CURRICULUM

Authority : **Academic Board (AB), AIMLTA**

Duration of course : One year course for regular and in-service candidates. The medium of instruction and examination shall be English.

Eligibility for Admission :

1) The eligibility conditions for the admission of the candidates to the DMLT course prescribed by Academic Board (AB) shall be followed by all institutions/colleges.
2) A candidate shall be eligible if he /she has passed the Intermediate Science or 10+2 examination with Physics, Chemistry, Biology or equivalent examination of recognized Indian Institution.
3) Obtained minimum 50% marks in aggregate of Science subjects. Scheduled Caste /Scheduled Tribes/ Backward class candidates shall be given relaxation of 10% in the above minimum marks. 5% seats shall be reserved for the handicapped and 5% seats shall be reserved for Govt. sponsored candidates and AB, AIMLTA sponsored candidates.
4) Completed the age of 17 years on or before 31st December.
5) Candidate should have adequate knowledge of English as per requirement of the course.

Conditions of Admission :

1) The number of students to be admitted in the institutions/ colleges recognized by AB, AIMLTA in a session and their eligibility conditions for admission to the course shall be prescribed by the AB.
2) Maximum 50 candidates can take admission in an institute/ college subject to sanction of seats by the academic board according to its infrastructure.
3) Admission, enrolment and registration of a candidate is liable to be cancelled at any time by AB if it is detected that there is something against the student for providing false information, act of gross misconduct and indiscipline involving moral turpitude.

4) A student shall be recognized as a member of the college/institute as soon as he/she has been accepted by the principal/Director of the college and has paid the fees required by the college/ Institute.

5) All students of such colleges shall fulfill the conditions prescribed by the ordinances of AB for the DMLT qualifying course for which recognition granted.

Attendance : Students shall satisfy certain minimum percentage of attendance. Students shall be allowed to appear in the examination provided they attend at least 75% of the classes. The attendance of the candidates shall be counted from the date on which the respective classes begin. The AB shall have power to condone any deficiency of attendance but only for congent reasons.

Instructions for In-service candidates :

1) In-service candidates should have five years working experience in medical laboratories/hospitals/institutions etc. Candidates are required to furnish a conduct certificate from the Head of the Institutions/Colleges/ Hospitals/Private Laboratories.

2) The In-service candidate will have to undergo a certified period of life membership for one year as per eligibility requirement for appearing in the examination.

3) Applications shall be forwarded by the respective State Secretary/CEC member of AIMLTA.

4) If the applications are not accompanied with fees shall not be considered.

Award of Certificate :

1) During the period of study, the candidate will maintain a record of work in all disciplines which will be evaluated by the external examiner during the examination.

2) DMLT qualifying certificate will be awarded to candidates securing 40% marks in theory and 50% marks in practical and in aggregate 50% marks.

3) The certificate of merit and prizes shall be awarded to the candidates obtaining highest number of marks at top position and next in order of second position.

NOTE : *The interpretation of any rules as well as amendment to it rests solely and entirely with the Governing Body of Academic Board, AIMLTA. This shall be final and binding on regular students/ in-service candidates/institutions/colleges and in no case shall lie in any court of law in respect of its decision.*

DISTRIBUTION OF MARKS

Paper	Subject	Theory	Practical
I	General Lab Principles, Equipment & Instrumentation 50 Anatomy and Physiology 50	100	—
II	Clinical Biochemistry (Chemical Pathology)	100	100
III	Histopathology 50+50 Clinical Pathology 50+50	100	100
IV	Hæmatology 75+75 Blood Banking/ Transfusion Medicine 25+25	100	100
V	Microbiology 75+75 Serology 25+25	100	100
	Total	**500**	**400**

Distribution of minimum days and hours for theory and practical classes :—

Name of Subject	No. of Days	Theory(FN)	Practical★(AN)
General Lab. Principles	20	60	
Anatomy	10	30	
Physiology	10	30	
Biochemistry	40	120	
Clinical Pathology	40	120	
Histopathology	20	60	
Hæmatology	40	120	
Blood Banking	10	30	
Microbiology	40	120	
Serology	30	90	
Total	260	780	

★ Practical in related disciplines will be done in the afternoon.

