



SEMESTER – III

PAPER CODE	SUBJECT NAME	THEORY HOURS	PRACTICAL HOURS	THEORY MARKS	PRACTICAL MARKS
DMLT301	LABORATORY MANAGEMENT & ETHICS	45 Min	1 Hrs.	50	50
DMLT302	CYTOLOGY & IMMUNOLOGY	45 Min	1 Hrs.	50	50
DMLT303	CLINICAL HEMATOLOGY	45 Min	1 Hrs.	50	50
DMLT304	LAB SAFETY & FIRST AID	45 Min	1 Hrs.	50	50

LABORATORY MANAGEMENT & ETHICS

Theory syllabus

1. Introduction to Medical Laboratory Management

- Definition and objectives of laboratory management
- Types of laboratories (hospital-based, private, research, public health)
- Levels of healthcare and laboratory services
- Role and responsibilities of lab manager/supervisor

2. Laboratory Organization and Staffing

- Organizational structure of a clinical laboratory
- Job responsibilities of laboratory personnel:
 - Lab technicians
 - Pathologists
 - Assistants and clerical staff
- Staff scheduling and duty rotation
- Training and continuing education

3. Laboratory Planning and Layout

- Design and layout of a clinical lab
- Work zones: Sample receiving, testing area, reporting area
- Ventilation, lighting, and space optimization
- Safety considerations in design (fire exits, chemical storage)

4. Equipment Management

- Types of common lab instruments and their functions



- Installation, calibration, maintenance, and servicing
- Equipment logbook and usage records
- AMC (Annual Maintenance Contract) importance

5. Laboratory Supplies and Inventory Control

- Procurement of chemicals, glassware, reagents
- Inventory management and stock register
- Storage and labeling of chemicals and reagents
- FIFO (First In First Out) method

6. Quality Assurance and Quality Control

- Internal and external quality control (IQC & EQC)
- Precision, accuracy, sensitivity, specificity
- Control charts and standard deviation
- Proficiency testing and corrective actions

7. Laboratory Safety Practices

- Personal protective equipment (PPE)
- Handling and disposal of biohazardous waste
- Needle stick injury prevention
- First aid for chemical burns, spills
- Fire safety and electrical safety

8. Medical Ethics in Laboratory Practice

- Definition and importance of ethics
- Patient confidentiality and informed consent
- Code of conduct for lab personnel
- Truthful and accurate reporting
- Ethical handling of human samples

9. Legal Aspects and Accreditation

- Legal responsibilities of laboratories
- Regulatory bodies (NABL, NABH, MCI, DCI, etc.)
- Basic overview of laboratory accreditation (ISO 15189)
- Documentation and audits

10. Communication and Reporting Skills

- Importance of good communication in labs
- Interaction with patients and healthcare professionals
- Format of lab reports and interpretation guidelines
- Telephone etiquette and complaint handling

Practical Syllabus

- Report writing based on visit to a NABL-accredited lab



- Demonstration of lab safety practices
- Logbook entries for quality control
- SOP writing practice for common procedures

CYTOLOGY & IMMUNOLOGY

Theory syllabus

CYTOLOGY

1. Introduction to Cytology

- Definition, scope, and importance
- Diagnostic and research applications
- Types of cytology:
 - Exfoliative cytology
 - Aspiration cytology (FNAC)
 - Liquid-based cytology (introductory)

2. Cell Structure & Functions

- Prokaryotic vs. eukaryotic cells
- Cell organelles (nucleus, mitochondria, ER, Golgi, etc.)
- Cellular differentiation and regeneration
- Normal vs. abnormal cellular morphology

3. Specimen Collection for Cytology

- Types of specimens:
 - Sputum
 - Urine
 - Cervical smears (Pap smear)
 - Body fluids (pleural, ascitic)
 - FNAC aspirates
- Fixation methods and preservatives
- Transport media (e.g., 95% ethanol, cytorich red/blue)

4. Staining Techniques in Cytology

- Papanicolaou (Pap) stain
- Hematoxylin and Eosin (H&E) stain
- Giemsa stain
- May-Grünwald stain (where applicable)

