

M.Sc. (Medical Lab Technology) (MSCMLT)

SEMESTER I

MSCMLT-101: Human Anatomy & Physiology

Unit I

Cell structure, division & function

Cell organelles

Tissue: Types of tissues and their functions

Skeletal system

Unit II

Digestive system: Physiology and anatomy of mouth, stomach, intestine

Absorption of food and its excretion

Role of Bile in digestion and excretion

Liver function and a brief description of liver and biliary tree

Unit III

Respiratory system: Brief description of larynx, bronchi, lungs

Cardiovascular system: Anatomy and Physiology of heart, arteries and veins

Circulation: Systematic and pulmonary (in brief)

Brief review of chambers

Unit IV

Urinary system: Structure and Function of the Kidney, uterus, bladder, urethra and nephron

Give special emphasis on formation of Urine

Physiology and Anatomy of male and female reproductive organs

Endocrine: Pituitary, thyroid, parathyroid, thymus, adrenals and pancreas

Unit V

Central nervous system: Brain, spinal cord and meninges explain with its functions

Skins: Structure and Functions

Study and give small project on bones and cartilages

HLA system

SEMESTER I

MSCMLT-102: Basic Biochemistry

Bioenergetics, Entropy, Enthalpy & their basic introduction

Concept of free energy, Thermodynamics 1st & 2nd Law.

Carbohydrate: Structure, properties, chemical reactions & functions

Amino Acids: Essential & non Essential amino acids with structure & function

Proteins: Primary, Secondary, tertiary & quaternary (Overview)

Lipids: Structure, Classification & properties

Enzymes: Classification, enzyme action & their mechanism. Enzyme inhibition, Mode of action of chymotrypsin & related enzymes

Nucleic Acids: Structure of Purine & pyrimidine bases

Nucleotide & Nucleosides

DNA & RNA: Structure & Properties

Vitamins

SEMESTER I

MSCMLT-103: Clinical Biochemistry

Unit - I

Carbohydrates: Carbohydrates intermediate metabolism, glycogenesis, glycogenolysis, gluconeogenesis & glycolysis.

TCA, HMP, and its regulations

Disorders of carbohydrates metabolism related to each cycle (inborn error of metabolism)

Unit – II

Proteins: Different metabolic pathway of amino acid

The flow sheet of amino acids oxidation. Transamination, oxidative deamination and pathways leading to acetyl co-A.

Decarboxylation of Amino acids, formation of nitrogenous excretion products. Urea cycle and ammonia excretion.

Unit – III

Lipid: Biosynthesis and oxidation of fatty acids (odd & even number)

Ketone bodies formation and their oxidation

Regulation and inborn error of lipid metabolism

Unit – IV

Biochemical aspects of Hormone: Hormone receptors and intracellular messengers, Adenylate cyclase, protein kinase and phosphodiesterase.

Role of Insulin, glucagons, epinephrine and their mechanism

Various endocrine and regulatory systems mediated by cyclic AMP.

Unit – V

Vitamin: Fat and Water soluble and their deficiency

Mineral metabolism : Minor and Major (Cu, Fe, Ca, Mg & P)

Inborn error of Nucleic acids metabolism

Practical:

Estimation of Protein by Folin's method in a given sample.

Estimation of Glucose / GOD – POD method

Estimation of bilirubin by kit method in a given sample

Estimation of Urea by kit method in a blood / Urine

Total protein test – A:G ratio

Urine Analysis Chemical, Physical, Microscopical

Draw a standard graph of GTT curve.

Demonstration of electrophoresis

Estimation of Sodium & Potassium by flame photometer.

SEMESTER I

MSCMLT-104: Basic Clinical Pathology

Introduction to Histology, the cell, cell Organelles, nucleus, cell division, tissues, fresh & fixed tissues.

Different types of Embedding Viz. Wax, Resin, Cryostat etc. Basic Cytology

Fixation of tissue, different kind of fixatives, simple fixative, compound fixative, formaldehyde,

mercuric chloride, osmium, Picric acid, alcohols, other acids, formaline, buffered formaline, osmic acid, Zenker's soln, Healy's soln, cytological fixatives, nuclear fixatives, fixation of smear etc., decalcification, method of decalcification, assessment of decalcification, soln for decalcification.

