Jaundice, Physiological basis of liver function tests
10. Small intestine : Secretion, movement and control.
11. Large intestine : Functions, secretions, movements.
12. Defaecation : Mechanism and control.
13. Physiology of vomiting, diarrhoea, constipation.
14. Gastrointestinal hormones
15. Digestion and absorption.

5. Renal system

1. Functional anatomy, Structure and function of a Juxta glomerular apparatus.
Renal circulation.
2. Mechanis urine formation involving processes of filtration, tubular reabsorption, Secretion and concentration. Water diuresis and osmotic diuresis.
3. Regulation of acid base balance.
4. Renal mechanisms for regulation of ECF volume, blood pressure and ionic composition.
5. Innervations of bladder, micturition and abnormalities of micturition.
6. Renal Function tests
7. Renal failure, Artificial kidney, dialysis and renal transplantation. Diuretics,
8. Integumentary system; Structure of Skin and its functions, sweat glands and thermoregulation

6. Respiratory system

1. Functional anatomy of respiratory system
2. Mechanics of breathing: Movements of thoracic cage during respiration, intrapleural and pulmonary pressure and volume changes, pressure-volume inter-relationships, lung compliance, surfactant, airway resistance, work of breathing.
3. Spirometry, lung volumes & capacities: Definitions, normal values and its significance
4. Alveolar ventilation, Dead space ventilation, Ventilation perfusion ratio and its Importance in respiratory diseases.

5. Diffusion of gases: Alveolar-capillary membranes, diffusion capacities, partial Pressure gradients and factors influencing diffusion of gases.
6. Gas Transport: Oxygen transport – oxygen dissociation curve- factors affecting its shift and Bohr's effect.
7. Carbon dioxide transport – tissue uptake, carriage in blood and release at the lungs importance of red blood cell, chloride shift, Haldane effect.
8. Regulation of respiration : Neural and chemical regulation, integrated responses.
9. Abnormal breathing : Apnoea, hyperpnoea, tachypnoea, dyspnoea, Chyne-stokes breathing and Biot's breathing- definition, features and physiological basis.
10. Hypoxia, cyanosis, asphyxia
11. Role of respiratory system in acid base balance
12. Pulmonary function tests
13. Artificial respiration: types, principles, indications, advantages and disadvantages.

8. Cardiovascular physiology

1. Functional anatomy and innervations of heart
2. Properties of cardiac muscle
3. Electrical activity of the Heart – origin and spread of cardiac impulse.
Electrocardiogram: Definition, waves and their explanations. ECG recording
Techniques Cardiac arrhythmias and their ECG interpretation
4. Heart rate and its regulation
5. Cardiac cycle – Phases, pressure and volume changes, Heart sounds, JVP, Arterial pulse
6. Cardiac output: Definition, normal values and variations, major determinants of cardiac output and regulation, Heart-lung preparation, measurement of cardiac output.
7. Haemodynamics: General principles of circulation
Blood flow - Laminar and turbulent flow, factors affecting blood flow and resistance, critical closing pressure. Regulation of blood flow
8. Arterial Blood Pressure : Definition, normal value, variations, measurement, mean arterial pressure (MAP) and its determinants. Regulation of blood pressure.
9. Regional circulation : Coronary, cerebral, cutaneous, capillary, splanchnic, skeletal muscle and foetal. Normal values, special features and regulation.
10. Cardiovascular changes during exercise.
11. Cardiac failure, circulatory shock.

10. Endocrinology

1. General principles of endocrinology; Classification and mechanism of action of hormones Functional anatomy, mechanism and actions of hormones and applied aspects of
2. Pituitary gland
3. Thyroid Gland
4. Parathyroid gland - Physiology of bone, Hormonal Control of Calcium Metabolism
5. Endocrine Pancreas &. Regulation of blood glucose level

6. The Adrenal Medulla & Adrenal Cortex
7. Pineal gland, Local hormones
8. Energy Balance, Metabolism & Nutrition

11. Reproductive system

1. Sex determination and differentiation, Chromosomal disorders
2. Male reproductive system:
 - Primary and accessory organs and their functions
 - Puberty in males
 - Spermatogenesis and its regulation
 - Testosterone- secretion, transport, metabolism, mechanism and physiological Actions. Control of testicular function
3. Female reproductive system:
 - Functional anatomy
 - Puberty in females
 - Ovarian hormones – Estrogen and progesterone, Mechanism and physiological actions, Control of ovarian function
 - Physiology of menstrual cycle: Ovarian cycle, Uterine cycle, vaginal and cervical Cycle. Physiology of ovulation and its detection
 - Menopause and menstrual abnormalities.
 - Physiology of fertilization and implantation.
 - Physiology of pregnancy : Endocrine changes, foeto-placental unit, changes in Mother during pregnancy, tests for pregnancy
 - Physiology of parturition and lactation
 - Contraception
 - Infertility and assisted reproduction

12. Central nervous system

1. Introduction: Organization of the nervous system
2. Synapse – electrical activities & properties
3. Sensory system – Receptors, ascending tracts, sensory cortex
4. Pain and other sensations
5. Motor system – Spinal cord, Reflexes, Motor cortex and descending tracts
6. Spinal cord lesions
- 7 Basal ganglia, Cerebellum and Vestibular apparatus
8. Control of voluntary and involuntary movements
9. Control of Posture and equilibrium
10. Thalamus, Hypothalamus and Autonomic nervous system
11. Cerebral cortex, Prefrontal lobe and Limbic system – Behavioral physiology
12. Cerebrospinal fluid and blood brain barrier
13. Reticular formation, Sleep & EEG
14. Higher cortical functions: Speech, learning and memory

