Curriculum & Syllabus

for

Two Years Diploma Course

in

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 :
No. 105 (First Floor)
K. K. Business Centre
19, Veer Savarkar Block
Shakarpur, Delhi-110092

Office :
404, A-Block
Capitol Tower
Fraser Road,
Patna - 800 001

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
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MEDICAL LABORATORY TECHNOLOGY

ACADEMIC BOARD, AIMLTA

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FOREWORD

As an Academic Board, AIMLTA committed to systemic and continuous improvement in the quality of DMLT education.

The Syllabus is restructured to develop in students a sustained interest to learn and develop the concepts of Medical Science and Technology in a logical manner and to develop better understanding of the health and diseases in humans.

While updating the syllabus, we have included various valuable suggestions given by medical personnel and doctors of medical colleges. To them we express our sincerest gratitude. Almost all subject matters have been updated adding more key terms and key points with more clarity.

This revised syllabus gives a new augmentation to the DMLT course contents so that the students appreciate the great importance and significance of the application of Medical Lab. Technology to medicine.

Although a consistent effort has been made to prepare the syllabus error free. Any oversights are strictly our own. Constructive suggestions, comments, valuable criticism from all concerned will be highly appreciated and incorporated in future for further improvement of this syllabus.

We record our appreciation and express thanks to helpful publishers K.B. Computers, Patna, Bihar.

The Controller of examinations will be responsible for keeping the syllabus.

September, 2019

Chairman
Academic Board
AIMLTA

CURRICULUM

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

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

(B) Duration of Course : Two years course for regular and in-service candidates. The medium of instruction and examination shall be English.

(C) Academic Session : July-June

(D) 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 Casts/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.

(E) 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 candidate can take admission in an institute/college in a session, subject to sanction of seats by the Academic Board according to its infrastructure.

3) A list of admitted students must be submitted to the controller's office mentioning father's name, mother's name, DOB, qualifications and the supporting documents by 31st of October.

4) 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.

5) 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.

6) The final list must be alphabetically arranged, typed in capital letters with seven columns in sequence (i) Serial No. (ii) Registration No. (iii) Roll No. (iv) Student's Name (v) Father's Name (vi) Mother's Name (vii) DOB

   The column (ii) & (iii) must be kept blank for office use in case of First year DMLT & Phlebotomy examinations.

   The Registration number allotted in the first year DMLT must be filled up serially in the final year list and column of Roll no. must be kept blank for office use.

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

(F) 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 justifiable reasons.

a) A student is expected to have full attendance i.e. 100% in the regular course of study.

b) All the candidates who have put in the minimum percentage of attendance 75% for appearing at the examination, will be allowed to appear at the respective examinations.

c) Each candidates is expected to have at least 75% attendance in a subject, which it is compulsory.

d) The condonation up to 10% may be considered by the Academic Board for specific reasons.

e) The attendance of the candidate shall be counted from the date of his/ her admission, while in the case of promoted candidate, attendance shall be counted from the date on which the respective class begins.

f) Institutions/ colleges shall be the end of each month submit the attendance record of their students to the Controller of Examinations so that the conditions laid down for appearing in the examination be fulfilled.

g) The Controller of Examinations may call for explanation from any concerning authority of the institute who may be at fault, pertaining to his/ her responsibilities and inform the Academic Board and may take necessary action against the person at fault.

(G) Promotion & Supplementary Examinations :

a) A candidate who has passed in all the subjects including practical and theory in the examination of First Year DMLT, comes under category promoted. He/She will automatically be promoted to Final Year (Second Year) DMLT course of study.

b) The candidate of First Year DMLT shall also be promoted to Final year DMLT course of study irrespective of the number of two papers/subjects in which he/she failed in the First Year DMLT examination.

c) A candidate fails in three papers/ subjects shall be declared failed.

d) Passing marks in each theory paper/ subject is 40%, in each practical paper/ subject 50% and in aggregate 50%.

e) A candidate who has passed in all papers/subjects but fails to secure 50% marks in aggregate shall be allowed to repeat the course by taking readmission as a regular student and 75% attendance shall be required for sitting in the examination.

f) A candidate failed in two paper/subjects either in theory or practical or both shall be allowed to appear in supplementary examination. If he/she failed in theory, will appear in theory & practical both of that paper/ subject. If he/ she failed in practical, will appear in practical only of the paper/ subject.

g) Supplementary candidates of One Year DMLT, First Year DMLT and Final Year DMLT shall have to qualify in their concerning subjects in supplementary examination which will usually be held during the forthcoming schedule of Annual DMLT examination.

h) Students will have to pass the DMLT (Two Year course) within four years from the year of admission, failing which he/she will have to leave the course.

i) A supplementary examination can only be granted twice and further this shall not be negotiable.

j) Absentees will not be permitted to appear in the supplementary examination and marks obtained by them previously at the examination shall not be taken into account as per examination rules of the Academic Board. They shall be deemed as failed.

k) Absentee from the supplementary examination for any reason shall be deemed as failed. The candidates failing at any of the subjects even after supplementary examination shall also be declared failed.

l) Those who are interested to appear in the supplementary examination shall submit their applications within 45days from the date of declaration of results to the Controller of Examinations. A consolidated fee shall be fixed by the Academic Board and prescribed by the Controller of Examination.

