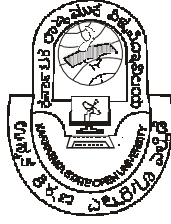


**MNPE-09425068494**



**Karnataka State Open University**

Mysore, Karnataka – 570006

In Association with BSAITM

**Syllabus**  
**For**  
**Master of Sciences Medical**  
**Lab Technology (MSCMLT)**

## MASTER OF SCIENCE –MADICAL LAB TECHNOLOGY

### Year-I

CODE	SUBJECT	CREDITS
MMLT-011	Human Anatomy and Physiology	4
MMLT-012	Basics of Biochemistry and Instrumentation	4
MMLT-013	Introductory Biology	4
MMLT-014	General Microbiology	4
MMLT-015	Basics of Haematology	4
MMLT-016	Lab Management and Ethics	4
MMLT-017	Communication Skills	4
Total		28

### Year-II

CODE	SUBJECT	CREDITS
MMLT-021	Clinical Biochemistry	4
MMLT-022	Clinical Haematology and Blood Banking	4
MMLT-023	Diagnostic Microbiology	4
MMLT-024	Immunology	4
MMLT-025	Cytology & Histopathology	4
MMLT-026	Research Methodology	4
MMLT-027	Project	4
Total		28

## Detailed Syllabus

Year-I

MMLT-011 Human Anatomy and Physiology

Section-1 Human Anatomy & Physiology

Unit-1 Cell structure, division & function

Unit-2 Cell organelles

Unit-3 Tissue: Types of tissues and their functions

Unit-4 Skeletal system

Section-2 Digestive system

Unit-5 Physiology and anatomy of mouth, stomach, intestine

Unit-6 Absorption of food and its excretion

Unit-7 Role of Bile in digestion and excretion

Unit-8 Liver function and a brief description of liver and biliary tree

Section-3 Respiratory system

Unit-9 Brief description of larynx, bronchi, lungs

Unit-10 Cardiovascular system: Anatomy and Physiology of heart, arteries and veins

Unit-11 Circulation: Systematic and pulmonary (in brief)

Unit-12 Brief review of chamber

Section-4 Urinary system

Unit-13 Structure and Function of the Kidney, uterus, bladder, urethra and nephron

Unit-14 Give special emphasis on formation of Urine Physiology and Anatomy of male and female reproductive organs

Unit-15 Endocrine: Pituitary, thyroid, parathyroid, thymus, adrenals and pancreas.

Section-5 Central nervous system

Unit-16 Brain, spinal cord and meninges explain with its functions

Unit-17 Skins: Structure and Functions, Study and give small project on bones and cartilages

Unit-18 HLA system

Reference Books :-

1.Human anatomy & physiology by Elaine Nicpon Marieb, Katja Hoehn

2.Anatomy & Physiology by Elaine Nicpon Marieb, Katja Hoehn

MMLT-012 Basics of Biochemistry and Instrumentation

Section-1 Introduction

Unit-1 Bioenergetics, Entropy, Enthalpy & their basic introduction

Unit-2 Concept of free energy

Unit-3 Thermodynamics 1st & 2nd Law

Section-2 Terms

Unit-4 Carbohydrate Structure

Unit-5 Carbohydrate properties

Unit-6 Carbohydrate chemical reactions & functions

Unit-7 Amino Acids Essential & non Essential amino acids with structure & function

Unit-8 Proteins (Primary, Secondary, tertiary & quaternary overview)

Unit-9 Lipids Structure

Unit-10 Lipids Classification & properties

Unit-11 Enzymes: Classification

Unit-12 Enzyme action & their mechanism

Section-3 Enzyme

Unit-13 Enzyme inhibition

Unit-14 Mode of action of chymotrypsin & related enzymes

Unit-15 Nucleic Acids

Unit-16 Structure of Purine & pyrimidine bases

Unit-17 Nucleotide & Nucleosides

Unit-18 DNA & RNA: Structure & properties, Vitamins.

