SYLLABUS

FOR

B. Sc. (MEDICAL LABORATORY TECHNOLOGY) COURSE

REGIONAL INSTITUTE OF MEDICAL SCIENCES IMPHAL-795004

www.rims.edu.in

SYLLABUS COMMITTEE

Vide letter No. 01/Misc/SMS-MU/2019 dated 19th June 2019 of Dean,

School of Medical Sciences, MU

1.	**Prof. Kaushik Debnath,** Department of Pathology, RIMS	…	Chairman
2.	**Prof. Ph. Madhubala Devi,** Head of the Department of Pathology, RIMS	…	Member
3.	**Prof. L. Saini,** Head of the Department of Biochemistry, RIMS	…	Member
4.	**Pro. A. Barindra Sharma,** Head of the Department of Transfusion Medicine, RIMS	…	Member
5.	**Prof. Naranbabu Singh,** Head of the Department of Anatomy, RIMS	…	Member
6.	**Prof. N. Meena Devi,** Head of the Department of Pharmacology, RIMS	…	Member
7.	**Prof. W. Kanan Devi,** Head of the Department of Physiology, RIMS	…	Member
8	**Prof. Brogen Singh Akoijam,** Head of the Department of Community Medicine, RIMS	…	Member
9.	**Prof. Khuraijam Ranjana Devi,** Head of the Department of Microbiology, RIMS	…	Convenor

CONTENTS

REGULATIONS of
B. Sc. Medical Laboratory Technology at
Regional Institute of Medical Sciences, Imphal

Introduction:- Aim is to train the students in all the routine, special and sophisticated diagnostic procedures in the field of Medical Laboratory Technology.

Short Title Commencement:The regulation shall be called the Regulation for B. Sc. Medical Laboratory Technology Course of the Manipur University.

The regulation and syllabus framed is subjected to modification/amendment from time to time by Academic Council of Manipur University.

1. Eligibility for Admission:

a) A candidate seeking admission to this course must have passed 10+2 examination from CBSE/ State boards or any other equivalent examination recognized by Manipur University, with at least 50% marks in aggregates of Physics, Chemistry, Biology/Zoology & Botany and English as subjects combination and must have passed in each of these subject.

b) Selection of the candidates will be based on merit i.e. qualifying mark obtained in NEET examination of the year of admission.

c) Age Limit: The candidate should have completed the age of 17 years at the time of admission or would be completed the said age on or before 31st Dec of the year of admission to the first year B.Sc. MLT.

d) Lateral Entry: Admission to second year for those 10+2 Science with 2 years diploma MLT holders.

i) Candidate who had passed Diploma MLT (2 years) from any AICTE recognized institution after his/her 10+2 Science, with the aggregate marks of 50% or above is eligible for admission to the second year (lateral entry) B. Sc. MLT but subjected to the availability of the seats in the Institution.

2. Duration: The duration of the Course is 3 years and 12 months internship.

3. Medium of Instruction and language of Examination: English

4. Academic Programme: During an academic year, a candidate shall be enrolled only for one programme of studies and shall not appear in any other examination of this or other university.

5. Commencement of the Course: 1st August of each academic year.

6. Commencement of Examination: Examination will be fixed by University after due consultation with the concerned Head of the Institution/department.

7. Working Days: Each academic year shall consist of not less than 180 working days.

8. Registration: A candidate admitted to the course shall register with the Manipur University by remitting the prescribed fees along with the application form for registration duly filled in and forwarded to the University through Head of the Institute/Head of Department within the stipulate date.

9. Eligibility for appearing in examination: A candidate attending less than 75% classes will not be eligible to appear in the any university examination

Examination: There shall be yearly examination to examine the students of the B. Sc. MLT course,

i. The duration of Examination in theory papers will be of 2 (two) hours and the practical papers will be of 2 (hrs) hours, unless specified otherwise.

ii. Maximum number of attempts permitted for each paper is 3 including first attempt

iii. The maximum period to complete the course will be 6 years.

iv. A student shall not be declared to have passed the examination unless he/she secures at least 50% marks in each theory and practical papers separately after adding the Internal Assessment (IA) marks

Question papers :

Total marks for each subject will be 200.

Theory : 80 marks for theory plus 10 marks from internal assessment for theory

Practical: 80 marks for practical plus 10 marks of internal assessment of Practical

Viva/ Oral: 20 marks for viva

Note: 20 marks (as indicated) is reserved for internal assessment marks.

v. External Examiners: External Examiners when and where necessary are to be appointed by the Manipur University from the panel of external examiners approved by relevant academic bodies.

Supplementary examination: A supplementary examination shall be conducted within 3 months of declaration of results so that the students who failed in the regular examination can join the same batch.

vi. Internal Assessment (IA):

Internal assessment will be done in each subject of study and the marks will be awarded to the candidates as detailed in the scheme of examinations. The marks awarded will be done on the basis of the candidate's performance in the assignments, class tests – written / practical, laboratory work, preparation and presentation of Project work/ seminars or any other accepted tools of assessment, as assessed by the teachers. Candidate should have scored a minimum of 50% in Theory (IA) and 50% in Practicals (IA) separately to be allowed to appear for the *final University examination.*

vii. Date of Examination: As notified by University/ Dean

viii. The result of the successful candidates will be classified at the end of the University examination on the basis of the aggregate marks obtained in all subjects

ix. QUALIFYING MARKS FOR A PASS

a. Candidate has to pass separately in Theory +Viva voce and Practical by getting a minimum of 50% marks in the aggregate marks obtained including internal assessment and Final University Examination.

x. Declaration of results:

- A successful candidate obtaining 75% and more marks in the grand total aggregate in the first attempt shall be declared to have passed with Distinction.
- A successful candidate obtaining 60% and more but less than 75% of marks in the grand total aggregate shall be declared to have passed with First Class.
- A successful candidate obtaining 50% and more but less than 60% of marks in the grand total aggregate shall be declared to have passed with Second Class.
- A candidate securing 75% or more marks in any papers (Theory + Practical) will be awarded honours in that paper or papers

Note: - For the lateral entry candidate, Diploma marks will be considered as 1st year. Aggregate may be calculated only from 2nd and 3rd year

1st Division/Class - 60% and above

2nd Division/Class - Above 50% below 60%

Practical Training: A practical training of 12 months after completion of final examination of 3rdyear is compulsory as an internship (Adjustment of study tour and project etc. shall be made within this period).

b) If a candidate fails in either theory or practical, he / she has to reappear for both theory and practical.

10. MAXIMUM DURATION FOR THE AWARD OF THE DEGREE:

a. The candidates shall be eligible for the Degree of Bachelor of Science in Medical Laboratory Technology when they have undergone the prescribed course of study for a period of not less than three

years in RIMS and have passed the prescribed examinations in all subjects.

b. The maximum period to complete the course successfully should not exceed 6 years.

11. Completion of Internship: Students before obtaining certificate and mark sheets should obtain satisfactory certificate of completion of Internship from the Head/Dean of Institute. Project, study tour and other course will be done during internship programme as decided by the department.

12. Re-evaluation of Answer Papers: Re-evaluation of answer script will be as per rules and regulation of Manipur University.

13. Course Structure: Proposed subjects in B. Sc. MLT (Both theory and practical in the various subjects are given below.

COURSE STRUCTURE OF B. Sc. MEDICAL LABORATORY TECHNOLOGY

1st year

SL. NO	SUBJECT	THEORY (hours)	PRACTICAL (hours)	
1	Anatomy & Physiology – I	30 hours	30 hours	
2	Anatomy & Physiology – II	30 hours	30 hours	
3	Principles of Biochemistry I	30 hours	30 hours	
4	Principles of Biochemistry II	30 hours	30 hours	
5	Basic Haematology Clinical Pathology & Instrumentation	30 hours	30 hours	
6	Blood Banking & Clinical Pathology	30 hours	50 hours	
7	Basic Microbiology	30 hours	30 hours	
8	Bacteriology	30 hours	30 hours	
9	Information Technology	30 hours	30 hours	
				Grand Total
	Total Hours	270 hours	290hours	**560 hours**

2ND year

SL. NO	SUBJECT	THEORY (HOURS)	PRACTICAL (HOURS)	
1	Metabolism & Analytical Biochemistry	60 hours	60 hours	
2	Basic Haematology	30 hours	30 hours	
3	Histological Technique	30 hours	30 hours	
4	General Pathology & Pharmacology	30 hours	30 hours	
5	Cytopathological Technique	30 hours	30 hours	
6	Immunology and Serology	30 hours	30 hours	
7	Medical Virology and Medical Mycology	30 hours	30 hours	
8	Environmental Science	30 hours		**Grand Total**
Total Hours		270 hours	240 hours	**510 hours**