PATTERN OF QUESTIONS AND DISTRIBUTION OF MARKS

Sl. No.	Pattern of Questions	Discipline allotted	Discipline allotted	Discipline allotted		Discipline allotted	
		Marks					
		100	**75**	**50**		**25**	
01.	MCQ (with 4 options)	20x2=40	15x2=30	15x1=15		10x1=10	
02.	True / False	10x1=10	5x1=5	5x1=5		5x1=5	
03.	Fill in the blanks	10x1=10	5x1=5	5x1=5		5x1=5	
04.	Very Short Answer (in a few words)	10x1=10	5x1=5	5x1=5		—	
05.	Short Answer (in not more than five lines)	5x3=15	5x3=15	5x2=10		—	
06.	Short Notes	3x5=15	3x5=15	2x5=10		1x5=5	

GENERAL LABORATORY PRINCIPLES, EQUIPMENT & INSTRUMENTATION

History of biological science and its technology.

Organization of Laboratory: Laboratory management and its place in patients' care and service.

Medical ethics and habits of scientific mind.

Basic Principle of specimen collection: Appropriate collection technique, patient education and Preparation, Patient or Site preparation, An awareness related to specimen Transport, Processing and Labeling.

***Preservation, Storage and Transport of specimens*:** Preservation of microbial cultures, antigen, antisera, antibodies (immunoglobulin), Blood, Urine, Serum, Platelets and Plasma etc.

Protection of specimen transporter, protection of specimen processor.

***Labeling and rejection of specimens*:** Requisitions, Source, Diagnosis/ History, Test required, Unacceptable specimens.

***An approach to laboratory diagnosis*:** Processing of clinical samples, Prioritization during processing, Gross examination of the specimen, Direct Media (liquid, solid, semisolid), Specimen inoculation, estimation and detection.

Personal cleanliness and awareness of handling: Acids, Organic solvents, Inflammable materials, Carcinogenic and corrosive chemicals, Infected materials, Phathogenic microorganisms and Viruses etc.

Preparation and cleaning of new and used glassware and process of decontamination.

Methods of disinfection and sterilization.

Knowledge of rapid and automation methods in diagnostic microbiology, Pathology and Biochemistry.

Instructions and precautions in Immunological and Serological work.

Safety regulation in health laboratories and safeguards against electrical and mechanical instruments.

Proper disposal of wastes.

***Basic knowledge of Medical and Entomology*:** Arthropods as transmitters of pathogens, sources of pathogens, Transmitted by insects.

Knowledge about structure of Microscope, Care and proper handling of microscope and its components, Instructions while handling Microscope, Micrometry, Different types of microscopes, Advantages of different types of microscopes (Fluorescent, Electron and Scanning Electron Microscope-SEM).

Care and use of Physical, Chemical, Analytical and Electrical balance.

Principle of Colorimeter. Use and care and maintenance.

Principles, Care, Maintenance and Use of common laboratory equipment and machines of the medical laboratories.

Elementary knowledge of Statistical evaluation.

***Abbreviations and conversion factors*:** Mass, Length, Area, Volume, Unit, Temperature, Time and other abbreviations.

Emergence of quality control: (Internal & External).

Knowledge of releasing diagnostic reports.

ANATOMY

1. Introduction of Anatomy and Histology, Elementary Histology of cell, Tissues of the body organs and system, Elementary Anatomy and Histology of :-

a)	***Skeletal System***	**:**	Development of bones, types of bones, Micro-anatomical and gross structure of bones, Osteology of human skeleton and various movements of joints.
b)	***Muscular System***	:	Structure and type of muscles in human body, important muscles and their group action.
c)	***Circulation System***	:	Structure of heart and blood vessels, Systemic circulation, pulmonary circulation, Portal circulation and coronary circulation.
d)	***Lymphatic System***	:	Lymph vessels, Lymph nodes and Lymphoid organs, their structure and functions.
e)	***Digestive System***	:	Gastrointestinal tract and associated glands (Salivery glands, Liver, Pancreas etc.)
f)	***Respiratory System***	:	Trachea, Lungs including other air passages.
g)	***Urinary System***	:	Kidney, Ureters and Urinary bladder etc.
h)	***Endocrine System***	:	Thyroid glands, Parathyroid glands, Adrenal glands and Pituitary glands.
i)	***Famale and Male roproductory organs and Systems:***		
j)	***Skin and its appendages:***		
k)	***Special sense organs***	:	Eye, Ear, Nose, Taste buds, Subcutaneous sense organs.
l)	***Nervous System***	:	Brain, spinal cord and peripheral nerves.

