STATE BOARD OF ALLIED MEDICAL SCIENCES ,ODISHA

B.Sc.IN MEDICAL LABORATORY TECHNOLOGY

(BMLT)

Programme: B. Sc. in Medical Laboratory Technology

Duration: Three years (Six semesters) full-time programme with 6 months internship in the last semester.

Eligibility: +2 Science with Physics, Chemistry & Biology or equivalent degree

Examination: Examination rules will be as per guidelines of respective Universities

Project: A candidate will have to carry out a mini project work as mentioned in the course structure. After completion of the mini project, the student has to submit the dissertation of the mini project. Internal evaluation of the same (consisting of presentation and viva-voce) will be conducted by the respective Institution.

Internship: A candidate will have to undergo internship for a period of six calendar months in a hospital/Diagnostics Centre equipped with modern pathology laboratory facility or in a fully equipped pathology laboratory, which fulfils the norms decided by the University.

Dissertation will be compulsory to all students. Students will carry out dissertation work individually or in the group of not more than three students. The format for dissertation/ Internship report will be similar to the research thesis style; incorporating chapters on: Introduction, Materials and Methods, Results and Discussion and References / Bibliography. The dissertation will be submitted in a typewritten and bound form.

Degree: The degree of B. Sc. in Medical Laboratory Technology course of the University shall be conferred on the candidates who have pursued the prescribed course of study for not less than three academic years and have passed examinations as prescribed under the relevant scheme and completed 6 months of compulsory internship in the last semester. On successful completion of three years programme, with a minimum pass mark of 50% candidates will be graduated **"Bachelor of Science in Medical Laboratory Technology (B.Sc. MLT)"** respective universities.

Plan of Classes & Examination Pattern for Degree course (BMLT)

- Total duration of each course is 3 years (6 Semesters).
- Each semester is of 6months duration.
- In each semester the classes will be of 5months duration & internal assessment will be conducted in the last month of each semester except 3rd & 6th semester .
- University examination will be conducted at the end of 3rd & 6th Semester.
- In each semester, the classes will be of 500 hours including theory and practical/clinical.
- **Distribution of classes**: There will be 5 hours of classes / day for 5 days in a week, 25 hours / week, 100 hours /month and 500 hours in each semester.
- Of the 500 hours of classes, 200 hours will be dedicated for the theory classes; rest 300 hours will be practical / clinical.
- **Attendance in Class:** A Student will be eligible to appear in the semester and university examination if he/she has attended minimum75% theory classes and 85% practical classes.

EXAMINATION PATTERN

- **Internal assessment:** Internal assessment will be conducted in the last month of each semester except 3rd & 6th semester(where there will be University examination.)
- **Mark Distribution:** 50 marks per each subject (30 Theory and 20 practical/clinical).Minimum qualifying mark: 50 % in each theory and practical/clinical.
- **Question Pattern for Theory (Semester Examination):**
  i. Short questions of 2 marks each X 5 = 10
  ii. Multiple choice question1 mark each X 5 = 5
  iii. Fill in the blanks 1mark each X 5 = 5
  iv. Match the following 1 mark each X 5 = 5
  v. Long Question (Choice) 1 X 5 = 5
- **University Examination:** Candidate has to pass two university examinations to be conducted at the end of 3rd Semester & 6th Semester, of 100 marks/ subject. A student will be eligible to appear in the university examination if he/she has secured 50% in internal assessment done at the end of 1st, 2nd, 4th & 5th semester.

Degree: On successful completion of three years programme, the candidate will be awarded with **"Bachelor of Science in Emergency Medicine Technology (B.Sc.-EMT)"** .

FIRST YEAR		
Sl. No.	**Subject**	**Subject type (The+Prac+Proj)**
1	Human Anatomy and Physiology	3+3+0
2	Cell Biology	3+2+0
3	Medical Instrumentation and Technique	2+4+0
4	Biochemistry	3+1+0
5	Clinical Pathology	3+2+0
6	Immunology	3+1+0
7	Molecular Biology	3+3+0
8	Medical Terminology ,Record keeping and orientation to Medical Laboratory Science	3+0+0
9	Medical Instruments and Techniques	2+4+0
SECOND YEAR		
1	Haematology	3+2+0
2	Microbiology	3+2+0
3	Medical Law and Ethics	2+0+1
4	Histology	3+1+0
5	Advanced Hematology	3+1+0
6	Research Methodology	2+0+1
7	Analytical Biochemistry	3+2+0
8	Applied Haematology	3+2+0
9	Immunopathology	3+0+1
10	Parasitology	3+2+0
THIRD YEAR		
1	Blood Banking	3+0+1
2	Medical Laboratory Management	3+0+2
3	Introduction to Quality and Patient Safety	3+0+2
4	Mycology & Virology	3+2+0
5	Immunology	3+2+0
6	Molecular Biology	3+2+0
PROJECT		
INTERNSHIP		

FOUNDATION COURSE

Introduction to Health care Delivery System in India	Basic computers and information Science	Communication and soft skills	Introduction to Quality and Patient safety (including Basic emergency care and life support skills, Infection prevention and control,	Medical Terminology and Record keeping (including anatomical terms)
Biomedical waste management	Disaster management and Antibiotic resistance)	Professionalism and values	Biostatistics & introduction to Research methodology	Medical Law and Ethics Biostatis methodo

BACHELOR OF SCIENCE IN MEDICAL LABORATORY TECHNOLOGY

Human Anatomy and Physiology

Subject Name	**Type of course**
Human Anatomy and Physiology	Theory+ Practical

Objectives:

- To identify different types of cells and describe their functions.
- To identify the organelles of a typical cell and describe their functions.
- To identify the major components of the integumentary system and describe their functions.
- To identify the major structures of the skin and describe their functions.
- To identify the major components of the circulatory, endocrine, nervous system etc and describe their functions.

Learning outcome:

- Use anatomical terminology to identify and describe locations of major organs of each system covered.
- Explain interrelationships among molecular, cellular, tissue, and organ functions in each system.
- Describe the interdependency and interactions of the systems.
- Explain contributions of organs and systems to the maintenance of homeostasis.
- Identify causes and effects of homeostatic imbalances.
- Describe modern technology and tools used to study anatomy and physiology.

Course Outline

Module-1 (10 Hours)

- Scope of Anatomy and physiology.
- Terms and terminology used in Anatomy.
- Structure of cell, function of its components with special reference to mitochondria and microsomes.
- Elementary tissues: Anatomy of epithelial tissue, muscular tissue, connective tissue and nervous tissue.

- Skeletal System: Skeletal system with classification, types of bone, features of long bone, ossification, blood supply,
- Joints : classification with examples, structure of typical synovial joints, Joint disorders.

Practice: - Demonstration of individual bone from skeleton.
-Identification of different organs and system from chart.

Module-2

1. Cardiovascular System: Structure and functions of various parts of the heart
   -Brief information about cardiovascular disorders.
2. Composition and functions of blood.
3. Blood groups – ABO system and Rh factor and coagulation of blood.
4. Brief information regarding disorders of blood.
5. Lymph – origin, circulation, functions of lymph and lymph nodes.
6. Blood pressure and its recording.
7. Respiratory system: Introduction and functional anatomy of respiratory tract,
   -Physiology of respiration.

