SEMESTER – IV

PAPER CODE	SUBJECT NAME	THEORY HOURS	PRACTICAL HOURS	THEORY MARKS	PRACTICAL MARKS
DMLT401	HISTOPATHOLOGICAL TECHNIQUES	45 Min	1 Hrs.	50	50
DMLT402	COAGULATION & TRANSFUSION MEDICINE	45 Min	1 Hrs.	50	50
DMLT403	QUALITY CONTROL IN LABS	45 Min	1 Hrs.	50	50
DMLT404	HAND HYGIENE & PREVENTION OF CROSS INFECTION	45 Min	1 Hrs.	50	50

HISTOPATHOLOGICAL TECHNIQUES

Theory syllabus

1. Introduction to Histopathology

- Definition and importance of histopathology
- Role of histopathology in disease diagnosis
- Overview of histology vs. histopathology
- Responsibilities of a histopathology technician

2. Specimen Collection & Fixation

- Types of specimens (biopsies, surgical specimens, autopsies)
- Principles of fixation
- Types of fixatives:
  - Formalin (10% NBF)
  - Bouin's solution
  - Alcohol-based fixatives
- Properties of an ideal fixative
- Fixation artifacts and errors

3. Tissue Processing

- Dehydration: graded alcohol series
- Clearing: xylene, toluene
- Impregnation: paraffin wax
- Embedding: paraffin block preparation
- Automation in tissue processing
- Common tissue processing errors

4. Microtomy

- Types of microtomes:
  - Rotary
  - Sledge
  - Cryostat (frozen sections)
- Knife types and sharpening (honing, stropping)
- Section cutting techniques (3–5 µm standard)
- Troubleshooting during sectioning
- Floatation and mounting

5. Tissue Staining Techniques

- Routine stains:
  - Hematoxylin & Eosin (H&E)
- Special stains:
  - PAS (Periodic Acid Schiff)
  - Ziehl-Neelsen (AFB stain)
  - Masson's trichrome
  - Silver stain
- Principle and procedure of each
- Differentiation, bluing, and mounting

6. Mounting and Labeling

- Types of mounting media (DPX, Canada balsam)
- Coverslip application
- Labeling of slides and storage
- Slide drying and sealing techniques

7. Cytopathology (Introductory)

- Definition and types (exfoliative, aspiration cytology)
- Pap smear (brief introduction)
- FNAC and body fluid cytology basics

8. Histopathological Artifacts

- Common artifacts:
  - Shrinkage
  - Folding
  - Knife marks
  - Bubbles
- Causes and prevention

9. Quality Control in Histopathology

- Internal QC procedures
- Standard Operating Procedures (SOPs)
- Slide and report accuracy
- Equipment maintenance and calibration

10. Safety Measures in Histopathology Lab

- Handling of chemicals and fixatives
- Disposal of hazardous waste (e.g., xylene)
- Use of PPE and fume hoods
- Fire and chemical safety precautions

Practical Syllabus

- **Collection and Fixation of Tissue**
- Demonstration of fixative preparation
- Fixing tissue specimens properly

➢ **Tissue Processing (manual and automated)**

- Dehydration, clearing, and embedding
- Paraffin block making

➢ **Microtomy**

- Section cutting using rotary microtome
- Knife sharpening (demo or practice)
- Use of warm water bath for ribbon spreading

➢ **Routine Staining**

- Hematoxylin & Eosin (H&E) staining procedure
- Differentiation and mounting techniques

➢ **Special Stains (if applicable)**

- PAS, Ziehl-Neelsen (demonstration level)
- Silver stain or trichrome (optional advanced)

➢ **Slide Mounting**

- Coverslip application
- Use of mounting media

➢ **Handling of Cytological Smears**

- Preparation and basic staining (optional introduction)

COAGULATION & TRANSFUSION MEDICINE

Theory syllabus

1. Introduction to Hemostasis

- Definition of hemostasis
- Primary and secondary hemostasis
- Role of blood vessels, platelets, and coagulation factors
- Sequence of clot formation

2. Coagulation Cascade

- Intrinsic and extrinsic pathways
- Common pathway
- Role of calcium and phospholipids
- Factors I to XIII (names, functions, deficiency effects)
- Natural anticoagulants (Protein C, Protein S, Antithrombin III)

