Saurashtra University

Diploma in Medical Laboratory Technology

The papers prescribed for the two terms or the D.M.L.T. examination.

Sr. No.	PAPER NO.	MARKS
1.	2.	3.
1.	PAPER No. I General introduction, Biochemistry	100
	Practicals for Paper I	100
2.	PAPER NO. II Haematology, Immunohaematology & Blood Banking.	100
	Practicals for Paper II	100
3.	PAPER NO. III General Microbiology, Medical Microbiology, Serology & Histopathology.	100
	Practicals for Paper III	100
4.	PAPER NO. IV Urine Analysis, Examination of Body fluids, Seminal fluid, Sputum, General Parasitology.	100
	Practicals for paper No. IV	100

Paper No. – 1
GENERAL INTRODUCTION, BIOCHEMISTRY

1. Introduction to medical technology i.e.

- What is entails
- Origin
- Progress till today
- Scope for future

2. General Laboratory Techniques & Apparatus.

- Centrifuge
- Autoclave
- Oven
- Water bath
- Inspissator
- Incubator
- Refrigerator
- Simple & Analytical Balance
- Colorimeter & Spectrophotometer
- Microscope
- PH Meter

3. Quality Control

- Standard deviation & selection of abnormal individual.
- Importance of quality control serum pool.
- Case histories.

4. Laboratory Glassware and Cleaning.

Pipettes, capillaries, test tubes, slides, Pasteur pipette, micropipettes etc.

5. Preparation of stain & proper staining techniques, methods of transmission of various specimen and material for laboratory examination.

BIOCHEMISRTY

1. Nitrogenous compounds.

- Proteins and amino acids.
  - Classification, metabolism & nitrogen balance
- Analytical techniques for protein determination
  - N analysis
  - Biuret Reaction
  - Phenol method
  - Ionic Precipitation.
  - Dye binding
  - Anionic & Cationic precipitation
  - Salting out technique.
  - Fibrinogen
  - Total protein and albumin
- Plasma Proteins.
  - Functions.
  - Properties.
  - Clinicopathologic correlations and diseases associated
  - Electrophoresis patterns.
  - M-components
  - Hypogamma and Agammaglobulinemia.
  - Polyclonal and monoclonal gammopathy.
  - Bence Jones proteins in urine & serum
  - Cryoglobulins.

2. Non protein nitrogenous compounds

- Urea.
- Creatinine.
- Uric acid

Biochemistry, Clinicopathologic correlation and methods of estimation of each.

3. Carbohydrates

- Classification
- Glucose
    - Metabolism
    - Digestion and absorption
    - Hepatic and Extra hepatic contributions
    - Intracellular metabolism of glucose.
    - Glucose tolerance curve.
    - Clinicopathologic correlations
        - Diabetes mellitus as a disease
        - Screening test-urine glucose, fasting blood glucose, Two Hours post prandial
        - Diagnostic test-glucose tolerance curve.
        - Management of diabetic patients.
        - Hypoglycemia.

Methods of estimation of glucose

- Folin-Wu Method
- Nelson-Somogye's method
- O-Toluidine method
- GOD-POD method
- Hexokinase method

4. Lipids

- Biochemistry and classification.
- Chemical reactions of Lipids and metabolism.
- Hepatic role in lipid metabolism
- Fatty liver
- Triglyceride metabolism and estimation.
- Cholesterol metabolism, cholesterol assays
- Blood lipids.
- Lipoprotein, abnormal lipoproteins.
- Clinical pathologic correlations.

5. Anatomy, Physiologic & Chemistry of liver function tests.

- Bilirubin metabolism, Classification of jaundice, estimation of direct & Indirect bilirubin.
- Metabolic tests.
    - Glucose tolerance, fructose tolerance, epinephrine tolerance, cholesterol estimation, estimation of bile acids, serum protein levels.
- Flocculation tests
    - Blood ammonia determination.
- Foreign substance excretions.
    - Rose Bengal excretions.
    - Sulobrompthdein excretion
- Thymol turbidity, Alkaline phosphatase, Acid Phosphatase, SGPT estimation.

6. Anatomy, Physiology and Chemistry of kidney function test

- Tubular function
- Principles of renal clearance
- Urea and creatinine clearance methods
- PSP excretion test
- Concentration test

7. Heart Enzymes

- SGPT, LDH, CPK their estimation.

