



SINGHANIA UNIVERSITY

(Established by the Govt. of Rajasthan & recognized as per section 2f of UGC Act, 1956)
Pacheri Bari, Distt. Jhunjhunu (Rajasthan) - 333515

SINGHANIA UNIVERSITY

SYLLABUS

M.sc M.L.T. (Biochemistry)

Master in Medical Lab Technology (Biochemistry)

Master in Medical Lab Technology (Biochemistry)



M.Sc. (MLT) Biochemistry- scheme and syllabus

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- **Scope and Objective**
- Post Graduate programme in Medical Laboratory Technology –Biochemistry gives
- opportunity for specialized study in the field of Laboratory Technology for BSc (MLT)
- graduates .Candidates who successfully complete MSc (MLT) course may obtain jobs as
- Specialized technologist in Biochemistry or supervisors of clinical
- Laboratories in hospitals.
- Laboratory scientists in Biomedical and research institutes.
- Teachers in training institutes of Medical Laboratory Technology.
- Utilize or apply the concepts, theories and principles of laboratory science.
- Demonstrate the ability to plan an effect the change in laboratory practice and
- Health care delivery system.
- Establish collaborative relationship with members of other disciplines.
- Demonstrate interest in continued learning and research for personal and
- Professional advancement.
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- **Eligibility for admission**
- (a) Candidates who have passed the B.Sc. (MLT) degree of any of the Universities AND other related courses
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- **Duration of the programme**
- Course of study including thesis work shall be for a period of two years.
- **Job Prospects:** The Medical Laboratory Technologists/ technician may be assigned to a specialized area of work in a large medical lab. In small labs, they may perform a variety of tests or all areas of lab work. They can also work as laboratory manager/ consultant/ supervisor, health care administrator, hospital outreach coordinator, laboratory information system analyst/ consultant, educational consultant/ coordinator/ director, health and safety officer etc.



Master in Medical Lab Technology (Biochemistry) M Sc. M.L.T. 1st year

- Human Anatomy & Physiology
- Clinical Biochemistry
- Clinical Pathology
- Clinical Microbiology

- **Practical**
 1. Human Anatomy & Physiology
 2. Clinical Biochemistry
 3. Clinical Pathology
 4. Clinical Microbiology

Master in Medical Lab Technology (Biochemistry)) M Sc. M.L.T1st year

- Advance Instrumentation & Techniques
- Physiology & Nutrition
- Biostatistics & Hospital Management
- General Aspects of Biochemistry

- **Practical**
 1. Advance Instrumentation & Techniques
 2. Physiology & Nutrition
 3. General Aspects of Biochemistry



Master in Medical Lab Technology (Biochemistry) M Sc. M.L.T 2nd year

- Lab Management
- Biochemistry
- Analytical and Physical Biochemistry
- **Practical**
 - 1 Biochemistry
 - 2 Analytical and Physical Biochemistry

Master in Medical Lab Technology (Biochemistry)) M Sc. M.L.T 2nd year

- Molecular Biology
- Enzymology, Metabolism and Inborn Errors of Metabolism
- Vitamins and Hormones
- Advanced biochemistry
- Dissertation & Viva

Practical

1. Molecular Biology
2. Enzymology
3. Diagnostic Microbiology



Master in Medical Lab Technology (Biochemistry) M Sc. M.L.T. 1st year

PAPER:- 1 HUMAN ANATOMY & PHYSIOLOGY

Paramedical Course - Masters

Anatomy

Syllabus:

UNIT-1 **Introduction:** Overview of the structure organization of the human body; anatomical terminology of positions & locations, planes.

Cell: Cell morphology and diversity; introduction to ultra structure and function of cell organelles.

Skeletal Muscles: Major skeletal muscles of the head, neck, thorax, abdomen and upper and lower limbs.

General Osteology: General morphology of bones; structural classification of bones, development and growth of skeletal tissue and bones.

General Astrology: Structural and functional classification of joints; general morphology of a synovial joint and associated structures; movements made available by synovial joints.

Detailed Osteology and Astrology Practical: Naming and identification of osteological features of individual human bones; Bones of Upper limbs – Clavicle, Scapula, Humerus, Radius, Ulna; Lower limbs – Femur, Hip bones, Sacrum, Tibia, Fibula, Ribs, Sternum Vertebral Column. Naming, identification and application of classification to the major joints of the human body; examples of variability in the human skeleton.

UNIT-2 **Cardiovascular System:** Macroscopic features, function and location of the adult and the location of major arteries and veins; macroscopic features of blood vessels including arteries, veins and capillaries; morphological features of the cellular components of blood.

Lymphatic System: Macroscopic features, major function and location of the lymphatic vascular structures, lymph nodes, tonsils and other mucosa-associated lymphatic tissue, spleen and thymus; microscopic anatomy of lymph nodes.

Nervous System: Macroscopic features and major functions of the brain brief structure, location & function of cerebrum, cerebellum & brain stem and spinal cord; morphological features and major function of the contents of the peripheral nervous system and autonomic nervous system.



- Respiratory System:** Macroscopic features and major functions of the nasal cavity, paranasal sinuses, pharynx, larynx, trachea, bronchi, lungs and thoracic wall including the thoracoabdominal diaphragm.
- Digestive System:** Macroscopic features and major functions of the mouth, salivary glands, pharynx, oesophagus, stomach, small and large intestines, liver pancreas, biliary system and peritoneal cavity.
- UNIT-3 **Urinary System:** Macroscopic features, major functions and location of the kidneys, ureters, urinary bladder and the urethra.
- Endocrine System:** Macroscopic features, location and basic function of the hypothalamus, pituitary gland, thyroid gland, parathyroid glands, suprarenal glands, pineal gland and organs with a minor endocrine function.
- Male Reproductive System:** Macroscopic features, Major functions and location of the scrotum, testes, epididymis, ductus deferens, inguinal canal, seminal vesicles, prostate gland, bulbourethral gland and penis.
- Female Reproductive System:** Macroscopic features, major functions and location of the ovaries, uterine tubes, uterus, vagina and external genitalia.
- Special Senses:** Macroscopic features and major functions of the contents of the orbital cavity, the eyeball, lacrimal apparatus, and external, middle and internal ear.
- UNIT-4 **Upper Limb:** Relevant osteology; detailed plain radiographic anatomy of skeletally mature individuals.
- Head and Neck:** Relevant osteology of the skull and cervical vertebrae; surface anatomy, lymphatics major blood vessels and nerves of the head and neck; regional anatomy of the brain and its meninges.
- UNIT-5 **Histology:** macroscopic and microscopic studies of epithelial tissue, general connective tissue, cartilaginous tissue, bone tissue, muscle tissue, nervous tissue and the integument; major functional advantages of each tissue type.

Anatomy Practical:

- Demonstration of bones identification and side determination upper limb-clavicle, scapula, humerus, radius, ulna, lower limb-femur, Hip bone, Tibia, Fibula, Vertebral Column, Ribs, Sternum, Sacrum
- Demonstration of heart.



- Demonstration of different parts of respiratory system and normal X-rays- lungs.
- Demonstration of the part of digestive system and normal X-rays- stomach, small intestine, large intestine, liver.
- Embalming of human cadavers for teaching purposes & social/ funeral embalming.
- Surface anatomy on cadaver.
- Demonstration of major vessels of the body-Aorta, subclavian, carotid, brachial, radial, ulnar, femoral, renal.
- Demonstration of bones & joints of the limb in normal X-ray.
- Demonstration of major muscles of the body-limbs, head & neck.
- Demonstration of other organs—spleen, testis, uterus.
- Histology-General epithelium, connective tissue, gland, bone, cartilage lymphoid tissue

Systemic-Lung, Esophagus, Stomach, Small Intestine, Pancreas, Liver, Kidney, Pitutary Gland, Thyroid, Testis, Ovary.

PARAMEDICAL SYLLABUS – PHYSIOLOGY (M.Sc.)