13. Special senses

1. Vision: Functional anatomy, aqueous humor, IOP,
Optics of vision, errors of refraction
Photochemistry of vision, Light and dark adaptation
Neurophysiology of vision: Visual pathway and visual cortex
Color vision and applied aspects
Movements of eyeball and squint
2. Hearing: Functional anatomy, Auditory pathway and auditory cortex
Mechanism of hearing
Deafness, Test for hearing, Audiometry
3. Olfaction: Physiology of olfaction and its disorders
4. Gustation: Physiology of gustation and its disorders

B. PRACTICALS :

1. Haematology:

- a. Study of Haemocytometer
- b. Determination of RBC count
- c. Estimation of Haemoglobin
- d. Reticulocyte count
- e. ESR and PCV
- f. Osmotic fragility of Red blood cells
- g. Specific gravity of blood
- h. Total leucocyte count
- i. Differential count of WBC and Arneth count
- j. Absolute eosinophil count.
- k. Platelet count
- l. Determination of bleeding time and clotting time
- m. Determination of Blood groups

2. Clinical Physiology:

- A. Elementary principles of clinical examination
- B. General examination
 - a. Cardiovascular system
 - i. Examination of arterial pulses and measurements of blood pressure.
 - ii. Examination of heart
 - b. Respiratory System
 - i. Examination of respiratory system
 - c. Gastro-intestinal system
 - i. Examination of abdomen.
 - d. Nervous System
 - i. Examination of higher mental functions.
 - ii. Sensory system

- iii. Motor functions
- iv. Examination of cranial nerves.
- v. Cerebellar function tests

3. Human Experiments:

- 1. Measurement of arterial blood pressure and effect of posture & exercise on BP.
- 2. Electrocardiography — ECG & its interpretation.
- 3. Recording of lung function tests by computerized or electronic spirometer
- 4. Stethography
- 5. Ergography

4. Animal Experiments

Since animal experiments have been banned by the CPCSEA the practical will be held by way of interpretation of the pre-recorded graphs both for mammalian intact and isolated preparations and amphibian experiments listed in the respective sections. This section of the experiments will include asking questions as part of bench viva in the following areas:

- i. Animals commonly used: dogs rabbits, guinea pigs and rats
- ii. Anesthesia: types of drugs used, advantages and Disadvantages, route of administration
- iii. Equipment used for the experiments, their identification and uses.
- iv. Dissection procedure
- v. Composition and preparation of various mammalian fluids.

a. Amphibian experiments (Simulated experiments)

- i. Preload and after load
- ii. Effect of continuous repeated stimulation (study of phenomena of fatigue)
- iii. Length tension diagram.
- iv. Properties of cardiac muscle: long refractory period, all or none law.
- v. Extrasystole and compensatory pause, beneficial effect
- vi. Regulation of heart, dissection of vagus nerve and effect of vagal stimulation.
- vii. Actions of acetylcholine, adrenaline and nicotine on heart (Langley's)
- viii. Perfusion of isolated frogs heart — role of Na⁺ K⁺ , Ca⁺
- ix. Decerebrate and spinal frog.

b. Mammalian: (Simulated experiments)

General management of mammalian experiments

- i. Rat/guinea pig ileum : intestinal movement recording
- ii. Isolated rabbit heart perfusion

SCHEME OF EXAMINATION

Maximum marks	Theory	Practicals	Viva- voce	Total
---------------	--------	------------	------------	-------

M.Sc. Physiology examination	300	200	100	600
------------------------------------	-----	-----	-----	-----

A. Theory: The written examination consists of three papers of 100 marks each. Each paper will be of three hours duration.

Each theory paper will consist of:

- Long Essay type questions - 2 X 20 marks= 40
- Short Essay type questions - 4 X 10 marks= 40
- Short answer type questions - 4 X 05 marks= 20

Paper-I:

System	Marks
General physiology	15
Nerve and muscle physiology,	20
Blood and applied aspects	25
cardiovascular physiology	40

Paper-II:

System	Marks
Respiratory physiology	40
Renal Physiology	25
Gastrointestinal physiology	25
Skin and body Temperature	10

Paper -III:

System	Marks
Endocrines physiology	25
Reproductive physiology	20
central nervous system	40
special senses	15

B. Practicals :

Experiments	Marks
Haematology Major + Minor (40+20)	60
Human Physiology	50
Clinical Physiology	30
Amphibian experiments	30
Mammalian experiments	30

C. Viva- voce – 100 marks

- a) The Viva-Voce would be on all components of syllabus including discussion on dissertation - 80marks
- b) Pedagogy - 20 marks

X. Recommended Text, Reference books and Journals (latest edition)

1. Guyton, Text Book of Medical Physiology, 12th edition (2011), Elsevier publication.
2. Ganong, Review of Medical Physiology, 23rd edition (2010), Mc Graw hill publications.
3. Prof Dr G K Pal, Text book of medical physiology, 2nd edition (2015), Ahuja publications.
4. Indu khurana, Medical physiology, 1st edition (2012), Elsevier publications.
5. JB West, Best & Taylor, Physiological basis of Medical Practice, 12th edition (1990), Williams & Wilkins publications.
6. Vernon B Mount Castle, Medical Physiology, 14th edition (1980), vol. I & vol. 2, CV Mosby Company publications.
7. Williams, Text book of Endocrinology, 10th edition (2002), W.B. Saunders publications.
8. Wintrobe, Clinical hematology, 12th edition (2008), Lea Febiger publications.