5. Microscopy and Interpretation

- Use of microscope for cytological screening
- Normal and pathological changes in smears
- Basic reporting terminology (e.g., negative for malignancy, atypical cells, malignant cells)



- Bethesda System (basic intro for cervical cytology)

6. Cytological Diagnosis

- Common cytological findings in:
 - Cervical cancer
 - Lung diseases
 - Urinary tract infections
 - Breast lumps (via FNAC)
 - Serous effusions

IMMUNOLOGY

1. Introduction to Immunology

- Innate vs. acquired immunity
- Cells of the immune system (T cells, B cells, macrophages)
- Organs of the immune system (thymus, spleen, lymph nodes)
- Antigens and antibodies

2. Antigen-Antibody Reactions

- Types of reactions:
 - Precipitation
 - Agglutination
 - Complement fixation
 - Neutralization
- Diagnostic applications of each type

3. Immunological Techniques

- ELISA (Enzyme-Linked Immunosorbent Assay)
- Rapid tests (Pregnancy test, HIV, HBsAg)
- Rheumatoid factor (RA), CRP, ASO, Widal
- Latex agglutination tests
- Immunochromatography basics

4. Hypersensitivity and Autoimmunity

- Types I-IV hypersensitivity (overview)
- Common autoimmune disorders:
 - Systemic Lupus Erythematosus (SLE)
 - Rheumatoid arthritis
 - Type 1 diabetes

5. Immunoprophylaxis and Vaccines

- Types of vaccines: live, killed, subunit
- National Immunization Schedule
- Role of immunization in disease prevention



6. Immunodeficiency Diseases

- Overview of primary and secondary immunodeficiencies
- Brief mention of HIV/AIDS and its effect on the immune system

Practical Syllabus

Cytology Practicals

- Pap smear preparation and staining
- Microscopic examination of cervical and sputum smears
- FNAC slide handling and fixation
- Reporting of basic cytological features

Immunology Practicals

- ELISA technique demonstration
- Widal test (for typhoid diagnosis)
- RA factor and CRP test
- Rapid card tests for HIV, HBsAg, pregnancy
- Blood grouping using antisera (ABO, Rh typing)

CLINICAL HEMATOLOGY

Theory syllabus

1. Introduction to Hematology

- Definition and scope
- Composition and functions of blood
- Types of blood cells – RBCs, WBCs, Platelets
- Hematopoiesis (formation of blood cells)

2. Collection and Anticoagulants

- Venipuncture and capillary collection
- Anticoagulants:
 - EDTA
 - Heparin
 - Sodium citrate
- Precautions during blood collection
- Blood sample labeling and storage

3. Hemoglobin Estimation

- Principle and methods:
 - Sahli's method
 - Cyanmethemoglobin method
- Normal values (men, women, children)
- Clinical significance (anemia, polycythemia)



4. Red Blood Cell (RBC) Studies

- RBC count (manual and automated)
- Calculation and normal range
- Morphology of RBCs in health and disease
- Reticulocyte count
- Hematocrit (PCV)

5. White Blood Cell (WBC) Studies

- Total leukocyte count (TLC)
- Differential leukocyte count (DLC)
- Normal and abnormal WBC morphology
- Leukocytosis, leukopenia, leukemia (introductory)

6. Platelet Studies

- Platelet count (manual and automated)
- Normal values and clinical significance
- Thrombocytopenia and thrombocytosis

7. Red Cell Indices

- MCV, MCH, MCHC
- Interpretation and relevance in anemia classification
- ESR (Erythrocyte Sedimentation Rate) – Westergren and Wintrobe method

8. Peripheral Blood Smear (PBS)

- Preparation, staining (Leishman, Giemsa)
- Identification of normal and abnormal cells
- RBC morphological abnormalities:
 - Anisocytosis, poikilocytosis, target cells, spherocytes, etc.
- WBC morphology: Blasts, toxic granules, shift to left/right

9. Bone Marrow Examination (Introductory)

- Indications and procedure overview
- Smear preparation and staining
- Overview of normal vs. abnormal bone marrow findings

10. Hematological Disorders Overview

- Anemia – types and lab diagnosis
- Leukemia – types and blood picture
- Bleeding disorders – hemophilia, ITP
- Sickle cell disease and thalassemia (introductory)

