CURRICULUM & SYLLABUS

For

TWO YEARS DIPLOMA COURSE

MEDICAL LABORATORY TECHNOLOGY (DMLT)

ACADEMIC BOARD

ALL INDIA MEDICAL LABORATORY TECHNOLOGISTS' ASSOCIATION

Member Society, International Federation of Biomedical Laboratory Science, Canada
(Registered under, Societies Registration Act XXI of 1860, Regd No. S/12081), New Delhi

Registered Office :
L-1/249-B, DDA Flats
Kalkajee, New Delhi

Office :
404, Capitol Tower
Fraser Road, Patna–800001

CURRICULUM

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

The functions of the study centres (Institution / Colleges) are within the framework of the objectives of Academic Board, AIMLTA.

Duration of Course : Two years 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 of 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 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) A 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 in a session, 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 as soon as he / she has been accepted by the Principal / Director of the college and has paid the fees required by the college.

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 he/she attended 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 cogent 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 / AB 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 their decision.*

DISTRIBUTION OF MARKS

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

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Paper	**Subject : Second Year Course**		Theory	Practical
I	Human Anatomy & Physiology		100	—
II	Clinical Biochemistry (Chemical Pathology)		100	100
III	Histopathology Clinical Pathology	50 50	100	100
IV	Hæmatology / Immunohæmatology Blood Banking / Transfusion medicine	75 25	100	100
V	Microbiology Serology	75 25	100	100
	Total		**500**	**400**

Duration of hours (Theory) **:** 1½ hrs. for each theory paper.
Duration of hours (Practical) **:** 3 hrs. for II, III, IV & V disciplines respectively.

DISTRIBUTION OF MINIMUM DAYS AND HOURS FOR THEORY AND PRACTICAL CLASSES

(First Year Course)

Name of Subject	No. of Days	Theory (FN)	Practical* (AN)
General Lab. Principles	20	60	
Human Anatomy	10	30	
Human Physiology	10	30	
Clinical 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 after noon.**

DISTRIBUTION OF MINIMUM DAYS AND HOURS FOR THEORY AND PRACTICAL CLASSES

(Second Year Course)

Name of Subject	No. of Days	Theory (FN)	Practical* (AN)
Human Anatomy	20	60	
Human Physiology	20	60	
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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 after noon.**
(The Director/Principal/Incharge can effect changes in the schedule according to the needs of the topics.)

TEACHER(S) FOR EACH FACULTY :

1.	Anatomy	—	Lecturer (MBBS, MD in the Subject) – one
2.	Physiology	—	Lecturer (MBBS, MD in the Subject) – one
3.	Biochemistry	—	1. Lecturer (MD (Biochemistry) / M.Sc. (Biochemistry)] - one 2. Demonstrator [M.Sc. (Bio-chemistry) / B.Sc., DMLT] - one 3. Lab. Boy - one
4.	Clinical Pathology & Histopathology	—	1. Lecturer [DCP, MD (Path)] - one 2. Demonstrator [B.Sc., DMLT] - one 3. Lab. Boy - one
5.	Microbiology & Serology	—	1. Lecturer [M.Sc. (Microbiology)] - one 2. Demonstrator [B.Sc., DMLT] - one 3. Lab. Boy - one

Note : The full-time or / and part-time teachers (lecturers) may be appointed for theoretical classes.

LIST OF RECOMMENDED BOOKS :

1.	Praful B. Godkar	—	Text Book of Med. Lab. Technology
2.	Kanai L. Mukherjee	—	Text Book of Medical Laboratory Technologists - Vol. 1, 2 & 3.
3.	Rakesh Patel	—	Experimental Microbiology Vol. 1 & 2
4.	Pleczar	—	Microbiology
5.	Zala & Mansuri	—	Medical Laboratory Technology Vol. - 1, 2 & 3
6.	Ramnik Sood	—	Text Book of Med. Lab. Technology
7.	K. C. Chatterjee	—	Clinical Pathology
8.	Crookshawn	—	Bacteriology & Serology
9.	King of Kings & Varley	—	Biochemistry
10.	Enderson	—	Text Book of Histopathology

11.	Dacee	—	Blood Banking & Clinical Hæmatology
12.	Dr. Murgesh	—	Anatomy & Physiology (Diagrammatic Charts)
13.	B.D. Chaurasia	—	Handbook of Anatomy Vol. 1, 2 & 3
14.	Vidya Ratan	—	Handbook of Human Physiology
15.	P. Chakravorty	—	Text Book of Microbiology
16.	J. Sengupta	—	Synopsis of Clinical Pathology & Microbiology
17.	Napier & Das Gupta	—	Hæmatological Technique
18.	Bharucha C, H. Meyer & Others	—	Handbook of Med. Lab. Technology
19.	Seiverd, C.E.	—	Hæmatology for Medical Technologists
20.	Williams, H.B.	—	Laboratory Manual of Serology, Immunology & Blood Banking
21.	Zmijewski, C.M. & W.E. Haesler Jr.	—	Textbook of Blood Banking Science
22.	Washington, J.A.II, Ed.	—	Laboratory Procedure in Clinical Microbiology
23.	Strasinger, S. K.	—	Urinalysis and Body Fluids
24.	Varley, H.	—	Practical Clinical Biochemistry
25.	Culling, C.F.A.	—	Handbook of Histopathological and Histochemical Techniques
26.	Thomas, C.L.	—	Taber's Cyclopedic Medical Dictionary
27.	Weast, R.C.	—	Handbook of Clinical Laboratory Data
28.	Hepler, O.E.	—	Manual of Clinical Laboratory Methods
29.	Text Book of General Lab. Principle		
30.	Dorland's Illustrated Medical Dictionary		

PATTERN OF QUESTIONS AND DISTRIBUTION OF MARKS

Sl. No.	Pattern of Questions	Discipline allotted	Discipline allotted	Discipline allotted	Discipline allotted	Discipline allotted	Discipline allotted
		Marks					
		100	**75**	**50**	**30**	**25**	**20**
1	MCQ (with 4 options)	20×2=40	15×2=30	15×1=15	10×1=10	10×1=10	10×1=10
2	True / False	10×1=10	5×1=5	5×1=5	5×1=5	5×1=5	5×1=5
3	Fill in the blanks	10×1=10	5×1=5	5×1=5	5×1=5	5×1=5	5×1=5
4	Cross Matching	5×1=5	5×1=5	5×1=5	—	—	—
5	Short Questions (One sentence Answer)	5×1=5	5×1=5	5×1=5	5×1=5	—	—
6	Short Questions (Answer within five lines)	5×3=15	5×2=10	2×2½=5	—	—	—
7	Short Notes	3×5=15	3×5=15	2×5=10	1×5=5	1×5=5	—

Initiation of Two Years DMLT Course :

Academic Board, AIMLTA suggests that henceforth DMLT course is to be of two years and hence all the institute / college imparting this course should switch over from one year to two years course by the year 2008. However, the Diploma holders of one year DMLT course before 2008 will be given full weightage.

Academic Board further suggests that the course curriculum of one year DMLT should be reviewed and modified according to the present knowledge and need incorporating few topics on newer fields in medical lab technology. This modified course may be approved as a condensed course of one year DMLT.