General Physiology: Cell: Structure and function of a cell, Transport across the cell membrane, Passive Transport: Diffusion (Simple and Facilitated), Osmosis (Osmotic pressure, Tonicity), Active transport: Primary (Na^+K^+ ATPase), Secondary, Carrier type (Uniporters, Symporters, Antiporters), Vesicular (Endocytosis and Exocytosis), Tissues: Definition and classification (Epithelial, Connective, Muscular, Nervous), Body water and body fluids: Distribution of total body water, Ionic composition of body fluids, Concept of pH and H^+ concentration. The Membrane Potentials: Resting membrane potentials (Genesis & function), Action Potential

Blood: Composition and functions of blood, Hemoglobin (Normal values and time), Blood Cells: RBCs, WBCs, Platelets (Development, structure and functions), Coagulation of blood and bleeding disorders, Haemophilia, Purpura, Blood groups (ABO, Rh) Uses, Lymphoid tissues (types) and immunity, Immune system (Natural and Acquired), Applied: Anaemia (Types), Jaundice, Hemophilia

Gastrointestinal Tract: Organization of structure of GIT, Functions of digestive system, Innervation of GIT (Enteric Nervous System). Mouth (Oral Cavity): Boundaries, Tongue, Teeth, Composition and functions of saliva, Mastication (chewing), Swallowing (Deglutition) Stages. Stomach: Structure, Functions of stomach and innervation, Composition and functions of gastric juice, Regulation of secretion of gastric juice, Gastric motility and emptying. Pancreas: Structure, Nerve supply, , Composition, functions and regulation of secretion of pancreatic juice. Liver: Structure, Functions and Liver function tests Bile: Composition, functions and control of secretion. Gall Bladder: Functions of gall



bladder. Small Intestine: Intestine juice, Digestion and movements. Large Intestine: Structure, movements, absorption and secretion, dietary fibers. Digestion and absorption in GIT: Digestion and absorption of carbohydrates, lipids and proteins. Food and nutrition: constituents of a normal diet, Balanced diet, Applied aspect (Deficiency diseases, Kwashiorkor, Marasmus)

Respiratory System: Structure and functions of respiratory system, Air Passages: Nose and nasal cavity, pharynx, larynx, tracheobronchial tree, lungs, respiratory membrane, pleura, Properties of gases: Partial Pressure, composition of dry air, Functions of respiratory system: Lung defense mechanism and pulmonary circulation. Mechanics of respiration: Mechanism of breathing (Inspiration and Expiration), Alveolar Surface Tension (Actions of surfactant), Alveolar Ventilation: Dead space (Anatomical and Physiological), Diffusion capacity of lungs (Clinical Significance), Lung volumes and capacities (Static: Tidal Volume, Residual Volume, Vital Capacity, Total Lung capacity; Dynamic: FEV₁, FEV₂, FEV₃, Minute/Pulmonary Ventilation, Maximum Voluntary Ventilation). Transport of gases: Oxygen transport [Carriage of oxygen in blood; Dissolved form & combined with hemoglobin, Carriage of oxygen in the body; In tissues (At rest and during exercise), In lungs]. Carbon-di-oxide transport [Carriage of Carbon-di-oxide in blood; In dissolved form, carbamino form (In plasma and RBCs), as bicarbonate, Carriage of Carbon-dioxide in lungs], Oxygen hemoglobin dissociation curve (Shift to right & Shift to left). Regulation of respiration: Nervous Regulation of respiration [Automatic control via Medullary and Pontine Respiratory centers, Voluntary control of respiration], Genesis of respiration (Inspiration and Expiration), Factors affecting respiration [Chemical and non-chemical stimuli], Chemical Regulation of respiration [Peripheral chemoreceptors (Carotid bodies and Aortic bodies) and Central (Medullary) chemoreceptors]. Physio clinical aspects: Dyspnea, Apnea, Hypoxia

Cardiovascular System: General Cardiac chambers (Valves in the heart, Heart sounds, Pacemaker tissue of the heart), Properties of Cardiac Muscle, Cardiac Cycle, Electrocardiogram (ECG), Circulation: Functions, Pressure changes in vascular system, Organization and functions of vascular system, Distribution of major vessels in the body, Lymphatic system, Regulation of cardiovascular system:, Local (Basic Myogenic tone), Systemic: Chemical, Neural (Autonomic and medullary; Baroreceptors and Chemoreceptors) Heart Rate: Definition, Factors affecting HR and it's control, Cardiac Output: Definition, Distribution and control, Arterial Blood Pressure: Definition, factors affecting and regulation

Excretory System: Anatomy and Physiology of Urinary System, Kidney: Structure, Organization and functions of Glomerulus, Glomerular membrane, Blood supply Functions of kidney: Formation of urine, Regulation of water balance, Regulation of electrolyte balance, Regulation of acid-base balance, Endocrine functions of kidney, Urinary Passages: Ureters, Urinary Bladder (Structure and function, Higher control of micturation)

Endocrine System: Definitions, Control (Neural and endocrine), Characteristics of hormones, Pituitary Gland: Physiological anatomy (Anterior, intermediate and posterior lobe), Anterior Pituitary – Six Hormones (GH, PRL, TSH, ACTH, LH, FSH, Growth Hormone (GH): Control and actions, Applied (Gigantism, Acromegaly, Dwarfism), Prolactin (PRL): Control and actions of PRL, Posterior Pituitary, ADH (Anti diuretic hormone): Control of ADH secretion, Actions of ADH, Applied, Oxytocin: Actions and Control of oxytocin secretion, Intermediate lobe of Pituitary , MSH (Melanocyte stimulating hormone), Thyroid Gland: Physiological anatomy, Types of hormones (T3 and T4), Regulation of thyroid secretion, Actions of thyroid hormone: Calorigenic , On carbohydrate metabolism, On lipid metabolism, On growth and development, Effect on nervous system, Applied (Goiter, Hypothyroidism, Hyperthyroidism), Parathyroid, Calcitonin and Vitamin-D: Role of calcium in metabolic processes, Distribution, Absorption



and fate of calcium in the body, Hormones regulating calcium metabolism (Vitamin-D, PTH, Calcitonin), Applied (Rickets, Osteomalacia & Adult Rickets, Hyperparathyroidism), Adrenal Cortex: Physiological Anatomy of adrenal gland, Regulation of glucocorticoid secretion, Actions of glucocorticoids, Cushing's Syndrome, Mineral corticoids (Aldosterone, Actions of aldosterone, Regulation of aldosterone secretion, Addison's Disease), Sex Hormones, Adrenal Medulla: Physiological Anatomy, Actions of catecholamine's, Actions (CVS, carbohydrate metabolism, lipid metabolism, BMR, CNS, Eyes, Urinary bladder, skin), Pancreas: Physiological Anatomy, Glucagon, Insulin (Actions), Applied (Diabetes Mellitus; Causes, Signs and symptoms), Thymus and Pineal Gland: Thymus: Functions, immunological role of thymus, Pineal gland: General features, Functions, control

Reproductive System: Physiology of reproduction: Sex determination and sex differentiation, Puberty: Control of onset and stages, reproductive hormones; Gonadotropin (FSH & LH), Male Reproductive System: Testis: Structure and functions, Spermatogenesis, Structure of the sperm, Seminal tract and related glands, supporting structure, seminal fluid (semen), Endocrine functions of testis (Testosterone, Control of testicular activity) Female Reproductive System, Female reproductive tract: Uterus and related structures, ovaries, ovarian hormones (Estrogen, Progesterone and Relax in) , Female Sexual Cycle: Changes in the ovaries and uterus (Menstrual cycle), Vagina and gonadotropin secretion Contraceptive measures

Central Nervous System: Organization and functions of nervous system Brain: Cerebral Hemisphere (Cerebrum), Basal Ganglia, Thalamus, Hypothalamus Brain stem: Midbrain, Pons, Medulla, Reticular formation, Cerebellum Spinal Cord: Structure and functions, Ascending (Sensory) tracts, Motor (Descending) tracts Cerebrospinal Fluid Peripheral Nervous system, Somatic Nervous System: Spinal nerves, Reflexes, Mono and Polysynaptic reflexes, Cranial nerves, Autonomic Nervous system (ANS): Sympathetic and Parasympathetic

