PROFESSIONAL PROGRAMME
PROGRAMME CODE--- 312  
Bachelor of Science in Medical Lab Technology (BSCMLT)

### SEMESTER I

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<tr>
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<tr>
<td>BSCMLT11</td>
<td>Biochemistry: chemistry</td>
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<td>BSCMLT12</td>
<td>Microbiology: general Microbiology</td>
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<td>BSCMLT13</td>
<td>Haematology: introduction haematology</td>
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<td>BSCMLT14</td>
<td>Anatomy and Histotechnology: different body systems of human beings</td>
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<td>BSCMLT15P</td>
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<td>BSCMLT22</td>
<td>Microbiology: techniques</td>
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<td>Basic cellular pathology</td>
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<td>BSCMLT24</td>
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<td>Applied microbiology</td>
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<td>Blood banking and special haematological tests</td>
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<td>BSCMLT34</td>
<td>Cytopathology</td>
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**Detailed Syllabus**

**SEMESTER –I**

**BSCMLT11 --- Biochemistry: Chemistry and techniques of Biochemistry**

**UNIT I: Introduction**

Bioenergetics, Entropy, Enthalpy & their basic introduction, Concept of free energy, Thermodynamics 1st & 2nd Law.

**UNIT II: Terms**

Structure, properties, chemical reactions & functions. Amino Acids :Essential & non Essential
amino acids with structure & function.

UNIT III: Proteins
Proteins: Primary, Secondary, tertiary & quaternary (Overview).

UNIT IV: Lipids
Lipids; Structure, Classification & properties, Enzymes: Classification, enzyme action & their mechanism.

UNIT V: Carbohydrates
Carbohydrates intermediate metabolism, glycogens, glycogenolysis, gluconeogenesis & glycolysis. TCA, HMP, and its regulations Disorcersds of carbohydrates metabolism related to each cycle (inborn error of metabolism).

UNIT VI: Proteins
Different metabolic pathway of amino acid. The flow sheet of amino acids oxidation. ransamination, oxidative deamination and pathways leading to acetyl co-A.

UNIT VII: Ammonia excretion
Decarboxylation of Amino acids, formation of nitrogen excretion products. Urea cycle and ammonia excretion.

UNIT VIII: Biochemical aspects of Hormone
Hormone receptors and intracellular messengers, Adenylate cyclase, protein kinase and phosphodiesterase. Role of Insulin, glucagons, epinephrine and their mechanism. Various endocrine and regulatory systems mediated by cyclic AMP.

UNIT IX: Vitamin
Fat and Water soluble and their deficiency. Mineral metabolism Minor and Major (cu, Fe, Ca, Mg & P) Inborn error of Nucleic acids metabolism.

UNIT X: Molarity
Molarity, Molality: volumetric apparatus, calibration of volumetric apparatus.

UNIT XI: Units of measurements
Units of measurements: S.I units: Definitions, conversions; Measurement of volume : Strength, Normality.

UNIT XII: Analytical balance

Reference Books: -
2. Basic Separation Techniques in Biochemistry by R O Okotore.
3. Modern physical methods in biochemistry by Albert Neuberger, Laurens L. M. van Deenen.

BSCMLT12 --- Microbiology General Microbiology and Techniques

UNIT I: Classification of bacteria
On bacilli of differential staining Gram, s Stain, ( its modification ) ZN, Stain, ( its modification) On basis of their structure, Pre –remit of sample collections-general & disease specific their processing & storage.

UNIT II: Features of bacteria
Identification of bacteria on basis of cultural characteristics, morphological, & serological features Staphylococcus & streptococcus including pneumonococci, Family Enterobacterial, Haemophilus bordetlla, Corynebacterium, Nessieria. Treponema, Leptospira, mycoplasma, chlamydia & Triaegents.
UNIT III: Identification of pathogenic & nonpathogenic fungi
(Morphologically, biochemically, Yeast, Dermatophytes, Cryptococci, Histoplasma, Nocardia, Common lab fungal contaminants.

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

UNIT V: Urology
Viral genome

UNIT VI: Classification
On basic of structure, On basic of nuclear material, Clinical diagnosis serological techniques for identification of bacteria: TMV Bacteriophages, HIV, SV 40, myxo & paramyxovirus.

UNIT VII: Antiseptics and disinfectants
Antiseptics and disinfectants; Definition, types, mode of action & properties. Uses of disinfectant & antiseptics, testing efficiency.

UNIT VIII: Glassware
Glassware: Description of glass ware, its use, handling and care, Decontamination and disposal of contaminated material.

UNIT IX: Virology
Introduction to virology, Physiochemical characteristics of viruses, Diseases caused by different viruses and mode of infection.

UNIT X: Parasitology
Introduction to medical parasitology and safety measures, General characters and classification of protozoa of Medical Importance.

UNIT XI: Morphology
Morphology, Life cycle and laboratory diagnosis of Intestinal Protozoa- Amoebae and Giardia.

UNIT XII: Sterilization

Reference Books:
1. General Microbiology by Hans Günter Schlegel, C. Zaborosch, M. Kogut.
2. General Microbiology by Roger Y. Stanier.

BSCMLT13 --- Basics of Haematology

UNIT I: Haematology
Introduction to haematology: Definition, importance, important equipment and chemicals, various tests performed, laboratory organization.

UNIT II: Red Blood Cells
Normal morphology count, Isolation from whole blood & count, Effect on count & morphology of physiochemical parameters & the diseased state, Red cell anomalies & their relevance w.r.t normal & diseased state.

UNIT III: Blood Transfusion
Pre-requisitement & the complication of mis-matched transfusion, Methods of blood matching.

UNIT IV: White blood cells & platelets
Morphology count & methods of isolation, Effect on count & morphology of cell by the
UNIT V: Formation of blood
Formation of blood : Erythropoiesis , Leucopoiesis , Thrombopoiesis.

UNIT VI: Anaemia
Anaemia’s: Definition (in general) & courses, types of anaemia & their classification,
Physiochemical, characteristic features & etiology of a plastic anaemia,
haemolytic, megaloblastic, Clinical features & diagnosis..