EXAMINAITON FEE

	First Year (Rs.)	**Second Year (Rs.)**
Examination Application	**According to AB Norms**	**According to AB Norms**
Practical Fees (per discipline)	„	„
Theory Examination	„	„
Mark sheet Statements	„	„
Diploma Certificate	„	„

First Year Course

GENERAL LABORATORY PRINCIPLES, EQUIPMENT & INSTRUMENTATION

1. **Laboratory management** system and basic requirements of a standardized clinical laboratory.
2. **The responsibilities** of laboratory workers.
3. **The "First-Aid" measures** and laboratory first-aid kit.
4. **Laboratory safety,** precaution for prevention of transmission of pathogens, personal cleanliness.
5. **Process of decontamination and sterilization,** disinfectants and their uses in the laboratory.
6. **Method of collection,** preservation, storage and transportation of various clinical specimens.
7. **Cleaning** of new and used glassware and plasticware, preparation of glassware cleaning solutions.
8. **Preparation of solutions,** stock solution, working solution, normal solution, percent solution, molar solution, isotonic, hypertonic, hypotonic solutions, saturated solution.
9. **Preparation of various reagents,** their storage and use.
10. **Basic knowledge of dyes,** indicators, stains and their use.
11. **Microscope :** Introduction, types of microscope, components of microscope, setting up, focusing of the object, use of low and high power objectives, use of oil immersion lens, care and maintenance of microscope.
12. **Instrumentation :** Principle of instruments and their functions, procedure for uses of balance, hot-air oven, autoclave, incubator, thermo-static water bath, inspissator, pH meter, colorimeter, photometer, centrifuges, microtomes, deionizer, aretoanalysers, care and maintenance of instruments and apparatus.
13. **Principle** of chromatography, electrophoresis, ELISA and uses.
14. **Method of writing** and releasing laboratory test reports.
15. **Proper disposal** of waste.
16. **Quality assurance** and quality control.
17. **Method of writing SOP.**

First Year Course

HUMAN ANATOMY AND PHYSIOLOGY

1. **Introduction** to Anatomy and Physiology.

2. **Skeletal system :** Basic structure of human body (Bones, cartilages, ligaments and tendons), classification of bones (Long, short, flat), axial and appendicular skeleton. The skull, bone of face, sternum, ribs, hyoid bone. Vertebral column, joints of vertebral arches, skeleton of limbs and girdles, joints of the skeleton, classification of joints, characteristics of movable joints, clinical notes.

3. **Digestive System :** Digestive system of human alimentary canal, histology of human gut, digestive glands, the duct system of liver gall bladder and pancreas, process of digestion and absorption of carbohydrates, protein, fat and nucleic acids.

4. **Respiratory System :** Structure of respiratory organs, mechanism of breathing, gaseous transport, cellular respiration, artificial respiration.

5. **Body fluids and circulation :** Blood and formed elements, coagulation of blood, principal blood vessels, Lymph (tissue fluid), circulatory pathways, Heart, cardiac cycle, electrocardiograph (ECG), Double circulation regulation of cardiac activity, disorders of circulatory system (high blood pressure, coronary artery disease, angina, heart failure).

6. **Excretory System :** Human urinary system, (kidney, ureters, bladder, urethra), urine formation, function of the tubules, mechanism of concentration of the filtrate, regulation of kidney function, micturition, other organs in excretion, disorders of the excretory system.

First Year Course

CLINICAL BIOCHEMISTRY (CHEMICAL PATHOLOGY)

THEORY :

1. **The chemical and complex biomolecules** of life, the cell, prokaryotic and eukaryotic cell.
2. **Water,** water balance in the body, function of water as major body constituents, water intake (Exogenous and endogenous), water output from the body.
3. **Electrolytes;** electrolytic balance, electrolytic composition of body fluids, regulation of electrolyte balance, osmosis & application of osmosis.
4. **Acid and Bases,** alkalies, ampholytes, acid-base balance, hydrogen ion concentration (pH), pH of important biological fluids, blood buffers of the body, disorders of acid base balance.
5. **Surface tension,** application of surface tension (digestion and absorption of fat), Hay's sulfur test, surface tension and absorption.
6. **Basic concept of corbohydrates,** diabetes, regulation of blood glucose level (homeostasis of blood glucose), sources of blood glucose (dietary source, gluconeogenesis, glycogenolysis), insulin, effects of insulin on glucose utilization, hormonal regulation of blood glucose (insulin, glucagon, epinephrine, thryroxine, glucocorticoids, growth hormone, ACTH, hypoglycæmia (post prandial hypoglycæmia, fasting hypoglycæmia), hyperglycæmia.
7. **Basic concept of lipids,** classification of lipids, essential fatty acids, steroids, plasma cholesterol, esters, and esterase, function of cholesterol, bile acids, ketone bodies, overproduction of ketone bodies, ketogenic and antiketogenic substances, clinical importance of cholesterol, bile acids, ketone bodies.
8. **Degradation of Hæme** to bile pigments, excretion of bilirubin into bile, urobilin, urobilinogen, bilirubin in urine, jaundice, van den Bergh reaction (direct and indirect), clinical importance of bilirubin.
9. **Basic concept of Amino acids,** essential and non-essential amino acids, glycogenic and ketogenic amino acids, blood urea, clinical importance of blood urea, clinical importance of creatine and creatinine.

10. **Basic concept of proteins and enzymes,** simple, conjugated and derived protein, denaturation of protein, the agents of denaturation, plasma specific and non-plasma specific enzymes, enzymes in Liver diseases.

11. **Vitamins,** their sources, functions and deficiency symptoms.

PRACTICAL / INVESTIGATIONS / EXERCISES :

1. **Acidimetry** and Alkalimetry titration.

2. **Estimation of chloride,** Serum calcium, Phosphate, Urinary calcium, Chyle, Urinary protein, Plasma proteins.

3. **Detection of bile pigment (Bilirubin),** Urobilin; Urobilinogen, Causes of absence of urobilinogen in urine.

4. **Bilirubin in blood** (van den Bergh) – Immediate and direct reaction, Biphasic reaction, Indirect reaction.

5. **Serum bilirubin** (King : Malloy & Evelyn Method).

6. **Serum protein** (Biuret Method).

7. **Blood urea :** Estimation of blood urea by Diacetyl monoxime method. Principle of the test, Causes of lowered and raised urea level.

8. **Serum Creatinine :** (Alkaline Picrate Method).

9. **Estimation of serum cholesterol** (Sackett's Method)

10. **Estimation of blood sugar** by Toluidine, Folin-Wu Method, Principle, Interpretation and significance, Causes of raised blood sugar, Causes of hypoglycæmia.

11. **Chloride estimation** in CSF.

12. **Sugar estimation** in CSF.

13. **Method of releasing** laboratory reports.

14. **Implementation of quality control** assurance scheme.

15. **Decontamination and cleaning** and washing of reusable glassware.

(First Year course)

HISTOPATHOLOGY

THEORY & PRACTICAL :

1. **Introduction** and definition of tissues and cells.
2. **Safety** in Histopathology laboratory.
3. **Laboratory management,** Reception and recording of specimens, Indexing of specimens, Maintenance of laboratory records, Instruments, Reagents and staining materials, Microtome knives, Embedding bath, Tissue floating bath, Automatic tissue processor, Hot plate etc.
4. **Method of examination** of tissue and cell and other Biopsy materials.
5. **Fixation of tissue.** The aims and function of fixatives, Classification and choice of fixatives.
6. **Tissue Processing :** Impregnation with wax, Preparation of paraffin blocks, Paraplast, Tissue mat, Ester wax, water soluble wax, Celloidin.
7. **Section Cutting :** Microtomes, Types of microtome, Principle, Microtome knives, Sharpening, Honing, Stropping, Care of microtome knives, Normal thickness of tissue sections, Techniques of cutting paraffin embedded section, Mounting of sections.
8. **Staining :** Dyes and their character, Theory of staining, Types of staining (Vital, Histochemical, Histological, Fat staining), Basic staining (Harri's Hæmatoxylin and Eosin Technique).
9. **Frozen Section Technique :** Rapid H.E. stain for frozen section.
10. **Mounting** of stained slides with Canada Balsam and DPX.
11. **Museum techniques** and preservation.