8. Electrolytes & blood gases

- Sodium, potassium, Calcium, Chloride, Bicarbonates, Phosphorus.
  - Anion, Cation electroneutrality

9. Electrophoresis

- Immunoelectrophoresis
- Gel diffusion.

10. Chromatography.

- Thin layer.
- Paper.
- Gas liquid.

11. Ca and P04 estimation

12. Amylase estimation

13. Automation

14 Study of Hormones

- Estimation & Function effects on body and diseases associated
  - ACTH hormone
  - thyroid stimulating hormone.
  - Testosterone
  - Estrogen, Progesterone
  - Prolactin
  - Growth hormone and oxytocin.
  - Endocrinology – detailed study

15. Toxicology

- Various drugs and measurement in various samples, their effect, clinical indications and correlation
  - Alcohol
  - Amphetamines
  - Antiepileptics
  - Barbiturates
  - Bromides
  - Hallucinogens
  - Narcotics
  - Phenothiazines
  - Salicylates
  - Metals like Arsenic, Iron, Lead, Lithium and Mercury

Paper No. – 2
HAEMATOLOGY, IMMUNOHAEMATOLOGY & BLOOD BANKING

1. Method of Blood collection

- Capillary and venous blood.
- Anatomy of veins from the elbow region.
- Complications of vein puncture.
- Talk on arterial blood collection.

2. Anticoagulants-their uses & reasons for choice.

3. Preparation & examination of thin, thick and wet blood films.

4. Physiology of blood formation & destruction of,

- Erythrocyte
- Leucocytes
- Thrombocyte
- Hemoglobin

5. Ultra structure of blood cells & its precursor.

6. Role of 2, 3 (DPG) Diphosphoglycerate in regulation of erythrocyte production.

7. Theory & estimation of

- RBC Count
- WBC Count
- Differential Count
- Packed cell volume
- Erythrocyte sedimentation rate.
- Hemoglobin.
- Red cell indices.
- Eosinophil Count
- Reticulocyte.

8. Talk on technique of marrow aspiration biopsy (E/ef)

9. Significance of each WBC

10. Haematological diseases like

- Lupus erythematosus
- Infection mononucleosis
- Paroxysmal nocturnal haematuria.
- Diagnostic tests for above diseases.

11. Anaemias

- Acute
- Chronic
- Iron deficiency anemia
- Vit. B_{12} & folate deficiency anemia.
- Aplastic anemia
- Sideroblastic anemia
- Hemolytic anemia
- Refractory anemia
- Relative polycythemia & polycythemia vera.

12. Leukemia

- Acute & chronic (Lymphocytic, Monocytic & Myelocytic)
- Cytochemistry method to identify type of leukemias.
- Hodgkin’s lymphomas & nonhodgkin’s diseases
- Multiple myeloma.
- Weldenstrom’s macrogioblinemia
- Leukemoid reactions

13. Hemoglobin electrophoresis & haemoglobinopathies.

- Normal & abnormal haemoglobins with nomenclatures.
- Abnormal hemoglobin syndromes
  - Thalassaemias: different types – β-Thalassemia (major & minor)
  - β-Thalassaemias in association with β-haemoglobinopathies (Doubly heterozygous states)
  - Thalassaemias
  - Laboratory studies in Thalassaemias and screening test.
- **Sickle cell disease.**
  - Complications
  - Sickle cell trait
- **Hemoglobin**
  - Hemoglobin C disease.
  - Hemoglobin C trait.
  - Hemoglobin D diseases and trait.
  - Double heterozygous states: SC, SD disease
- **Laboratory studies in haemoglobinopathies**
  - Osmotic fragility.
  - Sickling test.
  - Dithionite tube test.
  - Alkali denaturation test for Hb F.
  - Electrophoresis of Hb.

14. Glucose 6 phosphate dehydrogenate deficiency disease (G6PD)

- Cause and diagnosis.

15. Coagulation

- Intrinsic and extrinsic coagulation system and blood platelets.
- 13 coagulation factors.
  - Description, properties, significance & disease associated.
- Vascular hemophilia.
- Disseminated intravascular coagulation.
- Procedures to find deficiency of factors.
  - Prothrombin time
  - Bleeding time-duke and Ivy method.
  - Whole blood clotting time
  - Clot retraction.
  - Fibrinogen determination.
  - Platelet count.
  - Partial thromboplastin time.
  - Tourniquet test.