Journals:

1. Indian Journal of Physiology and Pharmacology, by APPI.
2. Physiological Reviews, By American Physiological Society
3. Annual review of Physiology, By American Physiological Society

SYLLABUS FOR SECOND AND FINAL YEAR
M.Sc (Medical) BIOCHEMISTRY

THEORY SYLLABUS

PAPER – I CHEMISTRY & TECHNIQUES

1. Chromatography: Principle, experimental procedure and applications of paper, thin layer, ion exchange, affinity, gel filtration, gas-liquid, HPLC.
2. Electrophoresis: Principle, experimental procedure and applications of paper, polyacrylamide gel, agarose gel and cellulose acetate.
3. Ultracentrifugation and ultrafiltration.
4. Photometry: Principle and applications of colorimetry, spectrophotometry, fluometry, flame photometry.
5. Isotopes: Detection and measurement of radioactive isotopes. Application of isotopes in research and clinical biochemistry.
6. Ph and buffers: Concept of pH and buffers, Henderson-Hasselbalch equation. Methods of determination of pH.
7. Monoclonal antibodies, hybridoma technology, immunodiffusion, immunoelectrophoresis, radio immuno assay(RIA), enzyme linked immunosorbent assay (ELISA), fluorescent in situ hybridization (FISH) techniques. Immunohistochemistry, Immunocytochemistry, Immunofluorescence and Fluorescence assisted cell sorting
8. Cell fractionation, biochemical activities of different fractions, marker enzymes.
9. DNA sequence determination. Recombinant DNA technique, cloning procedures, vectors, plasmids, phages, cosmids and restriction map and PCR techniques. Southern, Northern, Western blotting procedures. Restriction fragment polymorphism. In-situ hybridization. Genomic library and cDNA library. Transgenic animals and microinjection technique. Gene therapy. Next generation sequencing methodologies.
10. Stem cell technology-Isolation and characterization of stem cells, Maintenance AND DIFFERENTIATION OF STEM CELLS. Preparation of Induced pluripotent stem cells(IPSS). Role of stem cells in disease management.
11. Chemistry of amino acids and proteins: Structure and properties of amino acids. Protein structure and conformation. Methods to determine the amino acid sequence of proteins.

Chemistry of conjugated proteins, nucleoproteins, lipoproteins, immunoglobulins, glycoproteins. Structure-function relationship of proteins-haemoglobin, myoglobin and collagen. Protein-protein interactions.

12. Chemistry of carbohydrates: Monosaccharides, disaccharides, polysaccharides, glycoproteins.
13. Chemistry of lipids: Classification, fatty acids, compound lipids, steroids.
14. Nucleic acids: Chemistry and structure of bases, nucleosides, nucleotides, RNA and DNA, properties of nucleic acids. Mutations, mutagens, carcinogens and in vitro mutagenesis.
15. Immunoglobulins: Classification, structure and functions of immunoglobulins.
16. Bioenergetics and biological oxidation: Concept of free energy change, high energy compounds, ATP generation, redox potential, electron transport chain, oxidative phosphorylation, inhibitors, uncouplers, ionophores.
17. Enzymes; Classification, nomenclature, properties of enzymes, kinetics of enzyme activity, coenzyme and cofactors, mechanism of enzyme action, regulation of enzyme activity, enzyme inhibition, isoenzymes, proenzymes, multienzyme complexes, tandem enzymes. Purification of enzymes from cells, characterization and criteria of purity.
18. Bioinformatics & Biostatistics, Medical ethics
19. Preclinical pharmacology-Types of animals, maintenance, methods of drug administration, pharmacodynamics and pharmacokinetics and animal ethics.

PAPER II – INTERMEDIARY METABOLISM

1. Methods of investigation of metabolic pathways.
2. Carbohydrate metabolism: Digestion and absorption. Glycolysis, TCA cycle, HMP shunt, uronic acid pathway, metabolism of other hexoses. Glycogen metabolism. Gluconeogenesis. Blood glucose homeostasis. Glucose tolerance test. Diabetes Mellitus. Metabolic disorders of carbohydrate metabolism.
3. Amino acid metabolism: Digestion and absorption. Deamination and urea cycle. Metabolic reactions of amino acids. Biosynthesis of non essential amino acids. Metabolism of individual amino acids. One carbon metabolism. Biologically important substances formed from amino acids. Metabolic disorders associated with amino acid metabolism.
4. Lipid metabolism: Digestion and absorption of lipids, transport and storage. Fatty acid

oxidation and fatty acid biosynthesis. Biosynthesis of phospholipids, glycolipids. Metabolism of cholesterol. Metabolism of lipoproteins. Prostaglandins, synthesis and functions. Metabolic disorders associated with lipid metabolism.

5. Integration of metabolism: Hormonal regulation. Metabolism in fed state, fasting state and starvation. Inter organ pathways.
6. Purine and pyrimidine metabolism: Synthesis and degradation of nitrogen bases and nucleotides. Metabolic disorders associated with purine and pyrimidine metabolism.
7. Deregulation of metabolic pathways in disease condition (Diabetes, cancer, Neurodegenerative diseases)
8. Replication: Replication, DNA damage and repair, mutations, amplification of genes, telomeres, inhibitors of replication.
9. Transcription: Transcription, post transcriptional modifications, inhibitors of transcription.
10. Translation: Translation, genetic code, inhibitors of protein biosynthesis.
11. Muscle contraction.