UNIT VII: Leukaemia
Definition (in general) & their etiology, Classification of leukaemia, FAB classification, Etiologies
, physiochemical features of different type of leukaemias, with reference to clinical states,
Diagnosis of different types of leukaemias.

UNIT VIII: Coagulation studies
General pathways (intrinsic & extrinsic), Properties (physiochemical) mode of action of
coagulation factors, Platelet studies, platelet function tests (for different Coagulation factors),
Effect of promoters & inhibitors at diff steps in coagulation, their solution & mode of action,
Diseases associated with coagulation disorders, their etiology & characteristics Features.

UNIT IX: Red Cell mass studies
Chemical method & radioactive methods, Red Cell function studies.

UNIT X: Anticoagulants
Anticoagulants: Definition, uses, different types, mode of action, their merits and demerits
Morphology of normal blood cells: Normal morphology, morphology in diseases.

UNIT XI: Blood film
Blood film: Different types, Methods of preparation, Staining.

UNIT XII: Romanowsky stains
Romanowsky stains: Principle of staining, Different stains, their composition and preparation,
method of staining.

Reference Books:-
2. A beginner’s guide to blood cells by Barbara J. Bain.
3. Diagnostic Hematology by Norman Beck.

BSCMLT14 --- Anatomy and Histotechnology: Different Body Systems Of Human Being

UNIT I: Human Anatomy & Physiology
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
chamber.

UNIT IV: Urinary system
Structure and Function of the Kidney, uterus, bladder, urethra and nephron Give special emphasis
on formation of Urine, Physiology and Anatomy of male and female reproductive
organs, Endocrine: Pituitary, thyroid, parathyroid, thymus, adrenals and pancreas.
UNIT V: Central nervous system
Brain, spinal cord and meninges explain with its functions. Skins: Structure and Functions, Study and give small project on bones and cartilages, HLA system.

UNIT VI: Cytology
Cytological Staining, Cytological preparation with special emphasis on MGG, Pap stains, Cytological Fixatives, Cytological Screening.

UNIT VII: Histopathology
Theory of Histopathology, Reception of specimens, Histopathology of Tumor cell, Histopathology of Liver, Kidney, Adrenal, Ovary, Testies, Method of preparing stains & Fixatives.

UNIT VIII: Preparation
Preparation of smear for Fine needle aspiration cytology, Pap’s smear theory and identification of cells in a normal vaginal smear.

UNIT IX: Stool examination

UNIT X: Laboratory equipment
Laboratory equipment, its uses and maintenance, Laboratory hazards and safety precautions.

UNIT XI: Tissue processing
Theory of Tissue processing and embedding, Theory of H & E staining, Use of Microtome, Tissue section cutting, Embedding and preparation of blocks, Fixation of Tissue with DPX mount, Theory of frozen section preparation.

UNIT XII: Skeletal system
Skeletal system: Structure and function of all individual bones and joints, movement of joints, Skeletal muscles, Cardiac muscles, smooth muscles, muscles of upper arm & anterior compartment of thigh (their name, attachments, functions and nerve supply).

Reference Books:

BSCMLT15P --- Biochemistry: Chemistry Practical

UNIT I: Introduction
Bioenergetics, Entropy, Enthalpy & their basic introduction, Concept of free energy, Thermodynamics 1st & 2nd Law.

UNIT II: Proteins
Proteins: Primary, Secondary, tertiary & quaternary (Overview).

UNIT III: Lipids
Lipids: Structure, Classification & properties, Enzymes: Classification, enzyme action & their mechanism.

UNIT IV: Carbohydrates
Carbohydrates intermediate metabolism, glycogenesis, glycogenolysis, gluconeogenesis & glycolysis. TCA, HMP, and its regulations Disorders of carbohydrates metabolism related to each
cycle (inborn error of metabolism).

UNIT V: Ammonia excretion
Decarboxylation of Amino acids, formation of nitrogenous excretion products. Urea cycle and ammonia excretion.

UNIT VI: Biochemical aspects of Hormone
Hormone receptors and intracellular messengers, Adenylate cyclase, protein kinase and phosphodiesterase. Role of Insulin, glucagon, epinephrine and their mechanism. Various endocrine and regulatory systems mediated by cyclic AMP.

UNIT VII: Vitamin
Fat and Water soluble and their deficiency. Mineral metabolism Minor and Major (Cu, Fe, Ca, Mg & P) Inborn error of Nucleic acids metabolism.

UNIT VIII: Analytical balance

SEMESTER-II

BSCMLT21 --- Biochemistry: Techniques of Biochemistry

Unit I: Introduction
Bioenergetics, Entropy, Enthalpy & their basic introduction.

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

Unit III: Methods of tissue homogenization
(Potter-Elvejham, mechanical blender, sonicator and enzymatic). Principle and applications of centrifugation techniques- differential, density gradient.

Unit IV: Ultra-centrifugation
Ultra-centrifugation- preparative and analytical.

Unit V: Principle and applications of chromatographic techniques
Principle and applications of chromatographic techniques- paper, thin layer, gel filtration, ion exchange and affinity chromatography. Elementary treatment of an enzyme purification.

Unit VI: Electrophoresis
Electrophoresis- principles and applications of paper, polyacrylamide (native and SDS) and agarose gel electrophoresis.

Unit VII: Colorimetry and Spectrophotometry

Unit VIII: UV and visible absorption spectra
UV and visible absorption spectra, molar extinction coefficient, biochemical applications of spectrophotometer.

Unit IX: Tracer techniques
Tracer techniques: Radio isotopes, units of radio activity, half life, β and γ-emitters, use of radioactive isotopes in biolog.

Unit X: Mineral metabolism Minor and Major
Mineral metabolism Minor and Major (Cu, Fe, Ca, Mg & P) Inborn error of Nucleic acids metabolism.

Unit XI: Fat and Water soluble
Fat and Water soluble and their deficiency.

