Medical Laboratory Technology Syllabus

Introduction

Medical Laboratory Technology is an essential branch of medical science that supports the diagnosis, treatment, and monitoring of diseases through laboratory investigations. Laboratory technicians play a crucial role in healthcare, providing essential data for accurate medical decisions.

Sure, let's further detail the syllabus for each unit of the DMLT (Diploma in Medical Laboratory Technology) first-year curriculum:

First Year Syllabus for DMLT

****Unit 1: Anatomy & Physiology (2101)****

- **Unit 1.1: Anatomy (Theory)**

1. Introduction to Anatomy

2. Cells and Tissues:

- Structure and Function of Cells

- Types of Tissues: Epithelial, Connective, Muscle, Nervous

3. Skeletal System:

- Structure and Function of Bones

- Types of Joints

- Axial and Appendicular Skeleton

4. Muscular System:

- Types of Muscle Tissues: Skeletal, Smooth, Cardiac

- Structure and Function of Muscles

- Muscle Contraction and Relaxation Mechanisms

5. Genito-Urinary System:

- Structure and Function of Kidneys, Ureters, Bladder, Urethra

- Urine Formation and Excretion

6. Respiratory System:

- Structure and Function of Lungs, Trachea, Bronchi, Alveoli

- Mechanics of Breathing

7. Gastrointestinal System:

- Structure and Function of Digestive Organs: Mouth, Esophagus, Stomach, Intestines

- Digestive Processes: Ingestion, Digestion, Absorption, Defecation

8. Nervous System:

- Structure and Function of Neurons

- Central Nervous System: Brain, Spinal Cord

- Peripheral Nervous System

9. Cardiovascular System:

- Structure and Function of Heart, Blood Vessels

- Blood Circulation: Systemic and Pulmonary Circulation

- Cardiac Cycle

10. Movement of the Body:

- Types of Movements: Flexion, Extension, Abduction, Adduction, Rotation

- Role of Muscles and Bones in Movement

- **Unit 1.2: Physiology (Theory)**

1. Introduction to Physiology

2. Digestive System:

- Structure and Function of Digestive Organs

- Processes: Ingestion, Digestion, Absorption, Metabolism, Defecation

3. Respiratory System:

- Structure and Function of Respiratory Organs

- Mechanics of Breathing: Inspiration and Expiration

- Gas Exchange in Alveoli

4. Blood:

- Composition of Blood: Plasma, Formed Elements (Red Blood Cells, White Blood Cells, Platelets)

- Functions of Blood: Transportation, Regulation, Protection

5. Cardiovascular System:

- Structure and Function of Heart, Blood Vessels

- Cardiac Cycle: Systole and Diastole

- Blood Pressure Regulation

6. Excretory System:

- Structure and Function of Kidneys, Ureters, Bladder, Urethra

- Urine Formation: Filtration, Reabsorption, Secretion

- Role in Fluid and Electrolyte Balance

7. Endocrine System:

- Structure and Function of Endocrine Glands

- Hormones: Types, Functions, Regulation

- Endocrine Disorders

8. Reproductive System:

- Structure and Function of Male and Female Reproductive Organs

- Reproductive Processes: Gametogenesis, Fertilization, Pregnancy

- Reproductive Health Issues

9. Skin:

- Structure and Function of Skin Layers

- Functions: Protection, Sensation, Temperature Regulation

- Common Skin Disorders

10. Special Senses:

- Structure and Function of Sense Organs: Eye, Ear, Nose, Tongue, Skin

- Sensory Mechanisms: Vision, Hearing, Taste, Smell, Touch

****Unit 2: Microbiology & Parasitology (2102)****

- **Unit 2.1: Microbiology (Theory)**

1. Introduction to Microbiology

2. Study of Microorganisms:

- Viruses: Structure, Replication, Pathogenesis

- Bacteria: Morphology, Classification, Growth, Metabolism

- Fungi: Morphology, Growth Requirements, Reproduction

3. Techniques in Microbiology:

- Sterilization Methods

- Culture Media Preparation

- Microscopic Examination of Microorganisms

- Identification Techniques: Staining Methods, Biochemical Tests

4. Medical Microbiology:

- Pathogenic Bacteria: Identification and Characteristics

- Viral Infections: Types, Symptoms, Prevention

- Fungal Infections: Types, Diagnosis, Treatment

- **Unit 2.2: Parasitology (Theory)**

1. Introduction to Parasitology

2. Study of Parasites:

- Classification of Parasites: Protozoa, Helminths, Arthropods

- Life Cycles and Transmission Routes

- Morphology and Identification Techniques

3. Parasitic Diseases:

- Protozoan Infections: Malaria, Amoebiasis

- Helminthic Infections: Ascariasis, Hookworm Infection

- Arthropod-borne Diseases: Dengue, Lyme Disease

4. Diagnostic Techniques:

- Microscopic Examination of Parasites

- Serological Tests: ELISA, Immunofluorescence

- Molecular Techniques for Detection

****Unit 3: Haematology & Blood Banking (2103)****

- **Unit 3.1: Haematology (Theory)**

1. Introduction to Haematology

2. Blood Collection Techniques:

- Venipuncture, Capillary Puncture

- Blood Specimen Handling and Transport

3. Haematological Tests:

- Complete Blood Count (CBC): RBC, WBC, Platelet Count

- Haemoglobin Estimation: Methods and Clinical Significance

- Erythrocyte Sedimentation Rate (ESR)