Special Senses: The Smell: Olfactory receptors, Olfactory pathway, Physiology of olfaction, The Taste: Taste Receptors (Taste buds), Taste Pathway, Physiology of taste The Ear: Physiological Anatomy (External ear, Middle Ear, Inner ear, Cochlea), Physical Properties of sound, Mechanism of hearing, The Eye: Physiological Anatomy (Sclera, Choroid, Retina, Crystalline lens, photoreceptors), Visual Pathway, Image forming mechanism of eye, Visual Acuity, Visual reflexes, Accommodation, Defects of image forming mechanisms, Lacrimal Apparatus (Lacrimal gland, Lacrimal canaliculi, nasolacrimal duct, tears or Lacrimal fluid)

Skin and Temperature: Structure and function of skin, Temperature Regulation

Practical

Haemoglobinometry

- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups
- Leishman's staining and Differential WBC count
- Determination of packed cell Volume
- Erythrocyte sedimentation rate [ESR]
- Calculation of Blood indices



- Determination of Clotting Time, Bleeding Time

PAPER:- 2 CLINICAL BIOCHEMISTRY

Masters programs (M.Sc.)

Syllabus

1st year:

1) **Cell and Membrane:** Basic structure and function of the cell. Structure of the cell membrane. Functions of the cell membrane Transport through the cell membrane: active, passive, facilitated. Membrane proteins and functions.

2) **Chemistry of Carbohydrates:** definition, classification. Isomerism, optical isomerism, Structural presentation of monosaccharide's, The various chemical reactions of carbohydrates and their derivatives. Disaccharides and polysaccharides.

3) **Chemistry of Lipids:** definition, Classifications, properties , classifications. Fatty acids types and uses, Glycerides, Phospholipids, Glycolipids, Ecosanides, Steroids, Cholestrol, Lipoproteins, Amphipathic lipids and lipid bi layer.

4) **Chemistry of Amino acids and proteins:** definition of amino acids, Classification based on structure, requirement, metabolic fate, solubility, Physical properties of Amino acids, Chemical properties of amino acids. iso electric pH.Non standard amino acids.

Proteins: Definition, Structure, structural classification, Functional classification. Peptide bonds an structural Motifs in protein such as A helix, B pleated sheets etc, Reactions of proteins such as denaturation, heat coagulation, salting out, reaction with acids, reactions with alkali, precipitations by heavy metals, precipitations by organic solvents, precipitation by alkaloid reagents.

5) **Nucleotides and nucleic acids:** Nucleotides, Purines and Pyrimidines. Sugars in nucleotides,



DNA structure, Coiling and packaging of DNA, Histones, Genes and chromosomes.
RNA types and structure of RNA.

6) **Vitamins:** Fat soluble and water soluble vitamins, Uses of Vitamins, Deficiency disorders.

7) **Nutrition:** Diet, calculation of balanced diet, disorders of protein energy malnutrition.

8) **Water and electrolytes,** Acid Base balance: ECF, ICF, Intra cellular and extra cellular electrolytes. Dehydration.

Acidosis, alkalosis, Buffers, Means of maintaining pH.

Practical-Clinical Biochemistry

- Laboratory safety : Fire, chemical, radiation ,handling of biological specimens, waste
- Disposal regulations, workplace hazardous.
- Specimen collection, identification, transport, delivery and preservation.
- Patient preparation for tests.
- Anticoagulants' and preservatives
- Regulations and precautions regarding transport of biological specimens
- Preparation of high quality water
- pH determination
- Preparation of buffers and determination of pH
- Measurement of radioactivity
- Practical's related to solvent extraction, Partition coefficient, Dialysis, Concentration,
- Desalting and Ultracentrifugation.
- Calibration of equipments and laboratory wares.
- Familiarization and usage of Colorimetry, specterophotometry, fluorimetry,
- flame photometry, atomic absorption spectroscopy, nephelometry, osmometry,
- Chemiluminescence, ion selective electrodes, flowcytometry.
- Chromatography : - Paper, Thin layer, Gel filtration, Ion exchange, HPLC, GLC,
- Separation of various sugars, amino acids, lipids, drugs toxins etc. Urine amino gram.
- Electrophoresis: - Paper, Agarose gel, Cellulose acetate, PAGE, SDS-PAGE. Separation
- of serum proteins, lipoproteins, haemoglobin, globin chain and isoenzymes
- Tissue homogenization and cell disruption
- Cell fractionation methods
- Extraction of glycogen and its estimation
- Extraction of protein and its estimation
- Extraction of lipids and estimation of total lipids, glycolipid, phospholipids and cholesterol.



- Determination of saponification number and iodine number from oils
- Estimation of lactic acid and pyruvic acid
- Qualitative analysis of carbohydrate
- Detection of unknown sugars
- Qualitative analysis of proteins
- Isolation of DNA and RNA
- Estimation of DNA and RNA
- Agarose gel electrophoresis of DNA

PAPER:- 3 CLINICAL PATHOLOGY

Examination of Urine - Routine and Special tests

Examination of Stool - Routine and Special tests

Examination of Sputum - Routine and Special tests

Semen examination - Routine and Special tests

Examination of CSF - Routine and Special tests

Examination of various body fluids-Pleural Fluid, Pericardial Fluid, Synovial Fluid, Ascetic Fluid

Various methods of detecting HCG levels

Structure and molecular organization of Chromosomes

Identification of human chromosomes

Karyotyping

- Direct chromosome preparation of Bone Marrow cells

- Culture techniques

Banding techniques

Sex Chromatin bodies

Autoradiography of human chromosomes

Chromosome Identification by image analysis and Quantitative cytochemistry

Clinical Manifestations of chromosome disorders

Anemia and other disorders of Erythropoiesis

Disorders of Leucopoiesis

Homeostasis & its investigations

Investigations of Thrombotic tendency

Laboratory control of Anticoagulant , Thrombotic and platelet therapy

Collection and handling of Blood

All Routine and special Hematological Investigations

Blood and Bone Marrow preparations

Leucoproliferative disorders with special references to Leukemia

Automation in Hematology

Cytochemistry of Leukemic cells

Amniocentesis

Bone marrow transplantation

Application of different Microscopes



Preparations of various Reagents and Stains used in Hematology
Immunophenotyping
Flowcytometry
Molecular techniques in Hematology

Practical Clinical Pathology

- Examination of Urine - Routine and Special tests
- Examination of Stool - Routine and Special tests
- Examination of Sputum - Routine and Special tests
- Semen examination - Routine and Special tests
- Examination of CSF - Routine and Special tests
- Examination of various body fluids-Pleural Fluid, Pericardial Fluid, Synovial Fluid, Ascetic Fluid
- Various methods of detecting HCG levels
- Structure and molecular organization of Chromosomes
- Identification of human chromosomes
- Karyotyping
- Direct chromosome preparation of Bone Marrow cells
- Culture techniques
- Banding techniques
- Sex Chromatin bodies
- Autoradiography of human chromosomes
- Chromosome Identification by image analysis and Quantitative cytochemistry
- Clinical Manifestations of chromosome disorders

- Organization of Histology Laboratory



PAPER:- 4 CLINICAL MICROBIOLOGY

CLINICAL MICROBIOLOGY

THEORY

UNIT I

GENERAL MICROBIOLOGY

- History and Pioneers in microbiology
- Microscopy
- Morphology of bacteria and other microorganism
- Nomenclature and classification of microbes
- Growth and nutrition of bacteria
- Sterilization and disinfection
- Bacterial toxins
- Bacterial genetics
- Antibacterial substances used in the treatment of infection and drug resistance in bacteria
- Bacterial ecology-Normal flora of human body, Hospital environment, Air, Water and Milk

UNIT II

IMMUNOLOGY

- Normal immune system
- Innate immunity and acquired immunity
- Antigens
- Immunoglobulin



- Complement
- Antigen-Antibody reactions
- Cell mediated immunity & humoral immunity
- Hypersensitivity
- Immunodeficiency
- Auto-immunity