**Unit XII: Insulin**
Role of Insulin, glucagons, epinephrine and their mechanism. Various endocrine and regulatory systems mediated by cyclic AMP.

**Reference Books:**
2. Basic Separation Techniques in Biochemistry by R O Okotore.
3. Modern physical methods in biochemistry by Albert Neuberger, Laurens L. M. van Deenen.

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**BSCMLT22 --- Microbiology: Techniques**

**UNIT I: Origin of Life**
Time scale of Chemical and Biological evolution, Chance and necessity considerations, Molecular ontogenesis, Working assumptions, cosmo-chemistry, synthesis and polymerisation of biopolymers.

**UNIT II: Review of important milestones in Microbiology and Immunology**
Review of important milestones in Microbiology and Immunology - Contributions of scientists during 1990 to update.

**UNIT III: Microscopy**
Electron microscopy and high voltage electron microscopy.

**UNIT IV: Principle and structure**
Greater resolution, and higher magnification of electron microscope.

**UNIT V: General Methodology**
Sample preparation (fixation, dehydration, embedding, etc).

**UNIT VI: Ultramicrotomy**
Ultramicrotomy (instrument knife, thickness of section, etc), section processing (transfer on grid, staining procedures, etc).

**UNIT VII: Special techniques related to microscopy**
freeze etching, freeze facturing and epoxy resins, shadow casting.

**UNIT VIII: Microscopy techniques**
Immunoelectron and fluorescence microscopy techniques.

**UNIT IX: Applications**
Ultrastructure studies, localisation of enzymes and micromolecules.

**UNIT X: Pre-remit of sample collections**
General & disease specific their processing & storage.

**UNIT XI: General morphology**
General morphology & ultra structure of virus and growth cycles.

**UNIT XII: Clinical diagnosis serological techniques**
Clinical diagnosis serological techniques for identification of bacteria: TMV Bacteriophages.

**Reference Books:**
1. General Microbiology by Hans Günter Schlegel, C. Zaborosch, M. Kogut.
2. General Microbiology by Roger Y. Stanier.

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**BSCMLT23 --- Basic cellular Pathology**

**UNIT I: Study of Body Tissues**
Epithelial Tissue: Simple epithelium, Compound epithelium.
UNIT II: Connective Tissue
Connective Tissue: Connective tissue Proper, Skeletal tissue, Vascular tissue.
UNIT III: Muscular Tissue
Muscular Tissue: Striated Muscles, Unstriated Muscles, Cardiac Muscles.
UNIT IV: Alimentary system
Alimentary system: Diseases of Mouth (Inflammatory & Infectious conditions), Diseases of Pharynx (Tonsilitis and diphtheria), Diseases of Salivary Glands (Mumps, Calculus formation), Diseases of Oesophagus (Oesophageal varies, Inflammatory & infectious conditions).
UNIT V: Digestive System
Digestive System: Diseases of Stomach (Gastritis, Peptic Ulceration Tumours), Diseases of Intestine (Appendicitis, microbial diseases, typhod, food poisoning, cholera & desentry), bowel disease Tumours, Hernias, Intestinal, Obstruction & Malabsorption.
UNIT VI: Liver
Liver: Hepatitis, Inflammation & Liver failure.
UNIT VII: Pancreas
Pancreas: Pancreatitis, Fibrosis & Tumour.
UNIT VIII: Gall Blader
Gall Blader: Gall Stones, Jaundice.
UNIT IX: Circulatory System
UNIT X: Diseases of Heart
Cardiac failure, disorders of heart valves, rheumatic heart disease, cardiac arrhythmias, heart block), Disorders of blood pressure (types & hypotension).
UNIT XI: Respiratory system
Respiratory system: Disorders of upper Respiratory Tract (Infectious & inflammatory disorders common cold, sinusitis, tonsilitis pharyngitis, laryngitis, Diptheria, Hay fever).
UNIT XII: Disorders of lungs
Disorders of lungs - Pneumonia, Lung abscess, tuberculosis, Bronchial carcinoma, lung collapse.
Reference Books:

BSCMLT24 --- Human Anatomy & Physiology

UNIT I: Introduction Human Body
Overview of organ systems, Directional and regional terms, Cavities and planes, Homeostasis and negative and positive feedback systems, Life processes.
UNIT II: Tissues and Integumentary System
Cell membranes, transport and junctions, Structure, function and locations of epithelial, connective, muscle and nerve tissues, Microscopic identification of tissue types, Structure and function of skin, (layers and accessory organs).
UNIT III: Skeletal System
Functions of skeletal system, Anatomy of long bone, Bone histology, Naming all bones of axial and appendicular skeleton, Formation, growth and repair, Structural and functional classification of joints, Types of movement Calcium homeostasis.

UNIT IV: Muscular System
Functions of muscular system, Names of all major muscles, Origin, insertion and action, Sliding Filament Model: Neuromuscular junction, Structure (gross and microscopic), Physiology of muscle contraction, Muscle metabolism (ATP), Fiber types.

UNIT V: Cardiovascular System
Functions of circulatory system, Heart structures (chambers, valves, vessels), Circulatory routes (systemic, pulmonary, coronary and hepatic portal), Blood vessels and pressure, Blood components, function and typing Blood clotting, Regulation and conduction (EKG).

UNIT VI: Lymphatic/Immune System
Functions of lymphatic system, Structures (vessels, nodes, cells), Lines of defense, Humoral immune response, Cell mediated immune response, Immune cell types, Disease/AIDS.

UNIT VII: Digestion and Nutrition
Functions of digestive organs, Modes of mechanical digestion, Chemical digestion (hormones, enzymes, pH), Absorption and elimination, Name parts of GI Tract and accessory organs, Nutrition and metabolism (production of ATP), Biological polymers.

UNIT VIII: Excretory System
Functions of urinary system, Kidney, ureter, bladder, urethra, Microanatomy and function of nephron.

UNIT IX: Respiratory System
Functions of respiratory system, Anatomy of respiratory tract, Mechanics and regulation of breathing, Gas exchange and gas laws.