Practice: Demonstration of the morphology of different blood cells
Measurement of Blood pressure, Heart rates, respiration rate etc.

Module-3 (15 Hours)

Urinary System: Various parts of urinary system and their functions, structure and functions of kidney. Physiology of urine formation. Patho-physiology of renal diseases and edema.
Digestive System: Anatomy of digestive system and their functions. Structure and functions of liver, physiology of digestion and absorption.
Endocrine System: Endocrine glands and Hormones. Reproductive system. Structure and function of sense organs.

Practice: Demonstration of various parts of body, tissues of body, parts of digestive system, parts of respiratory system, parts of excretory system. Identification of different organs and system from chart

Cell Biology

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Cell Biology	Theory+ Project	3-0-1	Fundamental Science

Objective

- .Determine the parts of the cell membrane and the cell wall
- Distinguish the types and mechanism of mutation
- Compare and contrast the events of cell cycle and its regulation
- Understand the dynamic character of cellular organelles

Learning outcome

- Describe the fundamental principals cellular biology
- Develop a deeper understanding of cell structure and how it relates to cell functions.
- Understand how cells grow, divide, and die and how these important processes are regulated.
- Understand cell signaling and how it regulates cellular functions. Also how its dis-regulation leads to cancer and other diseases.

Course Outline

Module –1

An Overview of Cells: History, Cell theory, Structure and Function of Cell and its Organelles: Biological membranes - Nucleus - Nuclear envelope, Nucleolus, Mitochondria, Chloroplasts, Lysosomes, Gloxysomes and Peroxisomes, endoplasmic reticulum, ribosomes, Golgi complex (Structural organization, function, marker enzymes of the above organelles), Cell types: prokaryotes vs. eukaryotes; from single cell to multi-cellular organism; Different molecules of cell- water, salt and mineral ions etc.

Module- 2

Cell cycle and its regulation, Cellular communication and cell mobility: Cell cycle: G0/G1, S, G2 and M phages (Cell Division: Mitosis, meiosis and cytokinesis); regulation of cell cycle; cell adhesion and roles of different adhesion molecules, gap junctions, Extra- Cellular Matrix (ECM), Cell-cell interaction and cell- ECM interaction, The cytoskeleton, Microtubule- based movement and microfilament -based movement.

Module-3

Cell signaling, Programmed Cell Death (Apoptosis) and Cancer: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors (G-PCR), Tyrosine Kinase, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, bacterial chemotaxis, Intrinsic and Extrinsic apoptotic pathway, Caspase enzyme, Biology and elementary knowledge of development and causes of cancer; Tumor viruses, Oncogenes and tumor suppressor genes.

-Basic Medical Instrumentation and Techniques

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Basic Medical Instrumentation and Techniques	Theory+Practice	2-2-0	Fundamental Science

Objective

- To learn the principle, instrumentation & application of Microscopy
- Principle, instrumentation & application of Centrifugation.
- Principle of Spectroscopy

Learning outcome

- After completion of the course the student will be efficient in handling the microscopy equipment's.
- They will also be able to have idea about handling instruments like centrifuge, spectrophotometer, chromatography, flow cytometer, Automated and semi- automated Biochemistry analyzer.
- The conceptual understanding of the subject provides opportunities for skill enhancement and scopes for higher education.

Course Outline

Module -I

Microscopic techniques: Principle, Instrumentation, Specimen preparation and Application: Phase–contrast microscopy, fluorescene microscopy, polarization microscopy, electron microscopy (Scanning and Transmission);Bacterial Colony Counter (Principle and working). Laminar Air Flow (Principle and working technique).

Practice: *Demonstration of different Microscopes with their operation and maintain technique.*

Module- II

Colorimeter: Principle and Instrumentation; **Spectrophotometry**: Ultraviolet, Mass spectrophotometry; Flame photometry.**Centrifugation**: Principle; Preparative, Analytical, Density gradient centrifugation.**Cytometry**: Types, Flow cytometry and its applications.

Practice: *Operation, Demonstration and Quality control of Centrifuge, UV-Vis spectrometer, Colorimeter.*

Module- III

Microtomy: Sectioning, Staining. Application, Principle and Application of: Fully Automated Biochemistry Analyser, Semi- automated Biochemistry Analyser, Coagulometer.Principle, working and uses of: Incubator, Hot air oven, Autoclave.

Practice: Demonstration of Auto/ Semi auto Analyzer; Working procedure of microtome, Incubator, Hot air oven, autoclave and others

Biochemistry

Subject Name	Type of course	Th+Pr+Project	Prerequisite
Biochemistry	Theory+ Practice	3-1-0	Fundamental Science

Objective

- To understand the concept of metabolism of carbohydrates
- To understand the significance of amino acids, proteins
- Use of enzymes in enhancing metabolic reactions
- Role of lipids

Learning outcome

- After completion of the course the student will be developed a very good understanding of various biomolecules which are required

  for development and functioning of cells.

- Would have understood the significance of carbohydrates in energy generation and as storage food molecules for cells.

- They would have understood the significance of proteins and enzymes in accelerating various metabolic activities.

- The conceptual understanding of the subject provides opportunities for skill enhancement and scopes for higher education.

Course Outline

Module- I

Structure of enzyme: Apoenzyme and cofactors, prosthetic group-TPP, coenzyme NAD, metal cofactors, Classification of enzymes.

Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis, and Induced Fit hypothesis.

Enzyme inhibition, enzyme kinetics.

Diagnostic value of serum enzymes: Creatinine kinase, Alkaline phosphatase, Acid phosphatase, LDH, SGOT, SGPT, Amylase, Lipase, Carbonic anhydrase etc.

Practice: Study of effect of temperature on enzyme activity

Study of effect of pH on enzyme activity

Module- II

Carbohydrates: Biomedical importance & properties of Carbohydrates, Classification,

Families of monosaccharides: aldoses and ketoses, trioses, tetroses, pentoses, and hexoses. Stereo isomerism of monosaccharides, epimers, Haworth projection formulae for glucose; chair and boat forms of glucose.

Metabolism: Glycogenesis & glycogenolysis, Glycolysis, citric acid cycle & its significance, Components of respiratory chain, energy relationships during cell respiration, types of respiration. HMP shunt & Gluconeogenesis, regulation of blood glucose level.

Practice: Estimation of Glucose in urine

Estimation of Glucose in blood

Module- III

Amino acids: Classification, essential & non-essential amino acids. Chemistry of Proteins & their related metabolism, Classification, biomedical importance.

Metabolism: Ammonia formation & transport, Transamination, Decarboxylation, Urea cycle, metabolic disorders in urea cycle, catabolism of amino acids.

Practice: Estimation of Protein in urine

Estimation of Protein in blood

Module- IV

Chemistry of Lipids & their related metabolism: Classification, biomedical importance, essential fatty acids. Brief out line of metabolism: Beta oxidation of fatty acids, fatty liver, Ketogenesis, Cholesterol & it's clinical significance, Lipoproteins in the blood composition & their functions in brief, Atherosclerosis.

Diabetes mellitus: its types, features, gestation diabetes mellitus, glucose tolerance test, glycosuria, Hypoglycaemia& its causes.