PHYSIOLOGY

1.	***Blood***	:	Blood volume, composition and functions of blood, hæmopoiesis, blood groups, body fluids.
2.	***Cardiovascular System***	:	General plan of circulatory system, functioning of heart and blood vessels (arteries, arterioles, capillaries and veins), heart sound and E.C.G., nervous control of heart and blood vessels, regulations of blood pressure.
3.	***Respiratory System***	:	Functional anatomy of respiratory system, mechanism of breathing and exchange of gases in the lungs. Regulation of respiration, Oxygen and carbondioxide carriage, anoxia, dyspnea, cyanosis, artificial respiration and pulmonary function test.
4.	***Gastrointestinal System***	:	Alimentary canal and its various glands, digestion of food in mouth, stomach and small intestines, gastro-intestinal tract movements and absorption. Function of liver and liver function tests and metabolism.
5.	***Excretory System***	:	Structure and function of kidney and Urinary bladder. Structure and function of skin.
6.	***Endocrine Glands***	:	Endocrine glands and their function. Regulation of endocrine secretion.
7.	***Reproductive System***	:	Physiology of male and female reproductive system.
8.	***Muscular System***	:	Type of muscles, innervations of muscles, neuromuscular transmission, mechanism of muscular contraction.
9.	***Nervous System***	:	Neurone and its function, spinal cord and reflex action, sensory end organs and sensory path ways, cerebral cortex and motor path ways. Maintenance of posture and locomotion, automatic nervous system, Physiology of vision, hearing test and olfaction.

CLINICAL BIOCHEMISTRY (CHEMICAL PATHOLOGY)

1. Organization of laboratory, General laboratory instructions, Manners and Methods, Maintenance of laboratory records, Release of laboratory reports.

2. Cleaning and washing of used and new glassware in Biochemistry laboratory.

3. Preparation of anticoagulants, Reagents, Solutions and Buffer Solutions, Glass distilled water and De-ionized water.

4. Collection and preservation of specimens.

5. **Basic Concept of Chemistry:**

(i) Matters, Elements (Metals and Non-Metals), Modern periodic table, Compounds, Mixture, Properties of compound and mixture, Law of chemical combination, Concept of molecules, Ionization, Atoms, Atomic number, Mass number, Valency, Chemical bonding, Representation of chemical reactions, Factors that influence the speed of reactions, Chemical Equations, Balancing of chemical equation. Concept of important organic solvents used in Biochemistry laboratory.

(ii) Symbol, Formula and Mole concept, Significance of mole.

(iii) *Volumetric Analysis:* Acidimetry and Alkalometry, Oxidation-Reduction (Redox) titration, Precipitation titration, Concept of end point and equivalent point, Normal solution, Normality, Molarity, Equivalent weight, Basicity, Indicators, Range of pH indicators, salient features of ionic theory of acid base indicators.

6. Concept of carbohydrates, Fats, Lipids, Proteins, Amino acids, Vitamins, Salivery digestion, Gastric digestion and Intestinal digestion.

Investigations/ Exercises:

7. **Laboratory detection of a free inorganic and organic radicals of physiological importance:** Arsenic, Copper, Lead, Mercury, Chloroform, Alcohol, Morphine and clinical significance of these tests.

8. Process of determination of pH by means of indicators.

9. **Acidimetry and Alkalometry**: The titration (i.e., determination of concentrations) of free bases with a standard acid (Acidimetry) and the titration of free acids with a standard base (Alkalometry).

10. Estimation of chloride, Serum calcium, Sodium, Phosphate, Urinary calcium, Urinary protein, Chyle etc. and clinical significance of these tests.

11. Detection of Bile pigment (Bilirubin), Urobilin, Urobilinogen, Causes of absence of urobilinogen in urine, Causes of presence of excess urobilinogen in urine.

12. Preparation of protein free filtrates.

13. Liver Function Test:

(i) van den Bergh (VB) reaction (Bilirubin in blood) – Immediate direct reaction, Biphasic reaction, Indirect reaction,

(ii) Icterus Index,

(iii) Serum bilirubin (**King: Malloy & Evelyn method**),

(iv) Serum protein,

(v) Total serum protein, albumin and globulin (Biuret method)- Principle of the technique and clinical significance.

14. Renal Function Test:

Blood Urea : Estimation of blood urea by Diacetyl monoxide method, Significance and principle of test, Causes of lowered urea level (prerenal, renal, post renal), Causes of raised urea level.

Serum Creatinine (Alkaline Picrate method**: Jaffe's Picrate method**).

15. Lipids:

(i) Estimation of serum cholesterol (**Sackett's method**).

(ii) Estimation of cholesterol (Free, Total and Esterified- Principle and clinical significance of the test).