m) A candidate who improves his/her performance at the supplementary examination of concerned papers/ subjects and obtain qualifying marks shall be taken into account and issued a statement of marks to the effect that he/ she already having qualified marks in the respective papers/ subjects in the annual examination beside supplementary papers/ subjects, reappeared and qualified in supplementary papers/ subjects for the award of diploma.

n) Under the provision of amended rules, a candidate who meets the necessary standard of qualifying supplementary examination shall not be ranked in order of merit (Top ten rank & Distinction), but he/ she shall be entitled to such class/ division as he/ she obtains as a result of reappearance in concerning supplementary examinations. The progress report card (mark-sheet) of the candidate will determine pass or fail and the clearance of supplementary examination in concerning subject shall be transcripted in the mark-sheet.

o) The entire examination such as One Year DMLT, Phlebotomy, Final Year DMLT, and supplementary is liable to be cancelled for providing any false information, act of gross misconduct and indiscipline. In such cases re-examination shall be conducted by the Academic Board and the institute/ college shall have to pay a consolidated fee as fixed by the Academic Board and prescribed by the Controller of Examinations.

(H) Instructions for In-service : candidates

1) In-Service candidates should have five year 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.

(I) 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 shall be awarded to the candidates obtaining highest number of marks at top position and next in order of second position.

(J) Examination Fee : Examination fee must be remitted only through Bank Demand Draft (SBI) in favour of ACADEMIC BOARD, AIMLTA, payable at Patna. The Last date of receiving the fees by speed/Registered post only shall be 31st of March. The late fee will be charged after 15th of April for each candidate and further upto 30th of April the application forms and fees will be accepted.

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.*

(K) DISTRIBUTION OF MARKS

Paper	Subject : First Year Course		Theory	Practical
I	General Laboratory Principles, Equipment & Instruments + Human Anatomy and Physiology		100	
II	Clinical Biochemistry		100	100
III	Histopathology Clinical Pathology	50 50	100	100
IV	Hæmatology Blood Banking/ Transfusion Medicine	70 30	100	100
V	Microbiology Immunology/ Serology	70 30	100	100
	Total		**500**	**400**

(L) DISTRIBUTION OF MARKS

Paper	Subject : Second Year Course		Theory	Practical
I	Human Anatomy & Physiology		100	–
II	Clinical Biochemistry		100	100
III	Histopathology Clinical Pathology	50 50	100	100
IV	Hæmatology Blood Banking/ Transfusion Medicine	70 30	100	100
V	Microbiology Serology	70 30	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.

(M) 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/ Transfusion medicine	10	30	
Microbiology	40	120	
Serology	30	90	
Total	**260**	**780**	

*** Practical in related disciplines will be done in the after noon.**

(N) 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	
Clinical Biochemistry	40	120	
Clinical Pathology	40	120	
Histopathology	20	60	
Hæmatology	40	120	
Blood Banking/ Transfusion medicine	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.)

(O) PATTERN OF QUESTIONS AND DISTRIBUTION OF MARKS

SI. No.	Pattern of Question	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=10	5×1=5	5×1=5	5×1=5	5×1=5
3.	Fill in the blanks	10×1=10	5×1=10	5×1=5	5×1=5	5×1=5	5×1=5
4.	Cross Matching	5×1=5	5×1=10	5×1=5	–	–	–
5.	Short Question (One sentence Answer)	5×1=5	5×1=10	5×1=5	5×1=5	–	–
6.	Short Quest ion (Answer within five lines)	5×3=15	5×2=10	2×2½=5	–	–	–
7.	Short Notes	5×3=15	5×3=15	2×5=10	1×5=5	1×5=5	–

LABORATORY REQUIREMENTS

(1) INSTRUMENTS/EQUIPMENT

Microscope	Sahli Hemoglobinometer
Physical Balance	WBC Pipette (Thoma)
Colorimeter	RBC Pipette
Water Bath (Thermostatic)	Push Button Pipette
Hot Plate	Improved Neubauer Chamber
Centrifuge	Wintrobe's tube (with stand)
Incubator (Thermostatic)	Westergren's tube (with stand)
Autoclave	Centrifuge tube
Hot air Oven (Thermostatic)	Anticoagulants (Tubes/ Bulbs)
Refrigerator	Sphygmomanometer cuff
Thermometer (F°C)	Loop wire/Straight wire (for microbial culture)
Stop Watch (Timer)	Coplin jar
Bunsan Burner/ Spirit Lamp	Embedding box/ moulds
Urinometer	Wooden blocks
Esbach's Albuminometer	Belgium black vein yellow home

(2) GLASS WARE/PLASTIC WARE

Beakers (different capacities)	Graduated pipettes (different capacity)
Erlenmeyer Conical Flask (different capacities)	Serological pipettes (different capacity)
Volumetric Flask	Glass Slides, Cover Slips
Funnels	Pasteur pipettes
Measuring Cylinder (different capacity)	Test tubes (different capacity)
Reagent Bottles	Petri dishes
Wash Bottles	Cavity Slides (concavity slide)

(3) SOLUTIONS

Normal Saline	1N HCL (Hydrochloric acid)
1N NaOH (Sodium hydroxide)	20% Sulphosalic acid
1N KOH Solution	Soren seris Phosphate buffer
10% $BaCl_2$	Lactophenol Cotton Blue Solution
10% $FeCL_3$	20% H2SO4 Solution