UNIT III

SYSTEMIC BACTERIOLOGY

- Isolation, description and identification of bacteria
- Staphylococcus and Micrococcus
- Streptococcus
- Neisseria
- Corynebacterium
- Bacillus: The Aerobic spore bearing bacilli
- Clostridium: The anaerobic spore bearing bacilli
- Enterobacteriaceae
- Vibrios and Campylobacter
- Haemophilus and Bordetella
- Brucella
- Mycobacteria
- Actinomyces and Nocardia
- Pseudomonas
- Spirochaetes
- Chlamydiae



- Rickettsiae
- Mycoplasma & Ureaplasma

UNIT IV

VIROLOGY

- Classification of viruses
- Morphology, Virus structure
- Viral replication
- Pathogenicity of viruses
- Bacteriophages
- Pox viruses
- Herpes viruses
- Arboviruses
- Orthomyxovirus
- paramyxoviruses
- Enteroviruses: Polio & other enteric viruses
- Hepatitis viruses
- Rabies viruses
- Human immunodeficiency viruses



UNIT V

PARASITOLOGY

- Protozoan parasites of medical importance
Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Pneumocystis Carinii
- 2. Helminths: All those medically important helminths belonging to Cestodes, Trematodes and Nematodes
Cestodes: Diphyllbothrium, Taenia, Echinnococcus, Hymenolepis,
Nematodes: Trichuris, Trichinella, Strongyloides, Ancylostoma, Ascaris, Enterobius, Filarial worms, Dracunculus medinensis, etc.

UNIT VI

MYCOLOGY

- The morphology and reproduction in fungi
- Classification of fungi
- Opportinistic fungi
- Superficial mycotic infections
- Fungi causing subcutaneous mycoses
- Fungi causing systemic infections
- Laboratory diagnosis of fungal infections

UNIT VII

CLINICAL MICRO BIOLOGY

- Laboratory diagnosis of Meningitis, Lower respiratory tract infection, Upper respiratory infection, Genital tract infection.
- Gastroenteritis
- Blood stream infection
- Hospital acquired infection and Biomedical waste management



Practical

SKILLS TO ACQUIRE

BACTERIOLOGY

- Aseptic practice in Lab and safety precautions
- Washing and Sterilization of glasswares
- Care and operation of microscopes viz. Dark ground, Phase contrast and Fluorescent microscope,(Electron microscope).
- Operation and maintenance of Autoclave, Hot air oven, Distillation plants, Filters like Sietz and Membrane and sterility test and Testing of disinfectant-Phenol coefficient test and its uses.
- Care and maintenance of common laboratory equipments
- Collection of specimens for Microbiological investigations
- Preparations of stains viz. Grams, Alberts, Capsules, Spores, ZiehlNeelsons,etc and performing of staining
- Preparation and pouring of media- Nutrient agar, Blood agar, Mac Conkey agar, Sugars, Kligler iron agar, Robertson's cooked meat, Lowenstein Jensen, Sabouraud's
- Preparation of reagents-Oxidase, Kovac's, etc
- Identification of bacteria of medical importance upto species level(except Anaerobes which could be upto generic level)
- Preparation of antibiotics discs: performance of Kirby Bauer, Stokes, etc
- Disposal of contaminated materials
 - Quality control of media, reagents, etc.
- Techniques for Anaerobiosis



IMMUNOLOGY

- Collection and preservation of serum.
- Performance of common serological test
- Immuno electrophoresis
- ELISA
- CD4
- Skin test - Mantoux test

MYCOLOGY

- Collection and processing of clinical specimens for fungi.
- Special techniques like Wood lamp examination, hair baiting techniques, slide cultures.
- Stoke cultures maintenance

PARASITOLOGY

- Examination of faeces for ova and cysts: Direct and Concentration method.
- Egg counting techniques.
- Examination of peripheral blood, Urine, CSF, and other fluids for parasites.
- Permanent staining technique for parasites.

VIROLOGY



- Preparation and identification of CPE in various tissue cultures.
- Serological test for viral infections
- Handling of experiment animals and collection of various samples for evidence of viral infections in animals.
 - Laboratory diagnosis of AIDS
 - Laboratory diagnosis of Hepatitis
 - Laboratory diagnosis of Dengue
 - Safety measures

Master in Medical Lab Technology (Biochemistry) M Sc. M.L.T1st year

PAPER :- 5 ADVANCE INSTRUMENTATION & TECHNIQUES

Unit-I

Spectroscopy: Interaction of radiation with matter, emission of radiation. Beer-Lambert relationship, components of a spectrophotometer. UV and vis spectrophotometry. Fluorimetric methods, atomic absorption spectroscopy. Application of different spectroscopic techniques.

Unit-II

Principles of adsorption and partition chromatography. Absorption chromatography, liquid chromatography, Gas liquid chromatography, Ion exchange chromatography, Affinity chromatography and high pressure liquid chromatography. Application of chromatographic techniques in biology.

Unit-III

Dialysis, electrophoresis, immune electrophoresis, isoelectric focusing, isotachopheresis, capillary electrophoresis. Application of electrophoresis in biology. Blot techniques – southern and northern techniques.

Unit-IV

Centrifugation Preparative and analytical centrifuge, sedimentation analysis. Zonal and equilibrium density gradient. Ultracentrifuge. Light, phase contrast, fluorescence and electron microscopy. Flame photometry. Analyzers.

Unit-V

Radioisotopes, nature of radioactivity, type of radioactivity, radioactive decay. Units of



radioactivity. Detection and measurement of radioactivity. Knowledge of proportional scintillation and gamma counters. Autoradiography. Biochemical uses of radio isotopes.

Unit – VI

INSTRUMENTATION

1. Separation of DNA by Agarose Gel Electrophoresis
2. Separation of isoenzymes, lipoproteins by PAGE
3. Separation of amino acids by paper chromatography
4. Separation of amino acids & or carbohydrates by TLC
5. Determination of effect of inhibitor on K_m & V_{max} values
6. Estimation of proteins by Bradford's method
7. estimation of proteins by Folin-Lowry's method
8. Scanning of absorption spectra of color formed in biochemical assay on single beam spectrophotometer.

Practical

- Estimation of biochemistry parameter using autoanalyser, Semiautoanalyzer
- Scanning of absorption spectra of any amino acid on double beam spectrophotometer
- determination of Na^+ & K^+ in blood serum using flame photometer
- Determination of pH of blood and arterial blood gas analysis.
- Estimation of various minerals using Atomic absorption spectrophotometer (AAS).
- Estimation of various hormones, tumor markers by using Chemiluminescence (CLIA)

AND ELISA method.

Recommended Books:

- Biologist, S Guide to Principles and Techniques of Practical Biochemistry, K. Wilson and K.H. Goulding, ELBS edition.
- Principles and Techniques of Biochemistry and Molecular Biology, K. Wilson and J. Walker, Cambridge University Press, Cambridge.
- Introductory Practical Biochemistry, Sawhney, S.K. Singh, R. Narosa Publishing House, New Delhi.

PAPER :-6 PHYSIOLOGY & NUTRITION

General Physiology, Nutrition, Mineral Metabolism and Immunology.

Digestion and absorption of carbohydrates, lipids, proteins. Absorption of minerals and electrolytes.

Respiration: Oxygen transport, oxygen dissociation curves, Carbon dioxide



transport, factors affecting oxygen transport and carbon dioxide transport, oxygen toxicity, free radical formation, anti oxidants.

Blood clotting: Chemistry of blood coagulation and coagulation disorders.

Muscle contraction: Muscle proteins, Muscle energy metabolism, Chemistry of muscle contraction.

Detoxication: Mechanisms of detoxication, oxidation, reduction, hydrolysis, conjugation, detoxication of drugs.

Nutrition: Caloric values of foods, BMR, respiratory quotient, energy requirements, role of carbohydrates, lipids, proteins and amino acids in diet, nitrogen balance, protein energy malnutrition, glycemic index, diet in pregnancy and lactation.