16 Blood Parasites.

- Recognition of Malaria and Microfilaria parasites.
- Recognition of Principal blood Pictures.

17 Automation

- Coulter counter
- Particle counter

IMMUNOHAEMATOLOGY

- Heteroimmune disease.
- Isoimmune disease
- Hemolytic disease of the new born
- Autoimmune disease.
- Complete and Incomplete antibodies.

BLOOD BANKING

1. Blood groups and their applications
2. Methods of blood typing
    - Forward & back typing
3. Blood donor selection and screening
4. Blood collection and preservation
5. Compatibility testing
    - Cross matching, transfusion reaction and their investigations
6. Blood bank organization and methodology

Paper No. – 3
GENERAL MICROBIOLOGY, MEDICAL MICROBIOLOGY, SEROLOGY & HISTOPATHOLOGY

1. General Microbiology

- Collection and handling of clinical specimen
- Methods of sterilization
- Different staining methods
- Hanging drop preparation
- Composition and preparation of simple culture media

2. Medical Bacteriology

- General outline of culture and sensitivity.
- Antibiotic sensitivity, its importance and techniques.
- Bacteriological examination of sputum, pus, throat swab, urine, aspirated fluids, C.S.F., blood culture etc.
- Different Biochemical tests for identification of pathogens.

3. Medical mycology

- Fungal infections of skin
- Techniques of examining specimen for sub-cutaneous fungi
- Intermediate fungi

4. General Principles, Serological methods

- Agglutination test.
- Precipitating test.
- Flocculation
- Complement fixation test
- Fluorescent antibody method.
- Serodiagnostic tests for…
    - Syphilis.
    - Widal test.
    - IgG, IgM, IgA antibodies.
    - C-Reactive Protein.
    - Hepatitis associated antigen.
    - Rheumatoid factor.
    - Antinuclear antibody.
    - Antistreptolysin O titre.
    - ELISA.
    - Radio Immuno Assay (RIA).

HISTOPATHOLOGY

1. Selection of tissue for biopsy
2. Fixation of tissue, different types of fixatives.
3. Processing of tissue
    - 9 stage, clearing od tissue & various agents
4. Tissue embedding and wax impregnation
5. Cutting of tissue
6. Staining
    - Procedure, various stains
7. Microtomy
8. Objective of various histopathological staining methods
9. Mounting media
10. H&E stain and PAP smear staining for detection of cancer cells
11. Cytology
12. Clinical procedures for cytologic study of various body sites (histopathological practical during hospital training)

Paper No. – 4
URINE ANALYSIS, EXAMINATION OF BODY FLUIDS, SEMINAL FLUID, SPUTUM, GENERAL PARASITOLOGY

1. **Urine analysis**
   - Composition of Urine.
   - Examination of Urine.
     - Physical, chemical and microscopic examination of urine.
   - Common renal diseases.
   - Urinary Calculi.
2. **Examination of faeces**
   - Methods of collection.
   - Physical, Chemical & Microscopic Examination.
     - Protozoa: Trophozoites & cysts.
     - Helminths: Concentration methods for ova / cyst.
3. **Examination of body fluids**
   1. Cerebrospinal Fluid
      - Anatomy and Physiology of meanings.
      - Procedure of Lumber puncture and collection.
      - Physical, chemical and microscopic examination
   2. Aspirated fluid
      - Difference of transudate & exudates.
      - Mode of formation.
      - Methods of collection
      - Physical: General appearance, specific gravity etc.
      - Chemical: Pandy's test, Proteins.
      - Microscopic examination: Unstained & stained cells and bacteria, cells count etc.
   3. Gastric fluid
      - Anatomy and Physiology of stomach.
      - Various gastric stimulants and test meals.
      - Gastric intubation and collection of gastric juice.
      - Physical and chemical examination.
      - Abnormalities in gastric secretion in various diseases.
4. **Examination of seminal fluids**
   - Physiology
   - Collection.
   - Gross examination
   - Microscopic examination of seminal fluids
5. **The sputum**
   - Anatomy and physiology of respiratory system
   - Method and precaution in collection of sputum
   - Physical examination
   - Microscopic examination.
   - Concentration method for AFB finding in various diseases.
6. **General parasitology**
   - General introduction, Host-parasite relationship.
   - Protozoology & Helminthology: Introduction, classification and importance.
     - Protozoology: *E. histolytica*, *E. coli*, Intestinal, oral and genital flagellates, *B. coli*.
     - Helminths:
       – Cestodes: *T. saginata, T. solium, E. granulosus H. nana*.
       – Trematodes: *A. lumbricoides, Necator americanus, Ancylostoma duodenale, T. trichiura, E. vermicularis, W. bancrofti & B. malayi* (microfilaria) *D. medinensis.*