(4) STAINS

Methylene Blue	Giemsa
Gram Stain	India-Ink
Albert Stain	Nigrosin
AFB (ZN Stain)	PAS (Perodic Acid Schiff)
Leishman	Haematoxylin & Eosin (H&E)

(5) FEAGENTS & CHEMICALS

Benedict's Reagent (semi quantitative)	Acetone
Fouchet's reagent	Absolute Alcohol
Esbach's reagent	Common Alcohol
Ehrlich's reagent	Ethanol
O-toluidine reagent	Methyl Alcohol
Glacial Acetic Acid	Turk's fluid
Hydrochloric Acid	Hayem's fluid
Sulphuric Acid	Dacie's fluid
Nitric Acid	Reess Ecker fluid
Picric Acid	Dunger's fluid
Sodium Nitropruside	Formaldehyde
Ammonium Sulphate	Hydrogen peroxide
Sulphure Power	Sodium chloride powder
Paramethylaminobenzldehyde	

(6) COMMON DISINFECTANTS

Dettol	Glutaraldehyde
Savlon	Phenol
Acetone	

(7) CULTURE MEDIA

Bacteriological Agar Powder	Muller-Hinton Agar
Sterile Peptone Water	Mac Conkey Agar
Sterile Normal Saline	Sabouaud's Dextrose Agar
Sterile Nutrient Broth	

(8) ANTIBIOTIC DISC

Ampicilin (10µg)	Gentamycin (10µg)
Tetracycllin (30µg)	Nalidixic Acid (30µg)
Cephaloridin (10µg)	Nitrofurantoin (300µg)
Erythromycin (15µg)	

(9) MISCELLANEOUS ITEMS

Litmus paper strip	Wire gauze
pH indicator paper strips	Wire basket
Whatman's filter paper No.1	Tripod stand
Rubber bands	Tourniquet
Rubber bulbs	Disposable Syringes & Needles
Vaseline	Lancets
Glass rods	Sterile Gloves
Tissue paper	Liquid Soap
Wooden stick	Detergent Powder
Test tube holders	Soap
Test tube racks	Towel
Pipette stand	Match Box
Forceps	Bowls
Scissors	Buckets
Spatula	Waste disposal bags
Scalpels	

(10) AUTOMATION

Hæmatology-Autoanalyser	Semi-Autoanalyser
Chemical-Analyser (Discrete analyzer)	

(11) LABORATORY MANUAL/SOP

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. Worker – One
4.	Clinical Pathology & Histopathology	:	1. Lecturer [DCP, MD (Path)] – One 2. Demonstrator [B.Sc., DMLT] – One 3. Lab. Worker – One
5.	Microbiology & Serology	:	1. Lecturer [DCP, MD (Path)] – One 2. Demonstrator [B.Sc., DMLT] – One 3. Lab. Worker – 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 Technologist- 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.	Robert Cruickshank	:	Medical Microbiology (A guide to the Laboratory Diagnosis & Control of infection)
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	:	Hæmatology Technique
18.	Bharucha C, H. Meyer & other	:	Handbook of Med. Lab. Technology
19.	Seivered, C.E.	:	Hæmatology for Medical Technologists
20.	Williams, H.B.	:	Laboratory Manual of Serology, Immunology & Blood Banking
21.	Zmijewski, C.M. & W.E. Hæsler 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.	Helper, O.E.	:	Manual of Clinical Laboratory Methods
29.	Text Book of General Lab. Principle		
30	Dorland's Illustrated Medical Dictionary		

First Year : Theory Contents

PAPER I : SECTION A : GENERAL PRINCIPLES, EQUIPMENT & INSTRUMENTS

1. Set-up of a standardized Clinical Laboratory and functional components of the Laboratory.
2. The 'First-AID' measures and Laboratory first-aid kit.
3. Process of cleaning of new and used glassware, plasticware, drying of glassware, cleaning of new and used micro slides, WBC, RBC pipettes, ESR tubes.
4. Process of decontamination and sterilization, Disinfectants and their uses in the Laboratory.
5. Sterilization and decontamination of OT and ICU.
6. Method of collection, preservation, storage, stability and transportation of various clinical specimens.
7. Preparation of solutions and Reagents: stock solution, working solution standard solution, normal solution, percent solution, molar solution, isotonic, hypertonic, hypotonic salt solutions, saturated solution.
8. Basic knowledge of dyes, preparation of various reagents, stains, their storage, stability and use.
9. Microscopy: Components of microscope, different types of microscope and their use, setting of Binocular and Compound microscope, focusing of the objects use of low and high power objectives, use of oil immersion, lens, care and maintenance of microscope.
10. Colorimetry and Photometry, components of a photometer, principle, Beer and Lambert's Law, colorimetric and photometric procedure.
11. Principle and use of various types of instrument, components of instrument and procedure for use of instrument: Balance (Physical & Analytical), Incubator, Hot air Oven, Inspissator, Autoclave, Thermostatic water bath, VDRL shaker, pH meter, Colorimeter, Centrifuge, Microtome, Deionizer, Autoanalyser cell counter, PCR.
12. Electophoresis, principle and requirements, factors for migration of charged particles, supporting media and general methodology.
13. Method of writing and releasing test reports, Maintenance of practical record Manual.
14. Internal Qualify assurance in the Laboratory.
15. Proper disposal of waste by applying Biomedical Waste rules in India.