First Year Course

CLINICAL PATHOLOGY

THEORY & PRACTICAL :

1. **Introduction** of clinical pathology.
2. **Organisation of laboratory,** preventive measures, care of instruments, equipments, glassware, maintenance of laboratory records, method of writing clinical reports of the tests.
3. **Cleaning** of new and used glassware and plasticware.
4. **Preparation of reagents,** standard solutions, saturated solutions, Lugol's iodine, normal saline etc. and anticoagulants used for pathological investigations.
5. **Method of collection** of blood (capillary, venous), urine sputum, fæces, semen, CSF etc. separation of plasma and serum, method of preservation, storage and transportation of the specimens.
6. **Urine :** Physical characteristics of urine, colour, appearance, odour, reaction, specific gravity, pH, pathological conditions and causes of oliguria, anuria and polyuria.
7. **Various chemical tests** of urine, common causes of proteinuria, albuminuria, Bence Jones proteinuria.
8. **Diagnostic features of diabetes mellitus,** complications of diabetes mellitus, glycosuria, renal glycosuria, alimentary glycosuria.
9. **Ketone bodies,** causes of ketonuria, Rothera's test for defection of ketone bodies.
10. **Urinary deposites,** pathological significance of the presence of cells, casts, crystals, parasitic eggs in urine.
11. **Study of clinical test** to detect types of jaundice, pathological significances of bilirubinuria, cases of hyperbilirubinuria, tests for the detection of bile salts, bile pigments in urine.
12. **Detection of blood in urine,** hæmoglobinuria, conditions causing hæmoglobinuria, difference between hæmaturia and hæmoglobinuria.
13. **Sputum :** Chemical composition of sputum, microscopic examination (cover slip preparation) - Eosinophilic Leucocytes, C-L-Crystals, Curschmann's spirals, spirals, RBCs, bacteria, yeast and moulds, pathological conditions of sputum, AFB staining techniques.
14. **Parasites,** classification of human parasites, protozoan and helminthic infections, the salient features of worms, the microscopic examination of fæces to detect worms, ova, cyst, larvæ, trophozoites and cellular exudates, morphology of common parasites / eggs / ova / cyst.
15. **Biohazard and waste management,** decontamination and disposal options.

First Year Course

HÆMATOLOGY

THEORY :

1. **Introduction** of Hæmatology and organization of laboratory.
2. **Anticoagulants,** preparation of commonly used anticoagulants and their concentrations.
3. **Cleaning** and care of glassware, pipettes, instruments, apparatus, microscope etc.
4. **Maintenance of laboratory records,** method of writing of reports of test and keeping the records of the reports.
5. **Stains;** Component of Romanowsky's group of stains, preparation of diluting fluids, buffers, Leishman, Wright, Giemsa and Field's stains, staining technique of peripheral blood smear.
6. **Collection of blood** (venous, capillary and arteries) preservation and transportation of blood samples.
7. **Preparation** of thick, thin and wet blood films for microscopic observation to detect MP and MF.
8. **Blood,** Hæmopoiesis (Blood cell formation), component of blood and their function, Hæmatopoietic system; production, development and maturation of cellular elements of blood.
9. **Hæmoglobin,** function of hæmoglobin, hæmoglobin derivatives hæmoglobin, function of hæmoglobin, hæmoglobin derivatives hæmoglobin variants, hæmolysis, thalassæmia trait, thalassæmia major.
10. **Red cell morphology :** Microcytosis, Anisocytosis, Poikilocytosis, Spherocytosis, Target cells, Sickle cells, Schistocytes, Acanthocytes, Burr cells, Abnormalities in white blood cells.
11. **Hæmatocrit,** determination of PCV and erythrocyte indices (Wintrobe's constant, MCV, MCH, MCHC).
12. **Basic concept of Anæmias -** Aplastic, Megaloblastic, Iron deficiency, Pernicious, Sickle cell, Hereditary Spherocytosis Polycythæmia, Drug induce autoimmune hæmoloytic anæmia, Pancytopenia.
13. **Hæmostasis (General consideration),** mechanism of blood coagulation, Blood coagulation factors, significance of prolonged bleeding time (thrombocytopænia, thrombasthenia) significance of clotting time, prothrombin time, Hæmophilia A and B.

14. **Malaria;** Types of malaria, means of transmission, staining of blood films (Giemsa) microscopy and common stages found in smear, recognition of malarial parasite.

15. **Biohazard waste management;** decontamination storage and disposal options.

16. **Quality assurance** in the laboratory.

PRACTICAL / LABORATORY INVESTIGATIONS :

1. **Hæmoglobin Estimation** : Sahli's Acid Hæmatin Method.

2. **Normal and Abnormal Blood Cell Morphology** :

   (i) Total Leucocyte Count (TLC), Principle and Technique, Interpretations, Sources of error, Significance of Leucocytosis and Leucopenia.

3. **Examination of stained film in peripheral blood** :

   (i) Study the alteration in the shape, size, staining of red cells.

   (ii) Differential Leucocyte Count and detection of immature and abnormal Leucocytes, Evaluation of Neutrophilia, Neutropenia, Lymphocytosis, Eosinophilia, Basophilia, Monocytosis.

   (iii) Estimation of platelet and its morphology.

4. **Hæmatocrit** :

   (i) **Erythrocyte Sedimentation Rate (ESR)**; Interpretation of increased and decreased ESR rate.

   (ii) **Packed Cell Volume (PCV)** examination, Wintrobes's and Microhæmatocrit method, its Principle, sources of error and precautions.

5. **Hæmostasis :**

   (i) Bleeding Time (BT) and Clotting Time (CT): Duke and Ivy method, Precaution and significance of the test.

   (ii) Determinaiton of Prothrombin Time (PT), principle, technique and significance of the test.

6. **Investigation of Hæmoparasites :**

   (i) Examinaiton of Blood for Malaria, Preparation of peripheral blood smears, Preparation of thick blood film staining (Leishman's, Giemsa), Examination of trophozoite stage, Schizont, Gametocytes, Malarial Pigment and blood alterations in Malaria.

   (ii) Examination of blood for microfilaria, unstained and stained preparation.

(First Year course)

BLOOD BANKING / TRANSFUSION MEDICINE

THEORY & PRACTICAL :

1. **Discovery of human blood group**.
2. **Blood bank management**, Reception, Indexing and Recording.
3. **Documentation and packaging**.
4. **Storage and transportation** of blood, Prevention, Precautions, Physical and biochemical effects of storage of blood.
5. **Decontamination** of blood bags, work bench and instruments, Sterilization of transfusion sets (Physical and Chemical).
6. **Biosafety :** Universal precautions of laboratory workers.
7. **Guidelines for waste disposal**.
8. **Quality assurance**.
9. **Antigens** (agglutinogens), Antiboides (agglutinins), Agglutination, Natural antibodies, Immune isoantibodies, A, B & H antigens.
10. **Preparation and use of** ACD (Acid Cictrate Dextose), EDTA, CPD-A_1, CPD-A_2 (Citrate phosphate dextrose).
11. **Theory** of inheritance and nomenclature of ABO and Rh blood group system, Sources of errors in ABO grouping.
12. **Techniques for determination of** various blood groups (Natural and immune antibodies), Distribution of ABO antigens on the red cells and antibodies in the serum.
13. **Subgroups of** ABO system and Bombay group.
14. **Cross matching techniques**.
15. **Determination of Rh factors :** Rh blood group system, ABO Hæmolytic disease.
16. **Complications of blood transfusion :** Immunological complications, Non-Immunological complications.