Anemia: aplastic anemia, iron deficiency anemia, megaloblastic anemia, anemia due to blood loss

Mineral metabolism: Metabolism of calcium, phosphorus, magnesium, sodium potassium, chloride, sulphur, iron, copper, iodine, manganese, zinc, molybdenum, cobalt, nickel, chromium, fluorine, selenium.

Immunology: Principles of immunology, antigen, antibodies and their reactions .Immunoglobulins, MHC, Complement system, Interleukins , Interferons and Cytokines.

Cellular immunity, immune responses and cells involved , autoimmunity, immuno deficiency diseases .

Immunological Techniques, MIF, TRC, ELISA, Immuno electrophoresis, double diffusion technique , immunofixation, Immunoassay of enzymes, Nephelometric immunoassay, Chemiluminescence immunoassay western blot , Immunofluorescence and Radio immunoassay.

Preparation,assessment and storage of antisera (polyclonal and monoclonal).

Methods of assesing analytical sensitivity, specificity and standardization.

PRACTICAL –

Bleeding disorders – PT, APTT, TT, Fibrinogen

Estimation of Calcium , Phosphorus, Magnesium, Manganese, Sodium , Potassium,

Chloride, Iron , Copper, Iodine, Zinc, Protein bound iodine

Agglutination reaction, Precipitation reaction, Immunodiffusion, Double diffusion

technique, Immuno electrophoresis, Immunofixation, Migration inhibition factor, ELISA,

Nephelometric immunoassays, Chemiluminescence immunoassays, Immunofluorescence,



Western blotting and identification of blot by ELISA technique.

Preparation of antisera and its standardization.

Books Recommended:

1. Biochemistry by Geoffrey L Zubay, Fourth Edition, 1998
2. Fundamentals of Biochemistry by Donald Voet, Judith Voet and Pratt, second edition, 1995
3. Biochemistry – Lubert Stryer
4. Harper's Biochemistry by Murray et al. Appleton and Lange Publishers, 27th edition, 2006
5. Principles of Biochemistry by Lehninger, Nelson and Cox, fourth edition, W H Freeman and Company, New York, USA, 2005
6. Textbook of Biochemistry by West and Todd, Fourth Edition, 1966
7. Text book of clinical chemistry - Teitz
8. Varley's Practical Clinical Biochemistry by Alan H Gowenlock, published by CBS Publishers and distributors, India Sixth Edition
9. Practical Biochemistry – Wilson & Walker
10. Clinical chemistry – Marshal
11. Clinical Biochemistry Principle and Practice – Praful B Godkar
12. Lecture notes on Clinical chemistry – L.G. Whitby
13. Clinical Chemistry – Kaplan
14. Clinical chemistry in diagnosis and treatment – Philip D Mayne
15. Clinical Chemistry – Michael L Bishop
16. NMS Biochemistry
17. Immunology: Janis Kuby fourth edition, W H Freeman Company, USA (2000)
18. Essential Immunology : Ivan Roitt (Blackwell Science Publishers, UK, 1997)
19. A Hand Book of Practical Immunology: GP Talwar (Vikas Publishing House, 1983)

PAPER :-7 BIostatistics & Hospital Management

Unit-I



Bio-statistics

Introduction and some basic concepts, Sample and Population, Collection, classification and presentation of data, Measures of Central Tendency (Mean, Median, Mode), Measures of Dispersion—Average Deviation, Standard deviation, Binomial, poisson and Normal Distribution, skewness and kurtosis , Tests of significance, Correlation , Regression , χ^2 test , t and p test

Statistical definitions. Random sampling. Testing of hypothesis. Statistical tools for collection, presentation and analysis of data relating to causes and incidence o diseases. Measures of variation. Frequency distribution.

Unit-II

Concept of probability. Laws of probability. Probability distribution. Binomial, normal and chi-square distribution commonly used procedures of test of significance and estimation. Correlation and regression. Test of significance namely Z test, T test, Chi square test, F test. Analysis of variance.

Unit-III

Research statistics pertaining to medical laboratory technology and testing the efficacy of manufacturing drugs medicines and injections or curbing and controlling specific diseases. Statistical analysis of instrumental data and comparison of various biological techniques used in hospitals.

1 Types of Research:

- Basic or fundamental
- Applied
- Clinical Experimental

2 Qualification in Research Methodology

- Open trials – Bias and safeguards against it.
- Double blind, Triple blind studies

Cross over methods

3 Objectivity in Research Methodology



- Instrumental quantification, rationales and fallacies
- Reproducibility
- Scoring methods – Safeguards against subjective bias.

Records, Protocols and analysis

4 Special areas of research

- Clinical
- Experimental
- Histological & morphological
- Histochemical
- Genetic
- Epidemiologic studies

Unit-IV

Health care – an overview. Functions of hospital administration, Modern techniques in hospital management. Challenges and strategies of hospital management. Administrative functions – planning, organizing, staffing, leading and controlling organizational structure, motivation and leadership. Designing health care organization.

Unit-V

Medical record. House-keeping services. Laboratory performance. Management of biomedical waste. **Total patient care** – indoor and outdoor. Nursing and ambulance resources. Evaluation of hospital. services **Quality assurance.** Record reviews and medical audit.

Recommended Books :

Methods in Bio-Statistics for medical students, Mahajan, B.K., Jaypee Brothers Medical Publishers, New Delhi.

PAPER:- 8 GENERAL ASPECTS OF BIOCHEMISTRY

THEORY

UNIT I

CONTENT

1 Role of Medical Laboratory technologists – ethics of laboratory practice. Laboratory safety –



- Common lab accidents their prevention and their first aid. General laboratory layout as Applicable to biochemistry.
- 2 Laboratory glassware and its uses – Types of pipettes, calibration of pipettes, cleaning of glassware.
- 3 Preparation of solutions – units of weights and volume, Calculation of concentration and Methods of expressing concentration of solution. Types of water, their properties, uses and Method of production.
4. Basic and elementary concepts of chemistry and properties of carbohydrates as applicable to the Human body.
- 5 Basic and elementary concepts of chemistry and properties of lipids as applicable to the human body.
- 6 Basic and elementary concepts of chemistry and properties of proteins & amino acids as applicable to the human body.
- 7 Basic and elementary concepts of chemistry and properties of nucleic Acids as applicable to the human body,
- 8 Basic concepts of principles of nutrition and nutrients macro and micro nutrients. Vitamins & Minerals.
Vitamins- Fat soluble vitamins , Water soluble vitamins sources, Biochemical role, RDA, deficiency manifestations
Minerals – Calcium, Phosphorous, Iron, Copper, Zinc, Magnesium, Manganese, Iodine.
- 9 Working Principles and application of photometry, and atomic absorption, Spectrophotometry.
- 10 Fundamental concepts of biophysical phenomena like osmosis, dialysis, colloidal state, viscosity, absorption, osmotic pressure, surface tension and their application in relation to the human body.
- 11 Definition, basic concepts of classification mechanism of action and properties of enzymes, factors influencing enzyme action.
- 12 Definition and basic concepts of acids, bases, indicators and buffer, their application in laboratory.
- 13 Elementary concepts of radioactivity, radioisotopes, their application in medicines and agriculture isotopic dilution analysis, radioactivity counting techniques.
- 14 Working principles Types and applications of Electrophoresis – Paper, Agarose Gel, Cellulose Acetate and PAGE.
- 15 Working principles, types and applications of Chromatography - Paper Chromatography, TLC,
Ion Exchange, Affinity Gel, Filtration, Gas Chromatography and HPLC.
- 16 Working principles, types and application of centrifugation



PRACTICAL EXERCISES:

Uses of Analytical balance, preparation and standard solution,

1. General reactions and identification of carbohydrates glucose, fructose, maltose, lactose and starch.
2. General reaction of proteins, colour reaction and precipitation of proteins- albumin, casein, gelatin, peptone.
3. Acidimetry and alkalimetry
4. pH determination using colorimetric methods and using pH meter.
5. Simple tests for identification of food constituents.
6. Verification of Beer- Lambert Law.
7. Qualitative analysis of milk, egg.
8. Effects of temperature, pH, substrate concentration on enzyme activity.
9. Demonstration on Electrophoresis, Chromatography and Radioactivity Counting.