First Year : Theory Contents

PAPER I : SECTION B : HUMAN ANATOMY & PHYSIOLOGY

1. Introduction to Anatomy & Physiology
2. **Skeletal System:** Human Skeleton, classification of bones (Long, short & flat), Number of bones in human body. Axial Skeleton: (Cranial, Facial, Auditory, Hyoid bones), Vertebral column (Cervical, Thoracic, Lumber, sacrum, coccyx), Thoracic cage (Sternum & Ribs), Appendicular skeleton: Pectoral girdle (Clavicle, Scapula), Upper extremities (Humerus, Radius, Ulna, Carpals, Metacarpals, Phalanges), Lower extremities (Femur, Tibia, Fibula, Patella, Tarsals, Metatarsals), Types of Synovial Joints: Gliding, Hinge, Pivot, Ellipsoid, Saddle, Ball and Socket joints, Disorders of skeletol system (Arthritis, Osteoporosis, Osteomalacia, Gout).
3. **Digestion & Absorption:** Alimentary Canal, Digestive Glands (Salivary, Liver, Pancreas, Exocrine & Endocrine, Absorption of digestive products in mouth, Stomach, Small Intestine & Large intestine, Disorders of digestive system (Jaundice, Vomiting, Diarrhoea, Constipation, Indigestion)
4. **Breathing & Respiration :** Respiratory Orgons (Nasopharynx, Trachea, Glottis, Bronchi, Alveoli, Lungs), Mechanism of Breathing (Inspiration, Expiration), Exchange of gases, Transport of gases, Regulation of respiration, Disorders of Respiratory system (Asthama, Emphysema and occupational disorders).
5. **Body fluids & Circulation:** Blood, Composition of Blood, Plasma, Serum, Formed elements of blood, Blood groups, Coagulation of blood, Lymph, Heart, Cardiac cycle, Electrocardiography (ECG), Double circulation, Regulation of Cardiac activity, Disorders of Circulatory system (High blood pressure, Hypertension, Coronary heart disease, Angina pectoris, Heart failure), concept of Pacemaker.
6. **Excretory products & their Elimination:** Urine, Formation of urine, Function of tubules, structure & function of Kidney, Regulation of Kidney functions, Micturition, Nitrogenous wastes excretion (Ammonia, Urea, Uric acid), Role of other organs in excretion, Disorders of excretory system (Uremia, Renal failure, Renal calculi, Glomerulonephritis)

First Year : Theory Contents

PAPER II : CLINICAL BIOCHEMISTRY

THEORY

1. Pioneers in the field of Clinical Biochemistry.
2. The major biomolecules of cell (Protein, DNA, RNA, Glycogen, Lipids), The chemical composition of a normal man.
3. **Water:** Water Balance, Distribution of water in the body, Water intake (Exogenous & Endogenous), Water output (Urine, Skin, Lungs & Faeces).
4. **Electrolytes:** Composition of electrolytes in the body fluids (Extracellular & Intracellular fluid), Regulation of electrolyte balance (Aldosterone, ADH & Renin-angiotensin).
5. **Dehydration:** Causes of dehydration, Concept of Acid-Base balance of body, Production of acids and bases by the body, Blood buffers, Maintenance of blood pH, Disorders of Acid-Base balance (Acidosis, Alkalosis).
6. **Conceptual knowledge of Carbohydrates:** Concise consideration of carbohydrate metabolism (Glycoloysis, Glycogenesis, Glycogenolysis, Gluconeogenesis), concept of diabetes, Regulation of Blood Glucose level (Homeostasis), Determination of blood sugar level (Fasting & Post prandial) and clinical significance, Alcohol intake, due to insulin overdose), Hyperglycemia, Hyperglycemic complications.
7. The World **'Protein'**, Elemental composition of proteins, General classification of proteins on chemical nature (Simple, Conjugated & Derived), concise knowledge of Plasma proteins. Serum proteins, Fibrous proteins, Transferrin, Ferritin, Ceruloplasmin, C-reactive protein, Albumin, globulin Haptoglobin, Myoglobin and their clinical significance.
8. **Amino-acids:** Aminoacids present in proteins. Aminoacids essential to humans. Non-essential aminoacids, Aminoacids derivatives in proteins (Collagen, Histones, y-Carboxyglutamic acid), Aminoacids on their metabolic fate (Brief knowledge of Glycogenic, Ketogenic and Glycogenic-ketogenic aminoacids), concept of Phenylketonuria, Glycogenic Alkaptonuria, Albinism, Parkinson's disease, Proteinuria, Microalbuminuria.
9. Basic concept of **Functions of Liver:** (Metabolic, Excretory, Protective & Detoxificaiton, Hæmatologic, Tests to assess Liver function: Bile pigments. Bite salts, Urobilinogen, Bilirubin, Serum bilirubin, Total, unconjugated and conjugated bilirubin, Van den Bergeh reaction (Direct & Indirect), Icterus index, Total protein, Albumin, Globulin, A/G ratio.

10. Concept of excretory **Functions of kidney:** Acidification of urine, Fomation and disposal of urea, Non-Protein Nitrogen (NPN), Determination of urea nitrogen by diacetyl monoxime method and Berthelot reaction method, Determination of urinary protein, and Bilepigments.
11. Quality assurance in the laboratory.
12. Proper disposal of waste by applying Biomedical Waste Rules of India.