Processing of tissue, dehydration, impregnation in the wax, manual and automatic tissue processor, gelatin embedding, celloidin embedding, double embedding, cytological fixatives, preparation of different smears, vaginal, sputum, membrane.

Microtome, instrument, principle, use in section cutting, parts and working of commonly used microtome, different kinds of microtome, rotary, base sledge, sliding, low temperature microtome, cryostat, microtome knives, homing and stropping knives.

Section cutting of paraffin sections, section preparation from frozen sections, fixing of tissue to slide, preparation of celloidin section and fixation. Staining techniques, natural dyes, synthetic dyes, basic and acidic dyes, haematoxylin staining, Pap, Flucker & Conn, methanamine silver nitrate, Ziehl

Neelsen's stain, propylene glycol Sudan technique, Papanicolaou, Harn's alum, Haematoxylin, acridine orange technique.

SEMESTER I

MSCMLT-105: Introductory Biology

Unit I

Living World

Biology & Its Branches; relationships with other sciences; scientific methods in Biology; historical breakthroughs; scope of biology and career options; role of Biology in dispelling myths and misbeliefs; characters of living organisms, (elementary idea of metabolism, transfer of energy at molecular level, open and closed systems, homeostasis, growth and reproduction, adaptation, survival, death).

Origin and evolution of life - theories of evolution; evidence of evolution; sources of variations

(mutation, recombination, genetic drift, migration, natural selection); concept of species; speciation and isolation (geographical and reproductive); origin of species.

Unit II

Diversity of Life

Variety of living organisms, Systematics; need, history and types of classification (artificial, natural, polygenetic); biosystematics; binomial nomenclature; Two kingdom system, Five kingdom System, their merits and demerits, status of bacteria and virus; botanical gardens and herbaria; zoological parks and museums.

Unit III

Cell and Cell Division

Cell as a basic unit of life - discovery of cell, cell theory, cell as a self-contained unit; prokaryotic and eukaryotic cell; unicellular and multicellular organisms; tools and techniques (compound microscope, electron microscope and cell fractionation); Ultrastructure of prokaryotic and eukaryotic cell - cell wall, cell membrane - unit membrane concept (fluid mosaic model); membrane transport; cellular movement (exocytosis, endocytosis); cell organelles and their functions

- nucleus, mitochondria, plastids, endoplasmic reticulum, Golgi complex, lysosomes, lysosomes, microtubules, centriole, vacuole, cytoskeleton, cilia and flagella, ribosomes.

Molecules of cell; inorganic and organic materials - water, salt, mineral ions, carbohydrates,

lipids, amino acids, proteins, nucleotides, nucleic acids (DNA and RNA); Enzymes (Properties, chemical nature and mechanism of action); vitamins, hormones and steroids.

Unit IV

Genetics

Continuity of life - heredity, variation; Mendel's laws of inheritance, chromosomal basis of inheritance; other patterns of inheritance - incomplete dominance, multiple allelism, quantitative inheritance.

Chromosomes - bacterial cell and eukaryotic cell; parallelism between genes and chromosomes; genome, linkage and crossing over; gene mapping; recombination; sex chromosomes; sex determination; sex linked inheritance; mutation and chromosomal aberrations; Human genetics - methods of study, genetic disorders.

DNA as a genetic material - its structure and replication; structure of RNA and its role in protein synthesis; Gene expression - transcription and translation in prokaryotes and eukaryotes; regulation of gene expression, induction and repression - housekeeping genes; nuclear basis of differentiation and development; oncogenes.

Basics of Recombinant DNA technology; cloning; gene bank; DNA fingerprinting; genomics - principles and applications, transgenic plants, animals and microbes.

Unit V

Morphology of Plants and Animals

Morphology - root, stem and leaf, their structure and modification; Inflorescence, flower, fruit, seed and their types; Description of Poaceae, Liliaceae, Fabaceae, Solanaceae, Brassicaceae and Asteraceae.

Morphology of animals - salient features of earthworm, cockroach and rat; tissue systems, structure and function of tissues - epithelial, connective, muscular and nervous.