PAPER III – CLINICAL CHEMISTRY & NUTRITION

1. Vitamins: Fat soluble and water soluble Vitamins – chemistry, absorption, transport, active forms, biochemical function, RDA, deficiency manifestations, toxicity.
2. Mineral metabolism: Macrominerals – sodium, potassium, chloride, magnesium, calcium, phosphorus. Trace elements – iron, copper, manganese, zinc, cobalt, molybdenum, selenium, iodine and fluoride.
3. Nutrition: Energy requirements, balanced diet, BMR, SDA, RQ, nitrogen balance, Biological value of protein, nutritional disorders, protein calorie malnutrition, Kwashiorkor and Marasmus, dietary fibres.
4. Membranes: Chemical composition, structure, biological properties, functions, membrane transport systems, ion channels, endocytosis, exocytosis, defects.
5. Endocrinology: Mechanism of action of hormones, hormone receptors, signal transduction, G-proteins, second messengers, cyclic AMP, cyclic GMP, calcium, inositol triphosphate, diacyl glycerol. Biosynthesis of adrenal and thyroid hormones, thyroid and adrenal function tests and disorders.
6. Erythrocytes: Structure, metabolic pathways, haemoglobin, hemoglobinopathies, porphyries, heme biosynthesis and degradation, bilirubin metabolism, jaundice, laboratory findings in jaundice.

7. Composition of plasma in health and disease.
8. Biochemical investigations of liver, kidney and gastric functions, malabsorption disorder, inherited metabolic disorders, abnormal constituents of urine.
9. Cell biology: Cell cycle, regulation, oncogenes, tumor suppressor genes, apoptosis, tumor markers.
10. Reactive oxygen species and defence mechanisms, antioxidants and enzyme systems.
11. Diagnostic enzymology; LDH, CPK, AST, ALT, ALP, ACP, GGT, Amylase, 5'nucleotidase, etc., Cancer Biomarkers
12. Acute phase proteins: Alpha 1 anti trypsin, alpha 2 macroglobulin, haptoglobin, ceruloplasmin etc.,
13. Laboratory management: Accuracy, precision, specificity, sensitivity, percentage error, quality control, precautions in handling hazardous materials.

FINAL MSc (MEDICAL BIOCHEMISTRY) – PRACTICAL SYLLABUS

General Biochemistry Practicals:

1. Estimation of amino acids by ninhydrin method
2. Estimation of protein by Lowry's method
3. Estimation of protein by Folin's method, includes preparation of Folin's reagent
4. Estimation of protein by dye binding method
5. Titration of amino acid, formal titration and pK values
6. Paper chromatography of amino acids
7. Thin layer chromatography of amino acids
8. Paper chromatography of carbohydrates
9. Thin layer chromatography of amino acids
10. Poly acrylamide gel-electrophoresis, molecular weight determination
11. Absorption spectra of phenylalanine, tyrosine and tryptophan
12. Absorption spectra of purines and pyrimidines
13. Estimation of reducing sugars – arsenomolybdate method
14. Estimation of ketohexose – fructose by resorcinol method
15. Estimation of aldohexose – glucose by iodometric method
16. Periodate oxidation of sugars
17. Estimation of amino sugars
18. Saponification number of oil
19. Iodine number of oil
20. Estimation of Vitamin C, titration method and colorimetric method

21. Amylase, effect of substrate, pH and chloride
22. Effect of pH, temperature on trypsin or chymotrypsin by caseinolytic method and determination of K_m value
23. Sephadex gel chromatography of proteins, molecular weight determination
24. Affinity chromatography, blue sepharose and albumin
25. Purification of enzyme: amylase or urease

Clinical Biochemistry Practicals:

1. Estimation of glucose by glucose oxidase method
2. Estimation of glucose by ortho toluidine method
3. Estimation of glucose by Nelson-Somogyi method
4. Estimation of blood glucose by di-nitrosalicylate method
5. Estimation of blood urea
6. Estimation of serum creatinine
7. Estimation of total cholesterol and HDL cholesterol
8. Estimation of serum proteins by BCA method
9. Estimation of total protein, albumin, A/G ratio
10. Estimation of serum calcium
11. Estimation of serum electrolytes by ISE
12. Estimation of serum bilirubin
13. Estimation of serum alkaline phosphatase
14. Estimation of serum aspartate amino transferase
15. Estimation of serum alanine amino transferase
16. Electrophoretic separation of LDH and its isoenzymes
17. Estimation of serum amylase, by Somogyi method
18. Estimation of serum iron and iron binding capacity
19. Separation of proteins by agarose gel electrophoresis
20. Separation of lipoproteins by electrophoresis
21. Estimation of serum triglycerides
22. Calculation of creatinine clearance
23. Estimation of serum cortisol by fluorimetry
24. Calculation of urea clearance
25. Arterial blood Gas analysis
26. Estimation of protein, sugar and chloride in CSF
27. Electrophoresis of normal and abnormal hemoglobins
28. Estimation of glycated haemoglobin by affinity chromatography
29. Estimation of protein in urine
30. Estimation of GGT in serum
31. Estimation of serum lipase
32. Estimation of serum inorganic phosphate
33. Estimation of nucleic acid content by UV-Visible spectrophotometry and determination of purity of the nucleic acids by spectral scanning

34. Estimation of antioxidant activity using (a) FRAP – Ferric reducing antioxidant power and (b) DPPH – 2,2-diphenyl-1-picrylhydrazyl method

35. Isolation of DNA from mammalian tissues using phenol-chloroform method and kit method (Promega/Invitrogen)

36. Design of primers using manual procedures as well as primers3 software

37. DNA amplification using PCR.

Practical Training in Biochemistry: (First half of 2nd year)

Introduction to research methodology and bio statistics. Every postgraduate student should be given an introductory course in research methodology and research techniques. He / she must be taught as to how a research project can be planned and implemented. He / she must also acquire a basic knowledge in the statistical methods and their applications.