- Blood Coagulation Tests: PT, APTT

- Blood Grouping and Crossmatching

4. Disorders of Blood:

- Anaemia: Types, Causes, Diagnosis, Treatment

- Leukaemia: Types, Diagnosis, Treatment

- **Unit 3.2: Blood Banking**

1. Introduction to Blood Banking

2. Blood Group Systems:

- ABO and Rh Systems

- Other Blood Group Systems: Kell, Duffy, Kidd

3. Blood Donation and Collection:

- Donor Screening and Recruitment

- Blood Components: Whole Blood, Packed Cells, Platelets, Fresh Frozen Plasma

4. Blood Transfusion:

- Indications and Contraindications

- Compatibility Testing: Crossmatching, Coomb's Test

- Transfusion Reactions: Recognition and Management

5. Blood Safety:

- Blood-borne Pathogens: HIV, Hepatitis B and C

- Blood Screening Techniques: ELISA, NAT

****Unit 4: Basic Technology & Ethics (2104)****

- **Unit 4.1: Basic Technology (Theory)**

1. Introduction to Laboratory Technology

2. Laboratory Instruments:

- Microscopes: Types, Parts, Principles of Operation

- Centrifuges, Incubators, Autoclaves

- pH Meters, Spectrophotometers

3. Laboratory Techniques:

- Sterilization Methods: Dry Heat, Steam, Chemical

- Quality Control in Laboratory: Internal and External Quality Assurance

4. First Aid and Safety Measures:

- Emergency Procedures in Laboratory Settings

- Handling and Disposal of Biohazardous Materials

- **Unit 4.2: Ethics**

1. Ethics in Medical Laboratory Practice

- Code of Professional Conduct and Ethics

- Patient Confidentiality and Privacy

- Professional Boundaries and Communication Skills

2. Legal Aspects of Laboratory Practice:

- **Regulations and Standards: CLIA, HIPAA**

- **Reporting and Documentation**

- **Ethical Issues in Research and Clinical Trials**

****Unit 5: Histo-technology (2105)****

- ****Unit 5.1: Histo-technology (Theory)****

1. **Introduction to Histo-technology**

2. **Tissue Processing:**

   - **Collection and Preservation Techniques**

   - **Fixation: Chemical and Physical Methods**

   - **Processing: Dehydration, Clearing, Infiltration**

3. **Embedding and Sectioning:**

   - **Embedding Media and Techniques**

   - **Microtome: Types, Section Cutting Techniques**

4. **Staining Techniques:**

   - **Routine Staining: H&E, Special Stains**

   - **Immunohistochemistry (IHC) and In Situ Hybridization (ISH)**

5. **Autopsy Techniques:**

   - **Post-mortem Examination Procedures**

   - **Legal and Ethical Considerations**

****Unit 6: Biochemistry (2106)****

- ****Unit 6.1: Biochemistry (Theory)****

1. **Introduction to Biochemistry**

2. Carbohydrate Metabolism:

- **Glycolysis, Gluconeogenesis, Glycogen Metabolism**

- **Blood Glucose Regulation**

3. Lipid Metabolism:

- **Fatty Acid Oxidation and Synthesis**

- **Cholesterol Metabolism and Lipoprote**

Second Year DMLT Syllabus

Paper 01: Biochemistry & Clinical Pathology (2201)

Course Description: Students will gain knowledge of carbohydrates, proteins, lipids, vitamins, minerals, hormones, and relevant diagnostic tests.

Theory:

1. **Carbohydrates:**
    - Digestion and absorption
    - Metabolism of glucose, glycolysis, gluconeogenesis
    - Glycogen formation and breakdown, storage diseases
    - Maintenance of blood sugar levels, hormonal influence, diabetes mellitus
    - Interconversion of monosaccharides
2. **Proteins:**
    - Digestion of proteins
    - Urea synthesis, transamination
    - Metabolism of amino acids: aromatic amino acids, sulfur-containing amino acids
3. **Lipids:**
    - Digestion and absorption of lipids
    - Synthesis of fatty acids, oxidation of fatty acids
    - Lipoproteins
4. **Hormones:**
    - Role of biologically important hormones: insulin, glucagon, epinephrine, thyroid, growth hormones, steroid hormones
5. **Vitamins:**
    - Chemistry and biological role
6. **Minerals:**
    - Metabolism of iron, copper, calcium, magnesium, phosphorus, sodium, potassium, chloride, iodine
7. **ETC and Oxidative Phosphorylation:**

Urine:

1. **Composition of Urine:**
    - Collection and preservation
    - Changes in composition related to various diseases
    - Principle of dry chemistry

Practicals:

1. Complete urine analysis:
    - Physical examination
    - Chemical tests: protein, reducing substances, ketone bodies, blood pigments, bile
    - Sediment examination
    - Use of dipsticks in urine analysis
2. Cavity fluids and miscellaneous specimens: extra-vascular fluids, normal composition, transudations, and exudates
3. Cerebrospinal fluids and alterations in diseases
4. Semen analysis
5. Non-parasitological examination of stool including occult blood
6. Quality control: urine and extra-vascular fluids
7. Examination of CSF and reporting
8. Examination of cavity fluids and reporting
9. Semen analysis
10. Stool: occult blood, routine
11. Urine: urobilinogen, bile salt, bile pigment

Paper 02: Histopathology & Cytology (2202)

Course Description: Students will learn to fix, process, embed tissue, and make sections for microscopic examination. They will also be competent in routine cytological preparation.

Theory:

1. **Histopathological Techniques:**
    - Introduction to histopathological techniques
    - Reception of specimens
    - Fixation, formalin fixation
    - Tissue processing and embedding
    - Section cutting
    - Mounting and staining
    - Theory of H&E staining, PAS & PAP staining principles and uses
    - Stains for AFB (TB and leprosy)
    - Theory of frozen section preparation
2. **Cytology:**
    - Principles of exfoliate cytology
    - Fixation of smears
    - PAP staining and identification of cells in a normal vaginal smear

- Preparation of smears for fine needle aspiration cytology

Practicals:

1. Embedding and preparation of blocks
2. Section cutting and use and care of microtome
3. H&E staining
4. PAS staining
5. AFB staining (TB and leprosy)
6. Frozen section and care of cryostat
7. PAP staining
8. MGG staining for FNAC

Paper 03: Microbiology, Virology, Mycology & Advanced Serology (2203)

Objective: To provide students with a sound knowledge of pathogenic microbes, laboratory diagnosis, and a basic understanding of virology, mycology, and advanced serological techniques.

Theory:

1. **Systematic Bacteriology:**
   - Morphology, isolation, and identification of pathogens: cocci, bacilli, vibrio, spirochetes, actinomycetes
   - Laboratory diagnosis
   - Principles of antimicrobial therapy and antibiotic susceptibility tests
2. **Mycology:**
   - Common pathogenic fungi of skin, subcutaneous tissue, deep organs
   - Laboratory diagnosis
3. **Virology:**
   - Common viral diseases: transmission, diagnosis, isolation, serological tests
   - Preservation of microorganisms
   - Organization of a microbiology laboratory

Practicals:

1. Maintenance of stock cultures
2. Identification of pathogenic organisms
3. Methods of collection of clinical material for culture: urine, blood, sputum, CSF, throat swab, feces, and body fluids
4. Separation of sera, preservation, and transport for serological tests
5. Antibiotic susceptibility tests
6. Basic techniques of collection and examination of pathogenic fungi: KOH, lactophenol blue method
7. Cultivation of fungi
8. Basic techniques of collection and transport of specimens for virology studies
9. Diagnosis of viral infections: isolation and serological tests
10. Advanced serological techniques: ELISA, immunoelectrophoresis

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Paper 04: Coagulation & Transfusion Medicine (2204)

Course Description: Students will become familiar with the investigation of coagulation disorders and understand the principles of immunohematology. They will be competent to handle routine blood bank operations.

Theory:

1. **Coagulation Disorders:**
    - Principles of blood coagulation and hemostasis
    - Disorders of coagulation and hemostasis
    - Laboratory diagnosis of bleeding disorders
    - Quality control in coagulation laboratory
2. **Platelet Disorders:**
    - Disorders of platelets and laboratory diagnosis

Practicals:

1. Whole blood coagulation time
2. Clot retraction and clot lysis
3. Bleeding time
4. Tourniquet tests
5. One-stage prothrombin time
6. Partial thromboplastin time with correction
7. Factor assay
8. Investigation of platelet disorders, including simple methods to assess platelet adhesion, aggregation, and factor release

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Paper 05: Immunology, Hematology & Transfusion Medicine (2205)

Theory:

1. **Immunology:**
    - Principles of blood groups and antigen-antibody reactions
    - Genetics in blood banking
    - ABO blood group system
    - Rhesus blood group system
    - Other red cell antigens and antibodies
2. **Transfusion Medicine:**
    - Transfusion of antibodies
    - Coombs tests
    - Identification of antibodies
    - Transfusion reactions and investigation
    - Hemolytic disease of the newborn
    - Blood donor selection and screening
    - Diseases transmitted by blood transfusion and their laboratory diagnosis

- Blood components and their use
- Blood bank organization, donor motivation, and auditing

Practicals:

1. Blood collection and preservation using different anticoagulants and preservation solutions
2. Components preparation
3. ABO grouping
4. Rh typing
5. Antibody detection and titration
6. Coombs tests
7. Compatibility testing cross matches
8. Investigation of transfusion reactions
9. Investigation of hemolytic disease of the newborn
10. HBsAG and HIV antibody testing in blood bank