#### Section-4 Instruments

Unit-19 Microscope Light, phase contrast, interference, fluorescence, polarization and electron microscopy (principle, parts and its application)

Unit-20 Photometry Basic principal UV-Vis spectrometry and colorimetry instrumentation and its application

Unit-21 Fluorimetry Principal, Instrumentation and application

Unit-22 Electrophoresis: Principal, types and application ( agarose gel electrophoreses, starch gel and Polyacrylamide electrophoresis).

#### Section-5 Centrifuge

Unit-23 Basic principle

Unit-24 Type analytical and preparative centrifuges, different density gradient centrifuge and analytical with its application

Unit-25 Blood analyzer: Principal, instrument and its application.

#### Section-6 Microtome

Unit-26 Microtome Principal

Unit-27 Instruments and its uses

Unit-28 Incubator, hot air oven and autoclave: Principal, instrument and its application

#### Section-7 Radioactivity

Unit-29 Radioisotopes, half life units

Unit-30 Geiger Mueller counter, gamma counter and Scintillation

Unit-31 PH meter (principle types, types of electrodes and application)

Reference Books :-

1. Clinical biochemistry: techniques and instrumentation by John S. Varcoe
2. Modern physical methods in biochemistry by Albert Neuberger, Laurens L. M. van Deenen

## MMLT-013 Introductory Biology

### Section-1 Living World

Unit-1 Biology & Its Branches

Unit-2 Relationships with other sciences

Unit-3 Scientific methods in Biology

Unit-4 Historical breakthroughs

Unit-5 Scope of biology and career options

Unit-6 Role of Biology in dispelling myths and misbeliefs

Unit-7 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)

Unit-8 Origin and evolution of life - theories of evolution; evidence of evolution; sources of variations (mutation, recombination, genetic drift, migration, natural selection); concept of species

Unit-9 Speciation and isolation (geographical and reproductive)

Unit-10 Origin of species

### Section-2 Diversity of Life

Unit-11 Variety of living organisms

Unit-12 Systematic; need, history and types of classification (artificial, natural, polygenetic); biosystematics; binomial nomenclature

Unit-13 Two kingdom system, Five kingdom System, their merits and demerits, status of bacteria and virus; botanical gardens and herbaria; zoological parks and museums

### Section-3 Cell and Cell Division

Unit-14 Cell as a basic unit of life - discovery of cell, cell theory, cell as a self - contained unit

Unit-15 Prokaryotic and eukaryotic cell

Unit-16 Unicellular and multicellular organisms; tools and techniques( compound microscope, electron microscope and cell fractionation)

Unit-17 Ultrastructure of prokaryotic and eukaryotic cell - cell wall, cell organelles and their functions- nucleus, mitochondria, plastids, endoplasmic reticulum, Golgi complex, lysosomes, lysosomes, microtubules, centriole, vacuole, cytoskeleton, cilia and flagella, ribosomes.

Unit-18 Molecules of cell; inorganic and organic materials - water, salt, mineral ions, carbohydrates, lipids, amino acids, proteins, nucleotides, nucleic acids (DNA and RNA)

Unit-19 Enzymes (Properties, chemical nature and mechanism of action); vitamins, hormones and steroids

#### Section-4 Genetics

Unit-20 Continuity of life - heredity, variation

Unit-21 Mendel's laws of inheritance, chromosomal basis of inheritance

Unit-22 Other patterns of inheritance - incomplete dominance, multiple allelism, quantitative inheritance

Unit-23 Chromosomes - bacterial cell and eukaryotic cell

Unit-24 Parallelism between genes and chromosomes

Unit-25 Genome, linkage and crossing over

Unit-26 Gene mapping recombination, sex chromosomes, sex determination, sex linked inheritance, mutation and chromosomal aberrations

Unit-27 Human genetics - methods of study, genetic disorders

Unit-28 DNA as a genetic material - its structure and replication; structure of RNA and its role in protein synthesis

Unit-29 Gene expression - transcription and translation in prokaryotes and eukaryotes; regulation of gene expression, induction and repression - housekeeping genes; nuclear basis of differentiation and development; oncoenes. Basics of Recombinant DNA technology; cloning; gene bank