Practical

1. Study of parts of Compound Microscope
2. Study of mitosis in onion root tip and animal cell (grasshopper)
3. Study of meiosis in onion flower buds, and testis of grasshopper.
4. Study of cyclosis in leaf cell of Hydrilla, or Tradescantia and in Paramecium.
5. Study of cell wall components (cellulose, lignin, suberin and mucilage).
6. Study of mitochondria by staining with a Janus Green.
7. Study of specimens and their identification with reason - Bacteria, Oscillator, Spirogyra, Rhizopus, mushroom/bracket fungi, yeast, liverwort, moss, fern, Pinus, one monocotyledon, one dicotyledon and lichens.
8. Study of characters of specimens and identification with reason - Amoeba, Hydra, Liver - Fluke, Ascaris, Leech, Earthworm, Prawn, Silk moth honey bee, snail, Starfish, Dogfish, Rohu, Frog, Lizards, Pigeon/ any other bird and rabbit/ any other mammal.
9. Study of squamous epithelium, muscle fibres, nerve cells and mammalian blood film through temporary/permanent slides.
10. Study of external morphology of earthworm, cockroach, frog and rat through models.

SEMESTER I

MSCMLT-106: Communication & Soft Skills

UNIT I

Essentials of Grammar:

- Parts of Speech
- Punctuation
- Vocabulary Building

- Phonetics

UNIT II

Office Management:

- Types of Correspondence
- Receipt and Dispatch of Mail
- Filing Systems
- Classification of Mail.
- Role & Function of Correspondence
- MIS
- Managing Computer

UNIT III

Letter & Resume Writing:

- Types of Letters-Formal / Informal
- Importance and Function
- Drafting the Applications
- Elements of Structure
- Preparing the Resume
- Do's & Don'ts of Resume
- Helpful Hints

UNIT IV

Presentation Skills:

- Importance of Presentation Skills
- Capturing Data
- Voice & Picture Integration
- Guidelines to make Presentation Interesting

- Body Language
- Voice Modulation
- Audience Awareness
- Presentation Plan
- Visual Aids
- Forms of Layout
- Styles of Presentation.

UNIT V

Interview Preparation:

- Types of Interview
- Preparing for the Interviews
- Attending the Interview
- Interview Process
- Employers Expectations
- General Etiquette
- Dressing Sense
- Postures & Gestures

UNIT VI

Group Discussion & Presentation:

- Definition
- Process
- Guidelines
- Helpful Expressions
- Evaluation

(Note: Every student shall be given 15 minutes. of presentation time & 45 minutes of discussion on his/ her presentation.)

The student will be evaluated on the basis of :

his / her presentation style

Feedback of Faculty & Students

General Etiquette

Proficiency in Letter Drafting / Interview Preparation

The paper is internal and at least 3 tests will be taken. Best 2 of 3 shall account for final grades (70% Test & 30% Presentation)

SEMESTER I

MSCMLT-107: Practical

Human Anatomy & Physiology - 15 Marks

Basic Biochemistry - 15 Marks

Clinical Biochemistry - 15 Marks

Basic Clinical Pathology - 15 Marks

Introductory Biology - 15 Marks

Internal Assessment - 25 Marks

SEMESTER II

MSCMLT-201: Instrumentation

Unit – I

Mircroscope: Light, phase contrast, interference, fluorescence, polarization and electron microscopy (principle, parts and its application)

Photometry: Basic principal UV-Vis spectrometry and colorimetry instrumentation and its application

Unit – II

Fluorimetry: Principal, Instrumentation and application

Electrophoresis: Principal, types and application (agrose gel electrophoreses, starch gel and polyacrylamide electrophoresis)

Unit – III

Centrifuge: Basic principle, type analytical and preparative centrifuges, different density gradient centrifuge and analytical with its application

Blood analyzer: Principal, instrument and its application

Unit – IV

Microtome: Principal, instruments and its uses.

Incubator, hot air oven and autoclave: Principal, instrument and its application.

Unit – V

Radioactivity: Radioisotopes, half life units, Geeger Mueller counter, gamma counter and scintillation

PH meter (principle types, types of electrodes and application)

Practical:

Verification of Beer's Law

Electrophoresis of protein – native and under denaturing condition.