3rd Year

SL. NO	SUBJECT	THEORY (HOURS)	PRACTICAL (HOURS)	
1	Applied Biochemistry – I	30 hours	30 hours	
2	Applied Biochemistry – II	30 hours	30 hours	
3	Immunohaematology& Systemic Pathology	30 hours	30 hours	
4	Systemic Haematology	30 hours	30 hours	
5	Histopathological Technique & Management	30 hours	30 hours	
6	Systemic Cytological	30 hours	30 hours	

	technique			
7	Medical Parasitology	30 hours	30 hours	
8	Clinical and Molecular Microbiology	30 hours	30 hours	
9	Basic Preventive Medicine	30 hours	30 hours	**Grand Total**
	Total Hours	270 hours	270 hours	**540 hours**

B.SC. MLT 1ST YEAR

ANATOMY AND PHYSIOLOGY- I

Unit 1

- Introduction to Anatomy and Physiology
- Organization of the body and integrated physiology
- Structure and functions of Cells
- Cell division

Unit II- Tissues of the Body

- Types of Tissues:

  Epithelial tissue, Connective tissue, Muscular tissue, Nervous tissue
- Functions of the different tissues

Unit III

- Blood- Composition and functions, Blood Groups
- Bones- Structure and types, functions
- Joints- classification and movements
- Muscles- names of common muscles

Unit IV – Digestive System

- Gross anatomy of Digestive system
- Accessory organs of Digestion
- Physiology of Digestion
- Digestive juices- secretion, composition and functions

Unit V - Cardiovascular System

- Structure of Heart
- Conduction, Cardiac cycle
- Blood circulation
- Blood pressure
- Lymphatic system-basic study

ANATOMY AND PHYSIOLOGY- II

Unit VI- Respiratory System

- Gross anatomy of Respiratory tract
- Physiology of Respiration
- Transport of Oxygen and Carbon dioxide

Unit VII –Excretory System

- Gross anatomy of Excretory system
- Functions of Kidneys including Mechanism of Formation of Urine
- Structure and functions of Skin

Unit VIII – Central Nervous system

- Gross structure of Brain and Spinal chord
- Brief functions of Brain and Spinal chord
- CSF- formation, composition and functions

Unit IX – Reproductive System

- Structure and functions of Male Reproductive organs
- Structure and functions of Female Reproductive organs
- Physiology of Menstruation

Unit X – Endocrine System

- Names of Endocrine glands
- Gross structure of Pituitary, Thyroid, Adrenal glands, Pancreas
- Brief functions of Pituitary, Thyroid, Adrenal glands Pancreas

PRACTICAL

- Study of individual bones
- Study of models of Digestive system
- Study of models of Cardiovascular systems
- Measurement of Blood Pressure

- Study of models of –
  - Brain
  - Respiratory organs
  - Excretory organs
  - Reproductive organs
- Temperature recording by Thermometer
- Anatomical techniques: Microscope, Embalming of human cadaver, museum techniques, basic principles of karyotyping.
- Working principles and recording of chest movements with stethograph, ECG, Blood Pressure, radial pulse.
- Spirometry – recording of lung volumes and capacities.
- Mosso'sergography, Perimetry, Test of hearing.

PRINCIPLES OF BIOCHEMISTRY - I

Unit – I

- Introduction to Biochemistry
- Definition and roots of Biochemistry
- Importance of Biochemistry
- Clinical Biochemistry, Scope of Biochemistry

Unit – II

- Carbohydrates: Biological importance(functions), Classification
- Sugars - Definition and types.
- Reactions of monosaccharides
- Glycosides, derivatives of monosaccharides
- Disaccharides- sucrose, lactose and maltose
- Polysaccharides: Classification, Mucopolysaccharides.

Unit – III

- Amino acids: Standard amino acids
- Classification of amino acids, Essential and non-essential amino acids
- Properties: Physical and Chemical
- Non-standard amino acids
- Amino acids useful as drugs

Unit - IV

- Proteins – Biological importance(functions) of protein
- Structure of proteins, Clinical significance of primary structure
- Properties of protein, Denaturation, Classification of proteins
- Bonds responsible for protein structure
- Biologically important peptides

Unit - V

- Lipids: Definition, Classification
- Biological importance(functions) of lipids
- Fatty acids, Classification, Essential fatty acids and its functions
- Properties of lipids
- Functions of major lipid sub-classes, acylglycerols, phospholipids and steroids

PRINCIPLES OF BIOCHEMISTRY- II

Unit – VI

- Enzymes – Definition, Nomenclature and Classification of enzymes
- Chemical nature and properties of enzymes
- Units of enzyme activity
- Applications of enzymes
- Clinical importance of enzymes

Unit – VII

- Enzymes - Active site, Factors affecting enzyme activity
- Mechanism of enzyme action, Mechanism of enzyme catalysis
- Enzyme inhibition – Reversible, Irreversible and Allosteric inhibition
- Regulation of enzyme activity in living system
- Coenzyme - Coenzymes from B-complex vitamins, Non-vitamin coenzymes, Nucleotide coenzymes

Unit - VIII

- Nucleic acids – Functions of nucleic acids,
- Nucleosides and Nucleotides, Biological role of nucleotides

- Purine, pyrimidine and nucleotide analogs
- Structures of DNA – Chargaff's rule, DNA double helix,
- Denaturation and Renaturation of DNA
- RNA – Structure, Types of RNA, Ribozymes

Unit – VIV

- Water distillation apparatus – Working principle, Preparation and Storage of distilled water
- Photometry – Working principle and applications of - Colorimeter, Spectrophometer and Flame photometer
- Working principle and applications of pH meter.

Unit - VV

- Theory of acids and bases – Properties, Uses, pH, Buffer
- Acid-base balance - Acid-base regulation by Chemical buffers, Respiratory and Renal regulation, Disorders of acid base balance and Diagnosis
- Water balance -Functions of water, Distribution, Water turn over and balance,
- Electrolyte balance and imbalance - Electrolyte composition of body fluids, Osmosis, Regulation of electrolyte balance

PRACTICAL

- Cleaning and care of general laboratory glass wares and equipments used in Biochemistry lab.
- Storage of chemicals
- Collection and recording of biological specimens for Biochemical analysis preservation and disposal, separation of serum and plasma
- Qualitative Tests -
    i. Qualitative test for Carbohydrates
    ii. Qualitative test for Proteins
    iii. Qualitative test for Ben Jonce's protein
    iv. Qualitative test for Lipids
- Preparation of reagents and standard solutions -
    i. Normal solution
    ii. Molar solution

iii. Percent solution

iv. Primary standard solutions

- Study of normal organic and inorganic constituents of urine
- Study of abnormal urine constituents (glucose, protein, ketone bodies, blood, bile salts and bile pigments)
- Estimation of blood glucose by GOD/POD method
- Estimation of Total protein (Biuret method)
- Estimation of Albumin (BCG dye binding method)
- Acid-base titration
- Estimation of serum bicarbonate (Titration method)

BASIC HAEMATOLOGY, CLINICAL PATHOLOGY AND INSTRUMENTATION

Unit – I

- Introduction for basic laboratory principles
- Code of conduct for medical laboratory personnel (role and responsibilities)
- Safety regulation, common laboratory accidents and its prevention (first aid)
- Clinical laboratory reports and records
- Handling of infective materials; its precaution and disposal
- Stores and supplies; indenting of reagents and its storages

Unit – II

- Definition and scope of Haematology
- Components of blood and their functions
- Haematopoietic system of the body
  - Erythropoiesis
  - Leucopoiesis
  - Thrombopoiesis, Megakaryopoiesis
- Specimen collection for haematological studies
  - Venipuncture method
  - Skin puncture method
  - Arterial puncture method
- Anticoagulants

Unit - III

- Structure of haemoglobin, various estimation of haemoglobin concentration
- Red cell morphology, total count
- White cell morphology, total count
- ESR, various methods and factors affecting ESR

Unit – IV

- Introduction to urine analysis
- Physiology of urine formation
- Composition of normal urine
- Collection, transportation and types of urine specimens

Unit – V

- Introduction to blood banking
- Principles of Immunohaematology
- Human blood group system
  - ABO blood group system
  - Rh blood group system
  - Other blood group system
  - Technique of blood group
  - Compatibility testing
- Clinical significance of blood transfusion

PRACTICAL

- Study of instruments
  - Waterbath
  - Incubator
  - Hot air oven
  - Autoclave
  - Centrifuge
  - Refrigerator
- Preparation of different types of solutions
  - Percent solution