Practice: Estimation of Bile pigment in urine

Estimation of Bile salts in urine

Clinical Pathology

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Clinical pathology	Theory+ Practice	3-1-0	Fundamental Science

Objective

- Analyze body fluid for diagnosis of disease
- Analyze waste product for diagnosis of disease
- Understanding DOT Policy
- Understand Physiological disorder and infectious disease
- Analysis of pregnancy

Learning outcome

- Able to collect pathological specimen
- Able to detect diabetes, ketosis, nephritis, jaundice and other physiological disorder
- Able to detect infectious disease (UTI, Hematuria, Filaria, Dysentery, Ulcer, TB, etc.)
- Preservation and processing of pathological sample.
- Identification of Parasites
- Analysis of Infertility disorder

Module-I

Introduction of clinical pathology, Composition, collection and preservation of urine, Physical examination of Urine, Chemical Examination of Urine - Sugar and Ketone bodies, Diabetes and Ketosis, Nephritis and UTI, Albumin, Phosphate, BJP, Bile Salt and Bile pigment, Chemical Examination of Urine - Multistix reagent strip, Jaundice, Microscopical Examination of Urine, Operation of Urine Analyzer, Pregnancy test, Report writing and report analysis of Urine

Practice: Operation of Urine analyzer, Benedict Test, Heat and Acid Test, Rothera's Test, Benzidine Test, Fouchet's Test

Lab:-

Urine Analysis: Collection and Physical Examination, Specific Gravity, Benedict's Qualitative test, Acetone Rothera's Test, Protein and BJP Test, Hay's Test and Fouchet's test, Benzidine test, Microscopical Examination, Pregnancy Test, Auto-mentation by Urine analyzer

Module-II

Respiratory Tract Infection: Gram Staining and ZN Staining, Basic of DOT Centre, Report writing and report analysis of sputum, Sputum for the diagnosis of Mycobacterium tuberculosis, Clinical significance and Report writing of Stool, Difference between Amoebic, Dysentery and Bacillary Dysentery, Microscopical Examination of Stool, Physical and Chemical examination of Stool, Composition, collection and preservation of stool

Practice: Microscopic finding of stool, Morphology of stool parasite

Lab:-

Stool Analysis: Collection and physical examination, Chemical Examination, Occult test and reducing sugar, Microscopical Examination: Protozoa, Microscopical Examination: Helminthes

Sputum Analysis: Collection and physical examination, Tuberculosis (ZN Stain), Respiratory infection (Gram Stain)

Module-3 Routine laboratory investigation of Pleural Fluid, Routine laboratory investigation of Pericardial Fluid, Routine laboratory investigation of Synovial Fluid, Synovial fluid: Collection and preservation, Examination of CSF related to Meningitis, Brain Tumour and other disorder, CSF: Composition, Collection, Preservation and physical examination, Report analysis and report writing of Semen, Semen examination for male infertility disorder, Semen: Composition, function, collection and physical examination

Practice: Gram stain, ZN Stain, General consideration on specimen collection

Lab:-

- Semen Analysis: Collection and physical examination, Chemical Examination, Microscopical examination
- CSF Analysis: Collection and Routine Examination
- Synovial Fluid: Collection and Routine examination
- Pleural Fluid: Collection and routine examination
- Pericardial Fluid: Collection and routine examination
- Bacteriological Examination of throat swab

Immunology

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Immunology	Theory + Practice	3-2-0	Fundamental Science

Objective

- Understanding the concept of Innate & adaptive immune system; complement system; Hypersensitivity.
- Clinically relevant serological analysis for deeper understanding of antigen-antibody interaction.

Learning outcome

- Application of Immunology in disease diagnosis.
- The conceptual understanding of the subject provides opportunities for employability and scopes for higher education.

Course Outline

Module-I

Immunity: Classification, Measurement of immunity, Local immunity, Herd immunity.
Antigens: Types of antigen, Epitope. Biological Classes of antigens, Superantigens.
Immunoglobulins: Antibody structure, Immunoglobin classes.
Practice: Collection of blood sample by vein puncture
Separation and preservation of serum

Module-II

Complement System: Principal pathways of Complement activation, Quantitation of Complement (C) and its Components. Biosynthesis of complement, Complement Deficiencies.
Antigen-Antibody Reactions, Antigen-Antibody measurement, Parameters of serological tests.

Serological Reactions.

Practice:

-Performing Serological tests: Widal test, VDRL test, ASO test, C-Reactive Protein test, Rheumatoid factor (RF) test

-Precipitation in agarose gel

-Performing Ouchterlony Double diffusion test

-Demonstration of SDS-PAGE

-Demonstration of ELISA

-Demonstration of Western blotting

Module-III

Immune Response: Types of Immune response, Humoral immunity, Cell-mediated Immune Responses, Cytokines, Immunological tolerance.

Hypersensitivity Reactions: Classification of hypersensitivity reactions, Type I Hypersensitivity (IgE Dependent). Type II Hypersensitivity: Cytolytic and Cytotoxic. Type III Hypersensitivity-Immune Complex-mediated, Type IV Hypersensitivity-Delayed Hypersensitivity.

Molecular Biology

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Molecular Biology	Theory + Project	3-0-1	Fundamental Science

Objective

- To provide depth knowledge of biological or medicinal processes through the investigation of the underlying molecular mechanisms.
- Understanding of chemical and molecular processes that occur in and between cells. Understanding will become such that , can be able to describe and explain processes and their meaning for the characteristics of living organisms.

Learning outcome

- Conduct independent work in a laboratory.
- Read scientific articles and gain a critical understanding of their contents.
- Give a spoken and written presentation of scientific topics and research results.
- Present hypotheses and select, adapt and conduct molecular and cell-based experiments to either confirm or reject the hypotheses.

Course outline

Module I

Introduction: a. Introduction to molecular biology, b. Molecular biology of cell.Evolution &Molecular structure of cell and its organelles. Types of cells. Including different kinds of Prokaryotic & eukaryotic cells, Cell growth, Cell adhesion, cell junctions & extra cellular matrix organelles, Cell cycle, Cell membrane and its structure (fluid-mosaic model). Factors influencing on membrane fluidity, asymmetry of membrane and membrane transport (active and passive)

Project Topic: Causes, types and molecular mechanism of human cancer.

Module II

Molecular Nature of the Genetic Material in Prokaryotic and Eukaryotic Cells: Molecular biology of Genes, DNA: Molecular structure, types: Primary, secondary and tertiary, Double helix, types, Transferring information from DNA to RNA, Synthesis of RNA, Translation RNA: Molecular structure, types. Evolution of DNA and RNA, Gene and genetic codes.

Project Topic: Tumor suppressor gene and oncogene.

Module III

General Concept on: a. Regulation of the Gene Expression b. Regulating the Metabolism: The Lac- Operon system, Catabolic repression, Trp Operon system: regulating the biosynthesis of the tryptophan, Gene expression in Eukaryotic cells, Plasmids: types, maintenance and functions.

Project Topic: HUMAN GENOME PROJECT.

Module IV: DNA Replication and Gene Expression: DNA Replication: Semi conservative Nature of DNA Replication,DNA Replication in prokaryotic Cells,DNA Replication in Eukaryotic cell, Enzymes involved in DNA Replication: DNA polymerases, Proofreading, post-replication Modification of DNA. Transferring information from DNA to RNA, Synthesis of RNA (Transcription), RNA polymerase, Initiation & Termination of Transcription, Post & co-transcription modification of the RNA. Protein Biosynthesis**:** Translation of the genetic code, Translation of m RNA, Role of r-RNA in protein synthesis, Forming the polypeptides-elongation,Termination of the protein biosynthesis.