First Year : Laboratory Exercises

CLINICAL BIOCHEMISTRY

PRACTICAL (EXPERIMENTS)

1. Estimation of serum calcium and urinary calcium, clinical significance.
2. Estimation of serum chlorides, clinical significance.
3. Estimation of chlorides in CSF, clinical features.
4. Determination of serum Bilirubin (Malloy & Evelyn's method), significance.
5. Determination of Total Bilirubin & Direct bilirubin (Van-den Bergh reaction), clinical significance.
6. Determination of Serum Bilirubin (DMSO method), clinical significance.
7. Determination of total Serum Proteins (Biuret method), clinical significance.
8. Determination Serum Albumin (Bromocresal green method), clinical significance.
9. Qualitative estimation of Amino acids using Ninhydrin reaction, clinical significance.
10. Determination Plasma Glucose by a monostep method (GOD/POD), clinical significance.
11. Estimation of sugar in CSF, clinical significance.
12. Estimation of Blood Urea by Diacetyl Monoxime method, clinical significance.
13. Determination of Urea Nitrogen (Berthelot reaction method), clinical significance.

First Year : Theory Contents

PAPER III: SECTION A: HISTOPATHOLOGY

1. Introduction to Histopathological techniques.
2. Laboratory requirements: Glassware, Chemicals, Reagents and Equipment.
3. Receiving of sepciments, Grossing, Labelling.
4. Microtome, basic principle of microtome, Rotary microtome, Parts of rotary microtome and mode of operation, Microtome knives, sharpening of knives.
5. Basic steps for preparation and processing of the tissues:
   - ***i.*** **Fixation:** Aims and function of fixatives, Ideal fixatives, Factors affecting the fixation, Microanatomical fixatives (10% formalin, Buffered formalin, Formal calcium, Zenker's fluid, Helly's fluid, Gander's fluid and Bouin's fluid), uses of fluid, Advantages and disadvantages of fixatives.
   - ***ii.*** **Dehydration:** Dehydration, Reagents (Alcohol, Acetone, Dioxine), clearing reagents (Xylene, Toulene, Cederwoodoil, Chloroform), and their properties.
   - ***iii.*** **Impregnation with paraffin wax (Infiltration):** Embedding media and their properties, Paraffin wax, Paraplast, Tissue mat, Gelatin, Ester wax, Water soluble wax, Celloidin, Process of embedding.
   - ***iv.*** **Microtomy:** Section cutting, Mounting the tissue in slide (Mayer's albumin solution).
   - ***v.*** **Staining of Tissue section:** Hæmatoxylin Eosin stain, staining method, concept of progressive and regressive staining.
6. Maintenance of Practical performance record.
7. Proper disposal of Laboratory waste by applying Biomedical Waste Rules of India.

First Year : Laboratory Exercises

HISTOPATHOLOGY

PRACTICAL (EXPERIMENTS):

1. Squash and Impression smear preparation of the cells of tissue.
2. Fixation of tissue with buffered formalin.
3. Technique of dehydration, prepration of 70%(v/v) Alcohol, dehydration time for Alcohol.
4. Removal of Alcohol and other dehydrating agents by the clearing agent (Xylene & Chloroform).
5. Process of Impregnation to tissue manually.
6. Process of Embedding or Blocking.
7. Microtomy, Sharpening of microtome knives, method of Honing and Stropping.
8. Technique of cutting papaffin embedded sections.
9. Staining procedure of formalin fixed specimen with Hæmotoxylin & Eosin stain.
10. Method of mounting of the sections.
11. Maintenance of Practical record book.

PAPER III: SECTION B: CLINICAL PATHOLOGY

1. Collection of blood, urine sputum, stool and body fluids, precautions, Storage of specimens and their stability and transportation, preservatives used in urine specimen, Ideal urine specimens for routine analysis use of anticoagulants.
2. Physical analysis of urine specimen, conditions and causes of Polyuria, Oliguria and Anuria, Disorders causing high and low specific gravity of urine, conditions of low fixed specific gravity.
3. Microscopical examination of urine: Organic deposits of urine, Inorganic deposits of urine.
4. Chimical analysis of urine sample: Presence of protein (or Albumin) in urine, best method of quantitative estimation of albumin in urine. Common causes of proteinuria, conditions of Bence-Jones proteinuria.
5. Reducing substance in urine (sugars and non sugars), Glycouria, conditions of Glycosuria (renal and alimentary), conditions where glycosuria is detected, Benedict's test, principle of the test, Composition of qualitative Benedict's reagent.
6. Ketone bodies, utilization of ketone bodies, over production of ketone bodies, Rothera's test for detection of ketone bodies in urine.
7. Bile pigments in urine (Urochrome, Bilepigments, Bilirubin Urobilinoges, Biliverdin, Urobilin), Bilesalts in urine, significance of Bilirubinuria, concept of Obstructive and Hepatocellular jaundice.
8. Hæmoglobinuria, conditions causing hæmoglobinuria, Hæmaturia (Renal & Post renal causes) & microscopic examination, Test for blood in urine (Benzidine test, Orthotoluidine reagent test).
9. Collection of sputum, Chemical composition of sputum, Pathogenic bacteria found in sputum, Crystals Elastic fibres, Fatty acids, Curschman's spirals, RBCs, Yeast, Fungi, Parasites, ZN (AFB) staining to identity M.tuberculosis, Nocardia species and Actinomycetes spp.
10. Semen, purpose of examination, collection of semen, macroscopic appearance of seminal fluid, microscopic appearance (count of Sperm, Motility, Morphology), Abnormal morphologic forms of sputum, other findings (Pus cells, Epithelia cells, RBCs). Significance of fructose content of semen.