Unit-30 DNA fingerprinting; genomics - principles and applications, transgenic plants, animals and microbes

#### Section-5 Morphology of Plants and Animal

Unit-31 Morphology - root, stem and leaf, their structure and modification

Unit-32 Inflorescence, flower, fruit, seed and their types; Description of Poaceae, Liliaceae, Fabaceae, Solanaceae, Brassicaceae and Asteraceae

Unit-33 Morphology of animals - salient features of earthworm, cockroach and rat

Unit-34 Tissue systems, structure and function of tissues - epithelial, connective, muscular and nervous.

## MMLT-014 General Microbiology

### Section-1 Classification of bacteria

Unit-1 On bacilli of differential staining Gram, s Stain .( its modification ) ZN .Stain ( its modification) On basis of their structure

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

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

### Section-2 Features

Unit-4 Staphylococcus & streptococcus including pneumococci

Unit-5 Family Enterobacteriaceae, Haemophilus bordetella

Unit-6 Corynebacterium, Neisseria

Unit-7 Treponema, Leptospira, mycoplasma, chlamydia & Trichomonads.

### Section-3 Identification of pathogenic & nonpathogenic fungi

Unit-8 Morphologically

Unit-9 Biochemically

Unit-10 Yeast

Unit-11 Dermatophytes

Unit-12 Cryptococci

Unit-13 Histoplasma

Unit-14 Nocardia, Common lab fungal contaminants.

### Section-4 Characteristic diagnostic serological tests in diseases

Unit-15 Cholera



Unit-16 Typhoid

Unit-17 Tuberculosis

Unit-18 VDRL,TPHA

Unit-19 Satellitism.ELISA, PCR.

Section-5 Uerology

Unit-20 General morphology & ultra structure of virus and growth cycles

Section-6 Viral genome

Unit-21 Their types & symmetry

Unit-22 Cultivation of virus in embryonated eggs, primary culture & secondary culture

Unit-23 Assay methods: Physical & chemical.

Section-7 Classification

Unit-24 On basic of structure

Unit-25 On basic of nuclear material

Unit-26 Clinical diagnosis serological techniques for identification of bacteria

Unit-27 TMV Bacteriophages.HIV .SV 40 ,myxo & paramyxovirus.

Reference Books :-

1.General Microbiology by Hans Günter Schlegel, C. Zaborosch, M. Kogut

2. General Microbiology by Roger Y. Stanier

MMLT-015 Basics of Haematology

Section-1 Red Blood Cells

Unit-1 Normal morphology count

Unit-2 Isolation from whole blood & count

Unit-3 Effect on count & morphology of physiochemical parameters & the diseased state

Unit-4 Red cell anomalies & their relevance w.r.t normal & diseased state.

#### Section-2 Blood Transfusion

Unit-5 Pre-requisite & the complication of mis-matched transfusion

Unit-6 Methods of blood matching

#### Section-3 White blood cells & platelets

Unit-7 Morphology count & methods of isolation

Unit-8 Effect on count & morphology of cell by the physiochemical parameters, diseased

Unit-9 State & the relevance of condition of the diseases

#### Section-4 Anaemia's

Unit-10 Definition (in general) & courses, types of anaemia & their classification

Unit-11 Physiochemical, characteristic features & etiology of a plastic anaemia, haemolytic, megaloblastic

Unit-12 Clinical features & diagnosis

#### Section-5 Leukaemia

Unit-13 Definition (in general) & their etiology

Unit-14 Classification of leukaemia, FAB classification

Unit-15 Etiologies, physiochemical features of different Type of leukaemias, with reference to clinical states

Unit-16 Diagnosis of different types of leukaemias

#### Section-6 Coagulation studies

Unit-17 General pathways (intrinsic & extrinsic)

Unit-18 Properties ( physiochemical ) mode of action of coagulation factors

Unit-19 Platelet studies

Unit-20 Platelet function tests ( for different Coagulation factors )

Unit-21 Effect of promoters & inhibitors at different steps in coagulation, their solution & mode of action

Unit-22 Diseases associated with coagulation disorders, their etiology & characteristics Features.