11. Quality Control in Hematology



- Internal and external quality control
- Importance of accuracy and precision
- Daily QC logs and maintenance of instruments

Practical Syllabus

➤ Hemoglobin Estimation

- Sahli's and cyanmethemoglobin method

➤ Total RBC, WBC & Platelet Count

- Manual counting using Neubauer chamber
- Calculation and normal range

➤ Differential Leukocyte Count

- Preparation and staining of peripheral smear
- Identification and calculation of % of each cell type

➤ ESR

- Wintrobe and Westergren methods

➤ Hematocrit (PCV)

- Microhematocrit method
- Reading and interpretation

➤ Red Cell Indices Calculation

- MCV, MCH, MCHC using formulas

➤ Reticulocyte and Eosinophil Count

➤ Blood Smear Preparation

- Leishman staining
- Identification of abnormal blood cells

➤ Coagulation Tests (Introductory)

- Bleeding time (BT)
- Clotting time (CT)

➤ Sample Handling

- Anticoagulated vs. clotted samples
- Specimen rejection criteria



LAB SAFETY & FIRST AID

Theory syllabus

1. Introduction to Laboratory Safety

- Importance of safety in a medical laboratory
- Types of hazards:
 - Biological
 - Chemical
 - Physical
 - Electrical
- Lab safety rules and regulations
- Personal protective equipment (PPE)

2. Personal Protective Equipment (PPE)

- Types and proper usage:
 - Lab coats/gowns
 - Gloves
 - Masks/respirators
 - Face shields, goggles, shoe covers
- Donning and doffing procedures
- Infection control precautions (Standard & Transmission-based)

3. Biosafety Guidelines

- Biosafety levels (BSL 1–4) overview
- Safe handling of infectious materials
- Containment practices
- Working inside biosafety cabinets (BSC)
- Universal precautions

4. Chemical and Fire Safety

- Safe handling and storage of chemicals
- Labeling systems: GHS (Globally Harmonized System)
- Flammable, corrosive, and toxic substances
- Fire hazards in the lab
- Types of fire extinguishers and their use
- Fire triangle and classes of fire (A, B, C, D, K)

5. Biomedical Waste Management

- Waste segregation by color-coded bins
- Disposal of sharps, contaminated materials, chemicals
- BMW rules (India – BMW Rules 2016)
- Transport, treatment, and final disposal methods

6. Electrical & Equipment Safety



- Grounding of equipment
- Handling of electrical tools and appliances
- Routine equipment checks and maintenance logs
- Avoiding electrocution and short circuits

7. Accidents and Incident Reporting

- Types of lab accidents: spills, cuts, burns, exposure
- Incident reporting format and documentation
- Root cause analysis
- Safety audit and checklist in laboratories

8. First Aid Principles

- Basic principles and priorities (ABC – Airway, Breathing, Circulation)
- First aid box contents and their uses
- Wound care and bleeding control
- Burns: classification and first aid
- First aid for fainting, choking, fractures
- Snakebite, electric shock, and chemical exposure response

9. CPR (Cardiopulmonary Resuscitation)

- Introduction to CPR
- Basic Life Support (BLS) steps
- Adult and child CPR (theoretical steps)

10. Emergency Preparedness and Disaster Management

- Evacuation procedures
- Earthquake/fire/emergency drills
- Role of laboratory staff during public health emergencies (e.g., pandemics)

Practical Syllabus

➤ Demonstration of Lab Safety Measures

- Use of PPE
- Eye wash and safety shower use
- Spill clean-up procedure

➤ Fire Safety Drill

- Operation of fire extinguisher (theory/demo)
- Fire alarm and evacuation mock drill

➤ Biomedical Waste Segregation

- Color-coded waste segregation and disposal
- Handling of sharps



➤ **First Aid Demonstrations**

- Bandaging techniques for minor cuts and wounds
- Management of bleeding, burns, and fractures
- First aid kit usage and stocking

➤ **CPR Simulation (if facilities allow)**

- Chest compressions and rescue breathing (on manikin or demo)
- Recovery position