UNIT X: Nervous System
Functions of nervous system, Nerve cell anatomy, Neural physiology (action potential, synaptic transmission, Na/K pump), Brain anatomy and hemispheres, Spinal cord anatomy, reflex arc, PNS (autonomic and somatic), Sensory motor nerve functions, Sensory organs.

UNIT XI: Endocrine System
Functions of endocrine system, Naming organs/glands/cells and their hormones, Hormone types and target cells, Homeostasis and feedback loops, Chemical messengers.

UNIT XII: Reproductive System
Functions reproductive systems, Male and female anatomy, Menstrual cycle, Meiosis/gamete production.

Reference Books:

BSCMLT25P --- Microbiology: Techniques Practical

UNIT I: Microbiology laboratory
To demonstrate safe code of practice for a microbiology laboratory, To prepare cleaning agents and to study the technique of cleaning of glassware.

UNIT II: Compound microscope
To study the working and handling of compound microscope, To study the method of sterilization by Autoclave.

UNIT III: Method of sterilization
To study the method of sterilization by Hot Air Oven, To study the method of sterilization of media/solutions by filtration.

UNIT IV: Nutrient Agar
To prepare Nutrient Agar in laboratory, To prepare Blood Agar in laboratory.

UNIT V: Plates and agar slants
To prepare culture plates and agar slants, To perform inoculation of culture media (plates, slants and culture media).

UNIT VI: Antimicrobial susceptibility
To test the antimicrobial susceptibility of given bacterial culture on nutrient agar plates by Disc Diffusion Method.

UNIT VII: Morphology of giardia lambia
To study the morphology of giardia lambia from permanent slides.

UNIT VIII: Entamoeba histolytica
To study the morphology of Entamoeba histolytica from permanent slides.

SEMESTER-III

BSCMLT31--- Biochemistry: Clinical Aspects

UNIT I: Management and planning
Reception and recording of specimens, maintenance of laboratory records, reporting.

UNIT II: Specimen collection
Whole blood, plasma, serum, urine, C.S.F & other body fluids, preservation of specimens, anticoagulants.

UNIT III: Quality Control
Role of quality control and its importance. Accuracy, Reliability, Precision. Internal and external quality control measure, preparation of reagents, standardization of methods, safety measures and precautions.

UNIT IV: Glasswares
Types, use, care and maintenance of flasks, pipettes, cylinders, funnels, tubes, thermometers.

UNIT V: Analytical instruments and techniques
Principles, types, use, care and maintenance of photoelectric colorimeters, spectrophotometers, flamephotometers, electrophoresis, Chromatography, Elisa and RIA, isotopes.

UNIT VI: Medical lab technology
Introduction to medical lab technology: General introduction Role of medical lab technologists, ethics, responsibility, safety measures and first aid. Cleaning and care of general laboratory glassware and equipment.

UNIT VII: Biochemical test profiles
Principle and use of Glucose tolerance test, liver function tests, kidney function tests, Thyroid Function Test.

UNIT VIII: Distilled water
Distilled water: Types of distilled water plants, preparation & storage.

UNIT IX: Solutions
Definitions: Mole, molar and normal solutions (preparation, Standardization); \( \text{pH} \) (Definition, \( \text{PK} \) value, Example.

**UNIT X: Derivation of Henderson**
Derivation of Henderson-Hasselbalch equation; Buffer solutions (Definition, preparation of important solutions), \( \text{Ph} \).

**UNIT XI: Analytical balance**

**UNIT XII: Medical lab technologists**
General introduction Role of medical lab technologists, ethics, responsibility, safety measures and first aid.

**Reference Books:-**

**BSCMLT32---Applied Microbiology**

**UNIT I: Management and Planning.**
The reception and recording of specimen, cataloguing and indexing maintenance of laboratory records.

**UNIT II: Working and maintenance of Equipment**
A knowledge of working and maintenance of the following Incubators, Refrigerators, Water baths, Ovens, Steamers, Autoclaves, Inspissator, Centrifuges, Vaccum Pumps, Water Steel.leaning and sterilization of syringes and needles. Simple glass wares.

**UNIT III: Sterilization**
Methods of sterilization and their uses. Chemical, dry heat, steam sterilization, Tyndalisation,filtration, sterilization by ultra-violet light, Care and use of microscope.

**UNIT IV: Dark ground illumination**
Dark ground illumination, fluorescence and microscopy, Common bacteriological staining techniques, Cultural Methods.

**UNIT V: Systemic Bacteriology**
The general principles of the methods employed in identifying an unknown organism.
Elementary knowledge of common pathogens.

**UNIT VI: Technique oriented examination**
Technique oriented examination of specimens such as pus, urine, stool, sputum, throat swab, Parasitological techniques and elementary knowledge of life cycle and lab.

**UNIT VII: Parasites**
diagnosis of common parasites, Introduction to virology techniques.

**UNIT VIII: Serological Methods**
Methods of performing agglutination, complement fixation, precipitation tests. General knowledge of antigen antibody reactions, Mycology as related to Candida and Dermatophytes.

**UNIT IX: Preservation and Maintenance**
Methods of preservation of cultures, maintenance of stock cultures, disposal of infected material
and culture media.

**UNIT X: Introduction to Entomology Identiﬁcation of Adultworms**
Introduction to Entomology Identiﬁcation of Adultworms - mosquitoes, ﬂies, ticks and fleas
Animal care, handling and uses in parasitology.

**UNIT XI: parasitic antigens**
Preparation of parasitic antigens, antigens and antisera Handling and operating of sophisticated equipment.

**UNIT XII: Advanced techniques in microbiology**
Advanced techniques in microbiology ELISA, RIA, CCIEA, Co-agglutination GLC, HPLC etc.

**Reference Books:-**
3. Wastewater Microbiology (Wiley Series in Ecological and Applied Microbiology) by Gabriel Bitton (Hardcover - May 18, 2005).

**BSCMLT33 --- Blood Banking and special Hematological Tests**

**UNIT I: Red Blood Cells**
Normal morphology count, Isolation from whole blood & count, Effect on count & morphology of physiochemical parameters & the diseased state, Red cell anomalies & their relevance w.r.t normal & diseased state.