Clinical biochemistry laboratory posting:

Student should be trained in collection of samples, carrying out investigations, interpretation, maintenance of records of investigations and quality assurance, including quality control.

VI. Seminars, Journal Clubs

Students of biochemistry are expected to actively participate in the departmental seminars and journal clubs. A record should be maintained for each student and the list of seminars and paper presented in journal club by each student should be presented at the time of University examination. The journal club and the subject seminars shall be held on alternate weeks.

Post graduate students should participate in undergraduate teaching, in theory, practical and tutorials.

Final Exams- at the end of three years in MSc Biochemistry

SCHEME OF EXAMINATION:

Theory consists of 3 papers each of 100 marks : 300 Marks

PAPER – I Chemistry & Techniques

PAPER II – Intermediary metabolism

PAPER III – Clinical Chemistry & Nutrition

Practical conducted for 2 days : 200 Marks

Preparation of standard graph- : 50 marks

Enzyme kinetics	: 50 marks
Antioxidant assay	: 20 marks
Qualitative analysis of urine	: 20marks
Quantitative estimation (single standard)	: 20 marks
Biochemical techniques	: 40 marks
Viva- voce	: 80 Marks
Pedagogy	: 20 marks

RECOMMENDED TEXT BOOKS AND REFERENCE BOOKS

Text Books

1. MURRAY (Robert.K.M), Harpers Illustrated Biochemistry. Published by Lange Medicals
2. D.M.VASUDEVAN and SREEKUMARI.S Textbook of Biochemistry for Medical students, published by Jaypee Medical Publishers, New Delhi
3. CHAMPE, HARVEY & FERRIER. Lippincott's illustrated reviews of Biochemistry. Published by Lippincott, Williams and Wilkins
4. U. SATYANARAYANA Textbook of Biochemistry published by Books and Allied (P) ltd.
5. DEBAJYOTI DAS Biochemistry. Published by Academic publishers.

Reference Books

1. CHATTERJEA & SHINDE. Textbook of Medical Biochemistry. Published by Jaypee Medical Publishers, New Delhi
2. LEHNINGER'S. Principles of Biochemistry. WH Freeman and Company, New York .
3. STRYER (Lubert), Biochemistry Published by Freeman & Co.
4. DEVLIN (Thomas M). Biochemistry with Clinical Correlations. Published by Wiley-Liss, New York.
5. BURTIS (Carl.A) & ASHWOOD (Edward.R) and Bruns (David E.). Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. Published by Saunders.

SYLLABUS FOR 2ND AND FINAL YEAR
M.Sc (Medical) PHARMACOLOGY

I. General principles of pharmacology

- * Principles of pharmacokinetics and pharmacodynamics. *
- Principles of toxicology and treatment of poisoning.

- * Gene based therapy.

II. Systemic pharmacology including recent advances of drug affecting:

1. Autonomic nervous system

- *Neurohumoral transmission

- * Agonists and antagonist of cholinergic and adrenergic systems.

2. Cardiovascular system

- * Cardiac electrophysiology

- * Drugs used in ischemic heart diseases,
Hypertension C.C.F, Arrhythmias and Hyperlipoproteineas

3. Renal function

- * Physiology of urine formation.
- * Diuretics and antidiuretics.

4. Central nervous system

- *Neuro transmission in the central nervous system
- * General anaesthetics
- * Local anaesthetics
- * Sedatives and hypnotics
- * Antiepileptics
- * Analgesics-opioids

non-opioids

- * Psychopharmacological agents

- * Drugs for CNS degenerative disorders and migrane.

5. Gastro intestinal system.

- *Drugs for peptic ulcer
- * Cathartics,
- *Antidiarrhoealagents
- * Emetics and antiemetics.

6. Blood

- *Drugs affecting haemopoeitic system
- *Haematinics, coagulants, anticoagulants, fibrinolytics, antiplatelets

7. Autocoids

- * Histamine and antihistamine
- * 5-HT and its antagonists
- *Eicosanoides

8. Respiratory system

- * Drugs used for bronchial asthma and cough

9. Drugs affecting uterine motility.

- *Oxyocics and tocolytics

10. Heavy metals and chelating agents.

- *Lead, mercury, iron, copper and arsenic

11. Drugs used for immunomodulation.

- *Immunostimulants
- *Immunosuppressants.

11. Hormones and hormone antagonists

- * Hypothalamic and pituitary hormones
- * Thyroids hormones and antithyroid drugs
- * Sex hormones and their antagonists

- *Adrenocorticosteroids and their antagonists
- *Antidiabetic drugs. *Vit D₃

13. Chemotherapy of microbial diseases.

- * Antimicrobial agents – general considerations
- * Antimicrobial agents – O sulfonamides
 - O Quinolones
 - O B-lactam antibiotics
 - O Aminoglycosides
 - O Tetracyclines, chloramphenicol
 - O Macrolide antibiotics
 - O Miscellaneous antibiotics

*Antimycobacterialagents

* Antifungal agents

* Antiviral agents

* Antimalarial agents

*Antiamoebic agents

* Antiprotozoal agents

* Drugs for helminthiasis

14. Chemotherapy of Neoplastic diseases.

15. Miscellaneous topics

- * Basic knowledge about ethics of animal experimentation
- * Preclinical screening for the following:
 - Antihypertensives
 - Analgesics
 - Antiepileptics
 - Antiulcer drugs
 - Antiinflammatory drugs
 - Analgesics, antipyretics
 - antidepressants,