Section-7 Red Cell mass studies

Unit-23 Chemical method & radioactive methods

Unit-24 Red Cell function studies

Reference Books :-

1. Haematology at a Glance by Atul B. Mehta, Victor Hoffbrand
2. A beginner's guide to blood cells by Barbara J. Bain

MMLT-016 Lab Management and Ethics

Section-1 Lab Management

Unit-1 Ethics of the pathological clinics

Unit-2 Organization of a pathology laboratory under board of quality control

Unit-3 Personality development and patient relationship

Unit-4 Pathology reports writing Computer application in pathological clinics

Unit-5 Accountancy in clinical pathology

Unit-6 Hospital Management

Unit-7 Operation ethics

Unit-8 Social ethics of pathology

Unit-9 Proper handling of instruments

MMLT-017 Communication Skills

Section 1: Concord & Forms of Verbs

Unit-1 Rule of Concord or Agreement, Present Tense, Past Tense, Future Tense,

Unit-2 Tenses with Since, The Future Tense in Adverbial Clauses, Tense in Sentences of Condition

Section-2 : Idiomatic use of Prepositions and Conjunctions

Unit-3 What is an Idiom

Unit-4 Idiomatic Use of Prepositions, Words Followed by prepositions, Structural Use of Infinitive, Gerund and Participles, The Participle, The Infinitive, Gerunds

Section 3: Common Errors in English

Unit-5 Adjectives and Adverbs (Confused)

Unit-6 Errors in the Use of Adjectives and Adverbs

Section 4: Punctuation, Capitalization & Comprehension

Unit-7 Punctuation, Capitalization, Good Manners

Unit-8 The Conjurer's Revenge, The Home Coming, My Last Will and Testament

Section 5: Vocabulary Building in English Language

Unit-9 Useful Words for Expressing Ideas, Opinions and Emotions, Single Words for Phrases or Sentences, Derivations: Root Words, Prefixes and Suffixes, Antonyms and Synonyms, Nationality Words: Names of Countries and People

Section 6: Essay and Business Letter Writing

Unit-10 Writing an Essay

Unit-11 Business Letters

Year II

MMLT-021 Clinical Biochemistry

Section-1 Carbohydrates

Unit-1 Carbohydrates intermediate metabolism

Unit-2 Glycogenesis

Unit-3 Glycogenolysis

Unit-4 Gluconeogenesis

Unit-5 Glycolysis

Unit-6 TCA, HMP, and its regulations

Unit-7 Disorders of carbohydrates metabolism related to each cycle (inborn error of metabolism).

## Section-2 Proteins

Unit-8 Different metabolic pathway of amino acid

Unit-9 The flow sheet of amino acids oxidation

Unit-10 Transamination, oxidativedeamination and pathways leading to acetyl co-A

Unit-11 Decarboxylation of Amino acids, formation of nitrogenous excretion products

Unit-12 Urea cycle and ammonia excretion

## Section-3 Lipid

Unit-13 Biosynthesis and oxidation of fatty acids (odd & even number) Ketone bodies formation and their oxidation

Unit-14 Regulation and inborn error of lipid metabolism

## Section-4 Biochemical aspects of Hormone

Unit-15 Hormone receptors and intracellular messengers

Unit-16 Adenylate cyclase, protein kinase and phosphodiesterase

Unit-17 Role of Insulin, glucagons, epinephrine and their mechanism

Unit-18 Various endocrine and regulatory systems mediated by cyclic AMP

## Section 5 Vitamin

Unit-19 Hormone receptors and intracellular messengers

Unit-20 Adenylate cyclase, protein kinase and phosphodiesterase

Unit-21 Role of epinephrine and their mechanism

Unit-22 Role of glucagons and their mechanism

Unit-23 Role of epinephrine and their mechanism

Unit-24 Various endocrine and regulatory systems mediated by cyclic AMP

## MMLT-022 Clinical Haematology and Blood banking

### Section-1 Red Blood Cells

Unit-1 Normal morphology count

Unit-2 Isolation from whole blood & count

Unit-3 Effect on count & morphology of physiochemical parameters & the diseased state