**UNIT II: Blood Transfusion**
Pre-requisite & the complication of mis-matched transfusion, Methods of blood matching

**UNIT III: White blood cells & platelets**
Morphology count & methods of isolation, Effect on count & morphology of cell by the physiochemical parameters, diseased.

**UNIT IV: State & the relevance of condition of the diseases Anaemia**
Deﬁnition (in general) & courses, types of anaemia & their classiﬁcation, Physiochemical, characteristic features & etiology of a plastic anaemia, haemolytic, megaloblastic, Clinical features & diagnosis.

**UNIT V: Leukaemia**
Deﬁnition (in general) & their etiology, Classiﬁcation of leukaemia, FAB classiﬁcation, Etiologies, physiochemical features of different Type of leukaemias, with reference to clinical states, Diagnosis of different types of leukaemias.

**UNIT VI: Coagulation studies**
General pathways (intrinsic & extrinsic), Properties (physiochemical) mode of action of coagulation factors, Platelet studies, platelet function tests (for different Coagulation factors).

**UNIT VII: Effect of promoters**
Effect of promoters & inhibitors at diff steps in coagulation, their solution & mode of action, Diseases associated with coagulation disorders, their etiology & characteristics Features.

**UNIT VIII: Red Cell mass studies**
Chemical method & radioactive methods, Red Cell function studies.

**UNIT IX: Steps in Blood Management**
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.
UNIT X: Buffers collection of blood
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.

UNIT XI: Haematocrite
Determination of haematocrite and E.S.R, preparation of haemolysate and determination of
alkali resistant hemoglobin, paper electrophoresis of haemoglobin.

UNIT XII: Platelet studies
Platelet function tests (for different Coagulation factors).

Reference Books:
1. Special Tests for Orthopedic Examination - Paperback (Jan. 15, 1997) by Jeff G. Konin MEd MPT
   ATC, Denise L. Wiksten PhD ATC, and Jerome A. Isear Jr. MS PT ATC.
2. The Special Educator's Comprehensive Guide to 301 Diagnostic Tests - Paperback (Aug. 25,
   2006) by Roger Pierangelo Ph.D. and George Giuliani J.D. Psy.D.

BSCMLT34 --- Cytopathology

UNIT I: Cytology
General properties of living organisms; chemistry of the cells; cellular membranes; cytoskeleton;
endoplasmic reticulum; Golgi body; lysosomes; nuclear envelope; chromatin and chromosomes;
mitosis; meiosis.

UNIT II: Outline of Embryology
Gametogenesis; reproductive cycle; fertilisation; cleavage; a model of gastrulation.

UNIT III: Histology
Epithelial tissue; connective tissues (blood connective, cartilage, bone); muscular tissue; nervous
tissue.

UNIT IV: Evaluation
Introduction, Evaluation and reporting of Cytopathology specimens.

UNIT V: Clinical residents
Clinical residents in the following, keeping in view the special requirements of each case
(Cytohormonal status, malignancy, infection, etc.).

UNIT VI: Type of smear
Type of smear (morning specimen, after specimen, pre-menstrual specimen, etc.).

UNIT VII: Method of obtaining various specimens
Method of obtaining various specimens urine sample, gastric smear, colonic lavage etc.

UNIT VIII: Solutions of stains
Principles and preparation of solutions of stains.

UNIT IX: Techniques for concentration of specimens
Techniques for concentration of specimens: various filters and cytocentrifuge.

UNIT X: Gynaecological Cytopathology Module:
Normal anatomy, histology and cytology of the cervix and endometrium, Sampling methods for
the cervix, Microbiology of the female genital tract and the cytological presentations of
common infections of the cervix.

UNIT XI: Non - Gynaecological Cytopathology Module:
Introduction to routine screening and reporting of Non-Gynaecological Cytology specimens
including those from: Respiratory, Effusion, Urinary; as well as FNA cytology of Breast.
UNIT XII: Cytopreparation techniques
Cytopreparation techniques, Ancillary testing and Laboratory safety, The role of Cytology in clinical evaluation and patient management.

Reference Books:

BSCMLT35P --- Organization and ethics practical

UNIT I: Water analysis by MPN technique--Presumptive coliforms test, Confirmed coliforms test, completed coliforms test.
UNIT II: Isolation of microorganisms from air - air sampler techniques - settle plate method.
UNIT III: Isolation and counting of fecal bacteria from water.
UNIT IV: Detection of bacteria in milk by Dye reduction test; Detection and quantification of bacteria in milk.
UNIT V: Litmus milk reaction.
UNIT VI: Isolation of lactobacilli and staphylococcus from curd.
UNIT VII: Azolla - Morphological study; seed inoculation with rhizobia.
UNIT VIII: Isolation of bacteria and fungi from spoiled food, Isolation of fungi from molting leaves.

SEMESTER IV

BSCMLT41 --- Biochemistry: Metabolism

UNIT I: Introduction to Metabolism and Bioenergetics
Introduction, universal carrier molecules, Bioenergetics of phosphate compounds, Regulation of metabolic processes.
UNIT II: Glycolysis
Glycolysis: Introduction, Release of energy from glucose, Phases of glycolysis, Energy yield from the pathway, Anaerobic glycolysis, Sources of glucose for glycolysis.
UNIT III: The Citric Acid Cycle
Cellular respiration, Stages of cellular respiration, The Citric acid cycle, Phases of reactions of citric acid cycle.
UNIT IV: Additional Pathways in Carbohydrate Metabolism
Pentose phosphate pathway, Glyoxylate cycle, Gluconeogenesis, Glycogen synthesis, Starch synthesis.
UNIT V: Electron Transport and Oxidative Phosphorylation
Introduction, Components of electron transport chain, Electron Transport – Carriers and arrangement of carriers into complexes, pathway of Electron Transfer through the Carriers, Proton Motive force.
UNIT VI: Photosynthesis
Basic process of photosynthesis, physics of light, Chloroplast structure, Light reaction and
UNIT VII: Dark reaction
Dark reaction – Calvin cycle, Photorespiration.