TEXT BOOKS RECOMMENDED

Latest editions of the following books:

1. Medical laboratory Procedure Manual (T-M) by K.L. Mukerjee 1987, Vol.I, II & III Tata McGraw Hill Publication.
2. Text book of Medical Biochemistry by Ramakrishna
3. Text Book of Clinical chemistry by Norbert Teitz
4. Principles and Techniques of Practical Biochemistry by Wilson and Walker.
5. Clinical Chemistry - Principle and techniques by Rj Henry, Harper & Row Publishers.
6. Text Book Biochemistry by Vasudevan and SreeKumari.

Master in Medical Lab Technology (Biochemistry) M Sc. M.L.T 2nd year

PAPER :- 1 LAB MANAGEMENT

Unit 1 Pathological clinics

Ethics of the pathological clinics

Unit II Pathology laboratory,

Organization to a pathology laboratory under board of quality control.

Unit III Development

Personality development and patient relationship.

Unit IV Reports writing



Pathology reports writing

Unit V: Computer application

Computer application in pathological clinics.

Unit VI : Accountancy

Accountancy in clinical pathology

Unit VIII Operation ethics

Introduction Operation ethics

Unit IX : Social ethics

Introduction techniques Social ethics of pathology

Unit X: Instruments

Proper handling to instruments

Unit XI: Administration of Laborites

Unit XII: Operation Hazardous compound

Chemical solvent poisons isotopes, explosives and Biological strains

Pathological clinics

E Ethics of the pathological clinics

Organization of a pathology laboratory under board of quality control

Personality development and patient relationship

Pathology reports writing

Computer application in pathological clinics

Accountancy in clinical pathology

Hospital Management

Operation ethics



Social ethics of pathology

Proper handling of instruments

Laboratory management and use of computer in laboratory.

Laboratory safety, Personal management, Record keeping, Data analysis.

Applications of

computer in laboratory. Workload analysis

Finance: Budgeting, operational expenses, cost accounting, justification of budget.

Principles, Application and maintenance of Auto analyzers, Blood gas analyzers,

Electrolyte

analyzer, Chemiluminescence.

Reference Book

- **Clinical Lab Management by Williams & Wilkins**

PAPER:- 2 BIOCHEMISTRY

1) Bioenergetics and Biological oxidation: Oxidative phosphorylation, Substrate level phosphorylation, ETC, inhibitors and uncouplers of ETC,

2) Carbohydrate metabolism: Digestion and absorption of carbohydrates, Glycolysis, its regulation, energetics, fate of products, fate of acetyl coA. TCA cycle, its regulation, energetics, enzymes and vitamin co enzymes involved. Gluconeogenesis, Glycogen synthesis, Glycogenolysis, Metabolic disorders of carbohydrate metabolism, Glycogen storage diseases. HMP shunt. Regulation of blood glucose level, Diabetes mellitus.

3) Lipid metabolism: Digestion and assimilation of lipids, Oxidation of fatty acids, β , α , ω Oxidation, Oxidation of unsaturated fatty acids, Fatty acid biosynthesis,



Desaturation of fatty acids, microsomal elongation of fatty acid chain. Ecosonoids, Lipoprotein metabolism, cholesterol metabolism, Metabolism of phospholipids. Integration of metabolism. Ketosis,

4) Protein and Amino acid metabolism: Digestion and absorption and nitrogen balance, Catabolism of amino acids and Ammonia metabolism, deamination, transamination, Urea cycle, metabolism of methionine, cystine, cysteine, phenylalanine, tyrosine, tryptophan, branched chain amino acids, Histidine, proline, arginine, lysine glutamate glutamine, aspartic acid asparagine. Disorders of Amino acid metabolism.

5) Nucleotide metabolism: purine metabolism: de novo synthesis, salvage pathway, Gout, pyrimidine metabolism.

6) Heme metabolism: Heme biosynthesis, Heme catabolism, Billirubin synthesis, Jaundice, porphyria.

7) Mineral metabolism: Iron metabolism, Calcium metabolism, Iodine metabolism, Fluoride metabolism.

8) Xenobiotic metabolism: Cytochrome p450 monooxygenase system, Factors effecting xenobiotic metabolism, Xenobiotic toxicity.

9) Immunology: Antigens, haptens, Antibodies types, structure and classification, development of immunity, hypersensitivity, Autoimmunity, complement system. Vaccines.

PAPER:- 3 Analytical and Physical Biochemistry

1. **Electrolytes:** - Definition, ionization of weak acids, weak bases pH, Henderson, Heisenberg equation

2. **Buffer systems:** -definition, titration curve of weak acids, buffering capacity, physiological buffers, Respiratory and metabolic acidosis and alkalosis.

3. **Law of mass action:** - K_{eq} , activity coefficient.



4. **Osmosis:** - definition, osmotic crisis, transportation across membrane by membrane proteins.
5. **Dialysis:** - definition, purification of proteins on basis of solubility, size, charge and binding affinity.
6. **Definitions** - viscosity, surface tension
7. **Donnan equilibrium** - K_{eq} , membrane hydrolysis.
8. **Biological Oxidation & Bioenergetics:** - protein folding in terms of free energy changes, Entropy, Laws of Thermodynamics useful thermodynamic function for understanding enzymes, Biomedical Importance, Redox Potential, Enzymes Involved
In Oxidation , Reduction,
9. **High energy linkages:** - transport of molecules active and passive, involvement of ATP in biological systems.
10. **Immunoassays : Application To Biochemistry**
 - a. Radio Immuno-Assays (RIA)
 - b. Determination of Hormones by Using Radio Immuno assays (RIA)
 - c. Nonisotopic Immuno Assays
 - d. Homogeneous Enzyme Immuno Assays
 - e. Heterogeneous Enzyme Immuno Assays
 - f. Enzyme Linked Immuno-Sorbant Assay (ELISA)
 - g. Chemiluminescence & Bioluminescence
 - h. Microparticle Enzyme Immuno assay (MEIA)
 - i. Fluorescence Polarization Immuno assay (FPIA)
 - j. Radio Active Energy attenuation (REA) Assays

PRACTICAL-

1. Preparation of Phosphate buffer and determination of pH using Indicator and pH meter
2. Titration of strong and weak acids
3. Preparation of $2/3$ N H_2SO_4



4. Preparation of 0.2 N HCl
5. Preparation of 1N Na₂CO₃
6. Determination of pKa
7. Calibration of laboratory pipette
8. Standardization of Distilled water
9. Standardization of an endpoint reaction method
10. Determination of Hormones by Using Radio Immuno assays (RIA)
11. To perform Direct and Indirect ELISA
12. Demonstration of Osmosis and Dialysis

Master in Medical Lab Technology (Biochemistry) M Sc. M.L.T 2nd year

Paper 4: Molecular biology

Unit-I

Unit structure, types, coiling and super-coiling, topoisomerases, replication, organization of



prokaryotic and eukaryotic genome, highly repetitive, moderately repetitive and unique PNA sequences cot value and satellite DNA. Sequencing of DNA and RNA.

Unit-II

Transcription and translation factors, Types RNA, Genetic Coe, Lac operon, Tryptophan operon, Regulation in eukaryotes, gene amplification, generation of anti-body diversity, reverse transcriptase, institutes of transcription, zinc fingers.

Unit-III

Spontaneous, induced, point and silent mutation. Frame shift mutation. Physical and chemical mutagens, site directed mutagenesis. Significance of mutagenesis, isolation of mutants, DNA repair.

Unit-IV

Recombinant DNA technology – necessary elements, enzymes, vectors. Plasmids, cosmids, bacteriophages, shuttle vector, expression vectors. Genomic barriers, Restriction maps, Genetic engineering and the future.

Unit-V

Genetics in medicine. Hemoglobin and hemoglobinopathies prenatal diagnosis of genetic diseases. Application of DNA technology in medicine. Transgenic organisms, gene therapy therapeutic proteins, vaccines, antibodies, human genome project. POR, RELP, DNA finger printing.

