

SINGHANIA UNIVERISITY

RAJASTHAN

DETAILED SYLLABUS

(M.Sc. MLT)

M.Sc.MLT (MEDICAL LAB TECHNOLOGY)

(YEARLY PROGRAMME)

MSc MLT
Detailed Syllabus
(YEARLY PROGRAMME)

Msc.MLT
First Year

s.no	Paper Code	Subject Name	Theory	Practical	Total
1.	MSCMLT-110	HUMAN ANATOMY & PHYSIOLOGY	100	100	200
2	MSCMLT-120	INSTRUMENTATION	100	100	200
3	MSCMLT-130	BIOCHEMISTRY	100	100	200
4	MSCMLT-140	CLINICAL PATHOLOGY	100	100	200
5	MSCMLT-150	CLINICAL HAEMATOLOGY	100	100	200
6	MSCMLT-160	BLOOD BANKING	100	100	200
7	MSCMLT-170	LAB MANAGEMENT	100	100	200

Total 1400

Msc.MLT
Second year

s.no	Paper Code	Subject Name	Theory	Practical	Total
1	MSCMLT-210	VIROLOGY & MYCOLOGY	100	100	200
2	MSCMLT-220	PARASIT0LOGY & MICROBIOLOGY	100	100	200
3	MSCMLT-230	BACTERIOLOGY	100	100	200
4	MSCMLT-240	CYTOLOGY & HISTOPATHOLOGY	100	100	200
5	MSCMLT-250	REASERCH METHODOLOGY & TECHNIQUES	100	100	200
6	MSCMLT-260	IMMUNOLOGY	100	100	200

Total 1200

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

INSTRUMENTATION

Unit – I

Microscope: 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 (agarose 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

BIOCHEMISTRY

Part A 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

Part B Clinical Biochemistry

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)

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.

Lipid: Biosynthesis and oxidation of fatty acids (odd & even number)
Ketone bodies formation and their oxidation
Regulation and inborn error of lipid metabolism

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.

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.

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, sample 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, honing 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, Papanicolaou & Conn, methanamine silver nitrate, Ziehl

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

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) & causes
- 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. Diagonosis 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 coaguation, their solution & mode of action.
- d. Diseases associated with coagulation disorders ,their etology & characteristics features.
- 7 Red Cell mass studies ;
- a. Chemical method & radioactive methods
- b. Red Cell function studies

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, preperation 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

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

Practical

Instrumentation
 Clinical Haematology
 Blood Banking
 Lab Management
 Internal Assessment

Second Year

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.

PARASITOLOGY & MICROBIOLOGY

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 Ecoli, 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.

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 pneumonococci

B) Family Enterobacterical

C) Haemophilus bordetlla

D) Corynebacterium

E) Nessieria .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 Uerology

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 basic of structure

2 On basic of nuclear material

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

Practical

Bacteriology : 20 Marks

Virology & Mycology : 15 Marks

Parasitology : 20 Marks

Diagnostic Microbiology : 20 Marks

Internal Assessment : 25 Marks

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.

CYTOLOGY & HISTOPATHOLOGY

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

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

REASERCH 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.

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.

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