16. Glucose Metabolism:

(i) Estimation of blood sugar (fasting and postprandial) by Toluidine, Folin-Wu and glucose oxidase method, Principle of the method, interpretation and significance- Causes of raise in blood sugar, causes of hypoglycæmia.

(ii) **Glucose Tolerance Test**: Interpretation, significance-Syne glycosuria, Causes of glycosuria (Renal, Alimentary, Glycosuria of pregnancy) without hyperglycæmia, Causes of glycosuria with hyperglycæmia.

17. Cerebro Spinal Fluid (CSF): Estimation and its clinical significance

(i) CSF, chloride estimation.

(ii) CSF, protein estimation.

(iii) CSF, sugar estimation.

18. How to release laboratory reports.

19. Implementation of quality control assurance scheme.

CLINICAL PATHOLOGY

1. **Organization of Laboratory**: Reception and recording of specimen, Maintenance of Laboratory records. Proper care of apparatus and equipment.

2. **Preparation of Anticoagulants and its uses**:
   - (i) EDTA, Sodium Citrate Solution, Heparin, Double oxalate, Sodium fluoride, Trisodium Citrate etc.

3. **Collection of Blood**:
   - (i) Methods for venous blood
   - (ii) Methods for capillary blood
   - (iii) Vacutainer (Vacuum Tube) Method
   - (iv) Arterial blood
   - (v) Serum & Plasma

4. **Urine Examination**:
   - (i) Collection of urine specimen
   - (ii) Preservation of urine specimen
     - **(a) Physical Examination** : Colour, Odour, Reaction, Specific Gravity
     - **(b) Urine concentration Test**
     - **(c) Examination of urine for abnormal constituents**: Proteinuria: Sulfosalicylic test (Composition of sulfosalicylic acid solution), Heat Method, **Heller's Method**.
     - **(d) Quantitative estimation of proteins in urine**
       - (i) Using Esbach's albuminometer
       - (ii) Albuminuria + Bence Jones protein (both)
       - (iii) Bence Jones protein
       - (iv) Causes of Proteinuria
     - **(e) Reducing substances in urine**: Sugars, Non-sugars, Glycosuria, Benedict's Semi-quantitative test and qualitative test.
     - **(f) Keytone Bodies:**
       - (i) Causes of Ketonuria, **Rothra's Test**, Heat Test
       - (ii) Urobilinogen, Causes of Urobilinogen in Urine (**Ehrlich Test** and its principle)
       - (iii) Bilirubin: **Fouchet's Test** and its principle
       - (iv) Bile salts: **Hay's Sulphur Test**
       - (v) Bile Pigment Test: **Smith's Test**

(g) Test for Blood in Urine:

(i) Causes of Hæmaturia

(ii) Causes of Hæmoglobinuria

(iii) Benzidine Test

(iv) Orthotoluidine Test

(h) Microscopic Examination of Urine:

(i) Red Cells, Pus Cells, Epithelial Cells

(ii) *Crystals:* Uric Acid, Amorphous Urates, Crystalline Urates, Cystine, Phosphates, Amorphous phosphates, Calcium Carbonates

(iii) *Casts:* Hyaline Casts, Granular Casts, Cylindroids, Fatty Casts, Leucocyte Cell Casts, Red Cell Casts, Waxy Casts, Epithelial Casts.

(v) *Parasites:* Trichomonas, Ova of Schistosoma hæmatobium, Microfilaria

(vi) *Malignant Cells* (**Giemsa Stain, Pap Stain**)

(vii) *Other Cells:* Spermatozoa, Yeast Cells

5. Parasitological Examination of Fæces :

History of Protozoa and Helminths in brief

Association of Parasites and Host

Mechanism of disease production by parasites

(i) Microscopic Examination of protozoa, Trophozoites and Cysts

(ii) Microscopic Examination of Helminths (Nematodes, Cestodes, Trematodes)

(iii) Concentration Methods for Ova and Cysts

(iv) *Gross Examination of Stool:* Granular debris, Muscle Fibers, Fats, Elastic Fibers, Pus Cells, Epithelial Cells, Red Blood Cells, Crystals, Bacteria, Yeast and Moulds.

6. Examination of Sputum:

(i) Collection of Sample

(ii) *Macroscopic Examination*- Colour, Consistency, Odour and Granules

(iii) *Macroscopic Examination* (under cover slip preparation): Eosinophilic leucocytes, Curshmann's spirals, C-L crystals, Pus cells, Elastic fibers, Parasites, Asbestos bodies, Red Blood cells, Bacterial Macrophages, Yeast and Moulds.