- antianxiety
- antipsychotics,
- Sedatives-hypnotics,
- Muscle relaxants,
- Prokinetic agents/ antiemetics
- Antitussives, /anti-asthma agents
- Local Anaesthetics
- Oxytocics, antifertility agents
- Antidiabetics
- Behavioral pharmacology models and evaluation of drugs affecting learning and memory

* Toxicity studies in animals

- * Clinical trials – phase I, II, III & IV
- * Bioassay: principles and methods.
- * Principles and application of biostatistics
- * Essential drug concepts

*Drug addiction and drug abuse

*Important interactions and their mechanisms

PRACTICAL SYLLABUS FOR M.Sc. PHARMACOLOGY

- Chemical test for alkaloids- atropine, physostigmine, pilocarpine,

Acids- salicylic acid aspirin

Glycosides- digoxin

- Bioassay for(recorded graph discussion): acetyl choline

Histamine

Oxytocin

5-HT

- Screening methods for: antiepileptic agents

Anti inflammatory agents

Motor co-ordination.

- Estimation of antioxidant activity using (a) FRAP – Ferric reducing

antioxidant power and (b) DPPH – 2,2-diphenyl-1-picrylhydrazyl method

EXAMINATION PATTERN

Theory : **Maximum marks for each paper 100**

Paper I, II, III each of three hours duration covering the following topics.

Paper I : general pharmacology, clinical pharmacology,
screening procedures, biostatistics.

Paper II : systemic pharmacology: ANS, CNS, CVS, GIT,
Haemopoietic, renal and respiratory systems,
autocoids, (including recent advances)

paper III : Systemic pharmacology: Chemotherapy, Immunotherapy,
Endocrines and Miscellaneous topics. (including recent
advances)

B. Practical Examination (Total 200 marks)

PRACTICAL EXERCISE	MARKS
EXPERIMENTAL PHARMACOLOGY I:	
Bioassay	20
EXPERIMENTAL PHARMACOLOGY II:	
a) Graphs- Interpret the given graph	20
b) i) Techniques demonstration and short procedure	20
ii) Screening methods and instruments	20
c) Chemical testing	10
CLINICAL PHARMACOLOGY I:	
Clinical Problems	20
Prescription audit	10
CLINICAL PHARMACOLOGY II:	
Clinical trial Protocol writing	20
PK Problems	20
Journal Criticism	20
Drug stations	10
Therapeutic Guidelines presentation	10
TOTAL	200

WEIGHTAGE OF MARKS IN EACH PAPER

Paper I

TOPIC	WEIGHTAGE
General Pharmacology	40%
Bio statistics	20%
Clinical Pharmacology	20%
Screening procedures	20%

Paper II

	60
Autonomic Nervous system	20%
Central Nervous system	10%

Cardio vascular system	20%
Respiratory system	10%
Gastro intestinal Systems, l system	10%
Haemopoietic system	10%
Autocoids	10%

Paper III

Endocrine system	30%
Antimicrobial agents	40%
Cancer Chemotherapy	20%
Immunotherapy	10%

B. Practical Examination (Total 200 marks)	
PRACTICAL EXERCISE	MARKS
EXPERIMENTAL PHARMACOLOGY :	
a) Bioassay	20
b) Graphs- Interpret the given graph	20
c) i) Techniques demonstration and short procedure	20
ii) Demonstration of instrument	20
d) Chemical testing	20
e) PK Problems	20
	20
f) Journal Criticism	20
g) Drug stations	
Screening methods	20
Dosage forms of drugs	20
TOTAL	200
Pedagogy	20
Grand viva including discussion on dissertation	80

BOOKS RECOMMENDED:

Sl.no	Title of the book	edition	Author(s)
01	Pharmacology and Pharmacotherapeutics	25	R.S.Satoskar. S.B.Bhandarkar S.S.Anipure H.R.Satoskar
02	Essentials of medical Pharmacology	7	K.D. Tripathi
03	Goodman & Gillman's The pharmacological basis Of therapeutics	13	Joel G.Harman Lee E. Limbird Raymond W. Ruddon Perry B. Molinoff
04	Basic and clinical pharmacology	13	Bertram G. Katzung
05	Pharmacology	8	H.P. Rang M.M. Dale J.M. Ritter
06	Clinical pharmacology	8	D. R. Lawrence Benett
07	Screening Methods in Pharmacology	Year-2016	Robert turner
08	Evaluation of Drug Activities Pharmacometrics Vol. 1&2	Year-2011	D.R. Lawrence A.L. Bacharach
09	Fundamental of Pharmacology	6	M.N.Ghosh

10	Pharmacological experiment on Isolated tissue	25	L.M. Perry
11	Pharmacological experiment on	recent	W.L.M. Perry

	Intact preparations		
12	artindale, The complete drug reference	32	Kathleen Parfit
13	A.M.A Drug evaluation	6	merican Medical association
14	Remington's Pharmaceutical sciences	22	Alfanzo R. Gennaro
15	Annual Review of Pharmacology Toxicology	Year-1988	
16	Avery's drug treatment	4	Spfight Holford
17	Selected topics in Experimental Pharmacology	Year-1972	U.K.Seth N.K. Dadkar Usha G. Kamat