- Normal/molar solution
- Distilled water/normal saline
- Buffered solution

- Anticoagulant vial preparation
  - EDTA vial, Fluoride vial, Citrated vial
- Diluting fluid preparation
  - WBC diluting fluid, RBC diluting fluid & Platelets diluting fluid
- Blood collection
  - Veni puncture, skin puncture and arterial puncture
- Preparation of smears
  - Thick and thin smear; quality of smear
- Methods of preparation and procedure of staining solution
  - Leishman's stain, Wright's stain, JSB stain, etc
- Estimation of haemoglobin (Sahil's, CMG and specific gravity method)
- Determination of RBC count
- Determination of WBC count
- ESR estimation
- ABO/Rh blood grouping (forward and reverse grouping) or front typing and back typing

BLOOD BANKING & CLINICAL PATHOLOGY

Unit – I

- Blood bank – organization, operation and administration
- Collection of blood – selection and screening of donor, criteria for rejecting donors, registration of donor, equipment, collection procedure, laboratory screening for donors blood, adverse donor reactions and processing donor's blood.
- Importance of voluntary blood donation.
- Storage and preservation of blood
- Antiglobulin (Coomb's test)
- Compatibility test (cross match)
- Adverse effect of blood transfusion
- Preparation and use of blood components

Unit - II

- Determination of PCV
- Red cell indices and its estimation
- Reticulocyte count
- Absolute eosinophil count
- Platelets count

Unit - III

- Routine urine examination
  - Physical examination (volume, color, appearance, sediment formation, odour, reaction and pH, specific gravity)
  - Chemical examination (test for protein, glucose, ketone/acetone bodies, occult blood, bile pigments, bile salts and urobilinogent)
  - Microscopic examination (identification of cells, cast, crystals, etc)
  - Manual and strip technology
- Evaluation of renal function test
- Test for tubular function

Unit - IV

- Stool examination – introduction
- Clinical significance of stool examination
- Composition, specimen collection and handling
- Routine examination of stool:
  - Physical examination (consistency, color, presence of mucus, presence of blood, presence of adult parasites and odour)
  - Chemical examination (reaction & pH, occult blood)
  - Microscopic examination (identification of cells, protoxzoas (cysts etc), helminths(eggs/larvae), plant cells/fibres, bacteria etc)
- Concentration techniques of faecal parasites examination

Unit - V

- Body fluids: Formation, composition, clinical significance, abnormalities and routine examination of:
  - Ascitic fluid
  - Pleural fluid

- Pericardial fluid
- Synovial fluid
- Cerebrospinal fluid
- Seminal fluid
- Amniotic fluid

PRACTICAL

Laboratory screening of donor's blood

- Coomb's test
  - Direct Coomb's test
  - Indirect Coomb's test
- Compatibility test
- Routine urine examination
  - Physical examination
  - Chemical examination
  - Microscopic examination
- Routine stool examination
  - Physical examination
  - Chemical examination
  - Microscopic examination
- Concentration techniques of stool examination
- Routine examination of body fluids:
  - Ascetic fluids
  - Pleural fluids
  - Pericardial fluids
  - Synovial fluids
  - CSF
  - Seminal fluid
  - Amniotic fluid

BASIC MICROBIOLOGY

Unit – I

- Introduction and scope of Microbiology
- Brief history of Microbiology
- General characteristics and differences of Eukaryotes and Prokaryotes
- Classification and nomenclature of bacteria

Unit - II

- Modes of nutrition – Basic concepts.
- Bacterial growth and growth cycle.
- Factors affecting microbial growth.
- Extremophiles.
- Host and parasite relationships

Unit - III

- Microbial enzymes and significance in Microbial metabolism
- Bacterial cell division.
- Aerobic and anaerobic bacteria
- Anaerobic respiration

Unit – IV

- Basic principles and uses of microscopes (compound, phase contrast, dark field, fluorescent microscopes, Electron Microscopy)
- Sterilization and Disinfection methods
  - Physical
  - Chemical
  - Mechanical methods

Unit - V

- Isolation and culture of micro organisms
- Culture media - Enrichment techniques.
- Culture methods
  - Aerobic cultivation
  - Anaerobic cultivation

- Methods of isolating pure culture (Streak plate,Spread plate, Pour plate and Serial dilution methods)
- Bacterial colony morphology studies

BACTERIOLOGY

Unit – I

- Classification of Bacteria- -based on nutritional requirements, oxygen & temperature requirements
- Anatomy of bacteria- Cell wall, flagella, Pili, Capsule, spores.
- Growth and nutrition of microbes
- Fermentation and other biochemical properties (Indole, MR-VP test, Citrate utilization test, TSI test, Urease test, Oxidase test, Nitrate reduction test, Catalase and Coagulase test and uses)
- Antibiotic sensitivity test- Disc diffusion, broth dilution.

Unit - II

- Normal microbial flora of human body
- Microbe and bacterial host interactions (Symbiosis, Mutualism, Commensalism and Parasitism)
- Microbial infections and types
- Virulence and virulent factors – bacterial toxins (endotoxin, enterotoxin, exotoxin and neurotoxin)

Unit - III

- Morphology, cultural characteristics, pathogenicity and laboratory diagnosis
  - *Staphylococcus* species
  - *Streptococcus* species
  - *Pneumococcus pneumonia*
  - *Neisseria* species
  - *Corynebacterium diphtheriae*

Unit - IV

- Morphology, cultural characteristics, pathogenicity and laboratory diagnosis
  - *E. coli*
  - *Salmonella* species
  - *Shigella* species
  - *Vibrio species*

- *Pseudomonas* species
- *Haemophilus* species
- *Proteus* species

Unit - V

- Morphology, cultural characteristics, pathogenicity and laboratory diagnosis
  - *Brucella* species
  - *Mycobacterium tuberculosis* and *Mycobacterium leprae*
  - Spirochetes – *Treponema pallidum*
  - Clostridium – *Clostridium tetani* and *C. perfringens*

PRACTICAL

- Common laboratory glassware (uses and sterilization): Erlenmeyer flask, Petri dish, Test tube, Screw cap tubes, Glass spreader and L rods, Micro pipette.
- Principle, maintenance and uses of common laboratory instruments: Autoclave, Incubator, Laminar airflow, Hot air oven, Water bath, Centrifuge, Electronic weighing balances and Quebec colony counter.
- Collection, preservation and transportation of clinical specimen for microbiological investigation
- Sterilization and preparation of commonly used culture media
  - Simple media – Nutrient Agar
  - Enriched Media – Blood Agar, Chocolate Agar
  - Differential Media – Mac Conkey Agar
  - Selective media – TCBS agar, XLD agar, Mannitol salt agar, LJ media and Sabouraud Dextrose agar
- Composition and preparation of staining dyes and reagents
- Simple staining
- Differential staining – Gram staining
- Acid Fast staining – ZN staining
- Negative staining
- Principle, maintenance, working principles and uses of Microscopes
- Identification of Bacteria by biochemical tests
  - Indole test

- Methyl red test
- Vogues – Proskauer test
- Citrate utilization test
- TSI test
- H_2S production test
- Oxidase test
- Catalase test
- Coagulase test
- Urease test

- Motility test- hanging drop and Tube test
- Isolation of
  - Normal flora of the mouth
  - Normal flora of the throat
  - Normal flora of the skin
- Isolation and identification of pathogenic bacteria from clinical specimens (stool, urine, sputum and pus)
- Antibiotic sensitivity tests (Kirby- Bauer’s, agar dilution, broth dilution and epsilometer test, Automated methods)

INFORMATION TECHNOLOGY

UNIT-I

Introduction to computer: Characteristics of Computer, Basic computers organization, Computer Generations, Classification of Computers, Hardware and Software, Computer languages.

UNIT-II

Operating System: Definition, Functions and its type- Batch, Multiprogramming, Time sharing, Real time, Operating Systems, MS DOS Basic, Working with files, file management commands, Utility Commands, Internal and External DOS commands. Windows Basic, the Desktop, Control Panel, Windows Accessories.

UNIT-III

Introduction to Word Processing using MS Word: create, formatting and editing, save document, cut, copy and paste perform operations on blocks of text, header and footer, Handling graphic, working with tables, Mail Merge, printing of a document.

Introduction to Spreadsheet using MS Excel: Concept of worksheet, Cell formatting. Cell referencing, Excel formulas ad functions, making Charts and Graphs, Printing of worksheets.

Introduction to Presentation using MS Power Point: Concept and importance of presentation, making slide show, slide layout, Slide Transition, Custom animation.

UNIT-IV

Introduction to Database using MS access: Concept of Database, Seven main objects in Microsoft Access, database creation and manipulation.

Multimedia: Definition, components and applications.

UNIT-V

Computer Networks: Networking Concepts, Advantages ad Disadvantage, Types if Network- LAN, WAN, MAN.