3. Bleeding and Clotting Disorders

- Hemophilia A and B
- von Willebrand disease
- Thrombocytopenia and platelet function defects
- DIC (Disseminated Intravascular Coagulation)
- Hypercoagulable states (overview)

4. Coagulation Tests

- Screening tests:
  - Bleeding Time (BT)
  - Clotting Time (CT)
  - Prothrombin Time (PT)
  - Activated Partial Thromboplastin Time (APTT)
  - Thrombin Time (TT)
- Platelet function tests
- D-dimer test and FDP (Fibrin Degradation Products)
- Mixing studies and factor assays (introductory)

5. Introduction to Transfusion Medicine

- Historical perspective
- Importance in modern healthcare
- Role of blood banks

6. Blood Groups and Typing

- ABO and Rh blood group systems
- Inheritance patterns

- Forward and reverse typing
- Rh incompatibility and hemolytic disease of newborn (HDN)

7. Blood Collection and Processing

- Blood donation criteria and process
- Anticoagulants used in blood bags (CPDA-1, ACD)
- Component separation:
  - Packed RBCs
  - Platelet concentrates
  - Fresh frozen plasma (FFP)
  - Cryoprecipitate

8. Cross Matching and Compatibility Testing

- Major and minor crossmatch
- Direct and indirect antiglobulin (Coombs) test
- Antibody screening and identification

9. Transfusion Reactions

- Types:
  - Hemolytic (acute/delayed)
  - Febrile non-hemolytic
  - Allergic
  - Anaphylactic
  - TRALI (Transfusion Related Acute Lung Injury)
- Causes, signs, symptoms, and prevention
- Management and reporting of adverse reactions

10. Storage and Preservation of Blood

- Storage temperature and shelf-life of:
  - Whole blood
  - PRBCs, Platelets, Plasma
- Blood bag labeling and inventory control
- Cold chain maintenance

11. Legal and Ethical Issues

- Donor consent and screening
- Voluntary vs. paid donation ethics
- Documentation and traceability
- Blood Bank accreditation and quality systems (NACO, NABH)

Practical Syllabus

- **Coagulation Tests**

  - Bleeding Time (BT – Duke method)
  - Clotting Time (CT – Capillary tube method)

- PT/INR (with or without semi-auto analyzer)
- APTT (if facility available)
- Platelet count (manual or automated)

➢ **Blood Grouping and Rh Typing**

- Slide and tube method for ABO & Rh typing
- Forward and reverse grouping

➢ **Crossmatching Procedures**

- Saline method (major crossmatch demo)
- Gel method (optional advanced demo)
- Interpretation of compatibility results

➢ **Sample Handling**

- Blood bag labeling
- Sample identification and rejection criteria

➢ **Component Separation (Observation or demo)**

- Use of centrifuge
- Separated units (PRBC, FFP, platelets)

➢ **Transfusion Reaction Workup**

- Clerical checks
- Hemolysis check
- Reporting format (demo or practice documentation)

QUALITY CONTROL IN LABS

Theory syllabus

1. Introduction to Quality in Laboratory

- Definition of quality in clinical labs
- Importance of quality assurance (QA) and quality control (QC)
- Differences between QA and QC
- Goals of a quality laboratory system

2. Types of Laboratory Errors

- Pre-analytical errors:
  - Sample collection, labeling, transport
- Analytical errors:
  - Instrument failure, wrong reagent, technique errors
- Post-analytical errors:
  - Result interpretation, reporting mistakes

3. Quality Control Materials

- Types of control materials:
  - Internal and external controls
  - Lyophilized, liquid controls
- Use of commercial QC samples
- Control charts (Levey-Jennings chart)

4. Internal Quality Control (IQC)

- Daily monitoring of test performance
- Running control samples
- Accepting or rejecting test runs
- Standard deviation (SD), Coefficient of Variation (CV)
- Application in biochemistry and hematology

5. External Quality Assessment (EQA)

- Definition and purpose
- National and international EQAS programs (e.g., NABL, WHO)
- Proficiency testing
- Result analysis and corrective action

6. Calibration and Maintenance

- Instrument calibration (daily, monthly, annual)
- Calibration curves and standards
- Documentation of instrument logs
- Preventive maintenance schedules

7. Standard Operating Procedures (SOPs)

- Definition and need for SOPs
- Format of SOPs
- SOPs for sample collection, test procedures, equipment use
- Version control and review process