SYLLABUS FOR 2ND AND FINAL YEAR
M.Sc (Medical) MICROBIOLOGY

GENERAL MICROBIOLOGY

1. History and Pioneers in Microbiology
2. Microscopy.
3. Morphology of bacteria and other microorganisms.
4. Nomenclature and classification of microbes.
5. Growth and nutrition of bacteria.
6. Bacterial metabolism.
7. Sterilization and disinfection.
8. Bacterial toxins.
9. Bacterial antagonism: Bacteriocins.
10. Bacterial genetics and molecular techniques in microbiology
11. Gene cloning.
12. Antibacterial substances used in the treatment of infections
13. Phenotypic and Genotypic Drug resistance mechanisms
14. Bacterial ecology-Normal flora of human body, Hospital environment, Air, Water and Milk.
15. Host parasite relationship.
16. Hospital waste management: Organization for health care waste management (biomedical waste), techniques for treatment and disposal of biomedical waste and regulations on biomedical waste management, 2016

IMMUNOLOGY

1. Normal immune system- Structure, function and cells of immune system
2. Innate immunity.
3. Antigens.
4. Immunoglobulins
5. Complement.
6. Antigen-Antibody reactions.
7. Immune response (Cell mediated immunity, Humoral mediated immunity)
8. Hypersensitivity
9. Immunodeficiency
10. Auto-immunity
11. Immune tolerance
12. Immunology of transplantation.
13. Tumour immunity.
14. Prophylaxis and immunotherapy.
15. Measurement of immunity.

SYSTEMIC BACTERIOLOGY

1. Isolation, description and identification of bacteria.
2. Staphylococcus and Micrococcus: The anaerobic gram positive cocci.
3. Streptococcus and Lactobacillus
4. Neisseria, Branhamella & Moraxella
5. Corynebacterium and other coryniform organisms
6. Bacillus: The Aerobic spore bearing bacilli.
7. Clostridium: The Anaerobic spore bearing bacilli
8. Enterobacteriaceae
9. Vibrios, Aeromonas, Plesiomonas Campylobacter and spirillum
10. Haemophilus and Bordetella
11. Pasteurella and Francisella
12. Brucella
13. Mycobacteria
14. Actinomyces, Nocardia, and Actinobacillus
15. Pseudomonas
16. Spirochaetes
17. Chlamydiae
18. Rickettsiae
19. The bacteroidaceae: Bacteroides, Fusobacterium and leptotrichia
20. Mycoplasmatales: Mycoplasma, Ureaplasma, Acholeplasma
21. Erysipelothrix and listeria
22. Chromobacterium, Flavobacterium, Acinetobacter and Alkaligenes
23. Miscellaneous bacteria

VIROLOGY

1. Nature of viruses
2. Classification of viruses
3. Morphology, virus structure
4. Viral replication
5. The genetics of viruses
6. Pathogenicity of viruses
7. Epidemiology of viral infections
8. Vaccines and Anti viral drugs
9. Bacteriophages
10. Pox viruses
11. Herpes viruses
12. Vesicular viruses
13. Toga viridae
14. Flaviviridae
15. Arena viridae
16. Marburg and Ebola viruses
17. Rubella

18. Orbi viruses
19. Influenza viruses
20. Respiratory diseases: Rhinoviruses, Adenoviruses and Corona viruses
21. Paramyxiviridae
22. Enteroviruses: Polio & other enteric viruses
23. Hepatitis viruses
24. Rabies virus
25. Slow viruses, Prions
26. Human immunodeficiency viruses
27. Oncogenic viruses
28. Tetatogenic virusesand Vaccine preventable neoplasia
29. Viruses of gastroenteritis
30. Hanta virus, Zika virus, SARS

PARASITOLOGY

1. Protozoan parasites of medical importance:
Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Sarcocystis, Cryptosporidium, Babesia, Balantidium etc.
2. **Helminths** : All those medically important heminth belonging to Cestodes, Trematode and Nematode.
Cestode: Diphyllbothrium, Taenia, Echinococcus, Hymenolepis, Dipyllidium, Multiceps etc
Trematode : Schistosoma, Fasciola, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis, etc.,
Nematodes : Trichuris, Trichinella, Strongyloides, Ancylostoma, Ascaris, Enterobius, Filarial worms, Dracunculus, etc.,
Ectoparasites: common arthropods and other vectors (Lice, Ticks, Mites etc)

MYCOLOGY

1. The morphology and reproduction in fungi and antimycotic agents,
2. Classification of fungi,
3. Contaminant and opportunistic fungi
4. Superficial mycotic infections.
5. Fungi causing subcutaneous mycoses.
6. Fungi causing systemic infections.
7. Antifungal susceptibility testing methods

BACTERIOLOGY:

1. Preparation and pouring of media – Nutrient agar, Blood agar, Mac Conkey agar, Sugars, Kligler iron agar, Robertson’s cooked meat, Lowenstein Jensens, Sabouraud’s,

Biochemical media

2. Operation and maintenance of Autoclave, Hot air oven, distillation plant, filters like Seitz and Membrane sterility tests.
3. Washing and sterilization of glassware.
4. Preparation of reagents – oxidase, kovac, etc.,
5. Disposal of contaminated materials.
6. Testing of disinfectants – phenol co efficient test and its use.
7. Quality control of media, reagents etc.,
8. Aseptic practise in lab and safety precautions.
9. Care and maintenance of common laboratory equipments.
10. Preparation of antibiotics discs, performance of Kirby Bauer, Stokes etc., Estimation of minimal inhibitory/bactericidal concentrations by tube/plate dilution methods.
11. Tests for Beta lactamases & detection of Drug resistance in Bacteria (ESBL, Carbapenemase, AmpCetc)
12. Collection of specimens for microbiological investigations.
13. Techniques for Anaerobiosis.
14. Identification of bacteria of medical importance up to species level (except Anaerobes which could be up to generic level.
15. Preparation of stains viz, Grams, Alberts, Capsules, Spores, ZiehlNeelsens etc., and performing for staining.
16. Care and operation of microscopes viz., Light microscope, Dark ground, Phase contrast and Fluroscnt microscope, (Electron microscope).
17. Handling and uses of laboratory animals
18. Stock culture maintenance and laboratory inventory
19. Sero grouping to Streptococci.
- 20 Antibiotic susceptibility testing for Mycobacteria.