Separation of sub cellular organelles by different centrifugation

Separation of blood cells by density gradient centrifugation

Handling and management of instruments

Estimation of blood urea creatinine uric acid, calcium and phosphorous

MSCMLT-202: Clinical Haematology

1 Red Blood Cells :

a. Normal morphology count

b. Isolation from whole blood & count

c. Effect on count & morphology of physiochemical parameters & the diseased state

d. Red cell anomalies & their relevance w.r.t normal & diseased state

2 Blood Transfusion :

a. Pre-requisite & the complication of mis-matched transfusion

b. Methods of blood matching

3 White blood cells & platelets;-

a. Morphology count & methods of isolation

b. Effect on count & morphology of cell by the physiochemical parameters , diseased . State & the relevance of condition of the diseases

4 Anaemia's , :

a. Definition (in general) & courses

b. Types of anaemia & their classification

c. Physiochemical , characteristic features & etiology of a plastic anaemia, haemolytic, megaloblastic

d. Clinical features & diagnosis

5 Leukaemia

a. Definition (in general) & their etiology

b. Classification of leukaemia

c. FAB classification

d. Etiologies , physiochemical features of different Type of leukaemia, s with reference to clinical states

e. Diagnosis of different types of leukaemias

6 Coagulation studies ;

General pathways (intrinsic & extrinsic) b. Properties (physiochemical) mode of action of coagulation factors

c. Platelet studies , platelet function tests (for different Coagulation factors) > Effect of promoters & inhibitors at diff steps in coagulation, their solution & mode of action

d. Diseases associated with coagulation disorders , their etiology & characteristics features.

7 Red Cell mass studies ;

a. Chemical method & radioactive methods

b. Red Cell function studies

SEMESTER II

MSCMLT-203: Blood Banking

Reception, labeling and recording of laboratory investigations

Cleaning of glassware, pipettes, E.S.R tubes and counting chambers

Preparation of capillary pipette, distilled water, reagents, buffers

Collection of blood, preparation of blood smear, staining of blood and bone marrow smears.

Measurement of hemoglobin, counting of leucocytes, erythrocytes, platelets and reticulocytes.

Recognition of blood cells in peripheral blood smear

Determination of haematocrite and E.S.R, preparation of haemolysate and determination of alkali resistant hemoglobin,

paper electrophoresis of hemoglobin.

Test for sickle celling, bleeding time, coagulation time, prothrombin time, and kaolin cephalin clotting time.

Abo blood grouping and Rh typing

Performance of direct and indirect coombs test, red cell agglutination test (screening Paul bunnell test).

Preparation for the demonstration of L.E. Cell phenomenon.

Blood donor selection & screening

Blood collection and preservation, principal of clearing and preparing transfusion bottle and tubing sets – preparation and

composition of anticoagulant – preservative solutions.

Transfusion reaction and their investigations

SEMESTER II

MSCMLT-204: Lab Management

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

SEMESTER II

MSCMLT-205: Practical

Instrumentation : 20 Marks

Clinical Haematology : 15 Marks

Blood Banking : 20 Marks

Lab Management : 20 Marks

Internal Assessment : 25 Marks

SEMESTER III

MSCMLT-301: Bacteriology

Unit – I

Introduction, history and scope of microbiology

Contribution of Anatomy Von Leeuwenhook, Louis Pasteur. Alexender Fleming in the development of Microbiology

Morphology and ultrastructure of bacterial cell wall of eubacteria and archaebacteria cell membranes – structure, composition and properties

Unit – II

Bacterial Nutrition: Nutritional groups, common nutritional requirements, growth factors.

Growth of bacteria under extreme conditions: Psychrophiles, thermophiles, halophiles and acidophiles

Bacterial reproduction: Binary fission and endospore formation

Unit – III

Mycoplasmas: General characteristics, structure and reproduction

Cyanobacteria: General characteristics, structure, reproduction and economic importance

Bacterial growth curve, generation time, growth Kinetics – Synchronous, Batch and continuous cultures Measurement of

growth and factors affecting growth.