Project Topic: Molecular basis, types, causes and a case study of the effects of DNA mutation.

Discipline Core Courses (Haematology)

Subject Name	Type of course	Th+Pr+Project	Prerequisite
Hematology	Theory+Practice	3-2-0	Basic Medical science

Objective

- The overall aims are that the student should obtain advanced knowledge of the most common hematologic diseases & understanding the concept of Blood cells and other blood components.

- Be able to handle an investigation of hemorrhagic disorder and laboratory abnormalities such as anaemia, polycythemia, leukopenia, leukocytosis, thrombocytopenia, thrombocytosis, elevated ESR etc within hematology.
- Clinically relevant hematological analysis for deeper understanding of Evaluate normal and abnormal cell morphology with associated diseases and other blood components .

Learning outcome

- Differentiate various laboratory test findings with their associated clinical conditions.

- Identify the various skills necessary to perform blood counts, evaluate blood elements,and report results within the stated limits of accuracy.
- Describe the various components of blood ,their functions,and roles in various disease states.
- To be able to demonstrate good skills in the relevant Hematology laboratory methodology.
- Collection of blood for the investigations.
- Be able to distinguish the developmental stages of blood cells.It will also cover Bone marrow examination.
- To learn about tests carried out for hematological investigations.
- To be able to carry out blood sampling.

Course Outline

Module- I

Scope & importance of Hematology, important equipment and chemicals, various test performed in Hematology laboratory,Focusing different blood cells through microscope.

Practice*: Demonstration of instruments used in hematology- Microscope, Blood Cell counter, Sahali's Apparatus.*

Module- II

Identify and/or confirm the composition & function of various red blood cell inclusions.Function of normal cellular components. Formation of blood, Synthesis of blood in Bone marrow- Erythropoiesis, leucopoiesis, thrombopoiesis. Anticoagulants: definition, Uses, Different types of Anticoagulants., mode of action, their merits and demerits.
Morphology of normal blood cells, abnormal morphology & diseases.

Practice*: Demonstration of different blood cell, their synthesis from slide presentation or chart. Demonstration the normal and abnormal morphology of different blood cells.*

Module- III

Hematological Disorders

1. Classification of Anemia: Morphological &etiological.
2. Iron Deficiency Anemia: Distribution of body Iron, Iron Absorption,causes of iron deficiency, lab findings.
3. Megaloblastic Anemia: Causes, Lab findings.
4. Hemolytic Anemia: Definition, causes, classification & lab findings.

Bone Marrow: Cell composition of normal adult Bone marrow, Aspiration,Indication, Preparation & Staining, Special Stain for Bone Marrow -Periodic Acid Schiff, Sudan Black

Leukemia: Classification, Blood Picture, Differentiation of BlastCells.

Practice*: Collection of blood by different methods*

Different normal and abnormal morphology of RBCs, WBCs, Platelet.

Module- IV

Collection of blood, Methods & Preparation of Stains and Smears

Practice:

Cleaning and drying of glass and plastic ware, Collection of venous and capillary blood, cleaning of glass-syringes and its sterilization. Preparation of buffers, Preparation of the stains and other reagents, Preparation of peripheral blood film (PBF), To stain a peripheral blood Film by Leishman- stain, Haemoglobin estimation (Sahali's method and cyanmethaemoglobin method).

Module- V

-Routine Hematological Tests:

-Complete blood cell count, ESR, Differential Leukocyte count, Total leukocyte count, Bleeding time and Clotting time, Blood Grouping and Rh Typing.

Practice:

Complete Blood Counts, Determination of Haemoglobin, TRBC Count by Haemocytometers, TLC by Haemocytometer, Differential Leukocyte count, Determination of Platelet Count. Determination of ESR by wintrobes, Determination of ESR by Westergeren's method, Determination of PCV by Wintrobes, Erythrocyte Indices- MCV, MCH, MCHC. Reticulocyte Count, Absolute Eosinophil Count, Bleeding time and Clotting time, Blood Grouping and Rh Typing

Microbiology

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Microbiology	Theory+ Practice	3-2-0	Fundamental Science

Objective

- To know various Culture media and their applications and also understand various physical and chemical means of sterilization
- To know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and virus
- To master aseptic techniques and be able to perform routine culture handling tasks safely and effectively

Learning outcome

- This study demonstrates the theory and practical skills in microscopy and their handling techniques and staining procedures.
- Understanding the details of microbial cell organelles.
- Provides knowledge on growth of microorganism.
- Provides knowledge Culturing microorganism.

Course Outline

Module -1

Microbiology: Definition, history, host- microbe relationship, and safety measures in a microbiology laboratory. Morphology of bacterial cell wall, Bacterial anatomy (Bacterial cell structure: including spores, flagella, pili and capsules). Sporulation. Classification of bacteria according to cell wall and shape (arrangement), Classification of micro-organisms. Growth and Nutrition of Microbes**:** General nutritional requirements of bacteria, Bacterial growth curve

Practice:

1. Handling of Microscope
2. To learn techniques for Inoculation of bacteria on culture media.
3. To isolate specific bacteria from a mixture of organisms.

Module-2 (11 Hours)

Sterilization: Definition, sterilization by dry heat, moist heat (below, at & above 100℃), Autoclave, Hot air oven, Radiation and Filtration, preventive measures, controls and sterilization indicators. Use of laminar flow in sterilization.

Antiseptics and Disinfectants: Definition, types, properties, mode of action and use of disinfectants and antiseptics, efficiency testing of disinfectants.

Practice:

1.To demonstrate simple staining (Methylene blue)

2.Bacterial identification: To demonstrate reagent preparation and procedure for Gram stain, Z-N staining, Capsule staining, Demonstration of flagella by staining methods, Spore staining, To demonstrate spirochetes by Fontana staining procedure

Module-3 (15 Hours)

Staining techniques: Methods of smear preparation, Gram stain, AFB stain, Albert's stain and special staining for spore, capsule and flagella, Culture Media, Liquid and solid media, defined and synthetic media, routine laboratory media (basal, enriched, selective, enrichment, indicator, and transport media). Different Culture, media their preparation and uses in microbial growth.

Practice:

1.Biochemical tests for identification of bacteria

2.Preservation of stock cultures of bacteria

3.Antibiotic susceptibility test

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Medical Law and Ethics	Theory+ Project	2-0-1	Fundamental Science

Objective

- The course provides an introduction to ethics generally and more specifically to medical ethics, examining in particular the principle of autonomy, which informs much of medical law. The course then considers the general part of medical law governing the legal relationship between medical practitioners and their patients. It considers the legal implications of the provision of medical advice, diagnosis and treatment. Selected medico-legal issues over a human life are also examined. These may include reproductive technologies, foetal rights, research on human subjects, organ donation, the rights of the dying and the legal definition of death.