(iv) Ziehl- Neelsen's Method for Acid-fast bacilli (AFB)

(v) Concentration method(**Petroff's Method**)

7. Examination for Cerebrospinal Fluid (CSF)

(i) Procedure for Lumbar puncture

(ii) *Gross evaluation of CSF:* Normal CSF, Yellow CSF, Fibrin Clot in CSF, Turbid, Opalescent Cobweb Coagulum.

(iii) *Physical Examination:* Appearance, Specific Gravity

(iv) Cell Count (Sulphosalicylic Test)

(v) *Biochemical Examination:* Sugar, Protein, Globulin (**Pandy's Test**), Chloride.

(vi) Method of Total and Differential Count

8. Examination of Cavity Fluids:

(i) Differentiation of Transudate and Exudate

(ii) Macroscopic Appearance, Specific Gravity

(iii) Microscopic Examination of Unstained and Stained Cells

(iv) Total and Differential Counts

(v) Protein and Sugar Test

(vi) **Pandy's test**

9. Investigation of Gastric Function:

(i) *Fractional Test Meal:* Preparation of patient, Introduction of **Ryle's Tube**, Preparation of Test Meal (**Gruel Test Meal**, Alcohol Meal)

(ii) Test for free and total acidity on fasting and post stimulation samples

(iii) Test for Occult blood, Bile, Starch, Mucus etc.

(iv) Microscopic Examination of Unstained and Stained preparation

10. Seminal Fluid Analysis:

(i) Clinical Significance

(ii) *Mode of Collection:* Quantity, Viscosity, Appearance, Reaction (pH)

(iii) Time of complete liquification

(iv) Giemsa, Basic fuchsin and Pap Staining

(v) Microscopic Examination, Sperm count, Motility (Normal, abnormal), Sperm Morphology

11. Interpretation of results and method of writing diagnostic report.

HISTOPATHOLOGY

Laboratory planning and management, the reception and recording of specimens, Cataloging and indexing, Maintenance of laboratory records.

Introduction and definition of tissue and cells.

Method of examination of tissue and cells (Fresh and fixed specimens): Testing technique, Squash technique, Impression smears.

Fixation of tissues : The aims and functions of fixatives, Classification and choice of fixatives.

Fixatives: Formal saline, Buffered formalin, Formal sublimate, Formal alcohol, Formal calcium, Zenker's fluid, Carnoy's fluid, Bouin's fluid, Clarke's fluid, Formal nitric acid, Advantages and disadvantages.

Tissue Processing: Impregnation with wax, Preparation of paraffin blocks. Paraplast Tissue met, Ester wax, Water soluble wax, Celloidin.

Section Cutting: Microtomes, Types of microtomes, Basic principle of microtome, Microtome Knives, Sharpening of Knives, Honing, Stropping and Care of microtome knives, Normal thickness of tissue section.

Technique of cutting paraffin embedded section, Mounting of sections.

Staining: Dyes and their character, Theory of staining, Types of staining (Vital, Histochemical, Histological, Fat staining), Basic staining (Harris's Hematoxylin and Eosin technique), PAS stain, van Gieson stain (Collagen and muscle cells), von Kossa silver nitrate, Selection of stains.

Decalcification: Technique, Selection of tissue, Fixation, Decalcification method.

Mounting of stained slides with Canada Balsam and DPX.

Museum techniques and preservation.

Safeguards against chemicals.

Safety in histopathology laboratory.

Histological method for Amyloid.

Knowledge, Maintenance and use of microtome, knives, embedding bath, tissue flotation bath, automatic tissue processor, vacuum embedding oven, hot plate, freezing microtome etc.

Quality control in histopathology laboratory (Internal and External).

The Study of Exfoliative Cytology:

Definition, Collection of specimens (normal and abnormal cells shed into various body cavities and aspirates from body organs).

Laboratory techniques: Preservation, Fixation, Preparation of smears, Staining (Papanicolaou, Sex chromatin staining) and microscopy.

Morphology of normal and abnormal cells, Diagnostic features and inference.