Unit – IV

Chemical control of microorganisms: Heat, Filtration and radiation

Sterilization of soaps , detergents and dyes.

Chemical control of microorganisms: halogens, phenol and phenolic compounds, heavy metals, alcohols, ethylene oxide, aldehydes and hydrogen peroxide.

Unit – V

Basis of microbial classification. Classification and salient features of bacteria according to Bergey's manual of determinative bacteriology.

Kingdom fungi: Structure, reproduction and classification of fungi

General characteristics and life cycle of : Zygomycetes, Ascomycetes

Basidiomycetes and Deuteromycetes.

SEMESTER II

MSCMLT-302: Virology & Mycology

Unit – I

General morphology and ultra structure of Viruses: Capsids- Helical Symmetry, icosahedral symmetry and complex symmetry.

Envelope: Glycoprotein and matrix protein

Viral genome: their types and structure

Unit – II

Cultivation of Viruses in embryonated eggs, experimental animals and cell culture: primary and secondary cell culture, suspension cell culture and monolayer cell cultures.

Assays of viruses: physical and chemical methods of assays (protein nuclei acid, radioactivity traces, electrons microscopy, plaque method, pock counting method, end point method and infectivity of plant viruses). Serological methods: haemagglutination haemagglutinationinhibition, complement fixation, immunofluorescence assays (IFA) ELISA, RIA.

Unit – III

Plant viruses: Recent advances in classification of plant viruses
Life sciences and other details of TMV and mosaic virus, potato virus X
General idea about cyanophages, actinophages and mycoviruses.

Unit – IV

Bacteriophages: Classification, Morphology and ultrastructure
One step growth curve (Latent period, eclipse period and burst size)
Life cycle: Lytic and Lysogenic cycles of bacteriophages

Unit – V

Animal viruses; classification and nomenclature
Life cycles and other details of DNA viruses: herpes, adeno and SV40
Life cycle and other details of RNA viruses: Retroviruses, oncogenic viruses and lentiviruses (HIV), picorna, ortho myxo and paramyxo.

MyCOLOGY

1. Classification of Fungi
2. Growth and isolation
3. Mycoses (all types)
4. Laboratory diagnosis of mycotic diseases.
5. Immunity in fungal diseases and value of immuno diagnosis.
6. Role of mycotoxin
7. Antifungal agents
8. Epidemiology of fungal diseases.

MSCMLT-303: Parasitology

Unit I

- (i) General principle of host parasite interaction and definitions of terms in this connection.
- (ii) Classification of the parasitic protozoans.
- (iii) Introduction to parasite host and Vectors. Morphology, life cycle and lab diagnosis of E-coli, Trichomonas and Leishmania.

Unit II

- (i) Classification of parasitic helminthes.
- (ii) Morphology, life cycle and lab diagnosis of malarial parasite.
- (iii) Morphology, life cycle and lab diagnosis of Ascaries and Taenia.

SEMESTER II

MSCMLT-304: Diagnostic Microbiology

1 Classification of bacteria

On bacilli of differential staining Gram, s Stain .(its modification) ZN .Stain (its modification)

B) On basis of their structure

2 Pre -remit of sample collections-general & disease specific their processing & storage

3 Identification of bacteria on basis of cultural characteristics ,morphological , & serological features.

A) Staphylococcus & streptococcus including pneumococci

B) Family Enterobacterical

C) Haemophilus bordetIIa

D) Corynebacterium

E) Nessleria .Treponema

F) Leptospira ,mycoplasma,chlamydia & Trieagents

4 Identification of pathogenic & nonpathogenic fungi(Morphologically,biochemically

a) Yeast

b) Dermatophytes

c) Cryptococci

d) Histoplasma

e) Nocardia

f) Common lab fungal contaminants

5 Characteristic diagnostic serological tests in diseases : Cholera,Typhoid,Tuberculosis ,VDRL, ,TPHA, Satellitism.ELISA, PCR.