PRACTICAL: Molecular Biology:

- DNA replication, Transcription, Translation, Biosynthesis of proteins.
- Metabolism of Purine & Pyrimidine Nucleotides:
- Biomedical importance of purine & pyrimidine nucleotides, Biosynthesis of purines & pyrimidines, regulation of purine & pyrimidine nucleotides.
- DNA recombinant technology & genetic engineering, Polymerase chain reaction (PCR), regulation of gene expression.
- Isolation of mutant (UV/ NTG / HNO₂ / Dyes) .
- DNA isolation (plasmid & chromosomal).
- Agarose gel electrophoresis for DNA.
- Amplification of DNA / RNA by PCR.
- Restriction analysis of bacterial DNA.
- Study of transformation process.
- Induction of β -galactosidase in *E. coli*.
- Enumeration of bacteriophage.



Recommended Books:

- Outlines o Biochemistry, Conn, E.E., Stumpf, P.K., Bruening G Doi RH, John Wiley and Sons Inc, New York.
- Biochemistry, Styer, L. Freeman, WH and Co, New York.
- Fundamentals of Biochemistry, Voet and Voet Pratt, CW John Wiley and Sons Inc.

Paper:- 5: Enzymology, Metabolism and Inborn Errors of Metabolism.

Enzymology, Metabolism and Inborn Errors of Metabolism.

Enzymes: Classification, co-enzymes, cofactors, mechanisms of enzyme action, factors affecting enzyme action, enzyme kinetics, enzyme inhibition, regulatory enzymes, enzyme immobilization, Clinical enzymology. , Applications of Enzymology

Metabolism: Bioenergetics, free energy, biological oxidations, electron transport, oxidative phosphorylation.

Carbohydrate metabolism: glycolysis, gluconeogenesis, uronic acid pathway, TCA cycle, HMP pathway, glycogen metabolism, galactose metabolism, fructose metabolism, Regulation of blood glucose

Aminoacidmetabolism:Transamination, deamination, oxidative deamination, ammonia transport, urea formation

Metabolism of individual aminoacids

Biosynthesis of catacholamines, melanin formation, Nitrogen balance.

Lipid metabolism: Fatty acid synthesis, fatty acid oxidation, ketogenesis.

Metabolism of triglycerides, phospholipids, sphingolipids, and cholesterol. Lipoprotein metabolism, obesity, fatty liver, lipotropic factors and ketosis, atherosclerosis and coronary heart disease.

Purine,Pyrimidinemetabolism:Biosynthesis of purine and pyrimidine nucleotides.

Degradation of purine and pyrimidine nucleotides.

Hemoglobin metabolism: Heme synthesis, formation of hemoglobin, metabolism of



bilirubin, urobilinogen, and other bile pigments.

Inborn errors of metabolism:

Inborn errors of carbohydrate, amino acid, lipid, purine and pyrimidine, heme and bilirubin metabolism – Defect in protein biosynthesis arising from genetic mutations. Enzyme abnormalities occurring in genetic disorders. The biochemical consequences of a primary enzyme block in a metabolic pathway and the ways in which clinical and pathological signs may be produced. Methods of detecting metabolic disorders. Methods of treatment.

Biological Fluids

- a. Cerebro spinal fluid analysis
- b. Amniotic fluid – Bilirubin, Creatinine, alpha-fetoprotein, Lecithin / Spigomyelin ratio, Palmitate and other tests of foetal lung maturity. Screening for Down syndrome.
- c. Urine Analysis – Normal and abnormal urine composition including abnormal pigments.
- d. Biochemical analysis of Peritoneal fluid, Pleural fluid, Synovial fluid, Semen etc.

PRACTICAL –

Study of factors influencing enzyme reaction .

Type of inhibition shown by various inhibitors

Determination of K_m and V_{max} of enzyme.

Determination of activity of clinically important enzymes – Alkaline phosphatase,

Acid phosphatase, AST, ALT, Amylase, Lipase, LDH, CK, G⁶PD, Pyruvate kinase,

Aldolase, 5 α -Nucleotidase, Leucine amino peptidase, Gamma glutamyl trans peptidase,

Choline esterase, Enolase, Isocitrate dehydrogenase, Catalase, various isoenzymes etc.

Estimation and standardization of Glucose, Urea, Cholesterol, Triglycerides,

Phospholipids, Total lipid, Uric acid, Creatine, Creatinine, Ammonia, Ketone bodies,

Glycosylated haemoglobin, Bilirubin, Plasma haemoglobin, Myoglobin

Investigations of Alkaptonuria, Cystinuria, Pentoseuria, Glycogen storage diseases,

Galactosemia.



Estimation of porphyrins and porphobilinogen in urine.

Urine qualitative and quantitative analysis.

Biochemical analysis of CSF, Amniotic fluid, Peritoneal fluid, Pericardial fluid, Pleural fluid, Synovial fluid, Semen etc.

Recommended Books:

- Text book of Biochemistry for medical students. *Author: DM Vasuderam and SreeKumaris*
- A test book of Biochemistry for dental students. *Author: Harbans Lal*
- Harper's Review of Biochemistry. *Author: Marten, Majes, Rodwell, Granner.*

Paper:6: Vitamins and Hormones

Theory

Chemistry and functions of Vitamins and Hormones.

2. Digestion and Absorption of food.

Digestion of Carbohydrates

Digestion of Proteins

Digestion of Lipids

Digestion of Nucleic acids

Absorption of Monosaccharide

Absorption of amino acid, dipeptides and tripeptides

Absorption of Lipids

Absorption of Electrolytes

Absorption of Vitamins

Absorption of Water

3. Respiration

Lung volume and capacities

Internal and external respiration

Transport of oxygen and carbon dioxide

4. Muscle contraction



Sliding filament contractions

The contraction cycle

Excitation-contraction coupling

5. MINERALS AND THEIR ROLE IN NUTRITION

Common mineral salts Source, function and importance

Trace mineral salts - Source, function and importance

6. NUTRITION IN HEALTH AND DISEASE

Balanced diet-Regulations of food intake and energy storage.

Disorder of nutrition-Malnutrition, malabsorption, obesity, starvation, deficiency diseases

7. DETOXIFICATION

Pathways of metabolism.

Drug Biotransformation

8. ANTIBIOTICS

Introduction- Nomenclature & General characteristics

Classification & Mechanism of Action

Antibacterial antibiotics-Penicillin, Tetracycline, Cephalosporin & Sulphonamides

Antifungal antibiotics-Griseofulvin & Nystatin

Antiviral antibiotics & Interferons

9. NITROGEN FIXATION

Mechanism of nitrogen fixation.

Symbiotic nitrogen fixation.

Non-symbiotic nitrogen fixation.

Genetic Basis of Nitrogen Fixation

10. FERMENTATION

Types of fermentation.

Pathway of fermentation.

Anaerobic fermentation.

Enzymes as fermentation products.

Vitamins and Hormones

Vitamins: Classification of vitamins.

Chemistry, properties, biological importance and deficiency manifestations of fat



soluble vitamins.

Chemistry, properties, biological importance, deficiency manifestations and coenzyme functions of water soluble vitamins.

Hormones: Classification of hormones, mechanism of hormone action, regulation of hormone secretion.

Chemistry, metabolism, biological functions and disorders of-

- Hypothalamus & Pituitary hormones
- Thyroid hormones
- Parathyroid hormones
- Pancreatic hormones
- Adrenal hormones
- Gonadal hormones

PRACTICAL – VITAMINS

Estimation of vitamin A,C,E from serum and metabolites of vitamins in urine.

Analysis of various hormones related to biological functions and disorders of Hypothalamus, Pituitary, Thyroid, Parathyroid, Pancreatic, Adrenal, Gonads etc.

Estimation of hormone metabolites in urine – 17- ketosteroid, 17- ketogenic steroid,VMA, 5-HIAA, Urinary estriol etc.