11. Collection of Stool specimen, preservatives suitable for preservation of stool, preservatives for permanent stool slide preparation, Microscopic examination of common parasites and their pathogenic effects: Entoamœba histolytica and coli, Giardia intestinalis, Taenia solium and saginata, Trichuris trichiura Ancylostome duodenals and Nector Americanus, Acaris lumbricoides wucheria brancofti.

12. Waste management and disposal options, applying Biomed waste rules.

13. Preparation of laboratory manual.

First Year : Laboratory Exercises

CLINICAL PATHOLOGY

PRACTICAL (EXPERIMENTS):

1. Determination of specific gravity of urine, interpretation and clinical significance.
2. Microscopic examination of urine deposits: Epithelial cells, Pus cells, RBCs Bacteria, casts, Crystals etc., clinical features.
3. Tests for Protein (Albumin) in urine: Heat and acetic acid test, Heller's cold nitric acid test. Sulphosalicylic acid test and clinical significance.
4. Qualitative determination of sugar in urine: Benedict's test, Interpretation of test result.
5. Test for Bile pigments, Urobilinogen in urine: Fouchet's test, Gmelin's test
6. Test for Bile salts in urine: Hay's sulphur test.
7. Determination of ketones in urine: Rothera test, utility of the test and clinical significance.
8. Determination of Hb/Blood in urine: Orthotoluidine test, detection of AFB, clinical significance.
9. Microscopic determination of stool (unstained and stained preparation) for the detection of parasites, clinical significance.

First Year : Theory Contents

PAPER IV: SECTION A: HÆMATOLOGY

1. Introduction to Hæmatology and basic requirements of the Hæmatology Laboratory.
2. **Anticoagulants:** Preparation of commonly used anticoagulants and their concentration, properties of anticoagulants, choice for hæmatological test, advantage and disadvantage of anticoagulants.
3. **Blood:** Composition of blood (Cellular & Plasma fraction), Phlebotomy, collection of blood (Capillary, Venous and Arterial), Preservatino and stability of blood specimens for various haematological tests, specimen rejection criteria. Haemolysis of blood, Tests affected by haemolysis.
4. **Hæmoglobin:** Types of hæmoglobin, Function of hæmoglobin, hæmoglobin derivatives, various methods for determination of hæmoglobin concentration of blood, Drawbacks of acid hæmatin method, Principle of acid hæmatin method, clinical significance of Low and High hæmoglobin values.
5. **Hæmatocrit:** Packed cell volume (PCV), Estimation by wintrobe's method, conditions where PCV altered, Various methods for determination of PCV, utility of PCV estimation.
6. **Erythrocyte Sedimentation Rate (ESR):** Definition, Methods of estimation of ESR (Westergren's & Wintrobe's), Factors controlling rouledux formation, significance and alternations in ESR.
7. **Preparation of diluting fluids and buffer:** N/10 HCl, Drabkin's solution, Turk's fluid, Dacie's fluid, Hayem's fluid, Sorensen's Phosphate Buffer.
8. **Total Leucocyte Count (TLC):** Principle, Description of improved Neubauer's counting chamber and WBC pipette, importance of constituents of WBC fluids, methods of estimation of TLC, sources of error, clinical features of increase and decrease in TLC, conditions of Leucocytosis, Leucopenia, Autoimmune Leucopenia, Concept of Electronic counter.
9. Study of Erythrocytes, Leucscytes, Granulocytes (Basophils, Eosinophils Neutrophils), Agranular Leucocytes (Lymphocytes, Monocytes, Platelets) and their clinical importance.
10. **Stains:** Mention Romanowsky's group of stains, Principle of staining with Romanowsky's stains, Preparation of Leishman's and Giemsa stain and staining technique.
11. **Peripheral Smear (PS) and Differential Leucocyte Count (DLC):** Utility of PS smear examination, method of preparation, Fixation of smear, Possible errors, Steps observed for evaluation of PS, Staining of the smear (blood film), Microscopic observation, serpentine counting process for reporting the count, Alteration in DLC (Neutropenia, Neutrophilia, Lymphocytosis, Eosinophilia, Monocytosis, Basophilia, Anemias).

12. **Hæmostatic Mechanism:** Concept, Bleeding disorders, Estimation of bleeding time, whole blood clotting time and interpretation, clinical features, Hereditary and acquired coagulation disorders, Hæmophilia, A. Christmas disease (Hæmophilia B), Vitamin K deficiency and children and adult.
13. Method of cleaning and drying of Hb, WBC pipette, counting chamber, ESR tubes etc.
14. Proper waste management and disposal.
15. Writing of Laboratory manual and maintenance of practical performance record.