UNIT VIII: Lipid Metabolism
Lipid digestion and absorption, Fatty acid oxidation, Ketone body metabolism, Fatty acid biosynthesis, Cholesterol biosynthesis, Eicosanoids, Synthesis of phospholipids and sphingolipids.

UNIT IX: Carbohydrate Metabolism
Uptake of carbohydrates by animals, microbes and plants; Catabolism of carbohydrates.

UNIT X: Integration of Metabolism
Integration of Metabolism - Organ specialization and hormone action.

UNIT XI: Metabolic principles
Metabolism-Metabolic principles and analysis of pathways.

Reference Books:-
3. Annual Plant Reviews, Biochemistry of Plant Secondary Metabolism (Volume 40, 2) by Michael Wink (Hardcover - Jun 1, 2010).

BSCMLT42 --- detailed techniques of clinical microbiology

UNIT I: Classification of bacteria
On bacilli of differential staining Gram,s Stain .( its modification ) ZN .Stain ( its modification) On basis of their structure.

UNIT II: Pre –remit of sample collection
Pre –remit of sample collections-general & disease specific their processing & storage, Identification of bacteria on basis of cultural characteristics ,morphological , & serological features.

UNIT III: Features
Staphylococcus & streptococcus including pneumonococcl, Family Enterobacterical, Haemophilus bordetlla, Corynebacterium, Nessieria .Treponema, Leptospira ,mycoplasma,chlamydia & Trieagents.

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

UNIT V: General morphology
Urology General morphology & ultra structure of virus and growth cycles.

UNIT VI: Introduction to clinical microbiology
public health, diagnostic testing, pharmaceutical sales, and basic research and development.

UNIT VII: Mechanisms of Microbial Pathogenicity
microbial pathogenicity including both overt microbial factors and complex interactions with the host that produce symptoms of disease.

UNIT VIII: Microbial disease
The cellular, biochemical, molecular, and genetic bases for modern understanding of microbial disease.

UNIT IX: Epidemiology of Infectious Disease
the causes, distribution, control, and prevention of infectious disease in human populations. Basic epidemiological concepts, including study design, analysis, and modeling of infectious disease data, establishing causal relationships, detecting confounding factors.

UNIT X: Gram negative coco bacilli
Brucella,Bordetella,Pasteurella,Gardnerella,Francisella,Hemophilus,Legionella.

UNIT XI: Rickettsiae
Rickettsiae-Introduction,Pathology,Diagnostic procedures, Antibiotic susceptibility testing- -Agar disc diffusion test,MIC,Quality control.

UNIT XII: Chlamydiae
Introduction,Pathology,Diagnostic procedures.

Reference Books:-

BSCMLT43 --- Haematology: Haemostatis and Pathology

UNIT I: Introduction
Definition and scope of pathology, Causes of diseases, hereditary and acquired, Diseases, Subdivisions of pathology , Techniques in pathology , Diagnostic pathology ( biopsies, cytology, autopsy).

UNIT II: Inflammation
Definition, causes and types, General Effects of inflammation, Dynamics of Inflammation - Function of fluid exudates; function of cellular exudates, Chemical mediators.

UNIT III: Environmental and nutritional pathology
Smoking, Radiation injury, Nutritional: malnutrition, obesity, Vitamin deficience.

UNIT IV: Haemodynamics

UNIT V: Neoplasia
Definition, Nomenclature, Examples of benign and malignant tumours, Features of benign and malignant tumours, Spread of tumours.

UNIT VI: Growth disorders
Atrophy, hypertrophy, hyperplasia, metaplasia, dyplasia and neoplasia, Precancerous lesions, and carcinoma in situ.

UNIT VII: Introduction to Haematology & Haemostatis
Hematopoiesis, Anemia introduction & Classification.

UNIT VIII: Megaloblastic anemia
Iron deficiency anemia & other hypochromic microcytic anemias.

UNIT IX: Hemolytic Anemias Introductions
& Classification, Hemolytic Anemias II- Structural hemoglobinopathies, Aplastic Anemia, Anemia of chronic disorders Malaria.

UNIT X: Leukemias introductions
& classification, Acute leukemia, Chronic myeloid leukemias, Chronic Lymphocytic
leukemias, Myelodysplastic syndromes & other preleukemic conditions, Physiology of coagulation & Haemostasis.

UNIT XI: Bleeding disorders
Introduction & Classification, Congenital bleeding disorders, Acquired bleeding disorders.

UNIT XII: Haemolytic anaemias
Mechanisms of shortened red cell survival, Feature and management of congenital and acquired haemolytic states, Molecular pathology of thalassaemia and common haemoglobinopathies, Causes of haemolysis, Diagnostic of haemolytic anaemia. Anaemias complicating systemic disease, Aplastic anaemia, Myelodysplastic syndromes.

Reference Books:-

BSCMLT44 --- Histopathology and Techniques

UNIT I: Histopathology and Techniques
Management and planning, receiving and recording of specimens, indexing, maintaining records.

UNIT II: Maintenance and use
Knowledge of maintenance and use of the following: Microscope, Automatic tissue processor, vacuum embedding bath, microtomes (various types with working of each), hot plates, refrigerators, cryostat.

UNIT III: Tissue processing
Introduction, details of paraffin embedding, vacuum embedding, Decalcification.

UNIT IV: Microtomes
Section cutting and different types of microtomes.

UNIT V: Frozen section
Introduction, uses and techniques, Theory and principles of different staining procedures in Histopathology, Histochemistry.

UNIT VI: Functions of organs
Structure and function of vital organs like liver, spleen, kidney, heart, brain etc.

UNIT VII: Museum methods
Museum methods — mounting of specimens, preparation of mounting medium, sealing the Jars, Various medicolegal procedures maintaining records.

UNIT VIII: Histopathology
Theory of Histopathology, Reception of specimens, Histopathology of Tumor cell, Histopathology of Liver, Kidney, Adrenal, Ovary, Testies, Method of preparing stains & Fixatives.