, HORMONES,

1. Determination of bicarbonate
2. Estimation of total and differential proteins
3. Estimation of Electrolytes
4. Estimation of hormones:
 - a. T3
 - b. T4
 - c. TSH
 - d. LH
 - e. FSH



- f. Prolactin
- g. Testosterone – total and free
- h. Catecholamines
- 5. To determine Vitamin D3
- 6. To determine Vitamin B12
- 7. To determine serum Calcium

Paper :- 7: BIOCHEMISTRY

1) **Genetics:** The basics of genetics, Genetics code, The concept of gene, Mutations types and consequences, Transcription. Translation in eukaryotes, post transcriptional and post translational processing and modification, Inhibitors of protein synthesis. Regulation of gene expression, Lac operon, Tryptophan operon.

Recombinant DNA and other DNA based technologies and their uses: Blotting techniques, PCR, Formation of recombinant DNA, Cloning of DNA, DNA sequencing, Micro satellite repeats and DNA finger printing, Genetic diseases and Gene therapy.

2) **Cancer** , cancer markers, Cell cycle and apoptosis: Cell homeostasis and cell cycle. Regulation of cell cycle, Cell apoptosis, Tumor benign and malignant, Oncogenes and proto oncogenes, Etiology of cancer and chemical carcinogens, Anti cancer drugs and approaches.

3) **hormones:** Types, Target cells or organs, Hormone receptors. Synthesis and secretion of hormones, Regulation of hormone secretion, Hormonal disorders, Hypothalamic and pituitary hormones, Thyroid and parathyroid hormones, Pancreatic and GI Hormones, Adrenal hormones and Sex hormones.



4) **Free radical disease**, Disease and antioxidants: Reactive oxygen species (ROS), Generation of ROS, Cellular damage done by ROS, Cellular defense mechanism against oxidative stress, Disease produced by ROS.

5) **Glycoproteins**, Proteoglycans, Extracellular matrix: Collagen, Elastin, Fibrin and Laminin

6) Protein Targeting: Protein sorting and targeting. Role of Golgi apparatus, Signal Hypothesis, Protein targeting to mitochondria, Protein targeting of nucleus, Proximal protein import, Endoplasmic Reticulum and stress.

7) **Enzymology**: Definition, classification, General properties, Enzyme kinetics, Michaelis- Enzyme catalysis, Active site of enzymes, Mechanism of enzyme action, Regulation of catalytic activity , Allosteric enzymes, Covalent modification, Iso enzymes and their role in diagnostics, Plasma enzymes, Unit of enzyme activity, Clinical and diagnostic uses of enzymes.

8) **Electrophoresis:- Definition, General Methodology**

Factors affecting migration of charged particles

Proteins separation by gel Electrophoresis

Isoelectric Focusing

Two Dimensional Electrophoresis

Protein purification and Evaluation total protein, total activity , specific activity , yield ,

purification level

Densitometry

Blot Techniques- Southern & Northern Techniques

Ultracentrifugation , valuable for separating Biomolecules and Determining their masses

Fractionation of Serum Proteins by Agarose Gel Electrophoresis

Fractionation of Lipoproteins by Agarose gel Electrophoresis

Western Blotting Techniques for Detection of proteins Separated by gel Electrophoresis

Practical



1. Separation of Leaf Pigments by Adsorption Chromatography
2. Separation of Amino Acids by Ion – exchange Chromatography
3. Separation of Proteins by Two – dimensional Paper Chromatography
4. Separation of Proteins by Ion- Exchange Chromatography
5. Separation of Amino Acids by Paper Electrophoresis
6. Identification of Sugars in fruit juices by using Thin layer Chromatography
7. Separation of Lipids by Thin layer chromatography
8. Demonstration of principle and procedure of Column chromatography
9. Separation of Serum Proteins SDS –gel Electrophoresis
10. UV Absorption of Proteins & Amino acids
11. Colorimetric Estimation of Inorganic Phosphate
12. Demonstration of principle and use of flame photometer
13. Demonstration of principle and use of Spectrophotometer Protein targeting to mitochondria, Protein targeting of nucleus, Proximal protein import, Endoplasmic Reticulum and stress.

Dissertation

a). Eligibility to be a guide

Shall be a full time teacher in the college or institution he or she is working.

Viva- voce: -

Dissertation



ETHICS IN M.Sc. MLT BIOCHEMISTRY TECHNOLOGY

Introduction: With the advances in science and technology and the increasing needs of the patient, their families and community, there is a concern for the health of the community as a whole. There is a shift to greater accountability to the society. It is therefore absolutely necessary for each and every one involved in the health care delivery to prepare themselves to deal with these problems. Technicians like the other professionals are confronted with many ethical problems.

Standards of professional conduct for technicians are necessary in the public interest to ensure an efficient laboratory service. Every technician should not only be willingly to play his part in giving such a service, but should also avoid any act or omission which would prejudice the giving of the services or impair confidence, in respect, for technician as a body.

To accomplish this and develop human values, it is desired that all the students under go ethical sensitization by lectures or discussion on ethical issues.

Introduction to ethics-

What is ethics?

General introduction to Code of Laboratory Ethics

How to form a value system in one's personal and professional life?

International code of ethics

Ethics of the individual-

Technician relation to his job

Technician in relation to his trade

Technician in relation to medical profession



Technician in relation to his profession

Professional Ethics-

Code of conduct

Confidentiality

Fair trade practice

Handling of prescription

Mal practice and Negligence

Professional vigilance

Research Ethics-

Animal and experimental research/ humanness

Human experimentation

Human volunteer research - informed consent

Clinical trials

Gathering all scientific factors

Gathering all value factors

Identifying areas of value – conflict, setting priorities

Working out criteria towards decision

ICMR/ CPCSEA/ INSA Guidelines for human / animal experimentation

Recommended reading

- Francis C.M., Medical Ethics, 1 Edition, 1993, Jay pee Brothers, New Delhi p189.
- Good Clinical Practices: GOI Guidelines for clinical trials on Pharmaceutical Products in India (www.cdscsco.nic.in)
- INSA Guidelines for care and use of Animals in Research – 2000.
- CPCSEA Guidelines 2001(www.cpcsea.org).

Ethical Guidelines for Biomedical Research on Human Subjects, 2000, ICMR, New DelhiANNEXURE-I



SINGHANIA UNIVERSITY

(Established by the Govt. of Rajasthan & recognized as per section 2f of UGC Act, 1956)
Pacheri Bari, Distt. Jhunjhunu (Rajasthan) - 333515

Waste Category No	Waste Category ** Type	Treatment a Disposal
Category No. 1	Human Anatomical Waste: (human tissues, organs, body parts)	** Options Incineration deep burial
Category No. 2	Animal Waste: (animal tissues, organs, body parts, carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge form hospitals, animal houses)	Incineration deep burial
Category No. 3	Microbiology & Biotechnology Waste: (wastes from laboratory cultures, stocks or specimens or micro-organisms live or attenuated vaccines, human and animal Cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins, dishes and devices used for transfer of cultures)	Local autoclaving / micro waving / incineration.
Category No. 4	Waste sharps: (Needles, syringes, scalpels, blades, glass, etc, that may cause puncture and cuts. This includes both used and unused sharps)	Disinfection (chemical treatment / autoclaving / micro –waving and mutilation / shredding
Category No. 5	Discarded Medicines and Cytotoxic drugs: (wastes comprising of outdated, contaminated and	Incineration / destruction and drugs disposal in secured landfills.



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	discarded medicines)	
Category No. 6	** Solid Waste: (Items contaminated with blood, and body fluids including cotton, dressings, soiled plaster casts, Eners, beddings, other material contaminated with blood)	Incineration Autoclaving / micro waving
Category No. 7	Solid Waste: (Wastes generated form disposable items other than the waste ** sharps such as tubings, catheters, intravenous sets, etc)	Disinfection by chemical treatment, autoclaving / micro-waving and mutilation / shredding
Category No. 8	Liquid Waste: (Waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)	Disinfection by chemical treatment and discharge into drains
Category No. 9	Incineration Ash: (Ash from incineration of any biomedical waste)	Disposal in municipal landfill