6 Virology

a)General morphology & ultra structure of virus and growth cycles.

b)Viral genome : Their types & symmetry.

c) Cultivation of virus in embryonated eggs, primary culture & secondary culture

d) Assay methods: Physical & chemical

e) Classification

1 On basis of structure

2 On basis of nuclear material

f) Clinical diagnosis serological techniques for identification of bacteria : TMV
Bacteriophages.HIV . SV 40 ,myxo & paramyxovirus

MSCMLT-305: Practical

Bacteriology : 20 Marks

Virology & Mycology : 15 Marks

Parasitology : 20 Marks

Diagnostic Microbiology : 20 Marks

Internal Assessment : 25 Marks

SEMESTER-IV

MSCMLT-401: Immunology

Unit – I

Immune response: Immunity, Type (Innate & adaptive immune response)

Organs of Immune System: Primary and Secondary lymphoid organ

Ontogeny and phylogeny of Lymphocytes: T and B Lymphocytes, Null

Unit – II

Cell of Immune System: Mononuclear cell and granulocytes, Antigen presenting cell.

Antigen, Heptanes: Factors effecting immunogenicity, m epitopes (Properties of it)

Antibodies: Structure , Types and function

Unit – III

Complement System : Role of complement system in immune response, complements and Components and activation pathways.

Monoclonal antibodies: Production characterization and applications in diagnosis, therapy and basic research.

Antigen-Antibody interaction, avidity & affinity measurement.

Unit – IV

Hypersensitivity: Definition, factor causing hypersensitivity

Common hypersensitivity reaction, types, classification based on the time taken for reaction

Auto Immune disease

Unit – V

Immunodiagnosics: Precipitation techniques, Agglutination, Fluorescence techniques

ELISA, RIA

Double diffusion and Immuno-electrophoresis.

Immunodiagnosics: VDRL test, Widal test, RA factor, Blood grouping, Rh typing, Comb's test

SEMESTER IV

MSCMLT-402: Cytology

Cytological Staining

Cytological preparation with special emphasis on MGG, Pap stains

Cytological Fixatives

Cytological Screening

Quality Control in Cytology Lab

Collection of Various cytological specimens

Vagina (All types of smear)

Fluids (CSF, Ascitic, Pleural)

Urine (Millipore method)

Cervical Cytology

Basis of detection of malignant & premalignant testing

Hormonal assessment with cytological techniques, sex chromatin & Pregnancy test

Aspiration cytology principles, indications & utility of the techniques with special emphasis on role of

cyto-technician in FNAC System

SEMESTER IV

MSCMLT-403: Histopathology

Unit – I

Theory of Histopathology, Reception of specimens, Histopathology of Tumor cell

Histopathology of Liver, Kidney, Adrenal, Ovary, Testies

Method of preparing stains & Fixatives.

Unit – II

Theory of Tissue processing and embedding

Theory of H & E staining

Use of Microtome, Tissue section cutting

Unit – III

Embedding and preparation of blocks

Fixation of Tissue with DPX mount

Theory of frozen section preparation

Unit – IV

Preparation of smear for Fine needle aspiration cytology

Pap's smear theory and identification of cells in a normal vaginal smear

Stool examination: normal, abnormal constituent.

Unit – V

Normal and abnormal constituent of Urine

Normal and abnormal constituent of aminotic fluid

Normal and abnormal constituent of Semem analysis

SEMESTER IV

MSCMLT-404: Research Methodology & Techniques

Introduction to Research: Definition, Scope, Limitations, and Types.

Objectives of Research

Research Process

Research Designs

Data Collection: Secondary Data, Primary Data, and Methods of Collection.

Scaling Techniques: Concept, Types, Rating scales & Ranking Scales

Scale Construction Techniques, Multi Dimensional Scaling.

Sampling Designs: Concepts, Types and Techniques

Sample Size Decision

Theory of Estimation and Testing of Hypothesis

Small & Large Sample Tests, Tests of Significance based on t, F, Z test and Chi-Square Test.

Designing Questionnaire.

Interviewing.

Tabulation, Coding, Editing.

Interpretation and Report Writing.

SEMESTER IV

MSCMLT-405: Practical

Immunology : 20 Marks

Cytology : 15 Marks

Histopathology : 20 Marks

Research Methodology & Techniques : 20 Marks

Internal Assessment : 25 Marks