Learning outcome

- The ethical underpinnings of the law as it relates to medicine,
- The law of negligence in the context of the provision of healthcare,
- Legal and ethical issues surrounding end and beginning of life decisions,
- The maintenance of professional standards in the healthcare profession,
- The role of policy in the formation of law as it relates to medicine

Course Outline

Module-I

1. Medical ethics - Definition - Goal - Scope
2. Introduction to Code of conduct
3. Basic principles of medical ethics – Confidentiality

Module-II

4. Malpractice and negligence - Rational and irrational drug therapy
5. Autonomy and informed consent - Right of patients
6. Care of the terminally ill- Euthanasia
7. Organ transplantation

Module-III

8. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.
9. Professional Indemnity insurance policy
10. Development of standardized protocol to avoid near miss or sentinel events
11. Obtaining an informed consent

Suggested Readings:

1. Reflections on Medical law and Ethics in India by B. Sandeepabhat, publisher Eastern law house.

Histology

Subject Name	Type of course	Th+Pr+Project	Prerequisite
Histology	Theory+Practice	3-1-0	Basic Medical Science

Objective

- Understanding the concept of histotechnology;Basic concepts about routine methods of examination of tissues Collection.
- perform routine laboratory procedures encompassing all major areas of the histology laboratory.
- accurately and proficiently embed tissue and understand the principles of microtomy.
- Clinically relevant onchological analysis for deeper understanding of abnormal cell growth at anywhere in human body.
- The conceptual understanding of the subject provides opportunities for employability and scopes for higher education.

Learning outcome

- In this section students will be made aware of terminology used in histotechnology, various instruments and their maintenance and also learn the processing of various samples for histopathological investigations.
- Reception and labeling of histological specimens.
- Use of antiseptics, disinfectants and insecticides in a tissue processing laboratory.
- The students will learn about various staining procedures for demonstration of different substances & various cytological investigations.
- The students will learn about special staining procedures & handling & testing of various cytological specimens.

Course Outline

Module- I (8 Hrs)

Histotechnology, Care & Maintenance of histotechnology equipements and their parts and Safety measures of laboratory equipment used in histotechnology. Basic concepts about routine methods of examination of tissues, Collection and transportation of specimens for histological examination, fixation: Process, Various types of fixatives used in a routine histopathology laboratory- Simple fixatives, Compound fixatives, Special fixatives for demonstration of various tissue elements.

Practice: *Care & maintenance of Histology equipments, Collection & transportation of specimens, Fixation*

Module- II (8 Hrs)

Decalcification Criteria of a good decalcification agent, Technique of decalcification Followed with selection of tissue fixation, decalcification neutralization of acid and thorough washing. Various types of decalcifying fluids, Processing of various tissues for histological examination, Embedding, Schedule for manual or automatic Tissue processing, Components & principles of various types of a tissue processors.

Practice: *-Method of Decalcification, Embedding, manual or automatic tissue processings schedule.*

Module- III (10 Hrs)

Periodic Acid Schiff Staining, Impregnation and Mountains, Commonly used mountains in histotechnology lab. General Staining Procedures(routine H&E stain, PAP stain and other special stain) for Paraffin Infiltrated and Embedded tissue, To perform & practice the manual & automated Haematoxylin and Eosin staining technique, To perform & practice the Mallory's Phosphotungstic Acid Haematoxylin (PTAH). Introduction of FNAC and its staining tech, museum technique, post mertum technique.

Practice:

Procedure for manual Staining and Automatic Staining Technique, FNAC technique, Museum technique(Hospital Visit), Post mertum technique(Hospital Visit).

Module- IV (8 Hrs)

Demonstration of instruments used for dissection Use of antiseptics, disinfectants and insecticides in a tissue processing laboratory Reception and labeling of histological specimens Preparation of various fixatives -Helly's fluid, Zenker's fluid, Bouin's fluid, Corney's fluid, 10% Neutral formalin, Formal saline, Formal acetic acid, Pereyn's fluid, prepare 70% alcohol from absolute alcohol. To perform embedding and casting of block.

Practice:

Use of antiseptics, disinfectants and insecticides in tissue processing laboratory, Preparation of various Fixatives, Labeling of Histological specimens, Embedding and Casting of block

Module- V (8 Hrs)

Tissue Processor, Microtomy, Honing and Stropping technique, Use of tissue floating bath, Use of incubator

*Practice***:**

Processing of tissue by manual and automated processor. method To demonstrate various part and types of microtome. To learn sharpening of microtome knife (Honing and stropping technique) To perform section cutting, learn mounting of stained smears. To practice attachment of tissue sections to glass slides To learn using tissue floatation bath drying of sections in incubator (37^0 C)

Advanced Hematology

Subject Name	**Type of course**	**T-P-Pj**	**Prerequisite**
Advanced Hematology	Theory+Practice	3-1-0	Fundamental Medical science

Objectives

- The overall aims are that the student should obtain advanced knowledge of the most common hematologic diseases & understanding the concept of Blood cells and other blood components.
- Demonstrate an understanding of the components of human blood and characteristics, functions, and abnormalities and disease states of each.
- Demonstrate proficiency in the skills necessary to perform blood cell counts, and evaluation of blood elements within stated limits of accuracy.
- Determine suitability of hematology specimens and dispose of them in the appropriate bio-hazard containers.

Learning outcome

- Differentiate various hematological procedures and the use of basic equipment essential to working in a Hematology Laboratory.
- Discuss differences between Quality control, Quality Assurance, and Continuing Quality Improvement principles as used in the Hematology Laboratory.
- Categorize various hematology analyses , operational principles of various hematology instruments, and troubleshooting of various instruments.
- Explain the principles and theories utilized in a variety of problem-solving situations.
- Compare and contrast hematology values under normal and abnormal conditions

Course Outline

Module-I (8 Hrs)

Quality assurance in hematology: Internal and external quality control including reference preparation,Routine quality assurance**,** Protocol, Statistical analysis i.e. Standard deviation, Co-efficient variation,accuracy and precision, Safety precautions in hematology**.** Basic concepts of automation in hematology with special reference to: Blood cell counter, Coagulometer.

Practice: *Collection of blood from different body parts. Data and record Maintain, Handling hematological equipments.*

Module-II (12 Hrs)

Bone marrow examination:

1. Composition and functions, Aspiration of bone marrow (Adults and children), Processing of aspirated bone marrow (Preparation & staining of smear)

2. Brief knowledge about examination of aspirated bone marrow (differential cell counts and cellular ratios) .Special Stain for Bone Marrow -Periodic Acid Schiff, Sudan Black

3. Leukemia: Classification, Blood Picture, Differentiation of BlastCells. Laboratory diagnosis of leukaemias , Processing and staining of trephine biopsy specimens.

Practice: *Method of aspiration bone marrow, method of Processing and staining of trephine biopsy.*

Module-III

L.E. cell phenomenon

1. Definition of L.E. cell, Demonstration of L.E. cell by various methods , Clinicals Physiological variations in Hb, PCV, TLC and Platelets. Investigations of a case suffering from bleeding disorders.

2. Quantitative assay of coagulation factors - **a**. Principle **b**. Procedure **c**. Mechanism **d**. Tests

3. Biomedical waste management in hematology laboratory (Other than Radioactive material)

Practice-: *Demonstration of functional aspect of blood cell counter Study the RBCs abnormal morphological form -a. Variation in size, shape and staining Character, b. Red cell inclusion,* **c.** *Identify morphologically the- Immature Erythroid series of cells* **d.** *Immature Myeloid ad other WBCs series of cells*

Module-4 (10 Hrs)

Demonstration of various parts of centrifuge; its functioning and care, Cleaning and drying of glass and plastic ware, Cleaning of glass, syringes and its sterilization. Preparation of various anticoagulants, Preparation of buffers, Preparation of the stains and other reagents.