First Year Course

MICROBIOLOGY

THEORY :

1. **A brief historical event** of medical microbiology, scientific contributions in microbiology, branches of microbiology.
2. **Safety guidelines** in the laboratory and safe code of practice, organisation and functions of laboratory.
3. **Maintenance** of microscope, balance, instruments, glassware, reagents, chemicals and media.
4. **Method of cleaning** new and used glassware, reusable plasticware.
5. **Microbial control :** Disinfection and sterilization of important material and equipment.
6. **Method of collection,** storage and transportation of specimens, criteria for rejection of specimens.
7. **Concept** of free living nature of bacteria.
8. **Morphology of bacteria :** Size, shape, arrangement of cocci and bacilli structure of bacteria, structure of cell wall (Gram positive and Gram negative), flagella and their arrangements, fibriæ, pilli, slime layer, capsule, spores.
9. **Nutritional requirements** of bacteria, growth requirements, factors influencing growth, growth curve, generation time, batch-culture, total count, viable count.
10. **Culture media** for bacterial growth : Fluid media (liquid), classification of media, preparation of media (peptone water, alkaline peptone water, nutrient broth, selenite F broth, nutrient agar, blood agar, chocolate agar, MacConkey agar, CLED agar, DCA, TCBS, CBTM, VR holding medium, Stuart transport medium), storage of media.
11. **Culture technique :** Method of culture, streak culture (surface plating), lawn culture, stroke culture, stab culture, liquid culture.
12. **Description of colonies of bacteria :** Shape, surfaces, size, elevation, edges, colour, opacity, consistency, emulsifiability.
13. **Classification** of true bacteria on the basis of their shape (cocci, bacilli, vibrio, spirilla, spirochætes.

14. **Common stains and staining techniques :** simple staining, negative staining, differential staining.

15. **Identification of bacteria :** Gram staining, motility (hanging drop preparation) indole production, oxidase, catalase and coagulase test, urease test, citrate utilization, H_2S production, sugar fermentation.

16. **Presumptive identification** of E.coli, Klebsiella, Pseudomonas, Proteus, Streptococcus fæcalis, Streptococcus pyogenes, Staphylococcus, Salmonella, Shigella, Vibrio choleræ, Neisseria gonorrhoeæ.

17. **Biohazard waste management,** storage, disposal, burial.

18. **Quality assurance** in laboratory.

PRACTICAL :

I. Isolation of Pathogenic Microorganisms :

- ☞ Primary inoculation on Agar media for isolation of the organism (Streak Technique).
- ☞ Examination of culture from Agar plates (Colony characteristics).
- ☞ Oxidase, Catalase, Coagulase test.
- ☞ Staining of smears (Gram's staining).
- ☞ Morphology of the pathogens (Microscopic Examination).
- ☞ Biochemical Identification.
- ☞ Reporting of results (Predilection).
- ☞ Important points in diagnosis.
- ☞ Biosafety.

II. The sputum smear : Staining by Ziehl-Neelsen technique (AFB Examination under oil immersions)

First Year Course

SEROLOGY

THEORY :

1. **Biosafety** in serology laboratory.
2. **Method of preservation** of serum, plasma, antisera, antigens, antibodies blood etc.
3. **Preparation** of physiological saline, PBS, VDRL antigen and buffer, antigens for widal test.
4. **Antigens;** Biological classes of antigens, antigenic determinant (Epitope), heterophile antigens, Forssman Antigern, Weil Felix reaction. Paul-Bunnel test.
5. **Antibodies;** Immunoglobulin classes, function of immunoglobulins, important properties of immunoglobulin classes.
6. **Antigen-**Antibody reactions (General features), role of immunoglobulin classes in different serological reactions (Precipitation, Agglutination Complement fixation and lysis).
   (i) **Precipitation :** Uses of precipitation reaction, Lattice hypothesis (Zone phenomenon), precipitation reaction techniques; ring test, slide test (VDRL), tube test (Khan), gel diffusion.
   (ii) **Agglutination :** Agglutination reactions and uses, technique of agglutination test, microagglutination, macroagglutination, flaggellar antigen ('H' type) of agglutination, Somatic 'O' type of agglutination, Vi-agglutination (Widal test).
   (iii) **Passive or indirect agglutination test :** Rose-Waaler test, Latex reaction, Coombs' test. Complement fixation test (CFT) and uses of CFT.
7. **Neutralization test :** Antistreptolysin 'O' test.
8. **Internal quality assurance** in laboratory.
9. Method of interpretation and writing of reports of the tests.
10. **Decontamination and proper disposal** of waste.

PRACTICAL :

(i) **VDRL slide flocculation test** for syphilis (Qualitative and Quantitative), Principle, Preparation of VDRL buffer and antigen emulsion, Test procedure, Reading and reporting of results in dilutions, Factors affecting VDRL test, Precautions.

(ii) **Rapid Plasma Reagin (RPR) test** for diagnosis of syphilis, Test procedure (Qualitative and quantitative) Interpretation of results, Limitation of the tests.

(iii) **Widal test for diagnosis of enteric fever** (Qualitative and Quantitative), Principle, Test procedure, Interpretation of results, Precautions, Factors affecting Widal test, Effect of past infection or typhoid vaccination.

(iv) **Lab diagnosis of Kala-azar** (Nepier aldehyde test, Chopra antimony test).

Second Year Course

HUMAN ANATOMY AND PHYSIOLOGY

1. **Anatomy :** Skeletal tissues; cartilage, types of cartilage (hyaline, fibrous, white fibrous, yellow elastic calcified), bone (decalcified, periosteum and ligaments), endosteum, matrix) bone marrow (red and yellow), spongy bones, vascular tissues, difference between bone and cartilage and ligaments and tendon.
2. **The vertebral column,** cervical vertebræ, thoracic vertebræ, lumbar vertebræ, the sacrum, the coccyx, the curve of vertebral column, the joints of vertebral arches, the function of vertebral column.
3. **The pelvic girdle** (the female and male pelvic girdle), the joints of the pelvis and clinical aspects.
4. **The skeleton of upper and lower limb,** bones of wrist and hand, bones of foot, joints of upper and lower extremities.
5. **Muscle system :** Muscle tissues, fibres, types of muscle, need of skeleton for muscle action, functional classification of body muscles, mechanism of muscle contraction and relaxation.
6. **Neural control and coordination :** Neural system, central and peripheral neutral system, structure of neurons, nerve impulse, transmission of impulses, reflex action.
7. **Sensory reception and processing :** The eye, parts of eye, mechanisms of hearing.
8. **Endocrine System :** Endocrine glands and hormones, hypothalamus, pituitary gland, thymus, adrenal gland, pancreas (a composite gland), gonads, testes, ovaries, hormones; general classification of hormones, general characteristics of hormones, mechanism of hormone action.
9. **Human reproduction :** The male and female reproductive system, gametogenesis, menstrual cycle, fertilisation and implantation, pregnancy and embryonic development, sexually transmitted diseases and infertility.

(Second Year Course)

CLINICAL BIOCHEMISTRY (CHEMICAL PATHOLOGY)

THEORY :

1. **Overview of Biophysical Chemistry** : Water, Structure of water, Acid and bases, Acid-base reaction, Dissociation of water, Hydrogen ion concentration (pH), Buffers, Mechanism of buffer action, Buffering capacity, Molality, Normality, Solutions, Colloidal state, Properties of colloids, Diffusion, Osmosis, Donnan membrane equilibrium, Viscosity, Surface tension, Adsorption, Isotopes.
2. **Biomolecules and the Cell** : The major complex biomolecules of cells, Chemical composition of man, Prokaryotic and Eukaryotic cells, Comparison between prokaryotic and eukaryotic cells.
3. **Physiological Biochemistry** : Digestion and absorption, Digestion in the small intestine, Mechanism of digestion and absorption, Abnormalities related to digestion and absorption, Digestion and adsorption of carbohydrates, Proteins, Lipids and Enzymes, Diagnostic aspects of digestion and adsorption.
4. **Hæmoglobin and Porphyrins** : Hæmoglobin, Structure of globin, Fœtal hæmoglobin (HbF), Abnormal hæmoglobins, Porphyrins, Degradation of hæme to bile pigments, Excretion of bilirubin into bile, Diagnostic aspects and consideration of Hæmoglobin and porphyrins.
5. **Plasma Proteins** : Separation of plasma proteins, General characteristics, Synthesis and function of albumin (osmotic function, Transport function, Nutritive function, Buffering functions), Globulins (Macroglobulin, Hapatoglobin, Ceruloplasmin, Transferin), Diagnostic considerations of plasma proteins.
6. **Basic concepts of Immunoglobulins**, Structure and classes of Immunoglobulins, Clinical aspects.
7. **Introduction to Metabolism**, Metabolic pathway, Catabolism, Anabolism, Types of metabolic reactions.
8. **Basic concept of metabolism** of Carbohydrates, proteins and lipids, Disorders, Abnormalities and diagnostic aspects.
9. **Colloids** : Classification of Colloids, Properties of colloids, Diagnostic aspects and clinical significance.