Unit-4 Red cell anomalies & their relevance w.r.t normal & diseased state

### Section-2 Blood Transfusion

Unit-5 Pre-requisite & the complication of mis-matched transfusion

Unit-6 Methods of blood matching

### Section-3 White blood cells & platelets

Unit-7 Morphology count & methods of isolation

Unit-8 Effect on count & morphology of cell by the physiochemical parameters, diseased

Unit-9 State & the relevance of condition of the diseases

### Section- 4 Anaemia's

Unit-10 Definition (in general ) & causes

Unit-11 Types of anaemia & their classification

Unit-12 Physiochemical

Unit-13 Characteristic features & etiology of a plastic anaemia

Unit-14 Haemolytic

Unit-15 Megaloblastic

Unit-16 Clinical features & diagnosis.

### Section-5 Leukaemia

Unit-17 Definition (in general) & their etiology

Unit-18 Classification of leukaemia

Unit-19 FAB classification

Unit-20 Etiologies

Unit-21 Physiochemical features of different Type of leukaemias, with reference to clinical states

Unit-22 Diagnosis of different types of leukaemias

Section-6 Coagulation studies

Unit-23 General pathways (intrinsic & extrinsic )

Unit-24 Properties ( physiochemical ) mode of action of coagulation factors

Unit-25 Platelet studies

Unit-26 Platelet function tests ( for different Coagulation factors )

Unit-27 Effect of promoters & inhibitors at different steps in coagulation, their solution & mode of action

Unit-28 Diseases associated with coagulation disorders, their etiology & characteristics Features

Section-7 Red Cell mass studies

Unit-29 Chemical method & radioactive methods

Unit-30 Red Cell function studies

Section-8 Steps in Blood Management

Unit-31 Reception, labeling and recording of laboratory investigations

Unit-32 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.

Unit-33 Measurement of hemoglobin, counting of leucocytes, erythrocytes, platelets and reticulocytes

Unit-34 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 haemoglobin.

Section-9 Tests

Unit-35 Test for sickle celling, bleeding time, coagulation time, prothrombin time, and kaolin cephalin clotting time

Unit-36 Abo blood grouping and Rh typing performance of direct and indirect coombs test, red cell agglutination test (screening Paul bunnell test)

Unit-37 Preparation for the demonstration of L.E. Cell phenomenon

Unit-38 Blood donor selection & screening

Unit-39 Blood collection and preservation, principal of clearing and preparing transfusion bottle and tubing sets – preparation and composition of anticoagulant – preservative solutions.

Unit-40 Transfusion reaction and their investigations

## MMLT-023 Diagnostic Microbiology

### Section-1 Classification of bacteria

Unit-1 On bacilli of differential staining Gram,s Stain .( its modification ) ZN .Stain ( its modification)

Unit-2 On basis of their structure, Pre –remit of sample collections-general & disease specific their processing & storage

Unit-3 Identification of bacteria on basis of cultural characteristics

Unit-4 Morphological features

Unit-5 Serological features

### Section-2 Features

Unit-6 Staphylococcus & streptococcus including pneumonococci

Unit-7 Family Enterobacterical

Unit-8 Haemophilus bordetlla

Unit-9 Corynebacterium

Unit-10 Nessleria

Unit-11 Treponema

Unit-12 Leptospira

Unit-13 Mycoplasma

Unit-14 Chlamydia



Unit-15 Triagents

Section-3 Identification of pathogenic & nonpathogenic fungi

Unit-16 Morphologically

Unit-17 Biochemically

Unit-18 Yeast

Unit-19 Dermatophytes

Unit-20 Cryptococci

Unit-21 Histoplasma

Unit-22 Nocardia Common lab fungal contaminants

Section-4 Characteristic diagnostic serological tests in diseases

Unit-23 Cholera

Unit-24 Typhoid

Unit-25 Tuberculosis

Unit-26 VDRL

Unit-27 TPHA

Unit-28 Satellitism ELISA

Unit-29 PCR

Section-5 Uerology

Unit-30 General morphology & ultra structure of virus and growth cycles

Section-6 Viral genome

Unit-31 Their types & symmetry.Cultivation of virus in embryonated eggs, primary culture & secondary culture