Internet – Basic concepts and applications, e-mail.

Computer Maintenance and Security: Maintenance of Hardware & Software, Overview of Computer Viruses.

PRACTICAL - Practicals shall be dealt with the theoretical aspect

B SC MLT 2ND YEAR

METABOLISM & ANALYTICAL BIOCHEMISTRY

Unit – I

- Glycolysis and its regulation
- TCA cycle and its regulation
- Electron transport chain and Oxidative phosphorylation
- Pentose phosphate pathway

Unit - II

- Glycogenesis and Glycogenolysis
- Glycogen Storage Diseases
- Gluconeogenesis, Cori cycle
- Blood Sugar and its regulation

Unit - III

- Fatty acid oxidation(β-oxidation), ketone body formation and its utilization,
- Biosynthesis of fatty acids and its regulation,
- Cholesterol biosynthesis and its regulation, important derivatives of cholesterol
- Lipoproteins, classification, metabolism and disorders of lipoprotein metabolism
- Fatty liver, Lipotropic factors, Atheroslerosis

Unit - IV

- Biosynthesis of purine nucleotides and its regulation,
- Inhibitors of purine synthesis
- Degradation of purine nucleotides and disorders of purine metabolism

Unit - V

- Working Principle and Applications of
  - Radioimmunoassay (RIA)
  - Enzyme-linked immunosorbent assay (ELISA)

- Chromatography (Thin layer, Paper, Gas-liquid chromatography)
- Electrophoresis (Gel electrophoresis of serum protein)

PRACTICAL

- Blood glucose estimation by different methods
- Working Principle of glucometer
- Estimation of Glycosylated haemoglobin
- Lipid profile: Estimation of -
  - Triglycerides
  - Total cholesterol
  - HDL-cholesterol
  - LDL-cholesterol
  - VLDL-cholesterol
- Demonstration of paper electrophoresis for serum protein
- Demonstration of paper chromatography

ANALYTICAL BIOCHEMISTRY

Unit – I

- Amino acid pool
- Metabolism of amino acids - Transamination and deamination
- Metabolism of ammonia
- Urea cycle and associated metabolic disorders
- Degradation of haemoglobin

Unit - II

- Catabolism of carbon skeletons of Phenylalanine, Tyrosine and Tryptophan and associated metabolic disorders
- Metabolism of sulphur containing amino acids – Methionine, Cysteine and Cystine
- Inborn errors of sulphur-containing amino acid metabolism

Unit – III

- Biological importance of –
  - Catecholamines, Carnitine, GABA, Serotonin,

- Melatonin, Polyamines, Glutathione,
- S-adenosyl-methionine, Histamine, Melanin

Unit - IV

- Vitamins – Classification, General characteristics
- Water soluble vitamins - Biological role and deficiency states
- Fat soluble vitamins - Biological role and deficiency states

Unit - V

- Minerals – Biological roles, Deficiency states of
  - Calcium, Phosphorous,
  - Iron, Iodine, Fluoride, Cobalt and Zinc

PRACTICAL

- Estimation of -
  - Blood Urea/BUN
  - Serum Creatinine
  - Serum Uric acid (both manual and enzymatic methods)
- Estimation of Serum Bilirubin
  - Total, Conjugated and Unconjugated Bilirubin
- Estimation of Na, K
- Estimation of Ca, P, Cl

BASIC HAEMATOLOGY

Unit – I

- Haemoglobin
  - Biosynthesis of haemoglobin
  - Normal haemoglobin
  - Haemoglobinopathies; various types
  - Estimation of HbA2
  - Estimation of HbF
- Red Blood Cells
  - Structure

- Abnormal morphology of red cell
- Metabolism of red cells
- Nutritional requirement for the production of red cells
- Function of red cells
- Physiological variation of red cells

UNIT – II

- White blood cell
  - Physiology of white cells
  - Normal and Abnormal morphology of WBC
  - Function and normal white cell values
  - Pathological variations in white cell values

UNIT – III

- Leukemia
  - Definition
  - Types of leukemia (Definition, clinical & laboratory features)
    a) Acute myelocytic leukemia (AML)
    b) Acute lymphoblastic leukemia (CML)
    c) Chronic lymphoblastic leukemia (CLL)
  - FAB classification of Acute leukemia
  - Myelodysplastic disorders
  - Aleukaemic leukaemia

UNIT IV

- Special Hematological Test
  - Osmotic fragility
  - Heinz body preparation
  - Sickle cell preparation
  - Lupus erythematosus (LE) cell preparation
  - Iron and Total iron binding capacity in serum
  - Glucose -6-Phosphate dehydrogenase (G-6-PD) and its deficiency
- Bone marrow examination
  - Introduction

- Indication of performing bone marrow examination
- Clinical significance
- Performing (process) of bone marrow biopsy
- Site of biopsy
- Staining procedure
- Normal ranges for bone marrow differential count
- Contraindications of Bone Marrow aspiration

• Thrombocytes/Platelets
- Introduction
- Normal and abnormal morphology of platelets
- Thrombocytopenia, thrombocytosis, pupura
- Malignant condition
- Laboratory investigation of platelet disorders

• Haemostasis
- Process of haemostasis (vascular response, platelet plug formation and coagulation i.e. clotting factors)
- Normal haemostatic mechanism
- Fibrinolysis
- Abnormal haemostasis
- Coagulation test and Routine Coagulation test
- Diagnosis of bleeding disorders

PRACTICAL

• Laboratory investigation of haemoglobinopathies
- Complete blood count (CBC) include Hb estimation, TRBC count, Mean Cell Volume (MCV) and red cell distribution width (RDW)
- Hb electrophoresis
- Hb solubility test for Hb-5
- Sickle cell test
- Estimation of HbA2
- Estimation of HbF

• Differential leucocyte count (DLC)

• Examination of Peripheral blood film (PBF)

• Special test
- Osmotic fragility test

- Heinz body preparation
- LE cell preparation
- Test for Iron and TIBC in serum
- Detection of G-6-PD deficiency

• Bone marrow
  - Smear preparation and Fixation
  - Routine stain, Giemsa, May Grunwald stain, May Grunwald Giemsa (MGG) stain, Sudan Black B, myeloperoxidase stain (MPO), Acid phosphatise stain, Periodic Acid Schiff Reaction (PAS)

• Routine hemorrhagic disorder test (Coagulogram)
  - Bleeding Time (BT)
  - Clotting time (CT)
  - Clot retraction and lysis time
  - Prothrombin time (PT)
  - Thrombin time (TT)
  - Plasma recalcification time (PRT)
  - Partial thromboplastin time (PTT)
  - Activated partial thromboplastin time (APTT)
  - Protamine sulphate test
  - Fibrinogen determination

HISTOLOGICAL TECHNIQUE

Unit – I

• Cells and Tissue
  - Definition of cells and tissues
  - Cells and its organelles
  - Cells cycle, mitosis, meiosis
  - Epithelial tissue
  - Muscle tissues
  - Nerve tissue

Unit – II

• Histological study of organs and systems of the body
  - Elementary system

- Respiratory system
- Excretory system
- Urinary and reproductive system
- Circulatory system
- Endocrine system

Unit – III

- Managing of Laboratory
  - Introduction
  - Risk management
  - Quality management

Unit – IV

- Histopathology technique
  - Sample reception
  - Registering
  - Labeling
  - Fixation and fixative
  - Grossing of specimens
  - Decalcification
  - Processing
  - Waxes
  - Embedding
  - Microtomes
  - Abrasives
  - Dehydration
  - Clearing
  - Impregnation
  - Section cutting
  - Frozen section
- Mounting and labeling
- Reporting, record keeping/ filling

Unit – V

- Staining
  - Theory, Basic dye and acid dye
  - Practical implications
  - Progressive and regressive staining
  - Metachromasia
  - Mordants, accentuators
- Routine staining
  - Haematoxylene and eosin staining
  - Giemsa's stain
  - MGG stains
- Special staining
  - ZN stain
  - PAS stain, Mayer's mucicarmine stain

PRACTICAL

- Study of normal cells and tissue (including unitI &II)
  - Squamous cells
  - Glandular cells
  - Transitional cells
  - Bone
  - Cartilage
  - Muscle (striated and nonstriated)
  - Nerve cells and tissues
- Sample receiving, registering, labeling
- Demonstration class of
  - Methods of fixation
  - Grossing
  - Decalcification
  - Preparation of Graded alcohols, 0.1 %, 0.2 %, 0.5 % HCl, 1% NH_4OH in ethanol
  - Frozen section.
- Processing

- Blocking
- Microtomes/section cutting and sharpening of knives
- Preparation H & E staining solution methods
- Giemsa's MGG, ZN stains, PAS staining Mayer mucicarmine staining.