8. Laboratory Accreditation and Quality Standards

- NABL (National Accreditation Board for Testing and Calibration Laboratories)
- ISO 15189:2012 standards
- CLSI (Clinical and Laboratory Standards Institute) guidelines
- Benefits of accreditation

9. Documentation and Record Keeping

- Quality manual
- Log books (temperature, reagent use, maintenance)
- Report formats and validation
- Audit trails and traceability

10. Laboratory Safety and Ethics in QC

- Role of safety in quality systems
- Ethical reporting of QC failures
- Continuous quality improvement (CQI)
- Root cause analysis for quality failures

Practical Syllabus

- **Preparation and Use of Control Samples**

  - Running daily controls in hematology/biochemistry
  - Recording results and plotting control charts

- **Levey-Jennings Chart Practice**

  - Plotting values
  - Identifying trends, shifts, outliers
  - Westgard rules application

- **Calibration Procedures**

  - Calibrating a colorimeter or semi-auto analyzer
  - Checking calibration using standard solutions

- **SOP Practice**

  - Writing a sample SOP for glucose estimation
  - Following SOPs during testing

- **Documentation & Record-Keeping**

  - Maintaining quality control logs
  - Recording instrument maintenance reports
  - Filling up temperature chart forms

- **Quality Error Identification**

  - Case studies or demo: identifying pre-analytical, analytical, post-analytical errors
  - Reporting and corrective action exercises

HAND HYGIENE & PREVENTION OF CROSS INFECTION

Theory syllabus

1. Introduction to Hospital-Acquired Infections (HAIs)

- Definition of nosocomial infections
- Common pathogens (MRSA, VRE, C. difficile, etc.)
- Modes of transmission (direct, indirect, droplet, airborne)

- Impact on patient safety and healthcare system

2. Principles of Infection Control

- Chain of infection (Agent–Reservoir–Portal–Transmission–Entry–Host)
- Breaking the chain through hygiene practices
- Standard precautions and transmission-based precautions
- Universal precautions concept

3. Hand Hygiene

- Importance of hand hygiene in clinical settings
- When to wash hands – WHO's "Five Moments for Hand Hygiene":
    1. Before touching a patient
    2. Before clean/aseptic procedures
    3. After body fluid exposure
    4. After touching a patient
    5. After touching patient surroundings

4. Hand Hygiene Techniques

- Handwashing with soap and water
- Hand rubbing with alcohol-based hand rubs
- Steps of effective handwashing (20–30 seconds)
- Use of disposable towels and air dryers
- Indications for hand rub vs. handwash
- Nail hygiene, use of gloves

5. Personal Protective Equipment (PPE)

- Types of PPE: gloves, gowns, masks, face shields
- Donning and doffing procedures
- Proper disposal of PPE

6. Prevention of Cross Infection

- Cross-infection definition and sources
- Role of staff, instruments, surfaces in transmission
- Disinfection and sterilization protocols
- Isolation techniques and cohorting
- Cleaning of high-touch surfaces

7. Environmental and Equipment Hygiene

- Biomedical waste management (BMWM 2016 guidelines overview)
- Cleaning of patient care areas
- Disinfection of lab surfaces and equipment
- Safe handling of linen and spills

8. Role of Health Workers in Infection Prevention

- Ethical responsibility
- Monitoring compliance
- Reporting breaches in infection control

Practical Syllabus

- **Demonstration and Practice of:**

  - **Handwashing technique** (with soap & water)
  - **Hand rub technique** (with sanitizer)
  - WHO-recommended 7 steps of hand hygiene
  - Use of elbow tap or pedal-operated taps

- **Glove Usage and Removal**

  - Types of gloves (sterile, non-sterile)
  - Proper wearing and removal technique
  - Glove disposal in color-coded bins

- **Donning and Doffing PPE**

  - Gown, gloves, mask, goggles/shields – correct sequence
  - Hands-on PPE use training

- **Surface Disinfection Demo**

  - Cleaning a lab bench or patient table
  - Use of 1% hypochlorite solution and alcohol swabs

- **Cross Infection Case Studies**

  - Identification of infection source
  - Suggested preventive action
  - Group discussions or role play

- **Record Keeping and Hygiene Checklists**

  - Hand hygiene audit form
  - Daily cleaning checklist demo
  - PPE stock monitoring form