First Year : Laboratory Exercises

HÆMATOLOGY

PRACTICAL (EXPERIMENTS):

1. Estimation of Hæmoglobin (Hb) by Sahli's Acid Hematin method. Clinical significance of Hb values.
2. **Cell Counts:** Total Leucocyte Count (TLC), principle and method of estimation, clinical features, Description of improved Neubauer Chamber.
3. **Peripheral Smear & Differential Leucocyte Count (DLC):** Preparation of peripheral Smear (Blood Film), fixation of smear, staining of the smear with Leishman's stain evaluation of peripheral smear. Alterations in DLC.
4. Alterations in the shape & size of Red cells.
5. **Hæmatocrit:**
   i.
   - Erythrocyte Sedimentation Rate (ESR): Estimation of ESR by Westergren's method.
   - Estimation of ESR by Wintrobe's method.
   - Merits and demerits of the methods, stages of sedimentation. Factors controlling rouleaux formation, Alterations in ESR (Increased & decreased ESR), utility of the tests.

   ii. Estimation of **Packed Cell Volume** (PCV) by wintrobe's method Additional information from the method (Plasma column, Buffy Coat), utility of buffy coat, Clinical significance of variations in hæmatocrit (Increased & Decreased PCV).
6. **Hæmostasis:** Estimation of Bleeding Time (BT) by Duke's & Ivy method, whole blood Clotting Time (CT) by capillary tube method, Interpretation of BT, CT and their clinical signifincance.
7. Methods of Cleaning Hb pipette, WBC pipette, glass slides. Cover slip, Neubauer counting chamber, Westergren's and wintrobe tube.
8. Compilation of all experiments in book form.

First Year : Theory and Practical (Experiments) Contents

PAPER IV: SECTION B: BLOOD BANKING/ TRANSFUSION MEDICINE

1. Discovery of Human blood group, Important blood group systems with notation and their antigens.
2. Decontamination and sterilization of Laboratory instruments and other essential tools.
3. Biosafety and universal precautions of Laboratory workers.
4. Storage and transportation of blood, precautions, preservation of blood and blood components, physical and biochemical effects on storage of blood.
5. Blood group antigens and antibodies, definition of Agglutinins, Agglutinogens, Agglutination.
6. ABO groups, A,B & H antigens, Formation of AB & H antigens, types of blood group antibodies and significance, Complete and incomplete antibody, Bombay phenotype, Bombay blood group and Hgenotype sub type of group A.
7. Hæmagglutination reaction in blood grouping, Natural antibodies, Immune antibodies.
8. ABO grouping procedure: Slide technique, Tube technique, Iterpretation, Features of false positive agglutination (Alloagglutination, Pseudoagglutination, Autoagglutination.
9. Rh System: Rh (D) typing, slide and tube technique and interpretation, Rh factors in pregnancy.
10. Cross Matching: Cross matching the patient's serum against donor red cells (Donoar recipient compatibility).
11. Blood transfusion: Collection of blood, pre-donation checkup, screening tests of blood sample. Anticoagulants used (CPD and ACD, EDTA. Brief knowledge of complications of blood transfusion.
12. Method of writing Laboratory manual and maintenance of practical performance record.

First Year : Theory Contents

PAPER V: SECTION A: MICROBIOLOGY

1. Pioneers in Microbiology.
2. Universal regulations for a microbiology Laboratory, hand hygiene, hygienic hand disinfection technique.
3. Sterilization methodology and their use, Disinfectants and their activity.
4. Method of cleaning new and used glassware, plasticware and microscope slides.
5. Method of collection of specimens, Transport of specimens, precautions, CBTM, VR, Stuart's, Pike's transport medium and their use in transportation of specimen.
6. **Bacterial Morphology:** The shape, size, arrangement and characteristic grouping of various bacterial cells (Cocci & Bacilli), Aerobic Coccobacilli, Acid fast bacteria and spirochete, True bacteria or bacteria proper.
7. **Bacterial Anatomy:** Bacterial cell, cell wall, Bacteria with deficient cell wall (Mycoplasma, Capsule, Slime layer, Flagella Fimbriae), cell wall structure of Gram positive and Gram negative bacteria, Active, passive and Brownian motility of bacteria (Hanging drop preparation).
8. **Bacterial Spores:** Gram positive bacillus (B.anthracis, B.cereus, Cl.tetani, Cl.welchii, Cl.botulinum), Gram negative bacillus (Coxiella burnetti).
9. **Growth & Nutrition of Bacteria:** Nutritional requirements, Environmental factors, Generation time, Growth cycle, Bacterial count, Products of bacterial growth.
10. **Stains & Staining Technique:** Importance of staining, Commonly used acidic, basic and neutral stains, concept of simple stain, Differential stain, Indirect stain, Negative stain, Staining method of Gram's stain, Albert's stain, AFB stain and India-ink method.
11. **Culture of Media:** Classification of media, preparation & use of routine Laboratory media: Peptone water, Nutrient broth, Nutrient agar, MacConkey's agar, DCA agar, Blood agar, Chocolate agar, Semi-solid media for preservation of bacterial cultures, solidifying agents of media and their use, precautions and storage of prepared media in refrigerator.
12. **Aerobic Culture Technique:** Method of inoculation; streak Culture (Surface plating), Lawn culture or carpet culture, stroke culture, stab culture, liquid culture and colony characters after growth on culture plates.

13. **Identification of Bacteria:** Colonial characters, opacity, transparency pigmentation. Swarming, colour changes in media, elevation of colonies motility, Staining character, Biochemical reactions: Oxidase, Catalase, Coagulase, Indole production, H2S production, Citrate utilization, Urease, TSI, Fermentation of sugars (Glucose, Lactose, Sucrose, mannitol, maltose).
14. **Colonial, Microscopical morphology & Pathogenesis of Bacteria:** Staphylococcus, streptococcus pneumoniæ, Enterococcus fæcalis, Bacillus anthracis, Clostridium tetani, N.gonorrhœæ, E.coli, Klebsiella, Proteus, Salmonella, Shigella, Pseudomonas, Corynebacterium diphtheriæ, M.tuberculosis.
15. Biohazard waste management, storage, disposal, burial, applying Biomed. Waste rules of India.
16. Internal quality assurance.
17. Method of writing Laboratory manual and maintenance of practical performance record book.