GENERAL PATHOLOGY AND BASIC PHARMACOLOGY

Unit – I

Cellular Pathology

a) Causes of cell injury
   - Definition
   - Cause

b) Mechanism of cell injury
   - Ischaemic and hypoxic injury
   - Free radical mediation of cell injury
   - Chemical injury

c) Form and morphology of cell injury
   - Patterns of acute cell injury
   - Reversible injury
   - Necrosis
   - Apoptosis
   - Sub cellular response to injury

d) Cellular adaptation of growth and differentiation
   - Atrophy
   - Hypertrophy
   - Hyperplasia
   - Metaplassia
   - Dysplasia, Anaplasia

Unit – II

a) Acute Inflammation, definition, microscopic picture
   - Changes in vascular flow and caliber
   - Increases vascular permeability (vascular leakage)

- Mirgination enrolling
- Chemotaxis and activation
- Phagocytosis and degranulation
- Summary of the acute inflammatory response
- Names of chemical mediators
- Outcome of acute inflammation

b) Chronic Inflammation

- Chronic inflammatory cells
- Granulomatous inflammation
- Role of lymphatics in chronic and acute inflammation
- Morphologic pattern in acute and chronic inflammation
- Systemic effects of inflammation

Unit – III

Neoplasia:

- Definition
- Nomenclature
- Characteristics of benign and malignant neoplasm
- Epidemiology
- Carcinogenesis
- Biology of tumour growth
- Etiology of cancer
- Tumour immunity
- Lab. Diagnosis of cancer, tumor makers

Unit – IV

- Cell of immune systems
- B-lymphocytes
- T-lymphocytes
- Macrophages
- Dendritic and Langerhan cells
- NK cells

Unit – V

Pharmacology

1) General considerations and Pharmacokinetics

- Route of drug administration and dosage form
- Absorption and bioavailability
- Distribution of a drugs
- Fate of drugs
- Drug excretion
- Plasma half life and its significance

2) Pharmacodynamics

- Site of drug action
- Mechanism of drug action
- Drug receptors
- Adverse drug reaction
- Drug allergy
- Manifestation of ADR

3) Antimicrobial agents

- General consideration
- Classifications (Bacterial, Antifungal, Antiviral)
- Mechanism of actions (above)

PRACTICAL

- Study of acute inflammation in the slides
- Study of chronic inflammation in the slides
- Identification of normal cells Benign cells, malignant cells
- Histological identification of anaplasia, metaplasia hyperplasia, atrophy & hypertrophy

CYTOPATHOLOGICAL TECHNIQUE

Unit – I: Definition of cytology

- Exfoliative and Interventional cytology

- Difference between exfoliative and interventional cytology
- Role of cytology in the diagnosis
- Nuclear criteria of malignancy
- Material for operation and establishment of cytopathological

Unit – II: Reception

- Reception, registering, numbering
- Supply of material for collecting specimens
- Fixative, fixation and marking
- Preparation of smears
- Progressive changes of the cells
- Nuclear criteria of malignancy

Unit – III: Exfoliative cytology

a) Exfoliative cytology
b) Body cavity fluids
    - Effusion
    - Collection and processing of body cavity fluids specimens
    - Cyto preparation and staining
    - Clotted fluids
    - Cellular components in effusion
    - Neoplastic cells and macrophages in effusion
    - Cellular component in benign and malignant effusion
    - Adenocarcinomatous in effusion
    - CSF

Unit – IV: Interventional cytology

- Application, methods, advantages, procedures
- Preparation of smears
- General properties of wet and dry smears
- Aspiration of specific sessions. Eg: Cyst, thyroid, lung, peritoneum, prostate, testes, radiological imaging aids for FNAC
- Complications of FNAC
- Precautions, contraindications, advantage and disadvantage
- Imprint, crush smears, biopsy sediments and cell block preparation

Unit – V: Pap's stain

- Chemical requirements
- Preparation of various pap's stain and methods
- Stain maintenance
- Preparation of various haematoxylenes
- Preparation of graded alcohol
- Preparation of 0.5% HCl, lithium carbonate, E.A modified, 0.2% HCl, 1% ammonium hydroxide in 70% ethanol, orange6-6(OG_6), light green, Bismark Brown, EA-50, EA-36
- Procedure of pap's stains (techniques)
- MGG stain
- Giemsa stain

PRACTICAL CYTOLOGY

- Study of sample receiving, registering, labelling and numbering
- Preparation of smear from FNAC material
- Cyto preparation of body fluid samples like
  - Ascetic fluid
  - Pleural fluid
  - Pericardial fluid
  - CSF
  - Sperms/semen
- Collection of exfoliated cells and cyto preparation
- Cyto preparation of bloody fluids
- Study of fixative (preparation of solutions) and methods of fixations
- Preparation of staining solution (demonstration class)
  - Haematoxylene
  - Giemsa
  - MGG
  - Graded alcohol
  - O.2%, 0.5% HCl
  - Lithium carbonate

- EA modified
- OrangeG-6 (OG6)
- EA-36, 50

- Cyto preparation of cell block, imprint, crush smear, sediment cytological smears
- Staining of
  - Pap's stain
  - Giemsa
  - MGG
- Filing and record keeping of re

IMMUNOLOGY AND SEROLOGY

Unit – I

- Immunity (innate and acquired, humoral and cell-mediated).
- Cellular components of innate and acquired immunity.
- Antigen - antigenicity and immunogenicity, antigen recognition.
- Immunoglobulin- types, structure, distribution and function.
- Antigen-antibody reactions

Unit - II

- Major histocompatibility complex – structure and function of class I and class II antigens.
- Activation, maturation and differentiation of B-cells and T-cells
- Humoral immune response
- Cell mediated immune response
- Hypersensitivity
- Immunodeficiency diseases

Unit - III

- Hypersensitivity-Type I-IV
- The complement system.
- Autoimmunity - types of autoimmune diseases.
- Transplantation: Immunological basis of graft rejection; immune-suppressive therapy.
- The inflammatory Process and anti-Inflammatory agents

Unit - IV

- Immunological techniques
  - Immunodiffusion, immunoaffinity, immunoprecipitation and Immunoe-lectrophoresis.
- Vaccinology- active and passive immunization, types of vaccines
- Vaccine technology.

Unit - V

- Introduction to serology
- Common serological techniques and their application (VDRL/RPR, WIDAL, RA test, ASO test, Pregnancy test, HAV, HBs Ag, HCV, and HIV)
- Quality control measures in serology
- ELISA

PRACTICAL

- Agglutination test – bacterial, latex and co-agglutination
- Demonstration of precipitin reaction by Immunodiffusion test
- Serological tests in bacterial and viral diseases diagnosis –
  - VDRL/RPR
  - WIDAL
  - RA
  - ASO
  - CRP
  - HAV
  - HBs Ag test
  - HCV test
  - HIV test
  - Scrub typhus
  - Dengue and JE
- Skin hypersensitivity test (Mantoux test)

MEDICAL VIROLOGY AND MEDICAL MYCOLOGY

Unit – I

- Classification and nomenclature of viruses
- General characteristics of viruses (Morphology, chemical, biological properties and replication)
- Cultivation of viruses (animal inoculation, embryonated eggs, tissue culture)
- Bacteriophages (lysogenic and lytic cycles)

Unit – II

Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of

- Polio virus
- Mumps
- Rubella
- Measles
- Herpes I & II and Varicella zoster virus (Chicken pox)
- Hepatitis viruses (A, B, C, D, E)

Unit – III

Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of

- Influenza virus
- Dengue
- Rabies
- Chikungunya virus
- HIV virus
- Ebola virus
- SARS
- Rota virus
- Zika virus

Unit - IV

- Introduction to medical mycology
- Classification and nomenclature of Fungi
- General characteristics of fungi including structure, reproduction and cultivation
- Medically important fungal diseases

Unit - V

Morphology, cultural characteristics, pathogenicity, laboratory diagnosis and treatment of common pathogenic fungi

- *Candida* species
- *Cryptococcus* species
- *Dermatophytes*
- *Talaromyces*
- *Histoplasma* species
- *Coccidioides* species
- *Sporothrix*species
- Mucor species
- *Penicillium* species
- *Aspergillus* species

PRACTICAL

- Cultivation of fungi- preparation of media- SDA, BHIA, CMA, BSA, etc.
- KOH (Potassium hydroxide test) for fungi identification.
- Lacto phenol cotton blue wet mount preparation for fungi.
- Isolation of bacteriophages from sewage.
- Enumeration of bacteriophages in a sample by plague forming unit (PFU) method
- Demonstration of cultivation of viruses in chick embryo
- Demonstration of haemagglutination test for virus detection.
- Giemsa stain for detection of inclusion bodies
- Fungal staining methods - PAS, GMS.