UNIT IX: Tissue processing

UNIT X: Preparation
Preparation of smear for Fine needle aspiration cytology, Pap’s smear theory and identification of cells in a normal vaginal smear.
UNIT XI: Stool examination

UNIT XII: Staining
H and E staining, preparation of stain solutions.

Reference Books:-

BSCMLT45P --- Biochemistry Practical

UNIT I: Study of the cell
Cell culture, lymphocyte isolation & culture, growth rate studies, staining techniques, Cell fractionation, homogenization of the tissue, centrifugation, marker enzyme assays
Microscopy and microphotography.

UNIT II: Quantitative assays
Enzyme assays, RIA, ELISA, DNA, RNA & proteins.

UNIT III: Quantitative assays
Enzyme assays, RIA, ELISA, DNA, RNA & proteins., Protein fractionation – Salting in and out, gel filtration, electrophoretic separation, Gel filtration affinity based techniques, SDS-PAGE, Electrophoretic separation of LDH isoenzymes.

UNIT IV: Enzymology
Introduction, purification of enzyme & its kinetics.

UNIT V: DNA
Genomic and plasmid DNA isolation, Restriction enzyme digestion, Electrophoresis, PCR, RTPCR.

UNIT VI: blotting
Southern blotting, Western blotting.

UNIT VII: Chromatographic techniques
HPLC, Gel filtration, ion exchange, affinity chromatograph.

UNIT VIII: Absorption
Absorption & fluorescence spectroscopy.

SEMESTER-V

BSCMLT51 --- General Microbiology

UNIT I: Principle of staining methods
Principle of staining methods and preparation of reagents, Aerobic and anaerobic culture methods.
UNIT II: Antigen and Antibody
General characters and nature of antigen and antibody, Principle of antigen antibody reaction
Collection.

UNIT III: Microbiological Investigations
Transportation and processing of clinical samples for microbiological investigations.

UNIT IV: Bacteria and Fungi
Principle and mode of action of antibiotics and chemotherapeutic agents for bacteria and fungi
Care and handling of laboratory animals.

UNIT V: Laboratory organisation
Laboratory organisation, management, recording of results and quality control in microbiology.

UNIT VI: Virology
Isolation of viruses in laboratory by tissue culture, Embryonated eggs and different laboratory
animals, cell and tissue, culture technology, Animal cell lines.

UNIT VII: Principles of Virology
Principles of different serological tests used in Virology.

UNIT VIII: Parasitology
Morphology and diagnosis of Oral vaginal flagellates Trichomonas, E. Gingivalia, Morphology and
life cycle of Haemoprotozoa Material parasite including falciparum, Laboratory diagnosis of
Material infection.

UNIT IX: Medical Helminthology
General characters and classification of Medical Helminthology.

UNIT X: Morphology and life cycle
Morphology and life cycle of Nematodes(Intestinal) Ascaris, Enterobious, Ancylostoma, Trichuris,
Strongloides.

UNIT XI: Intestinal nematode infection
Laboratory diagnosis of intestinal nematode infection.

UNIT XII: Microscope optical systems
Compound microscope optical systems, magnification and maintenance.

Reference Books:-
1. General Microbiology by Hans Günter Schlegel, C. Zaborosch, M. Kogut.
2. General Microbiology by Roger Y. Stanier.

BSCMLT52 --- Methodology of Staining

UNIT I: Microbial Media
Microbial Media: Preparation of media for bacteriological culture (Nutrient agar, Mc
Conkey), Specimen collection from patients, clinics and hospitals, Specimen collection for
epimiological investigation.

UNIT II: Types of media
Types of media with their general or special use and example.

UNIT III: Microbial culture
Microbial culture: Mixed and pure culture, Isolation of pure culture.

UNIT IV: Cultural characteristics of different plate
Cultural characteristics of Spread plate, Streak plate and Pour plate, Aerobic and Anaerobic
culture, Storage of stock culture.

UNIT V: Microbiological stains
Introduction, uses, Microbiological stains.

UNIT VI: Staining technique
Different types of staining techniques and their uses, The wet mount, hanging drop and fixation.

UNIT VII: Structural staining
Staining of smear, simple, negative, differential and structural staining.

UNIT VIII: Staining properties
Staining properties of bacteria.

UNIT IX: Gram
Gram positive and gram negative stain.

UNIT X: AFB Staining
Introduction, properties of AFB Staining.

UNIT XI: Physical and chemical theories of staining
Principle, procedure and applications of simple positive and negative staining.

UNIT XII: Structural staining
Cell wall, endospore, flagella and capsule.

Reference Books:-
3. Davis, Dulbeto, Eisen Microbiology.

BSCMLT53 --- Microbial Molecular Genetics

UNIT I: The study of Microbial genetics
Inheritance of characteristics and variability,) Phenotype & genotypic.

UNIT II: Genotypic changes
Mutation (Types), It's Occurs, Repairing.

UNIT III: Bacterial Recombination
Introduction: Conjugation ,Advantages, Properties.

UNIT IV: Transduction
Introduction generalized and specialized transduction, Transformation.

UNIT V: Gene Activity
The Regulation and expression of gene Activity , properties.

UNIT VI: Control of Microbes and Antibiotics
Physical methods of control: Moist heat-principle and application of pasteurization, tyndallization and autoclaving.

UNIT VII: Microbial Physiology
Properties, nomenclatures, classification, mechanism of action, factors affecting enzyme activity, enzyme inhibitors, regulation.

UNIT VIII: Microbial Genetics
Nucleic acids: DNA and RNA-composition, structure, replication in prokaryotes and eukaryotes, models of replication.

UNIT IX: Microbial interactions
Rhizoplane, rhizosphere, mycorhizza, symbiotic and non-symbiotic, interactions.

UNIT X: Types of Microbiology
Agricultural Microbiology, Environmental Microbiology, Food and Dairy Microbiology, Industrial Microbiology, Medical Microbiology.
UNIT XI: Nucleic Acids
Structure, physical and chemical properties of DNA and RNA, extrachromosomal DNA-profile, function and evolution. DNA replication, damage and repair, spontaneous and induced mutation, reversion of mutation.