IMMUNOLOGY

1. Collection and preservation of serum.
2. Preparation of antigens.
4. Performance of common serological tests.
5. Immuno electrophoresis
6. Immunodiffusion and CIEP.
7. ELISA
8. CD4, CD8 counts.
9. CLIA

MYCOLOGY

1. Collection and processing of clinical specimens for fungi.
2. Special techniques like Woods lamp examination, hair baiting techniques, slide cultures.
3. Stock culture maintenance.
4. Antifungal susceptibility testing

PARASITOLOGY

1. Examination of faeces for ova and cysts: Direct and concentration methods.
2. Egg counting techniques.
3. Examination of peripheral blood, urine, CSF, and other fluids for parasites.
4. Examination and identification of histopathology slides for parasitic infection.
5. Serological test for parasitic diseases.
6. Preservation of parasites.
- 63
7. Permanent staining techniques for parasites.

VIROLOGY

2. Serological tests for viral infections
3. Laboratory diagnosis for AIDS
4. Laboratory diagnosis of Hepatitis.
5. Prevention and laboratory safety measures.

Molecular Methods

1. PCR
2. Gel electrophoresis and documentation
3. RFLP

METHODS OF TRAINING

Training is given under the following heading:

1. Seminars.
2. Journal clubs.
3. Animal experiments- Handling and uses
4. Culture seminars.
5. Symposia.
6. Slide seminars.
7. Serological tests.
8. Dissertation
9. Maintenance of record book.
10. Guest lectures/Conferences/Workshops/CME.

Each candidate is posted to different sections in the department on rotation. They will be acquainted with the basic microbiology for first three months.

Final Exams- at the end of three years in MSc Microbiology

(As per University regulations)

SCHEME OF EXAMINATION:

Theory consists of 3 papers each of 100 marks : 300 Marks

Practical conducted for 2 days : 200 Marks

Viva- voce : 100 Marks

Details of distribution of topics for each paper will be as follows:

PAPER I - General microbiology and Immunology.

PAPER II - Systemic Bacteriology and Parasitology.

PAPER III - Mycology and Virology

PRACTICALS

Duration of examination: 2 days(as per the scheme given below) Marks: 200

The examination will consists of the following exercises conjointly conducted andevaluated by examiners (1 internals and 1 externals)

1. Exercise in clinical bacteriology.
2. Isolation and identification of bacteria from various clinical samples.
3. Exercise in bacteriological techniques.
4. Isolation and identification of bacteria from a pure culture.
5. Identification of various fungi, and slide culture.
6. Animal experiments- Handling and uses
7. Exercise in virology techniques.
8. Exercise in Parasitology.
9. Serology exercise in Bacteriology and Virology
10. Applied bacteriological techniques-Staining or Serology exercise
11. Immunology exercise

C. VIVA-VOCE Marks: 100

The Viva-Voce examination consists of question on Bacteriology, Mycology, Virology, Immunology, and Parasitology topics, it will also include recent advances, history and scope of Microbiology.

1. Viva-Voce Examination: 80 Marks
2. Pedagogy: 20 marks

Students will be examined by all the examiners together about comprehension, analytical approach, expression and interpretation of data.

Maximum marks for M.Sc.Microbiology	Theory	Practical	Viva and pedagogy	Grand Total
	300	200	80+20	600

RECOMMENDED BOOKS: (LATEST EDITIONS)

Sl. No.	Title	Author	Publishers
1.	Medical Microbiology	Samuel Baron	Churchill Livingstone Inc
2.	Laboratory Diagnosis of Viral Infections	Edmin H Lennette	Newyork Marcel Dekker, Inc
3.	Manson's Tropical Diseases	Gordon Cook	London, ELBS
4.	Bergey's Manual of Determinative Bacteriology	John G Holt et al Maryland,	Williams & Wilkins
5.	Manual of Clinical Microbiology	Albert Balwows Washington D.C,	American Society for Microbiology
6.	Bailey & Scott's Diagnostic Microbiology	Ellen Jo Baron et al	Missouri, Mosby
7.	Clinical Virology	Douglas D.Richman Newyork,	Churchill Livingstone
8.	Burrows Textbook of Microbiology	Bob A Freeman	W.B.Saunders
9.	Anaerobes in Human Disease	Brian I Duerden &B.S.Drasar Great Britain,	Edward Arnold
10.	Introduction to Diagnostic Microbiology	Elmer W Koneman et al Philadelphia, J.B.	Lippincott Company
11.	Field's Virology Vol.1	Bernards N	Lippincott-

		Fields et al Philadelphia,	Ramen
12.	Field's Virology Vol. 2	Bernards N Fields et al Philadelphia,	Lippincott- Ramen
13.	Medical Microbiology, A guide to Microbial Infections, Pathogenesis, Immunity, Laboratory Diagnosis and control	Daniel London, Churchill, Greenwo od et al	Livingstone
14.	Mackie & McCartney Practical Medical Microbiology	J.G.College et al	London, Churchill Livingstone
15.	Hospital Infections	John V Bennett & Philip S Brachman	Little Brown
16.	Manual of Clinical Laboratory Immunology	Noel R Rose et al	Washington D.C, American Society for Microbiology
17.	Fundamental Immunology	William E Paul	Newyork, Raven Press