Unit-32 Assay methods: Physical & chemical

## Section-7 Classification

Unit-33 On basic of structure

Unit-34 On basic of nuclear material, Clinical diagnosis serological techniques for identification of bacteria: TMV Bacteriophages.HIV .SV 40 ,myxo & paramyxovirus.

## MMLT-024 Immunology

### Section-1 Immune response

Unit-1 Immunity, Type (Innate & adaptive immune response)

Unit-2 Organs of Immune System: Primary and Secondary lymphoid organ, Ontogeny and phylogeny of Lymphocytes: T and B Lymphocyt, Null.

### Section-2 Cell of Immune System

Unit-3 Mononuclear cell and granulocytes, Antigen presenting cell

Unit -4 Antigen, Heptanes: Factors effecting immunogenicity,m epitopes (Properties of it) antibodies: Structure , Types and function.

### Section-3 Complement System

Unit-5 Role of complement system in immune response, complements and Components and activation pathways

Unit-6 Monoclonal antibodies: Production characterization and applications in diagnosis, therapy and basic research

Unit-7 Antigen-Antibody interaction, avidity & affinity measurement

### Section-4 Hypersensitivity

Unit-8 Definition, factor causing hypersensitivity, common hypersensitivity reaction, types, classification based on the time taken for reaction auto Immune disease

### Section-5 Immunodiagnostic

Unit-9 Precipitation techniques, Agglutination, Fluoresence techniques, ELISA, RIA, Double diffusion and Immuno-electrophoresis

Unit-10 Immunidiagnostics: VDRL test, Widal test, RA factor, Blood grouping, Rh typing, Comb's test

## MMLT-025 Cytology and Histopathology

### Section-1 Cytology

Unit-1 Cytological Staining,

Unit-2 Cytological preparation with special emphasis on MGG, Pap stains

Unit-3 Cytological Fixatives, Cytological Screening

### Section-2 How to Conduct Cytology

Unit-4 Quality Control in Cytology Lab

Unit-5 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

Unit-6 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.

### Section-3 Histopathology

Unit-7 Theory of Histopathology

Unit-8 Reception of specimens

Unit-9 Histopathology of Tumor cell, Histopathology of Liver, Kidney, Adrenal, Ovary, Testies

Unit-10 Method of preparing stains & Fixatives. Theory of Tissue processing and embedding, Theory of H & E staining

Unit-11 Use of Microtome Tissue section cutting. Embedding and preparation of blocks, Fixation of Tissue with DPX mount Theory of frozen section preparation

### Section-4 Preparation

Unit-12 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-13 Normal and abnormal constituent of Urine, Normal and abnormal constituent of amniotic fluid, Normal and abnormal constituent of Semen analysis

MMLT-026 Research Methodology

Section-1 Introduction to Research

Unit-1 Definition, Scope, Limitations, and Types, Objectives of Research, Research Process, Research Designs

Unit-2 Data Collection: Secondary Data, Primary Data, and Methods of Collection

Section-2 Scaling Techniques

Unit-3 Concept, Types, Rating scales & Ranking Scales, Scale Construction Techniques, Multi Dimensional Scaling

Section-3 Sampling Designs

Unit-4 Concepts, Types and Techniques, Sample Size Decision

Unit-5 Theory of Estimation and Testing of Hypothesis, Small & Large Sample Tests

Unit-6 Tests of Significance based on t, F , Z test and Chi-Square Test, Designing Questionnaire, Interviewing, Tabulation, Coding, Editing, Interpretation and Report Writing.

\*\*\*\*\*