Practice: Use centrifuge machine to separate serum & plasma from whole blood cells, Sterilization, Buffer & stain preparation.

Research Methodology

Subject Name	Type of course	Th+Pr+Project	Prerequisite
Research Methodology	Theory+ Project	2-0-1	Fundamental Science

Objective

- To equip students with a basic understanding of the underlying principles of quantitative and qualitative research methods.
- Provide students with in-depth training on the conduct and management of research from inception to completion using a wide range of techniques.

Learning outcome

- Students can understand the ethical and philosophical issues associated with research in education
- This study provides knowledge on various modes of presenting and disseminating research findings.
- Enable students to acquire expertise in the use and application of the methods of data collection and analysis.
- Provide learning opportunities to critically evaluate research methodology and findings.
- Enable students to be reflexive about their role and others' roles as researchers.

Course Outline

Module- I

Introduction to Research: Definition, Scope, Limitations, and Types. Objectives of Research. Research Process: Proposal Development: Basic steps involved in the health research proposal

development process Literature Review: Importance and Sources, Strategies for gaining access to information, Library search, Computer search.

Research Designs: Research Title and Objectives Criteria for selecting a research title, Formulation of research objectives, Types of research objectives, Qualities of research objective

Module- II (8 Hrs)

Data Collection: Secondary Data, Primary Data, and Methods of Collection. Scaling Techniques: Concept, Types, Rating scales & Ranking Scales, Scale Construction Techniques and Multi-Dimensional Scaling. Sampling Designs: Concepts, Types and Techniques and Sample size Decision.

Module- III

Research Hypothesis**:** Definition, Qualities of research hypothesis Importance and types of research hypothesis.Theory of Estimation and Testing of Hypothesis Small & Large Sample Tests, Tests of Significance based on t, F, Z test and Chi-Square Test. Designing Questionnaire. Interviewing. Tabulation, Coding, Editing. Interpretation and Report Writing.

Project: Writing a review on Nosocomial urinary tract infection.

Writing a research article on antibiotic resistance patterns in wound infections.

Writing a review on Virus culture

Literature survey on Covid-19

Analytical Biochemistry

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Analytical Biochemistry	Theory+ Practice	3-2-0	Fundamental Science

Objective

- Understanding the concept of Biochemical analyzing instruments both automated and semi automated.
- To learn about how to Care & Maintenance of Equipment & Chemicals.
- To learn normal ranges of biochemical components in our body.
- Clinically relevant biochemical analysis for deeper understanding of all biochemical components i.e., Proteins, Electrolytes, Hormones etc.

Learning outcome

1) Understanding of instrumentation technique & principle of spectrophotometry, colometry, photometry and electrolyte analyzer.

2) To learn about Various tests carried out for biochemical analysis & Hormone investigations.

3) To learn about safety precautions and handling the equipment in biochemical laboratory.

Course Outline

Module- I (12 Hrs)

Chromatography: Paper, Thin layer, Column, Ion exchange, Affinity chromatography, Gel filtration, Gas Chromatography, HPLC, FPLC

Practice: *Handling the Equipments and chemicals used in biochemical laboratory.*

Module-III (12 Hrs)

Electrophoresis: Moving boundary, Zone (Paper Gel) electrophoresis, Immuno electrophoresis, Isoelectric focusing, 2-D electrophoresis. Principle, Instrumentation, Specimen preparation and Application of: X-ray diffraction, NMR, ESR

Practice: *Estimate Erythrocyte sedimentation rate*

Module- III (26 Hrs)

Principle and Application of: Fully Automated Biochemistry Analyser, Semi- automated Biochemistry Analyser, Coagulometer. Method of estimation and assessment for: a. Glucose tolerance test. Clearance test for renal function. Gastric analysis, LFT, KFT, Lipid profile, Qualitative test for Urobilinogens, Renal calculi, Barbiturates, T3, T4 and TSH, 17 Ketosteroids. Principles, clinical significance and procedures for estimation, of Acid phosphatase, Alkaline phosphatase, Lactate dehydrogenase, Aspartate transaminase, Alanine, transaminase and Creatine phosphokinase.

Practice: *Glucose Tolerance Test, Clearance Test, Gastric juice collection, Gastric Analysis, Kidney Function Test, Liver Function Test, Lipid Profile,Renal calculi, Hormone Test*

Applied Hematology

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Applied Hematology	Theory+Practice	3-2-0	Basic Medical science

Objective

1) The overall aims are that the student should obtain advanced knowledge of the most common hematologic diseases & understanding the concept of Blood cells and other blood components.

2) Demonstrate an understanding of the components of human blood and characteristics, functions, and abnormalities and disease states of each.

3) Demonstrate proficiency in the skills necessary to perform blood cell counts, and evaluation of blood elements within stated limits of accuracy.

4) Determine suitability of hematology specimens and dispose of them in the appropriate bio-hazard containers.

Learning outcome

- The students be made aware of Safety precautions, Quality assurance, biomedical waste management and automation in haematology. It will also cover Red cell abnormalities, Disorder of leukocytes, Investigations of a case suffering from bleeding disorders, To learn about tests carried out for hematological investigations.
- Understanding of Haemopoietic disorders, laboratory diagnosis of leukemia, hemolytic anemia.
- Collection & preservation of blood for the investigations.

Course Outline

Module-I

Laboratory diagnosis of leukaemias Definition and laboratory diagnosis of Leukamoid reactions .Cytochemical staining, procedure and their significance in various haemopoietic disorders. Laboratory diagnosis of iron deficiency anaemia, Laboratory diagnosis of megaloblastic anaemia ,Laboratory diagnosis of haemolytic anemia.

Practice: *Collection of blood from different body parts. Data and record Maintain, Handling hematological equipments, Demonstrate the different abnormal morphology of RBCs in Anemia cases.*

Module-II

Chromosomal studies in various hematological disorders and their significance. Mechanism of normal fibrinolysis and Laboratory diagnosis of hyperfibrinolysis. Mechanism and laboratory diagnosis of disseminated intravascular coagulation (DIC).

Practice: *Laboratory diagnosis of Hyperfibrinolysis (D- dimer Method), laboratory diagnosis of disseminated intravascular coagulation (DIC)*

Module-III

Laboratory diagnosis of Hemophilia and von-will brand disease. Laboratory diagnosis of Idiopathic thrombocytopenic purpura (ITP), Platelet function tests and their interpretation.

Practice: Complete Blood Count, Total Platelet Count, Bleeding time, Clotting time, Activated Partial Thromboplastin Time (APTT) Test, Prothrombin Time (PT)

Module-IV

Measurement of:

1. Blood volume, b. Determination of Red cell volume and Plasma volume, c. Red cell life span,
2. Platelet life span. Estimate serum iron, total iron, Hb-F, Plasma and urine hemoglobin. Demonsrtrate the presence of Hb-S by Sickling and solubility, Perform various Platelet functiontest.