10. **Enzymes** : Classification, Chemical nature and property, Factors affecting enzyme activity, Diagnostic importance of enzymes.

11. **Hormones** : Definition, Classification, Hypothalamic and pituitary hormones, Thyroid hormones. Hormones of Adrenal Cortex and Medulla, Hormones of Gonads.

12. **Basic concepts of vitamins** and their function, Deficiency symptoms, Diagnostic approach.

13. **Diabetes Mellitus** : Metabolic changes in diabetes, Insulin, Structure of insulin, Regulation of insulin secretion, Metabolic effects of insulin, Glucagon, Regulation of blood glucose level (Hæmostasis of blood glucose), Utilization of blood glucose, Disorders, Clinical significance and diagnostic approach.

14. **Collection and preservation of specimens**, Choice of anticoagulants.

PRACTICAL :

1. **Acidimetry and Alkalimetry :** 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 (Alkalimetry).

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

3. **Estimation** of Chloride, Serum calcium, Urinary calcium, Urinary protein, Chyle etc. and clinical significance.

4. **Liver function test** :
   - i) Bilirubin in blood (van den Bergh reaction – Immediate direct reaction, Biphasic reaction.
   - ii) Serum bilirubin test (King : Malloy and Evelyn Method)
   - iii) Urobilin in urine (Wallace Diamond test)
   - iv) Total serum protein albumin and globulin test (Biuret Method)
   - v) Detection of Hepatitis B (Latex agglutination test)
   - vi) Alkaline phosphatase test

5. Renal Function Test:

i) Blood urea by Diacetyl monoxime method, Principle, Causes of raised and lowered urea level (Pre renal, renal and post renal)

ii) Serum Creatinine (Alkaline picrate method : Jaffe's Picrate Method)

iii) Estimation of uric acid (Caraways Method)

6. Lipids :

i) Estimation of Triglycerides

ii) Estimation of Cholesterol (Free, Toal and esterified) – Principle and clinical significance of the tests

7. Glucose Metabolism :

i) Estimation of blood sugar (Toluidine, Folin-Wu and Glucose Oxidase Method, Principle, Interpretation of result and clinical significance, Causes of raised blood sugar, Causes of Hypoglycæmia

ii) Estimation of True sugar (glucose)

iii) Glucose tolerance test (GTT) – Interpretation and clinical significance (Hæmostasis of blood glucose, Syne glucosuria, Causes of pregnancy without hyperglycæmia, Hyperglycæmia.

8. Separation of Amino acids, Sugars, Sugar derivatives and peptides (Paper Chromatography)

9. Separation of Serum protein : Gel Electrophoresis

10. Assessment of Thyroid function (T_3, T_4, TSH) by ELISA

11. Knowledge of releasing laboratory reports.

12 Quality Assurance.

13 Biosafety and proper disposal of waste.

(Second Year Course)

HISTOPATHOLOGY

THEORY & PRACTICAL :

1. **Introduction and definition** of Tissue and Cell.

2. **Recording and Labeling of the sample**. Maintenance of records and Museum.

3. **Examination of Tissues and Cells** (fresh and fixed), Testing Techniques, Sqash technique and impression Smears.

4. **Fixation of Tissues** : Appropriate fixatives, Classification of fixatives, Aims and function of fixatives, Choice of fixatives.

5. **Fixatives :** Formal Saline, Buffered formalin, Formal sublimate, Formal alcohol, Formal calcium, Aldehyde fixatives, Mercuric chloride fixative, Picric acid fixative, Alcoholic fixatives, Zenker's fluid, Carnoy's fluid, Bouin's fluid, Clarke's fluid, Formal nitric acid and their advantages and disadvantages.

6. **Tissue Processing :** Dehydration, Clearing, Impregnation with paraffin wax (infiltration), Embedding and Blocking (preparation of paraffin blocks, paraplast tissue mat, Ester wax, Water soluble wax, Celloidin)

7. **Section Cutting** : Microtomes (knowledge of types of microtomes), Basic Principle of microtomes, Microtome knife, Sharpening of knives, Manual honing, Belgian yellow stones, Stropping, Inspection of knife edge, Normal thickness of tissue selection.

8. **Technique of** Cutting Paraffin embedded section, mounting of sections, Difficulties in sectioning.

9. **Decalcification of Bony Tissues :** Selection of tissue, Fixation, Methods of decalcification, Test for decalcification (Chemical test), Mounting of stained slides (Canada Balsam, DPX), Permanent mounting, Temporary mounting.

10. **Staining** : Dyes and their character, Staining and Staining rules, Theory of staining (Vital, Histochemical, Fat staining), Basic staining (Harri's Hæmatoxylin and Eosin technique), PAS stain, van Gieson Stain (Collagen and muscle cells), von Kossa Silver Nitrate, Selection of stain for diagnosis.

11. **Hæmatoxylin & Eosin Staining** : Staining procedure, Precaution factors, Factors influencing staining reaction.

12. **Forzen Section Technique** : Fixation of slides, Rapid H.E. stain for frozen section (method).

13. **Museum Preparation** : Presentation of selective part of organs for museum, Fixation, Restoration of colour of organs, Method of colour maintenance of organs for mounting of museum specimens, Mounting techniques (Vacuum embedding tech., Immunoperoxidase tech.)

14. **Exfoliative Cytology** : Definition, Collection of specimens (normal and abnormal cells shed into various body cavities and aspirates), Fine Needle Aspiration Biopsy (FNAB).

15. **Fixation, Preparation of** smears, Staining techniques (Papanicolaou, Methyl green pyronin, Unna-Pappenheim's methyl green pyronin stain), Microscopy-Microscopy of cell, Diagnostic features and influence.

    (i) von Kossa's stain for calcium

    (ii) Pearl's (Prussian blue reaction) for Hæmosiderin.

    (iii) van Gieson's differential stain for fibrous tissue and muscle tissue.

    (iv) Zeil-Neelsen Method – M. tuberculosis in tissue section.