HÆMATOLOGY

1. Introduction of hematology, Composition of blood, Cellular and humoral components.
2. Maintenance of records of laboratory investigations, apparatus, equipment, glassware, reagents, etc.
3. Cleaning of glassware, Pipettes, ESR tubes and Counting chamber.
4. Sources of error in laboratory procedure, precautions, Advantage and disadvantage of tests, interpretation of results and their clinical significance.
5. Quality control in the laboratory.
6. Preparation of capillary pipettes, Reagents, Diluting fluids, Stains(Leishman's, Wright's Simon's, Giemsa, Supravital), buffer solution etc.
7. **Collection of blood specimen from patients**: Capillary, Artery and Venous blood.
8. Preparation of thin, thick and wet blood films, different stains for staining blood films.
9. Brief Knowledge about Anæmia, Leukæmia, Abnormalities of RBCs (RBCs and WBCs series), Thalassæmia.
10. **Routine Examination, Estimation and Enumeration of blood cells :**

(A) Hæmoglobin Estimation:

(i) The principle of **Sahli's Method** and procedure, disadvantages of the test,

(ii) Colorimetric method,

(iii) Hb cell counts and absolute values by hæmatology autoanalyzer.

(B) Normal and Abnormal Blood cell Morphology:

(i) **Total Leucocyte Count (TLC):** Principle, and method , interpretation, Sources of error, Significance of Leucocytosis and leucopenia.

(ii) **Red Cell Count (RBC):** Equipment, Procedure, Sources of error in RBC count, Interpretation of results and Clinical significance of polycythæmia rubra vera

(iii) **Platelet Count (Direct and indirect):** Principle, Procedure, Interpretation of counts and clinical significance of Thrombocytopænia, Thrombocytosis, Pernicious anæmia, Acute leukæmia.

(iv) **Enumeration of Reticulocytes:** Staining solution, Procedure, Interpretation and Significance of high retic count, Low retic count, Retic correction of anæmia.

(v) **Absolute Eosinophilic Count (AEC):** Equipment, Procedure, Interpretation of results, Significance of eosinophilic leukæmia, Idiopathic hypereosinophilic syndrome, Tropical eosinophilia, Secondary causes of eosinophilia.

(C) Peripheral Smear and Differential Leucocyte Count (DLC):

(i) Peripheral smear (how to make), Sources of error, Fixation of smear, Staining of smear (Leishman's, Romanowsky, Giemsa Stain), Differential count of WBC including Arneth and Schilling counts.

(ii) *Evaluation :* Neutrophilia, Neutropenia, Lymphocytosis, Eosinophilia, Monocytosis, Basophilia.

(D) Red Cell Morphology and Anemia:

(i) Macrocytosis, Microcytosis, Target Cells, Sickle cells, Schistocytes (Fragmented cells), Burr cells.

(ii) *Evaluation of Anemia :* Macrocytic, Microcytic, Hypochromic, Dimorphic, Sickle cell, Normochromic, Normocytic, Thalassæmia Major, Hemophilia.

(E) Hæmatocrit, Red cell Indices, Erythocyte Sedimentation Rate (ESR):

(i) *Packed Cell Volume (PCV) estimation :* Wintrobe's and Microhæmatocrit method. Its principle, Sources of error and precautions.

(ii) Mean Corpuscular Volume (MCV),

(iii) Mean Corpuscular Hæmoglobin (MCH),

(iv) Mean Corpuscular Hæmoglobin concentration (MCHC),

(v) *ESR Estimation :* Stages of sedimentation, Factors affecting ESR, Westergren's Method, its precautions and Advantages, Wintrobe's Method, Advantages and sources of error, Evaluation of ESR, Alterations in ESR.

(F) Hæmostasis:

(i) Bleeding Time (BT) and Clotting Time (CT): **Duke and Ivy method**, Precaution and Significance.

(ii) Determination of Prothrombin Time: Principle, Method, Precaution and Significance.

(G) Laboratory Investigations of Hæmoparasites:

(i) *Examination of blood for Malaria :* Vector, Asexual and Sexual life cycle, collection of specimen, preparation of peripheral blood smears, preparation of thick blood film, Staining (Leishman's, Giemsa), Examination of trophozoite stage, Schizont, Gametocyte stage, Malarial pigment and blood alterations in Malaria, Identification of P. falciparum and P. vivax.

(ii) *Examination of blood for Microfilaria :* Causes, Collection of blood, Unstained and stained preparation, Concentration method, Morphology, Procedure for counting microfilaria and calculation.

BLOOD BANKING / TRANSFUSION MEDICINE

Discovery of human blood groups.

Blood bank management and planning : Reception and recording of specimen, cataloging and indexing, Maintenance of blood bank records.

Principles of immunohæmatology : Introduction, Antigen-Antibodies, Immune response, Antigen-Antibody reactions, Reagents used in antigen-antibody reaction in vivo.

Blood Bank : Prevention, Decontamination, Disinfection and Sterilization.