Practice: *Demonstration the sickle cells ,To estimate serum iron and total iron binding capacity. To estimate Hb-F in a given blood sample. To estimate plasma and urine. Haemoglobin in the given specimens. To demonstrate the presence of Hb-S by Sickling and solubility tests.*

-Immunopathology

Subject Name	Type of course	Th+Pr+Project	Prerequisite
Immunopathology	Theory+ Project	3-0-1	Fundamental Science

Objective

- To understand how the immune system is working, about the components of the immune system, their functioning, the defense mechanisms against different pathogens (viruses, bacteria ,and parasites), the pathogenesis of immune diseases (hypersensitivity ,autoimmunity, immunodeficiencies),and on the mechanisms underlying the rejection of the transplants and the antitumor immune response.
- It also provides knowledge of the main immunological techniques used in research and diagnostics.

Learning outcome

- To know and describe the organization and functioning of the immune system, its cells and its molecules.
- To know the principles of diagnostic tests described on immunological techniques.
- To know the fundamental stages of the immune system and its changes over the course of life (intrauterine life, newborn ,adult, elderly)
- The conceptual understanding of the subject provides opportunities for employability and scopes for higher education.

Course Outline

Module(7hrs)

Basic Components of the Immune System, Immunological Techniques, Immune Regulation, Immunological Aspects of Infection, Immunological Aspects of Immunodeficiency Diseases.

Module II (8 hrs)

Autoimmunity, Blood related disorder, Chronic Lymphocytic Leukemia, Immunology of HIV Infections and other viral infection, Immunological Aspects of Allergy and Anaphylaxis, Immunological Aspects of Skin and venereal Diseases.

Module III (10 hrs)

Experimental Approaches to the Study of Autoimmune Rheumatoid Arthritis Diseases,Immunological Aspects of Cardiac Disease, Immunological Aspects of Chest Diseases Pulmonary Tuberculosis (MDRT), and XDRT, Immunological Aspects of Gastrointestinal and Liver in case of Hepatitis ,Immunological Aspects of Endocrine Disease (Thyroid, diabetes, hypertension), Immunological Aspects of Organ T

Parasitology

Subject Name	Type of course	Th+Pr+Project	Prerequisite
Parasitology	Theory+Practice	3-2-0	Fundamental Science

Objective

- Describe basic morphology, life cycle, pathogenesis, lab diagnosis and treatment of parasites (Protozoa, metazoa and Helminth)
- Perform appropriate laboratory techniques used in the processing of specimens and identification of parasites.

Learning outcome

- Identification of pathogenic parasite in disease diagnosis and treatment.
- The conceptual understanding of the subject provides opportunities for employability and scopes for higher education.
- To serve as a resource for the clinical laboratories professionals in the different region.

Course Outline

Module-I

Introduction to Medical Parasitology, General characteristics and classification of protozoa and helminthes. Collection, Transport, processing and preservation of samples for routine parasitological investigations.

Practice: Method of sample Collection, Transport, processing and preservation of samples for routine parasitological investigations.

Module II

Morphology, life cycle and lab diagnosis of *Giardia* and *Entamoeba*, T.*solium, T.saginata,* malaria parasite with special reference to *P. vivax and P. falciparum* and *Leishmania donovani* (Kala azar). Morphology, life cycle and lab diagnosis of hook worm and round worm *(Ascaris lumbricoides and Anchylostoma duodenale).*Most common symptoms of parasitic infection and diagnosis and treatment methods. Procedures used in microscopic examination of stool from a

parasitic infected individual.

Practice: Routine Stool examination for detection of intestinal parasites. Concentration techniques for demonstration of Ova (Principles and applications). Identification of adult worms from model's or slide's method.

Module III

Laboratory Diagnosis of Various Parasites: Direct method, Indirect method. Rapid Diagnostic Tests (RDTs), Quantitative buffy coat assay (QBC), Malaria Rapid diagnostic test (MRDT), Leishmanin test.

Practice: Demonstration of some rapid diagnostic method used for parasite identification.

Basic Computer and Information Science

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Basic Computer and Information Science	Practice	0-2-0	Fundamentals of Computer

Objective

- **Identify the function of computer hardware components.**
- **Identify the factors that go into an individual or organizational decision on how to purchase computer equipment.**
- **Identify how to maintain computer equipment and solve common problems relating to computer hardware.**
- **Identify how software and hardware work together to perform computing tasks and how software is developed and upgraded.**
- Identify different types of software, general concepts relating to software categories, and the tasks to which each type of software is most suited or not suited.

- **Understand the fundamental hardware components that make up a computer's hardware and the role of each of these components.**
- **Understand the difference between an operating system and an application program, and what each is used for in a computer.**
- Describe some examples of computers and state the effect that the use of computer technology has had on some common products.

Learning outcome

Course Outline

Module- I

Introduction to computer: introduction, characteristics of computer, block diagram of computer, generations of computer. Types of Input output devices. Processor and memory: The Central Processing Unit (CPU), main memory. Storage Devices.

Module- II

Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge. Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs. Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.

Module- III

Introduction to MS-DOS: History of DOS, features of MS-DOS, MS-DOS Commands (internal and external). Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.). Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid). Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.

Suggested readings:

1. Objective Computer Awareness
2. Computer Networking (Global Edition)

DC-12 - Blood Banking

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Blood Banking	Theory+ Project	3-0-1	Fundamental Science

Objective

- Understanding blood bank method, demonstrate knowledge of testing
- Knowledge of Anticoagulant used in blood bank
- Get knowledge about blood regulation policy
- Understanding solid organ transplantation and it's policy
- Basic of transfusion reaction
- Investigation related to blood bank

Learning outcome

- Perform phlebotomy and related donor room activity in blood bank
- Manage the blood bank
- Identifies and communicate abnormal test report by alerting supervisory personal
- Organize blood donation blood bank
- Inventory and stock management in blood bank
- Perform and maintain record of QC procedure related reagents, kits and equipments.

Course Outline

Module-I (11 Hrs)

Basic principle in blood banking, Blood bank organisation, Planning and documentation, NACO Blood bank policy, National blood policy, Equipment used in blood bank

Anticoagulant use in blood bank, Selection of blood donor, Rhesus blood group system, Human blood group system

Practice: Documentation, ABO Grouping, RH Typing, Operation of equipment.

Module-II (14 Hrs)

Auto-mentation technique used in blood bank, Techniques used for the separation of blood constituent, CBC , Blood preservation, Special investigation for processing of blood under the guide lines of NACO, Routine investigation for processing of blood, Phlebotomy in blood bank, Quality control in blood bank

Practice: **Phlebotomy in blood bank, Cross matching and compatibility test, Measurement of Blood Pressure, Arrangement of blood bank lab**

Module-III (20 Hrs)

Blood transfusion alternative, Prevention of diseases transmitted through blood transfusion, Transfusion reaction investigation, Transfusion reaction, Precaution taken for infusion of blood components,, Pre-transfusion testing, Transfusion in solid organ transplantation, Exchange blood transfusion, Pre-surgical blood transfusion, Blood and blood components transfusion, Selection of blood components, Aphersis and Hemapheresis

Practice: Routine hematological test, HIV, VDRL, Hbs-Ag, Other STD Test.

Medical Laboratory Management

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Medical Laboratory Management	Theory+ Project	3-0-2	Fundamental Science

Objective

- Explain and apply principle of effective test utilization
- Interpret, implement and complying law, regulation, accrediting standards and guidelines of Govt. and NG organizations.
- Design, implement and evaluate resources in lab
- Communicate effectively with laboratory personnel and health care professional.
- Explain and apply the major principle and tactics of laboratory administration.