16. **Quality Control** in Histopathology laboratory

(Second Year Course)

CLINICAL PATHOLOGY

THEORY :

1. **Organization of laboratory**, Reception and recording, Maintenance of laboratory records, Precautions, Proper care of specimens, Apparatus and equipment.
2. **Decontamination of reusable glassware**, Cleaning of used and new glassware.
3. **Preparation** of anticoagulants, Reagents, Buffers etc. and its uses.
4. **Basic idea of significance**, Testing level of significance, Pathology, Pathogenesis, Disease diagnosis.
5. **Collection of Blood** : Methods for venous, Capillary and Arterial blood, Concept of blood buffers, Serum, Plasma, Inorganic components of plasma, Organic components of plasma, Plasma proteins, Hæmoglobin, Hæme, Amino acid for buffering action of Hæmoglobin, Porphyrin, Various types of Hæmoglobin, Degradation of Hæme to bile pigments. Characterization and significance of multiple Myeloma.
6. **Immuno globulins :** Globulins, Immuno globulins and its classes, Hypersensitivity.
7. **Jaundice** : Classification of Jaundice, Jaundice due to genetic defects, causes of Gilbert's disease, Concept of Hæmolytic Jaundice, Infective hepatitis.
8. **Urine** : Physical nature, Composition of urine, Normal and abnormal constituents of urine, Hormones involved in urine formation, Disease status, Concept of glycosuria (Transitory or persistant).
9. **Tuberculosis of Lymph nodes** : Miliary tuberculosis (Lung), Tuberculosis of kidney and hypertrophic ileocecal tuberculosis (Crohn's disease), Mycotic granuloma, Protozoal granuloma (skin-dermal leishmanoid).
10. **History of protozoa and Helminths**, Association of parasite and host, Important properties, Mode of transmission, Clinical findings, Diseases and diagnostic features. Laboratory diagnosis of medically important intestinal protozoa, Urogenital protozoa, Cestodes, Trematodes, Nematodes.
11. **Diseases** : Diseases caused by pathogens, Reservoir of infection and transmission of disease, Body's defense mechanism, Immunity, Interferons, Autoimmunity, Immune disorders, Common human diseases, Communicable diseases, Diseases caused by bacteria viruses, Protozoa, Helminths, Non-communicable diseases, Human genetic disorders.

PRACTICAL / EXPERIMENTAL CLINICAL PATHOLOGY :

1. **Urine Examination** : Collection of urine specimen, Preservation of urine specimen.
2. **Physical Examination** : Colour, Odour, Reaction (pH), Specific gravity, Causes of high specific gravity and low specific gravity, Causes of fixed specific gravity, urine concentration test (conditions of increased and decreased volume of urine).
3. **Estimation of urine for abnormal constituents** : Test for Albumin (Sulfosalicylic, Heat method and Heller's method), Functional and organic causes of Albuminuria, Proteinuria.
4. **Estimation of proteins in urine** : Principle, Technique and clinical significance,
   - (i) Using Esbach's albuminometer (Quantitative test for Albumin)
   - (ii) Albumin + Bence Jones protein both
   - (iii) Bence Jones protein (Osgood and Haskin's test)
   - (iv) Test for Chyle, Excess of phosphate (Sulkowitch test)
   - (v) Calcium in urine
5. **Reducing substances in urine** : Principle and clinical significance
   - (i) Non-sugars (Ascorbic acid, Uric acid, Urates, Salicylates, Streptomycin, Phenol, PAS)
   - (ii) Sugar (Benedict's qualitative test), Interpretation and indication of diseases (Glucosuria-Diabetes mellitus, Renal glycosuria, Pregnancy, Alimentary glycosuria, IV infusion of glucose, Increased intra cranial tension).
6. **Ketone bodies** :
   - (i) Occurrence of Acetone bodies, Concept of Ketosis, Qualitative test for Diacetic Acid (Gerhardt's test)
   - (ii) Rothra's test, Heat test, Gerhardt's test, causes of ketonuria, Diabetic coma, Starvation.
   - (iii) Urobilinogen in urine (Ehrlich test, Wallace–Diamond test), interpretation of decreased / absent urobilinogen in urine, Diagnosis of the disease, concept of Hæmolytic jaundice, Infective hepatitis, Cirrohosis, Pernicious anæmia.
   - (iv) Urobilin (Schesinger's method)
   - (v) Bile pigment test (Smith's test, Gmelin's test), Bile salts (Hays test)

7. **Quantitative estimation of sugar** (Benedict's quantitative test by titration), Principle and clinical signification of the test.

8. **Estimation of urea** (Window's method)

9. **Estimation of Diastase** (Doremus Ureometer)

10. **Amylase activity in urine**

11. **Test for blood in urine** : Clinical significance, Disease diagnosis
    (i) Benzidine test
    (ii) Indican in urine (Jaffer's test)
    (iii) Porphobilinogen test
    (iv) Estimation of plasma calcium

12. **Microscopic examination of urine** : Clinical significance and interpretation of disease, Detection of Red cells, Pus cells, Epithelial cells, Crystals, Casts, Parasites, Malignant cells (by Giemsa & PAP stain), Spermatozoa, Yeast cells.

13. **Parasitological examination of fæces** : Microscopic examination of protozoa : Trophozoites, Cysts examination of Nematodes, Cestodes, Trematodes), Concentration method for Ova and cyst, Chemical examination (Occult blood), Gross examination of stool.

14. **Examination of sputum** :
    (i) Microscopic examination (Eosinophilic Leucocytes, Curschmann's Spirals, C-L-Crystals, Pus cells, Asbestos bodies, Red blood cells, Bacteria, Parasites, Yeast cells, Moulds etc.)
    (ii) Ziehl-Neelsen method for AFB and Petroff's method

15. **Physical examination of CSF** cell count (Sulphosalicylic test), Gross evaluation of CSF, Biochemical examination (Sugar, Protein, Globulin – Pandy's test, Chloride).

16. **Examination of cavity fluids** : Total and differential counts, protein and sugar test, Pandy's test.

17. **Thymol turbidity test** and thymol flocculation test (gamma globulin in serum, Takata – Ara test (gamma globulin in serum).

18. **Seminal fluid analysis** : Clinical significance and interpretation, Collection, Quantity, Viscosity, Reaction (pH), Time of complete liquification, Microscopic examination (sperm count, Motility, sperm morphology).

19. **Biosafety and disposal of wastes**.

(Second Year Course)

HÆMATOLOGY / IMMUNOHÆMATOLOGY

THEORY :

1. **Blood,** Components of Blood (Cellular and Humoral) and their functions, Hæmopoiesis (Blood cell formation), Blood cell morphology.
2. **Selection of anticoagulants** and effect of anticoagulants on blood cell morphology.
3. **Collection of blood specimens** (capillary, venous and artery), CSF, Bone marrow aspirate, Plasma, Serum etc., Effect of storage of specimens.
4. **Handling of blood specimens** and precautions, preparation of peripheral smear and thin, thick and wet blood films.
5. **Study of Red Cell Morphology** : Macrophages, Microcytosis, Anisocytosis, Poikilocytosis, Spherocytes, Stomatocytes, Hypochromia, Siderocytes, Target cells, Sickle cells, Burr cells, Howell-Jolly bodies, Cabot's ring, Crescent bodies, Basophilic stippling, Megaloblasts, Crenated cells, Plasma cells, Endothelial cells, Reticulocytes.
6. **Degeneration Disturbances of Nutrition** : Cell damage, Causes, Proteinous degeneration, Hyaline degeneration, Amyloid degeneration (liver and spleen), Fatty degeneration (Necrosis) and their microscopic appearance.
7. **Anæmias** : Definition, General considerations, Pathophysiology of anæmia, Clinical features, Classification, Investigation of Anæmic subject, Spot identification by blood picture and red cell indices, Microscopic appearance, Demonstration of Sickling Thalassæmia Major.
8. **Leukæmias** : General considerations and indications, Clinical features, Classification, Microscopic appearance of Acute Blastic Leukæmia, Chronic Myeloid Leukæmia (CML), Chronic Lymphocytic Leukæmia (CLL).
9. **Blood Coagulation** : Principle of blood coagulation, Blood coagulation disorders and whole blood coagulation time, Phases of Hæmostasis, Extrinsic and Intrinsic pathways, Conversion of fibrinogen to fibrin, Prothrombin to thrombin, Fibrinolysis, Abnormalities in blood clotting (Hæmophilia A and B), Deficiency of vitamin K in blood clotting stystem.