Preparation and use of ACD (Acid Citrate Dextrose), EDTA, SAGM, Heparin, CPD-A1, CPD-A2 (Citrate Phosphate Dextrose), Normal saline, Antisera etc.

Inheritance of blood groups : ABO and Rh blood group.

Techniques for determination of various blood groups (Natural and Immune Antibody)

Sub groups of ABO blood group system and Bombay group.

Source of error in grouping and their elimination.

Selection and preparation of group sera.

Determination of Rh factors.

Titration of Rh antibodies to predict and detect Rh.

Coombs test compatibility : Direct and indirect method.

Compatibility testing (Cross matching) : Clinical significance, major cross matching, minor cross matching, cross matching by LISS (Low Ionic Strength Solution) method.

Hæmolytic disease of new born (HDN) : Material, preparation of cell suspension, procedure, Expression of results.

Preservation and storage of blood, Platelets, plasma blood components etc.

Blood transfusion: Clinical significance, Collection, Donor selection, Procedure of venepuncture, Volume of blood collected from donor, Screening of donor (history, age, weight, Hb, pulse, BP, temperature, interval, registration), Post donation care, processing of blood, Separation of components, Blood group compatibility (ABO) in blood transfusion, Criteria for selecting and rejecting donors and other necessary precautions.

Disposal of wastes.

Routine investigations: VDRL, HIV I and II, Hepatitis A,B,C, Malaria, Microfilaria and ASO titre.

Biosafety and infection control in blood bank and medico-legal aspects.

Quality control in blood bank

MICROBIOLOGY

1. Organization and function of laboratory
2. Safety guidelines in laboratory and safe code of practice for a microbiology laboratory.
3. Implementation of quality assurance scheme (Inernal and External)
4. Method of cleaning glassware.
5. Treatment of contaminated materials.
6. **Method of collection, storage and transportation of specimens**: Sputum, Urine, Throat swab, Pus, Pus swab, Fæcal samples, Blood clot, Serum, Tissues, Pleural fluid, Pericardial fluids, Aspirates, Joint fluids, Bronchial secretions, Exudates, Urethral discharge etc.
7. **Biohazard waste management**: Disposal options.
8. **Microbial control**: Disinfection and sterilization (Dry heat, radiation, filtration and chemical method).
9. **The growth and nutrition of bacteria**: Generation time, the lag and log phase (exponential phase), Stationary phase, Decline phase, Factors influencing growth, the nutritional requirements, Environmental Factors affecting growth.
10. **Morphology of bacteria**: Shape and group pattern of bacteria, Anatomy of bacterial cell, Cell wall (Gram negative and Gram positive),Capsule, Slime layer, Flagella, Fimbriæ, Pili and Spores etc.
11. **Staining and use**: Commonly used acidic, basic and neutral stains, Simple staining, Differential staining-Gram staining, **Ziehl-Neelsen** staining (Hot and cold), **Albert** staining, **Wayson** staining, Negative staining (India ink preparation), **Hiss's** staining, **Schuffer and Fulton's** method of staining, Visualization of the morphology of the organism and their reactions to the chemical present in the stain.
12. **Bacteriological media and uses**: Liquid, Solid, Semisolid, Basal media, Differential media, Indicator media, Enriched media, Enrichment medium, Selective, Carbohydrates media, Transport medium and Solidifying agents (Agar, Gelatin), Prepation of media and Checking pH: Peptone water, Nutrient broth, Thioglycollate broth, Brain heart infusion broth, Nutrient agar, **Mueller-**

Hinton agar, **MacConkey** agar, Deoxycholate citrate agar (DCA), Thiosulphate Citrate Bile Salt Sucrose agar (TCBS), Blood agar, Blood tellurite agar, **Loeffler's** serum slope, **Lowenstein-Jensen** medium, CBTM (Carry-Blair Transport Medium) and Transport medium.

13. **Cultivation of bacteria**: Inoculation techniques-instrument for seeding bacteria, seeding a culture plate, seeding a liquid and solid media, subculture from a solid medium, inoculation of carbohydrates fermentation media, seeding semi solid media in test tubes, erobic incubation of cultures, creation of anerobic and microerophilic atmosphere, precaution about inoculation of culture media.

14. **Motility of bacteria**: Hanging drop preparation, **Cragie's** tube method, Coagulase test, Catalase test and Oxidase test bacteria.