History, geographic distribution, Habitat, morphology and life cycle, pathological effects and laboratory diagnosis of above parasites.

List of Practicals

Paper No. – 1

Biochemistry

1) Estimation of Glucose by GOD-POD method.
2) Estimation of total lipids by phosphovanillin method.
3) (i) Estimation of cholesterol by Wybenga-Pilleggi method.
   (ii) Estimation of HDL cholesterol.
4) Estimation of Triglyceride by enzymatic method.
5) Estimation of Total proteins and albumin by modified Biuret method.
6) Estimation of Urea by DAM method.
7) Estimation of Creatinine by Alkaline Picrate method.
8) Estimation of Uric acid by Phosphotungstate method.
9) Estimation of Billirubin by Diazo method.
10) Estimation of SGPT enzyme by Reitman & Trahkel method.
11) Estimation of SGOT enzyme by Reitman & Trahkel method.
12) Estimation of Alkaline Phosphatase by Kind & King's method.
13) Estimation of Acid Phosphatase by Kind's method.
14) Estimation of LDH.
15) Estimation of CPK by modified Hughes method.
16) Estimation of Chloride.
17) Estimation of Calcium by OCPC method.
18) Estimation of Inorganic Phosphorous by Gomori's method.
19) Estimation of Amylase by Street & Club method.
20) Estimation of Iron & Total Iron Binding Capacity.
21) Estimation of Na & K level by flame photometry.

Paper No. – 2

1) Vein puncture and finger pricks
2) Preparation of EDTA, citrate vials

Haematology

1) Estimation of hemoglobin by
   (i) Sahli's method
   (ii) Drabkin's method
2) Estimation of WBC & RBC & Platelets.
3) Estimation of ESR.
4) Estimation of PCV.
5) Differential count.
6) Determination of G6PD deficiency
7) Reticulocyte count
8) Sickling test
9) Demonstration of LE cell
10) Coagulation study
    a) Clotting time
       (i) Lee White method
       (ii) Capillary method
    b) Bleeding time
    c) Prothrombin time determination

Blood banking

1) Blood grouping – (i) Tile test (ii) Tube test
   a. Forward grouping i.e. front typing
   b. Backward grouping i.e. back typing
2) Determination of "D^U" antigen
3) Coomb's test – direct & indirect test
4) Crossmatching
5) Rh Antibody titre determination

Paper No. – 3

Bacteriology

1) Various cultural test for different pathological organisms
2) Antibiotic sensitivity test

Serology

1) VDRL – Slide flocculation test
   Preparation of VDRL antigen
2) Widal – Agglutination test (i) Tube test (ii) Slide test
3) Slide test for Rheumatoid factors (Rhelax R F)
4) ASO latex test (Antistreptolysin O)
5) Pregnancy test (mono-rapid slide test)
6) Visual ELISA Pregnancy test
7) C-Reactive Protein test
8) HIV detection – COMB AIDS visual test (Dot Immunoassay)

Other tests

1) Gel Immunodiffusion tests
2) Radial Immunodiffusion tests

Paper No. – 4

Urine analysis

1) Physical: Color, Odour, Volume, Specific gravity
2) Chemical: pH, Protein, Sugar, Occult Blood, Ketones, Bilirubin, Bile Salts
3) Microscopic: Pus, RBC, Epithelials, Casts, Crystals.
4) Multiple reagent strips

Examination of Faeces

1) Physical
2) Chemical
3) Microscopic

Body fluids

1) Semen analysis
2) Sputum analysis
3) Cerebrospinal fluid analysis

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