ENVIRONMENTAL STUDIES

Unit- I:

Introduction to environmental Studies

Multidisciplinary nature, scope and importance

Ecosystems- structure & function; energy flow; food chain; food webs & ecological succession. Case studies of –

Forest ecosystem

Grassland ecosystem

Desert ecosystem

Aquatic ecosystem

Unit – II

Natural Resources: Renewable &Nonrenewable Resources

Land resource & land use change, Land degradation, soil erosion & desertification.

Deforestation: caused & impacts due to mining, dam building on environment, forest, biodiversity & tribal populations.

Water: Use & over exploitation of surface & ground water, floods, droughts, conflicts over water (international & inter-state)

Energy resources: Renewable & non-renewable, use of alternate energy sources, growing energy needs

Unit – III

Biodiversity & Conservation

Levels of biological diversity: genetic, species & ecosystem diversity; biogeographic zones of India; biodiversity patterns & global biodiversity hotspots.

India as a mega-diversity nation; endangered & endemic species of India

Treats to biodiversity: Habitat loss, poaching of wildlife, man-wild life

Conflicts, biological invasions; Conservation of biodiversity: in-situ & ex-situ

Ecosystem & biodiversity services: ecological, economic, social ethical, aesthetic & informational value

Unit – IV

Environmental Pollution

Types, causes, effects &controls; Air, water, soil & noise pollution

Nuclear hazards & nuclear health risks

Solid waste management: control measures of urban & industrial waste

Unit – V

Environmental Policies & Practices

Sustainability & sustainable development

Climate change, global warming, ozone layer depletion, acid rain & impacts on human communities and agriculture, greenhouse effect

Environmental Laws: Environment Protection Act, Air (Prevention & control of Pollution) Act; Water (Prevention & Control of Pollution) Act; Wildlife Protection Act: Forest Conservation Act,

Human Communities and the Environment

Human population growth: impact on environment, human health & welfare

Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan

Environmental communication and public awareness, case studies (e.g. CNG vehicles in Delhi)

B.Sc. MLT 3rd Year

APPLIED BIOCHEMISTRY I

Unit – I

- Liver function tests –
  - Functions of liver
  - Tests to assess liver function
  - Metabolism of Bilirubin
  - Jaundice

Unit – II

- Thyroid function tests –
  - Abnormalities of thyroid function
  - Classification of thyroid function tests
  - Laboratory diagnosis of thyroid function
- Glucose tolerance test (GTT) -
  - Procedure, Interpretation
  - Other relevant aspects of GTT

Unit – III

- Renal function tests -
  - Major functions of kidney
  - Formation of urine
  - Tests to assess kidney functions
- Cardiac function tests –
  - Parameters used to assess cardiac functions
  - Diagnostic indicator or marker of myocardial infarction

Unit – IV

- Diagnostic importance of enzymes – plasma functional and plasma non-functional enzymes
- Important enzymes in diagnosis of diseases –
  - Alkaline phosphatese (ALP)
  - Amylase

Alanine transaminase (ALT)

Aspartate transaminase (AST)

Creatine phosphokinase (CPK)

Gamma Glutamyltranspeptidase (GTT)

Lactate dehydrogenase (LDH)

Unit – V

Automation – Meaning of Automation

Advantages of auto analyzers

Benefits of a Semiautomatic Analyzer

Broad Based Classification of Analyzers

PRACTICAL

Thyroid function test –

Determination of serum T3 (Triiodothyronine)

Determination of serum T4 (Thyroxine)

Determination of serum TSH (Thyroid Stimulating Hormone)

Estimation of clinically important enzymes –

Amylase

Alkaline phosphatise (ALP)

Alanine transaminase (ALT)

Aspartate transaminase (AST)

Creatine phosphokinase (CPK)

Gamma Glutamly Transpeptidase (GGT)

Lactate dehydrogenase (LDH)

APPLIED BIOCHEMISTRY II

Unit – I

Tumour markers – Introduction

Brief history

Classification

Clinical applications

Unit – II

Brief study of some important tumour markers

Alpha-fetoprotein (AFP)

Carcinoembryonic Antigen (CEA)

Prostate Specific Antigen (PSA)

Unit – III

Hormones – Classification

Biological roles of -

Insulin

Glucagon

Epinephrine

Growth hormone

Unit – IV

Biological roles of –

Thyroid hormones

Steroid hormones -

- Aldosterone
- Cortisol
- Sex hormones (Estrogen, Progesterone and Testosterone)

Unit – V

Adulteration of food – Introduction, types of common food adulterants and their ill-effects, Prevention of Food Adulteration Act – 1954

Basic statistics – Mean, Median, Mode, SD, CV, normal reference range

Quality Control in Clinical Biochemistry

Definition

Precision, Accuracy, Sensitivity, Specificity

Methods of quality control – Internal and External quality control

PRACTICAL

Estimation of Tumour Markers

Alpha-Fetopretein (AFP)

Carcinoembryonic antigen (CEA)

Prostate specific antigen (PSA)

Infertility profile

Thyroid Stimulating Hormone (TSH)

Follicle Stimulating Hormone (FSH)

Luteinising Hormone (LH)

Testosterone

Estrogen

Prolactin

Physical and chemical tests for detection of food adulteration

IMMUNO HAEMATOLOGY & SYSTEMIC PATHOLOGY

Unit – I

Principles of immunohaematology

Antigens

Antibodies (immunoglobulins)

Production of antibodies

Properties of immunoglobulins and types

Complement

Antibodies in new born, antibody activity invitro

Sensitization

Agglutination

Factors affecting antigen-antibody reactions.

Haemolysis

Neutralization

Precipitation

Complement fixation

Effect of nature of antigen and antibody

Immune response

Unit – II

Leucocytes and platelets antigens

HLA – system

Tissue typing technique

Sources of HLA typing term

Separation of T&B lymphocytes

Mixed lymphocytes culture

Granulocytes antigens

Platelets antigens

Unit – III

Diseases transmitted through blood and their screening (TTI)

Haemolytic disease of newborn

Exchange transfusion

Unit – IV

Blood component preparation and their uses

Haemapheresis

Massive transfusion, Autologous transfusion

Quality assurance

Unit - V

Pulmonary tuberculosis and lab diagnosis

Hepatitis, type lab diagnosis

Diabetes melitus, type, lab diagnosis

Thyrotoxicosis, hypo and hyper thyrodism, lab diagnosis

Hypertension, type, lab investigation

Acute and chronic renal failure

PRACTICAL

Detection of antibodies in (IgG, IgM, IgA)

Principle

Method

Technique

Detection of diseases through blood and their screening – Hepatitis B, C, HIV, Malaria and syphilis.

Principle

Methods

Blood component preparation

Demonstration of

Plasma concentrate, Red cell concentrate

Pletelets concentrate, Leucocyte concentrate

Detection of warm and cold antibodies

SYSTEMIC HEMATOLOGY

Unit – I: Anaemia

Definition

Classification

Causes of anemia

Unit – II: Hypochromic Anaemia

Iron deficiency anaemia

Pathophysiology

Causes

Laboratory feature of iron deficiency anaemia

Thalassaenua, Trait, Minor, Major

Classification

Causes

Laboratory features

Sideroblasticanaemia

Classification

Causes

Laboratory features

Unit – III

MegaloblasticAnaemia – B-12 and Folate deficiency

General consideration in vitamin B12 and Folate deficiency

Laboratory features

Investigations

Megaloblastianaemia of various causes

Anaemia of systemic disorder and laboratory features

Anaemias of infections (System disorder)

Investigation (Normochronic Normocytic anaemia)

Pancytopaenia, Aplastic Anaemia, Pure red cell aplasia

Laboratory investigation

HaemolyticAnaemia

Definition

Classification

Laboratory investigation (features)

Coagulation Disorders

Laboratory diagnosis of coagulation disorder

Haemophilia

DIC

Unit – IV

Lymphoma

Definition

Classification

Myeloma

Laboratory features

Polycythaemia, definition, causes, laboratory features

Myelofibrosis

Unit – V

Purpura's

Qualitative & quantitative platelets disorders

Investigation of bleeding disorders

Administration of clinical laboratory

Organization

Management

Reference values

Quality controls

PRACTICAL

Laboratory diagnosis of Thalassaemia and abnormal haemoglobin

Laboratory diagnosis of –

- Iron deficiency anaemia
- Megaloblastic anaemia
- Haemolyticanaemia

Laboratory diagnosis of coagulation disorder/DIC

Staining of Bone Marrow

- MGG
- PAS
- Sudan Black
- Iron
- Fats

Leucocyte cytochemistry

- NAP Acid Phosphatose
- Esterases
- Sudan B. Black

HISTOPATHOLOGICAL TECHNIQUE & MANAGEMENT

Unit – I

- Connective tissue and staining
- Carbohydrates and staining
- Nucleic acid and staining
- Lipids and staining
- Proteins and staining
- Micro-organism and staining