15. **Media for biochemical characterization and identification of bacteria**: TSI (Tipple sugar Iron) agar, SIM (Sulphur Indole Motility), Glucose, Sucrose, Lactose, Mannitol, Maltose (fermentation of acid and gas production), Urease and citrate(**Simmon's**) utilization, Bile solubility test, Additonal test- Optochin and Polymixing B sensitivity test.

16. **Infection:** Classification of infection, Sources of infection, Transmission of infection, Factors Predisposing to microbial pathogenicity.

17. **Diseases caused by bacteria:** Gram positive cocci (Staphylococcus, Beta hemolytic streptococcus, S. pneumoniæ) Gram negative cocci (N. gonorrhœa, N. meningitides), Non-spore forming Gram positive bacilli (Corynebacterium diphtheria), Spore forming Gram positive bacilli (Bacillus sublitis, B. anthracis, Clostridium tetani, C. perfringens); Mycobacteria, Gram negative bacilli (Escherichia coli, Klebsiella proteus, Citrobacter, Serratia, Pseudomonas, Salmonella, Shigella, Vibrio and Campylobacter.

18. **Antimicrobial susceptibility testing:** Procedure (Modified **Kirby-Bauer** method), Basic sets of drug for routine susceptibility tests, Quality assurance, Turbidity standard, Results and interpretation.

19. Preservation of microorganisms in artificial midia.

EXERCISES / EXPERIMENTS

1. *Study of morphology of bacteria*

(i)	Gram's staining	:	Methods and interpretation.
(ii)	Capsule staining	:	Negative staining (India ink preparation)
(iii)	Spore Staining	:	Method and Interpretation
(iv)	Albert staining	:	Method and Interpretion
(v)	AFB staining	:	**Ziehl-Neelsen** (Hot stain) Method

2. Detect the motility of bacteria in a given culture by hanging drop preparation.

3. *Identification of unknown organism provided :* E coil, Klebsiella, Proteus, Serratia, Pseudomonas, Salmonella, Shigella, Streptococcus, Fæcalies, staph aureus, S. pneumonia, N. gonorrhea.

4. *Antibiotic susceptibility testing :* Demonstration.

SEROLOGY

1. Greneral instruction for serological tests.

2. Preparation and preservation of sera, Antisera, Antigens, Antibodies (Immunoglobulins), Plasma, Blood etc.

3. Biosafety in serology laboratory and method of disposal of wastes.

4. *Study of principal types of antigen antibody reactions :* Introduction, Antigens, Antibodies (Immunoglobulins), Immune response : Primary and Secondary union, Antigen Antibody reaction, Effects of electrolytes , Factors effecting antigen antibody reactions , Precipitation, Flocculation, Agglutinations, Hetrophil agglutination, Hæmagglutination, Reverse Passive Hæmagglutination (RPHA), Complement fixation, Neutralization, Opsonization.

5. Enzyme Immuno Assay, Carrier Particle agglutination (Latex), Fluorescent antibody tests.

6. Preparation of physiological saline, 10% saline, Buffer solutions, VDRL antigen and buffer, Antigens for Widal test (O., H. and AH).

7. Quality Control Assurance (Internal and External).

DIAGNOSTIC SEROLOGY

A) *VDRL slide flocculation test for syphilis (qualitative and quantitative) :* Principle, Reagents and Materials, Specimen (Blood and CSF), VDRL Antigen and buffer, Preparation of Antigen emulsion, Test procedure, Reading and reporting of results in dilutions, Limitation of the test and precautions, Factors affecting VDRL test.

B) *Rapid plasma reagin (RPR) test for diagnosis of syphilis :* Principle, Specimen, Reagents and Materials, Test procedure (qualitative and quantitative), Interpretation of results, Limitation of the tests.

C) *Widal test for the diagnosis of enteric fever (qualitative and quantitative) :* Principle, Materials, Specimen, Test procedure-qualitative slide test, quantitative slide test and tube test, Interpretation of results, Precaution, factors affecting Widal test, Effect of past infection or typhoid vaccination and time of collection of blood samples.

D) *Latex agglutination test for the rapid detection of HBsAg (Australia Antigen) :* Principle, Malerials, Specimen, Test procedure, Precaution, Use of controls, Interpretation,Limitation of the tests.

E) Laboratory diagnosis of kala-azar (Napier Aldehyde test, Chopra Antimony Test).

F) Paul-Bunnell Test for diagnosis of infectious mononeucleosis.

CURRICULUM & SYLLABUS

For

ONE YEAR DIPLOMA

IN

MEDICAL LABORATORY TECHNOLOGY

(DMLT)

ACADEMIC BOARD

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