Learning outcome

- Become professional competent in medical laboratory
- Exhibit a sense of commitment to the ethical and human aspect of patient care
- Recognize the role of clinical laboratory scientist in the assurance of quality health care
- Application of safety and governmental regulation and standards as applied to medical laboratory practice.

Course Outline

Module-I (16 Hrs)

Ethics of pathological clinics, Code of conduct for medical laboratory personal, Safety measure in the laboratory, Organization of Pathology laboratory under board of quality control, Clinical laboratory science, Functional components of the clinical laboratory, A Standardized clinical laboratory set up, Various types of laboratories, PPE in labs, Important instruction to minimize infection in laboratory workers

Practice:PPE Practice, Lab Setup, Sample collection and preservation.

Module-2 (16 Hrs)

Release of laboratory reports, Clinical alerts , Reporting results: Basic format of pathology reports, Transportation and preservation of lab sample, Patient management for clinical sample collection, National and international agency for clinical laboratory accreditation, Good laboratory practice, Medical legal problems,Laboratory regulation,Factors affecting productivity of laboratory, Responsibility of lab worker

Practice: Report writing, Lab record management

Module-3 (14 Hrs)

Quality management system, NABL Policy, Clinical establishment act policy, Annual maintenance contact for laboratory, General safety precautions in case of STD and drug resistant tuberculosis, Procurement and supply management, Different types of laboratory record management, Laboratory information management system (LIMS), Profit and loss analysis, WHO Policy for medical lab

Practice: Management information system, Procurement management, Profit and loss analysis

-Introduction to Quality and Patient Safety

Subject Name	Type of course	Th+Pr+Project	Prerequisite
Introduction to Quality and Patient Safety	Theory+ Project	3-0-2	Fundamental Science

Objective

- Knowing patient safety
- Report Distribution system
- Laboratory infection control Policy
- Bio-Medical waste management
- Understanding Patient rights
- ISO Policy for medical laboratory

Learning outcome

- Know about rights and duties of patient
- Know about right and duties of lab technician
- Understand various policy to manage lab
- Understand infection control procedure

Course Outline

Module-I (11 Hrs)

Human factor Engineering, Patient safety, Health literacy, Report distribution system,

Error in reporting system, responding to adverse events, Investigation of error/ Root cause analysis, Medical Error, The science of safety

Practice: Safety precaution in laboratory, Report distribution, Prescription reading

Module-II (11 Hrs)

Team work and communication, Leadership, Quality control policy, Major development and

evaluation in diagnostic division, Clinical establishment act policy, National accreditation board of laboratory, ISO Policy for medical laboratory, Fire and safety policy for medical laboratory

Practice: Fire Safety in lab, Documentation for Lab establishment

Module-III (13 Hrs)

Personal protective equipment in the laboratory, AIDS and laboratory safety, Safety protection in lab in STD and other infectious disease., Biomedical waste management, Patient care in medical laboratory, Patient rights., Counselling of patient during phlebotomy, First aid in medical laboratory service.

Practice: PPE, Bio-Medical waste management, First-Aid, Patient Counseling

Mycology & Virology

Subject Name	**Type of course**	**Th+Pr+Project**	**Prerequisite**
Mycology and virology	Theory+ Practice	3-2-0	General biology

Objective

- To describe the characteristics and diseases caused by pathogenic viruses and fungi.
- To perform basic laboratory techniques in mycology, to isolate fungus from clinical samples.
- Understanding different methods of virus cultivation.
- Understanding collection, transportation and preservation methods of clinical specimen.

Learning outcome

- Broad idea about structure and basic characteristics of virus and fungus.
- Plan, write and implement research projects in virology and mycology analyze their results and publish these in peer-reviewed journals.
- Coordinate with concerned agencies regarding viral and fungal diseases and their outbreaks.
- Plan and execute epidemiological studies and provide advice in relation to viral diseases

Course outline

Module I

Introduction to medical mycology, Basic concepts about superficial and deep Mycoses. Taxonomy and classification and general characteristics of various medically important fungi. Normal fungal flora. Morphological, cultural characteristics of common fungal laboratory contaminants, Culture media used in mycology and staining process.

Practice-: To prepare culture media used routinely in mycology. To perform all the staining techniques for identification of fungi as mentioned in theory syllabus.

Module II

Direct microscopy in Medical mycology laboratory. Processing of clinical samples for diagnosis of fungal infections i.e. Skin, nail, hair, pus, sputum, CSF and other body fluids.Techniques used for isolation and identification of medical important fungi Methods for identification of yeasts and moulds.

Practice-: To identify given yeast culture (By performing various identification techniques studied in theory). To identify given mould culture (By performing various identification techniques studied in theory. To demonstrate dimorphism in fungi. To process clinical samples for laboratory diagnosis of fungal infection that is from skin, hair and nail etc.

Module III

Introduction to medical virology, Classification of viruses. Introduction to medically important viruses (Both DNA and RNA). Collection, transportation and storage of sample for viral diagnosis .Staining techniques used in Virology. Processing of samples for viral diagnosis (Egg inoculation and tissue culture). Antiviral drugs.

Practice: Demonstration of fertilized hen egg. Demonstration of various inoculation routes in fertilized hen egg.

Mini Project

The student is supposed to carry out project work in assistance with a mentor. The project should be relevant to the syllabus and should be qualitatively initiated towards fetching a research publication/ case study/ clinical study/ community service/ survey on successful completion within the stipulated time.
Outcome: Research paper publication/ new idea generation/ case study/ clinical study/ community service/ survey.

Project

Subject Name	Type of course	Th+Pr+Project	Prerequisite
Project	Project	0-0-12	Basic Medical science

Project work:

Suggested Project title

1. Antibacterial activity of sweet orange (citrus sinesis) on Staphylococcus aureus and Escherchia coli isolated from wound infected.
2. The incidence of Salmonella and Escherchia coli in livestock (Poultry) feeds
3. Microbial evaluation of milk from a dairy farm.
4. Gastroenteritis in primary school children (6-12yr) of specific locality.
5. Comparative analysis of microbial load of the main water production and water available to university campus

Internship

Subject Name	Type of course	Th+Pr+Project	Prerequisite
Internship	Project	0-0-12	Basic Medical science

Internship Thesis Guideline

This Guideline is designed to provide students the knowledge and practice of public health research activity, to enable them to carry out researches and solve research related problems and to help them in writing thesis and defend their work. Upon successful completion of the course, the students shall be able to:

1. Search relevant scientific literature
2. Develop a research proposal
3. Employ appropriate data collection techniques and tools
4. Manage collected data
5. Analyze data with appropriate statistical techniques
6. Write thesis
7. Defend the findings

Proposal Development:
At the ending of third year (Sixth Semester), students individually consultation with designated faculties and extensive literature survey will develop research proposal during the initial 6 months period.

Data Collection/ Thesis Writing:

Students will carry out data collection, data management, data analysis, and thesis writing during the remaining period (Six Semester).
The Dissertation should have following format:

1. Title
2. Introduction
3. Materials and Methods
4. Results
5. Discussion
6. Conclusion
7. Recommendation
8. References
9. Appendix

Internship

1. Case record
2. Lab management and ethics
3. Evaluation -Guide(internal)
   -Industries guide(external)
   -University-project report/ Viva

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