Unit – II

- Muscle and staining
- Amyloid and staining
- Pigments and staining
- Nerve cells and staining
- Liver, lymph nodes biopsy, skin biopsy, bone biopsy
- Renal biopsy, intestinal biopsy, muscle biopsy, nerve biopsy

Unit - III

- Immunohistochemistry
  - Introduction

- Theory
- Applications
- Methods
- Chemistry

Unit - IV

- Microscopy
  - Binocular
  - Dark ground
  - Fluorescence
  - Polarising
  - Phase contrast
  - Interference
  - Electron Microscopy

Unit – V

- Clinical laboratory: organization purposes and practice
- Quality management – quality assurance, quality control, technique
- Stock maintenance, checking and inventory procedures
- Museum technique
- Autopsy, Indication, Preservation of tissue, Medicolegal importance

PRACTICAL

- Staining of:
  - Connective tissues
  - Pigments
  - Carbohydrates
  - Nucleic Acid
  - Lipids
  - Proteins
  - Muscle
  - Amyloids
- Demonstration of Immunohisotchemistry

SYSTEMIC CYTOLOGICAL TECHNIQUE

Unit – I

Female Genital Tract

- Collection of specimens for routine exams
- Gynaecological exfoliated cells
- FNAC of specific tissues

Unit – II

Respiratory Tracts

- Sputum
- Bronchial washing, brushing etc.
- Cytomophological features of squamous cells Ca, Adenocarcinoma of pulmonary origine
- FNAC of lungs etc

Unit – III

Gastro Intestinal Tract

- Collection of specimens and processing
- Gastric Lavages
- FNAC of GI tracts

Unit – IV

Urinary Tract

- Collection of specimens
- Diagnostic utility, cytopreparation etc.

Breast specimens:-

- Collection and processing
- FNAC of breast lump and cytopreparation

Unit – V

Staining (Revision)

- Giemsa's staining
- MGG stain
- Pap's stain
- Modified Pap's stain
- Special Staining

PAS stain

Alcian Blue staining

Combine Alcian Blue and PAS staining

Mayers and Southgate Mucicarmine stain

Gram staining

ZN staining

PRACTICAL

Cyto preparation of GI tract specimens

Cyto preparation of respiratory tract specimens

- Bronchial wash
- Bronchial brush
- Sputum

Cyto preparation of female genital tracts specimens

Cyto preparation of urinary tract specimens

- Voided urine
- Bladder washing
- Retrograde catheterizations

Cyto preparation of –

- Breast secretion
- Speicmens of oral cavity
- Ulcer scrapping

Revision of stain

- Giemsa’s
- MGG
- Pap’s stain

Special stains

- Modified Pap’s stain
- PAS stain
- Alcian Blue staining
- Mayers and Southgate Mucicarmine stain

Gram's stain, ZN stain

MEDICAL PARASITOLOGY

Unit – I

Introduction to medical Parasitology

General characteristics and classification of medically important human parasites

Safety measures in parasitology laboratory

Host- parasite relationship and Immunology of human parasitic infections

Basics of sources of infections, Carriers, Hosts, Epidemiology, Prevention and control measures of human parasitic infections.

Unit – II

Morphology, transmission, life cycle and laboratory diagnosis:

Introduction to Protozoa (Pathogenic and Non-pathogenic protozoa)

Free living protozoa: *Naegleria fowleri* and *Acanthamoeba*

Amoebae: *Entamoeba histolytica*

Flagellates:

Intestinal and genital –*Giardia lamblia* and *Trichomonas vaginalis*

Hemoflagellates – *Leishmania donovani* and *Trypanosoma cruzi*

Ciliates: *Balantidium coli*

Intestinal protozoa's – *Isospora belli* and *Cryptosporidium parvum*

Blood and Tissue parasites- *Plasmodium* species and *Toxoplasma gondii*

Unit – III

Introduction and general characteristics of Helminths

General characteristics of nematodes

Morphology, transmission, life cycle and laboratory diagnosis:

Intestinal nematodes – *Ascaris lumbricoides, Enterobius vermicularis, Trichuris trichiura and Hookworms*

Unit – IV

Introduction and general characteristics of Platyhelminths

Cestodes- *Echinococcus granulosus, Taenia saginata* and *Taenia solium*

Trematodes – *Fasciola hepatica* (Liver flukes), *Paragonimuswestermani* (Lung flukes), *Fasciolopsisbuski* (Intestinal flukes) and *Shistosoma*species (Blood flukes)

Unit – V

Introduction to Arthropods

General characteristics of Arthropods and its importance in medical Parasitology

Classification of medically important arthropods

General characteristics and Medical importance of the vectors: Mosquito, Fleas, lice, Ticks, Mites and house fly

PRACTICAL

- Collection, storage and transportation of specimens (Stool, Urine, Blood and tissues)
- Wet mount of stool samples (Saline, Iodine methods)
- Acid fast staining of stool smears for intestinal protozoa
- Faecal concentration methods for detection of intestinal parasites
- Blood smear examinations (Leishman stain and Giemsa stain) for common blood parasite
- Staining methods for detection of malarial parasite
- Demonstration of Rapid Diagnostic Tests (RDT)

CLINICAL AND MOLECULAR MICROBIOLOGY

Unit – I

Quality control in microbiology laboratory

Culture collection centers and methods of preservation of bacteria

Bacteriology of water, air, milk and food.

Gene transfer in bacteria–Conjugation, transduction and Transformation.

Transmission of genetic material in bacteria- Horizontal and Vertical gene transfer.

Transposons - roles and its significance in bacteria.

Unit – II

Bacterial mutants- Mutagenic agents and their mode of action, Mutation rates, types of mutations. Useful phenotypes (Auxotrophic, conditional, lethal, resistant).

Reversion vs Suppression

Mechanism of drug resistance in bacteria.

Hospital acquired infections and antimicrobial drug resistance.

Unit – III

Introduction to molecular microbiology

Plasmid (Types and importance)

Isolation, purification and quantification methods of nucleic acids.

Molecular techniques for the detection of drug resistant bacteria in clinical samples.

Unit – IV

Principles, methods and application of molecular techniques –

Indirect Hemagglutination test

ELISA

Immunofluorescence test

Western blot

Southern blot

Immunoelectrophoresis

PCR

Unit – V

Introduction to genetic engineering and its applications in diagnosis.

Monoclonal and polyclonal antibodies production and applications

Vaccine preparation protocols.

Importance of gene therapy.

PRACTICAL

- Preparation and maintenance of stock cultures
- Bacteriology of water-MPN and Membrane filter-methods (MFM)
- Bacteriology of food – Microscope and culture methods
- Bacteriology of milk – MBRT and culture methods
- Bacteriology of air – settle plate, sweep plate and dust sampling

- Isolation of antibiotic resistant bacteria
- Isolation of genomic and plasmid DNA
- Demonstration of

  Agarose Gel Electrophoresis

  Immunoelectrophoresis

  Bacterial conjugation

  ELISA

  Western blot

  PCR

BASIC PREVENTIVE MEDICINE

UNIT I

Concept of Health and Diseases:

Concept of health:

1. Definition of health
2. Determinants of health.
3. Indicators of health.
4. Levels of health care.

Concept of disease:

1. Definition of disease.
2. Concept of causation.
3. Natural history of disease
4. Agent factors.
5. Risk factors.
6. Spectrum of disease.
7. Concepts of control and prevention
8. Modes of intervention.

UNIT II

Principles of Epidemiology and epidemiological methods:

1. Definition, concepts, components, and aims of epidemiology.
2. Measurements of mortality and morbidity.

3. Various Epidemiological methods.

UNIT III

Environment and Health:

1. Definition of environment

2. Water: sources, uses, pollutants, purification, water quality, criteria and standard.

3. Air: Composition, pollutants, prevention and control of air pollution.

4. Noise: Definition, measurement and effect of noise. Prevention and control of noise.

5. Radiation: Sources, types and effects of radiation. Modes of protection from radiation.

6. Disposal of solid waste: Sources, storage, collection and methods of disposal.

7. Excreta disposal: Methods of disposal and public health importance.

8. Sewage treatment and disposal of effluent.

UNIT IV

Biological Waste Management and Occupational Health

1. Definition, sources of biological waste, hazards of waste.

   Treatment and disposal of waste

2. Definition of Occupational health, types of occupational hazards.

3. Preventive measures in the work place.

UNIT V

Health Education and Communication

Definition, contents and principles of health education

Practice of health education including the various methods.