10. **Evaluation of bone marrow** aspirates, Cellularity, M:G ratio, Erythropioesis, Megakaryopoiesis, Other cells and abnormal cells, Iron stores.

11. **Cerebrospinal Fluid (CSF) Examination** : Lumbar puncture procedure, Gross evaluation of CSF, Complications of Lumbar puncture.

12. **Malarial parasites :** Geographical distribution, Habitat, Schizogony (Life cycle in man), Pathogenesis of plasmodium, Clinical picture, Morphological features of P. vivax, P. falciparum, Laboratory diagnosis.

13. **Leishmania donovani** : Geographical distribution, Habitat, Morphology, Culture, Mode of transmission, Clinical picture, Laboratory diagnosis.

PRACTICAL :

1. **Estimation of Hæmoglobin** : Sahli's Method, Colorimetric method, Hb cell counts. Principle, Sources of error, Disadvantages, Significance of Hb value, Advantages of colorimetric method.

2. **Total RBC** count by direct method and bulk dilution method. Sources of error and clinical significance of increased red cell count and decreased red cell count.

3. **Hæmogram** : Total blood counts : Hb, Total RBC, Total WBC, DLC, Platelet, PCV, MCV, MCH, MCHC, Reticulocyte, Evaluation of the tests and clinical significance.

4. **Platelet Count** : (Direct and Indirect) : Sources of error, Clinical aspects of increased and decreased platelet counts.

5. **Absolute Eosinophil Count (AEC)** : By using Fuch's Rosenthal Chamber, Significance of high AEC and fall in AEC, Evaluation of laboratory findings and causes of Adrenal–related disorders (eg. Cushing's disease, Idiopathic eosinophic syndrome.

6. **Enumeration of Reticulocytes** : High rectic and low rectic count, Rectic correlation of Anæmia.

7. **Evaluation of Peripheral Smear** : Differential count of WBC including Arneth and Schilling counts, Alteration in DLC and its significance, Chronic myeloid leukæmia (CML).

8. **Hæmatocrit** : Red cell indices, Packed cell volume (PCV), MCV, MCH, MCHC and ESR. Factors affecting ESR, Alterations in ESR, Sources of error and clinical significance.

9. **Hæmostasis** : Whole blood clotting time (Lee and White Method), Bleeding time (BT), Clotting time (CT), by Duke and Ivy method. Prothrombin time (PT), Quick's one stage prothrombin time, Fragility test (colorimetric).

10. **Test for Fibrinogen** / Fibrin degradation product (FDP / D-DIMER by commercial kit system), Clinical significance of the test.

11. **Autoimmune disorder** : LE Cell test (gamma globulin in serum, Rheumatoid Arthritis (RA) test (Latex agglutination).

12. **HB Electrophoresis** for Thalassæmia major and quantitative estimation of HbF by alkali denaturation method.

13. **Clinical Immunology** :
    - (i) Separation of Human Lymphocytes and preparation of Rosette forming cells from peripheral blood.
    - (ii) Identification of B and T–cells
    - (iii) Single Radial Immunodiffusion (SRID) Test (Mancini Technique).

14. **Laboratory diagnosis** of blood parasites, MP, MF, LD bodies.

15. **Quality control assurance**, Biosafety and proper disposal of wastes.

(Second Year Course)

BLOOD BANKING / TRANSFUSION MEDICINE

THEORY & PRACTICAL :

1. **Discovery of Human blood group**.
2. **Quality control assurance**, Role of training and personal proficiency testing.
3. **Prevention, Documentation, Disinfection and Sterilization**.
4. **Physical and biochemical effects of** storage of blood.
5. **Guidelines for waste disposal**.
6. **Preparation and use** of ACD (Acid citrate–Dextrose), EDTA, SAGM, Heparin, CPD-A_1, CPD-A_2 (citrate phosphate dextrose).
7. **Preservation, storage and transportation of blood**.
8. **Inheritance of blood groups** : Phenotypes & Genotypes, ABO and Rh blood group (Karl Landsteiner and Weiner's Principle).
9. **Techniques for determination of** various blood groups (Natural antigens & Immune antibodies).
10. **Subgroups of ABO system** & Bombay group.
11. **Sources of error in grouping** and their elimination.
12. **Rh grouping** (slide and tube technique), Rh (D) grouping in Hæmolytic disease of new born (HDN).
13. **Testing for** A_1 and A_2 subgroups.
14. **Compatibility testing** (crossmatching), Clinical significance, Major cross matching, Minor cross matching, Cross matching by Liss (Low ionic strength solution).
15. **Antihuman globulin test (A.H.G.)** : Direct Coombs' test, Indirect Coombs' test.
16. **Routine investigations** : Hepatitis A, B and C, AIDS, Cytomegalovirus (CMV-ElISA), Toxoplasmosis (ELISA), Human T-Cells, Leukæmia, Parvovirus infection, Syphilis, Malaria, Microfilaria, ASO titre.
17. **Blood Transfusion** : Procedure of venepuncture, Volume of blood collected for Donor, Screening of Donor, Selection and rejection of donor, Post donation care, Processing of blood, Separation of components, Blood grouping compatibility, ABO in transfusion.
18. **Adverse reaction to blood transfusion** : Types of transfusion reactions (Hæmolytic reaction, Immediate Hæmolytic reaction, Acute Extravascular Hæmolytic reaction, Allergic reaction.
19. **Biosafety and infection control** in blood bank and medicolegal aspects.

(Second Year Course)

MICROBIOLOGY

THEORY :

1. **Safety guidelines** in laboratory and safe code of practice for microbiology laboratory.

2. **Treatment of contaminated materials**.

3. **Biohazard waste management**, Disposal options.

4. **Quality assurance** in microbiology laboratory.

5. **Methods of collection**, Storage and transportation of specimens.

6. **Microbial Control** : Disinfection and sterilization (Dry Heat, Moist heat, Radiation, Filtration and Chemical method).

7. **Factors influencing the growth of bacteria**, Nutritional requirements, Environmental factors affecting growth of bacteria.

8. **General features of eukaryotic and prokaryotic** cells, Cell wall, Cell membrane, Capsules, Pilli, Flagella, Tactic movement, Storage, Granules, Mesosomes, Nucleoid, Biosynthesis of cell wall etc. Diversity of cell size and shape.

9. **Mechanism of cell wall** of Gram positive and Gram negative bacteria.

10. **Classification of Medically Important Bacteria** : (1) Rigid thickwalled cells, Gram positive Cocci, Spore forming rods (Ærobic, Anærobic), Non-spore forming rods (non filamentous, filamentous), Gram – negative Cocci, Rods, Facultative (Respiratory, Zoonotic, Enteric and related organisms), Acid-Fast, Non-free living organism (Obligate intracellular parasites), (2) Flexible thinwalled cells (Spirochætes), (3) Wall less cells – Mycoplasma.

11. **Study of Gram-negative rods related to animal sources** – (Zoonotic organisms) : Brucella, Francisella, Yersinia pestis, Pasteurella multocida.

12. **An approach to laboratory diagnosis** of V. choleræ and related genera.

13. **Bacterial Genetics** : Mutations, Transfer of DNA within and between bacterial cells (Conjugation, Transduction, Transformation, Recombination), An overview of regulation of gene expression in prokaryotes and eukaryotes.

14. **Viruses** : General properties, Characteristics of common viral diseases like Influenza (pneumotrophic), Herpes simplex, Small pox, Measles, Rubella (dermotrophic), Dengue, Hepatitis, Rabies, Yellow fever, Piliomyelitis, Human Immunodeficiency Virus.

15. **Medically Important Fungi** : Introduction, Etiology, Disease diagnosis of Candidiasis, Histoplasmosis, Aspergillosis, Cryptococcosis and dermatomycosis.