UNIT XII: Transposition
Structure of transposons, replicative and non-replicative transposition, transposon mutagenesis, Genetic recombination, Molecular models and mechanism, Gene conversion.

Reference Books:

BSCMLT54 --- Applied Immunology

UNIT I: Basic concepts
Introduction of Immunology and its application, Antigen, Antibody, Immune complex.

UNIT II: Autoimmunity
Introduction of Autoimmunity, Laboratory test for detection of Antigen and Antibodies, Autoimmune disorders.

UNIT III: ELISA and RIA

UNIT IV: Serological techniques
Basic and advanced Serological techniques and its application.

UNIT V: Serological tests
Serological tests : Widal, VDRL Resewaller, Brucella agglutination and Cold agglutination.

UNIT VI: Electrophoresis and Chromatography
Principle, Technique and application., I. Thin layer chromatography (TLC), II. Polyacrylamide Gel Electrophoresis (PAGE), SDS – PAGE, III. Agrose Gel Electrophoresis.

UNIT VII: Antigens and antibodies
Types of antigens, antigenecity, factors influencing antigenicity and types of immunoglobulins.

UNIT VIII: Structure of Immunology
Structure of Immunoglobulins, production of polyclonal and monoclonal antibodies.

UNIT IX: Major histocompatibility complex
Major histocompatibility complex: Generation of humoral and cellular immune responses and effector mechanisms; antigen processing and presentation.

UNIT X: Antigen antibody
Antigen antibody interactions and its applications.

UNIT XI: immunological memory
Complement system; action of cytotoxic T lymphocytes; Natural killer cells, ADCC.

UNIT XII: Immunology in health and disease
Autoimmunity, immunodeficiencies hypersensitivity; concept of immunotherapy.

Reference Books:

BSCMLT55P --- Microbial Molecular Genetics Practical

UNIT I: Bacterial genome
The bacterial genome and gene expression, DNA replication and fidelity of replication in bacteria.

UNIT II: Mutations Terms
Mutations, mutants and mutagenesis, DNA damage and repair.

UNIT III: Genetic information
Exchange of genetic information between bacteria, The eukaryotic genome and gene expression.

UNIT IV: Control of gene
Control of gene expression in prokaryotic and eukaryotic systems.

UNIT V: Bacterial molecular genetics
Bacterial molecular genetics and recombinant DNA technology.

UNIT VI: Experiments-I
Bacterial molecular genetics including DNA damage by UV-light and exchange of microbial resistance genes via conjugation.

UNIT VII: Experiments-II
Demonstrate the key techniques in gene cloning.

UNIT VIII: Molecular cell biology
Molecular cell biology dry practical case study and data interpretation.

SEMESTER VI

BSCMLT61 --- Virology

UNIT I: General morphology and ultra structure of Viruses
Introduction, Capsids- Helical Symmetry, icosahedral symmetry and complex symmetry, Envelope: Glycoprotein and matrix protein.

UNIT II: Viral genome
Introduction: their types and structure.

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

UNIT IV: Assays of viruses
Introduction of 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.

UNIT V: Serological methods
Haemagglutination, haemagglutination inhibition, complement fixation, immunofluorescence assays (IFA) ELISA, RIA.

UNIT VI: 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 VII: Bacteriophages
Classification, Morphology and ultrastructure, One step growth curve (Latent period, eclipse period and burst size).

UNIT VIII: Life cycle
Lytic and Lysogenic cycles of bacteriophages.

UNIT IX: Animal viruses
Animal viruses; classification and nomenclature.

UNIT X: DNA viruses
Life cycles and other details of DNA viruses: herpes, adeno and SV40.

UNIT XI: RNA viruses
Life cycle and other details of RNA viruses: Retroviruses, oncogenic viruses and lentiviruses (HIV), picorna, ortho myxo and paramyxo.

UNIT XII: Characteristics of the following viruses with tests
Pox virus, Myxovirus, Arbovirus, Herpes virus, Enterovirus, Rabies virus, Rota virus, HIV virus, Oncogenic viruses (in brief).

Reference Books:

BSCMLT62 --- Mycology

UNIT I: Mycology
Introduction to mycology, classification of fungal infections, fungal infections in men.

UNIT II: Fungal infections
Laboratory diagnosis of fungal infections-Specimens collection, transport of specimens.

UNIT III: Direct microscopic
Different methods employed-direct microscopic examination, Slide culture technique, fungal culture, serology and animal inoculation.

UNIT IV: Cutaneous mycoses
Superficial cutaneous mycoses- Malassezia infections, Taenia nigra, Piedra, Dermatophytosis.

UNIT V: Subcutaneous mycosis
Subcutaneous mycosis-Mycetoma, Sporotrichosis, Chromoblastomycosis, Phaeohyphomycosis, Rinosporidiosis, Lobomycosis.

UNIT VI: Systemic mycoses
Systemic mycoses-Histoplasmosis, Blastomycosis, Coccidioidomycosis, Paracoccidioidomycosis.

UNIT VII: Opportunistic mycoses
Introduction- Candidiasis, cryptococcosis, Penicilliosis, Aspergillosis, Zygomyces, Occulomycosis, Otomycosis, Mycotic poisoning.

UNIT VIII: Types of Mushroom Poisoning
Types of Mushroom Poisoning and other Mycotoxins: Prognosis and Treatment, Culture isolation and identification.

UNIT IX: Treatment options for infections
Treatment options for infections in animals humans, Isolation and culture of pathogenic fungi; Common laboratory contaminants.

UNIT X: Superficial mycoses
Introduction, Pityriasis Versicolor; Tinea Nigra; Piedra.

UNIT XI: Subcutaneous mycoses
UNIT XII: Opportunistic Infections
resulting from a weakened immune system due to a variety of intrinsic and extrinsic causes:
Candidiasis; Cryptococcosis; Pseudallescheriasis Aspergillosis; Zygomycosis.

Reference Books:-