Definition of communication, components and barriers of communication

PRACTICAL

Visit to rural health centre

Visit to PHC

Field visits

Books Reference:

Anatomy and Physiology

Ross and Wilson Anatomy and Physiology in Health illness

Human Anatomy (Vol 1 – 3) - Chaurasia

Human Anatomy - Samar Mitra (All the Volumes)

Human Anatomy - A.K.Dutta (All the Volumes)

Cunningham's Anatomy (All the Volumes)

Gray's Anatomy

A text book of Histology - Krishna Garg

Human Physiology - C.C. Chatterjee

Guyton's Human Physiology

Samson's Wright Human Physiology

Sear's Anatomy and Physiology for Nurses- Winwood Smith

Clinical Atlas of Human Anatomy –McMinn

Biochemistry

The Enzymes by Bayer P.D, Hardy H and Myrback K.

Biochemistry- by AC Deb, Harper, Zubang, Varley and Lehringer

Clinical significance of enzyme activity measurements - Wilkinson

Principles of Biochemistry - A.C. Rastogi

Enzymes catalased reactions - Gray C.J

Biochemistry of the amino acids - Meister A

The proteins - Neurath H, Hill R.L

Biochemical Diseases - Martin N.H

Medical Biochemistry – N.M Rao (New age)

Laboratory Manual in Biochemistry – P.Gunasekaran (S. Chand Pub.)

Biochemical Methods – Sadasivam S and Manickam A (New age)

Immuno diagnostic – S.C Rastogi (New age)

Text Book of Medicinal Biochemistry – R.L. Nath (S. Chand Pub)

Practical and Viva in Biochemistry – Dandekar (S.Chand Pub.)

Pathology – I, II & III

Text book of Laboratory Technology - RamnikSood

Hand Book of Medical Laboratory Technology - CMC Vellore

Synopsis of Clinical Pathology and Microbiology - J.Sengupta

Transfusion Medicine Technical Mannual - DGHS

Clinical Diagnosis and Management by Laboratory Method - John Bernard Henry M.D

Robin Pathologic basis of Diseases

Text book of Pathology – Harsh Mohan

Anderson's Pathology Vol I – II

Walter, Israel General Pathology

Cytopathoylogy – Marlive

Rells's FNAC

Hematology

De Gruchy's Clinical Haematology in Medical Practice - Frank Fiskin et al

Wintrobe's Clinical Hematology (Vol. I,II& III)

Essential Haematology - AV Hoffbrand

Post Graduate Haematology - Hoffbrand& Lewis

An introduction to Medical Laboratory Technology - F.J Baker

Practical Haematology - John V. Dacie

Haematology for Medical Technologists - Charles F. Served

Technical Haematology - Arthur Simons

Medical Laboratory Technology - Lynch

Blood Coagulation and Haemostasis - Thomson .J.

Lab Haematology Practice - Willey Blackwell

Histopathological & Cytopathological Technique

Cytology Technical Manual - Dr.LalsangluraRalte

Diagnostic Cytology and its Histopathologic Basis- Leopold G. Koss Vol I & II

Hand book of Histopathological and Histochemical Techniques - CFA Culling

Manual of Histological Techniques and their diagnostic application - John Bancroft et al

A text book of Histology - Garg et al

Theory and Practice of Histology Techniques- John Bancroft

Diagnostic Cytopathology - Chandra Grubb

Diagnostic manual and colour Atlas of FNAC

Manual and Atlas of FNAC - S. R.Orell etc.

Chemical Apiration Cytology-Joseph A. Linsketc

Comprehensive Cytopathology by -Marlive

Microbiology

Bridge E, A (1992). Modern microbiology – Win C.Brown Publishers, Dubuque, U.S.A.

Holt J.S Krieg N.R Sneath P.H.A and Williams S.T (1994). Bergey'sMannual of Determinative Bacteriology. (9^{th} Edition). – William & Wilkins, Baltimore.

Topley and Wilson's (1990) – Principles of Bacteriology, Virology and Immunity. VIII th edition. Vol. 1, 2, 3, 4 Edward Arnold. London.

Apurba Sankar Sastry , Sandhya Bhat - Essentials of Medical Parasitology (Latest Edition- Jaypee)

Apurba Sankar Sastry ,Sandhya Bhat - Essentials of Medical Microbiology. (Latest Edition- Jaypee)

Dr. M.K. Majumdar – Microbiology and Immunology _ an Encyclopedia

Heritage, Evans and Killington – Introductory Microbiology, Cambridge University Press, New York.

Prescott Microbiology by Prescott, Harley, Klein, William C. 1996.Brown Press, 7th ed 2008.

E.Joan Stokes, G.L Ridgeway and M.W.D. Wren (1993).Clinical Microbiology.

7th Edi. Edward Arnold publishers.

David Greenwood, Richard C.B. Stack and John Forrest Peutherer. (1992).Medical Microbiology.

14th Edi. ELBS. Churchill Livingstone

R. Ananthanarayan and C.K. Jayaram Panicker- Text book of microbiology:

5th Edition (1996), Orient Longman ltd. Madras.

Robert Cruickshank – Text book of Microbiology. (Latest Edition.).

Satish Gupte - Short text book of Medical Microbiology.

7thEdition (1999), Jaypee brothers. Medical publishers (P). Ltd. New Delhi.

Dr. P.Chakrabarti – A text book of Microbiology: new book agency. New Delhi.

Mani Mohan Banerjee – Essentials of Medical Microbiology (1992). Latest Edition.

Nalini Printing Press, Dhanbad, Bihar.

Textbook of Practical Microbiology SC Parija - Ahuja's.

Foundations in Microbiology by Talaro and Talaro,

1996. Second Edition, Wim.C.Brown publishers.

Immunology:

Ivan M. Roit.1994. Essential Immunology – Blackwell Scientific Publishers. Oxford.

Helen Chapel, ManselHaeney. 1986. Essentials of Clinical Immulogy. ELBS.

Jains Kuby 1993. Immunology II edition. W.H. FrumenandCompany, New York

Richard. M. Hyde 1995.

Immunology III rd Edition. National Medical series, Williams and Wilkins. Hardware publishing company.

Mrs. Singania – Microbiology & Immunology, Virali Prakashan (P) Ltd.

Molecular Microbiology and Molecular Biology:

Molecular biotechnology II edition by Primrose 2001. Panima Publishing Corp., New Delhi

Culture of Animal Cells: A Manual of Basic Technique by Freshney R.I. 2005.

Fifth Edition, Wiley Publications.

Animal Cell Culture Methods by Mather J. P. 2006. Elsevier Publications

Environmental molecular microbiology by Liu W. T. and Jansson J. K. 2010. Caister Academic Press.

Virology:

Morag, C. Timbury. (1994). Medical Virology. Xth Edi, Churchill Livingstone.

Conrat., H.F.Kimball, P.C and Levy, J.A (1998).

Virology. IInd Edi. Prentice Hall, Eaglewood cliff, New Jersey.

Topley and Wilson's (1990) – Principles of Bacteriology, Virology and Immunity.

VIIIth edition. Vol. 4 .Virology. Edward Arnold. London.

Virology- Edward Arnold, London.

Mycology:

Fisher, Cook: Fundamentals of Diagnostic Mycology. SAUNDERS of Elsevier (latest edition)

JagdishChander – A text book of Medical Mycology. Interprint Publishers, New Delhi.

Parasitology:-

K.D. Chatterjee Text Book of Parasitology

Medical Parasitology – Jayram Paniker

Practical:

Monica Cheesbrough (1998). District Laboratory Practice in tropical Countries.

Part I and II. Cambridge Low Price Edition.

Bucker. J.M., Caldwell G.A Zachgo, E.A 1990. A Laboratory Course. Academic Press.

J.C. Colleen, J.P., Duguid, A.C. Fraser, B.P and Marimon (1989). Mackieand Mc. Cartney, Practical Medical Microbiology- 13th Edi. Churchill Livingstone.

Sathish Gupte – Practical Microbiology: 1st Edition, Jaypee Brother's Publications. New Delhi

Basic Preventive Medicine and Health Care

K.Park: Park's Text Book of Preventive and Social Medicine Latest Edition, BanarsidasBhanot publishers, Jabalpur.

Information Technology:

1). Computer Fundamentals by Pradeep K. Sinha &Priti Sinha, IVth Edition BPB Publications.

2). Fundamentals of Computers by V. Rajaraman, 2nd Edition, Eastern Economy Edition.