16. **Role of pathogenic microorganisms in water pollution**, Methods of isolation of pathogenic bacteria from water sources.

17. **Normal microbial flora** of Human body.

18. **Infection** : Introduction, Classification of infection, Sources of infection, Transmission, Factors predisposing to microbial pathogenicity.

19. **Bacteriology** : An approach to laboratory diagnosis, Isolation, Morphology, Biochemical characterization and identification of medically important pathogenic bacteria.

20. Role of antimicrobial agents and mechanism of their action with reference to antibiotics, Drug resistance in bacteria and drug sensitivity test (NCCLS Recommendation).

21. **General introduction** of anærobic bacteria.

22. **Mycobacteria and mycobacterium Lepræ** : Disease, Characteristics, Habitat and transmission laboratory diagnosis, Prevention.

23. **Bacterial Vaccines** : Immunization, Capsular polysaccharide vaccines, Toxoid vaccines, Whole bacterial vaccines.

PRACTICAL :

1. **Preparation of Media** : Basal media, Differential media, Enriched media, Enrichment media, Selective, Carbohydrate media.

2. **Culture of specimens for the isolation of pathogenic bacteria** : Blood culture, Urine, Throat swab, Sputum, Wound swab, Genital tract culture (vaginal discharge, High vaginal swab), Urethral canal swab, Cervix swab, CSF, Aspirates, Stool etc.

3. **Inoculation techniques**, Seeding a culture plate, seeding a liquid and solid media, Subculture, Incubation of cultures.

4. **Staining procedure** : Gram staining, Ziehl-Neelsen staining (Hot and Cold), Albert staining, Negative staining (India ink preparation), Spore staining, Visualization of morphology of the organism and their reaction to the chemical agents present in the stain.

5. **Morphology of Bacteria** : Shape, Size, Group pattern of bacteria, Swarming, Pigment, Gram negative and Gram positive cocci and bacilli, Capsules, Slime layer, Flagella, Pilli and Spores etc.

6. **Motility testing** : Hanging drop preparation.

7. **Coagulase** (Slide and Tube), Catalase Oxidase test of suspected pathogenic bacteria.

8. **Biochemical Characterization and Identification** : Inoculation – TSI (Triple Sugar Iron Agar), SIM (Sulphide Indole Motility), Glucose, Sucrose, Lactose, Mannitol, Maltose (acid and gas production), Urease and Citrate (Simon's) utilization, Bile solubility test, Additional tests – optochin and polymyxin B sensitivity test.

9. **Antimicrobial Susceptibility Testing** : Procedure (Modified Kirby – Bauer Method), Basic sets of drug for routine susceptibility tests (NCCLS recommendation).

10. **Cultivation of fungi** : KOH preparation.

11. **Preservation of microorganisms** in artificial media.

12. **Diagnosis of pus or purulent sputum** :

    (i) The staining of the smear, **Zeihl-Neelsen** technique (Examination under oil immersion Lens).

    (ii) Inoculation of the sputum on **Sabouraud** dextrose agar for the examination of fungus.

(Second Year Course)

SEROLOGY

THEORY :

1. **General instruction** for serological tests and directions for biosafety in serology laboratory and methods of disposal of wastes. Preventive measures against laboratory infections, Decontamination of some of the commonly reusable materials.
2. **Quality control** for commonly used tests.
3. **A brief history** of immunology
4. **Immunity** : Introduction, Classification, Differences between active and passive immunity, Concept of humoral and cell mediated immunity.
5. **Non specific immunity** (Natural or Innate) : Types of non-specific immunity, Phagocytosis, Chemotaxis, Opsonization, Ingestion and degranulations.
6. **Specific Immunity** : The concept of specific immunity, Antigens and Antibodies. The structure, functions, types and characteristics of immunoglobulins, Cells involved in the specific immunity; T-Lymphocytes, B-Lymphocytes, Null Cells, NK Cells.
7. **Complement :** A general over view of the activities of complement, Complement in disease status (Rheumatologic, infectious disease, Renal dermatologic, Hæmatologic).
8. **Antigen – Antibody reaction in vitro** : Introduction, Natural of antigen and antibody, Fundamental reaction. The specificity and sensitivity of tests. The Principle of immunological tests.
9. **Immune deficiency syndrome :** Acquired immune deficiency syndrome (AIDS), auto immune diseases.
10. **Serological tests for syphilis** : Reagin test, FTA-ABS, Dark-field microscopy, Rapid plasma Reagin, TPI, TPHA.
11. **Viral Hepatitis** : Introduction, Serologic test for HAV, HBsAg, HCV, Non-A and Non-B hepatitis.
12. **Serologic methods for** : Ouchterlony double diffusion, Counter electrophoresis, CFT, Latex agglutination, ELISA, Hæmagglutination.

PRACTICAL (DIAGNOSTIC SEROLOGY) :

1. **Precipitation Test** : Detection of antibodies by precipitation test (Interfacial ring test).

2. **Agglutination Test** : Widal test (Qualitative & Quantitative) for the diagnosis of enteric fever, Principle, Mechanism, Method of preparation of 'O', 'H' and 'AH' antigen, Test procedure, Factors affecting Widal test, Interpretation of test, Effect of past infection or typhoid vaccination, Vi agglutination test.

3. **Flocculation Test** :
   (i) VDRL slide flocculation test for syphilis (Qualitative and Quantitative), Preparation of antigen emulsion, Test procedure, Interpretation of test result, Limitation of the test, Factors affecting VDRL tests.
   (ii) Rapid plasma regain (RPR) test for syphilis (commercial kit)

4. **Hæmagglutination test** : Paul-Bunnel test for infectious mononucleosis, Concept of disease status.

5. **ELISA** for M. tuberculosis and Toxoplasmosis, Principle and Mechanism, Factors influencing ELISA (Commercial kit).

6. **Carrier Particle Agglutination Test** : Latex, Rapid detection of HBsAg (by commercial kit)

7. **Single Radial Immunodiffusion SRID** : Mancini Technique for quantitative determination of immunoglobulin classes in serum.

APPLICATION FORM

ACADEMIC BOARD

ALL INDIA MEDICAL LABORATORY TECHNOLOGISTS' ASSOCIATION

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Year	Examination Passed	Board / University	Division	% of Marks

9. Professional Qualification :

Year	Name of the Course	Name of the Institute	Division	Duration

10. Details of Experience and Appointments held :

Name of the Hospital / Institute	Designation	Period of Service

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STUDENT MEMBERSHIP FORM

ALL INDIA MEDICAL LABORATORY TECHNOLOGISTS' ASSOCIATION

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N.G.O., Member World Health Organisation (W.H.O.)
Member, Asian Association of Med. Lab. Scientists, Japan
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Regd. No. 12081

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Dear Sir,

I desire to join the All India Medical Laboratory Technologists' Association as a Student Member. I hereby also declare that I shall abide by all the rules and regulation of AIMLTA and have gone through the Constitution of the association and shall try my level best to fulfil the aims and objectives of the association. I am paying Rs.300/- only as membership fee by D.D. The association reserves the right to allow or disallow my membership if found any discrepancies.

All my particulars are given below to the best of my knowledge.

Yours faithfully,

Place _____

Date _____ ***Signature of the Applicant***

Name (in Capital letters) _____

Permanent Home Address _____

Father's Name _____

Date of Birth (Not age)_____ Sex _____

Qualification (Academic) _____ (Technical) _____

Name of Hospital / College / Institute attached with _____

Experiences _____

_____

It is essential to attach photocopies of all certificates (Qualification - Academic, Technical, Date of birth and authorities' certificates) with this application.

FOR ASSOCIATION OFFICE USE

Recommendation of Chairman, Academic Board _____

Remarks of the Central Committee

General Secretary
AIMLTA

President
AIMLTA