First Year : Laboratory Exercises

MICROBIOLOGY

PRACTICAL (EXPERIMENTS):

1. Use of low and high power objectives, oil immersion lens of a microscope.
2. Isolation of bacteria : Inoculation on Nutrient agar and MacConkey's agar plate (Surface plating, streak culture technique).
3. Identification of colonial morphology, appearance of bacterial colony on MacConkey agar plate; colour, shape, surface, size, elevation, Edges, pigmentation and swarming.
4. A motility preparation in normal saline and distinguish the motility of bacteria (E.coli) by Hanging drop preparation.
5. Microscopical morphology : Examination of bacterial colony by Gram Staining method.
6. Morphological and cultural characters of E.coli, kilebsiella, staphylococcus aureus, Staphylococcus epidermidis, Enterococcuos fæcalis.

PAPER V: SECTION B: IMMUNOLOGY & SEROLOGY

1. Biosafety in serology Laboratory.
2. Method of preservation of blood, serum, plasma, antisera, antigens etc.
3. Conception of Immunity: Innate, Acquired, Naturally acquired (active & passive) immunity, Artificially acquired (active, passive) immunity, cell-mediated-immunity, Responsible cells for cellular immunity (T-cell, T-cells cytotoxic, Helper T-cell).
4. Definition of Antigen, complete (immunogen) antigen, Icomplete (hapten) antigen, Antigenic determinant, Forssman antigen. Cardiolipin antigen, Non-specific antigen (Reagin), Heterophil antigen.
5. Definition of Antibody, Basic structure of Immunoglobulin molecule Synthesis of immunoglobulins, Immunoglobulin classes and their clinical importance.
6. Characteristics of Antigen-Antibody reaction, Antibody titre, Antigen-Antibody interactions (Precipitation & Agglutination reaction) Factor responsible for antigen-antibody reaction.
7. Precipitation reaction: Reaction in liquid medium. Zone phenomenon, Precipitation test (Ring test, Slide flocculation test-VDRL, Radial immunodiffusion test).
8. Agglutination: Slide agglutination and Tube agglutination test (Widal), Prozone phenomenon.
9. Heterophil agglutination test: Weil-Felix reaction, Paul-Bunnell test.
10. Passive agglutination test: Detection of specific antibody in serum. Latex agglutination test for RA, CRP, Rose waaler test.
11. Antigenic structure of salmonella, concept of O, H, Vi antigens, Typhoid & Paratyphoid fever, incubation stage, septicaemic stage, detection of carriers.
12. Laboratory diagnosis of syphilis: VDRL, RPR and TPHA test.
13. Treponomes, causative agents of syphilis, stages of syphilis, congenital syphilis, Immobilization (TPI test).
14. Decontamination and proper disposal of waste.
15. Maintenance of Practical record book.

First Year : Laboratory Exercises

SEROLOGY

PRACTICAL (EXPERIMENTS):

1. Preparation of VDRL buffer and antigen emulsion.
2. Separation of serum, Process of inactivation of serum for VDRL test.
3. VDRL agglutination test for syphilis (Qualitative and Quantitative), Interpretation, Factors affecting VDRL test.
4. Rapid Plasma Reagin (RPR) test for diagnosis of syphilis (Qualitative and Quantitative method), Interpretation of result, Limitation of test.
5. Agglutination test: Widal test for the diagnosis of Enteric fever (typhoid & paratyphoid). Qualitative & Quantitave techniques, Interpretation of agglutination reaction, Factors affecting widal test, effect of past infection or typhoid vaccination.
6. Precipitation reaction: Ring test.
7. Laboratory diagnosis of Kala-Azar (Nepier Aldehyde test).

Second Year : Theory Contents

PAPER I : HUMAN ANATOMY AND PHYSIOLOGY

1. **Anatomy:** Skeletal tissues; cartilage, type 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 vertebrae, thoracic vertebræ, lumbar vertebrae, 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 tissue, 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 eyes, 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, fertilization and implantation, pregnancy and embryonic development, sexually transmitted disease and infertility.

Second Year : Theory Contents

PAPER II : CLINICAL BIOCHEMISTRY

1. **Osmosis:** Osmotic pressure, (hypertonic & hypotonic), Application of osmosis (Fluid balance, Red cell and fragility, Transfusion, Osmotic diuresis, Edema).
2. **Surface tension:** Application of surface tension, Hay's sulfur test surfactants and lung infection.
3. **Buffers:** Mechanism of buffer action, Buffering capacity, Hydrogen ion concentration (pH), the pH of important biological fluid: Pancreatic juice Blood Plasma or whole blood, CSF, Tears, Intestinal fluid, Saliva, Gastric juice, Human milk, Urine).
4. **Plasma Proteins:** Components of plasma proteins, Albumin, Functions of Albumin (osmotic, transport, nutrition & buffering), Globulins Clinical significance of Emphysema and a1-antitripsin deficiency. Function of haptoglobin, Ceruloplasmin, Transferrin, plasma cell cancer (Multiple myeloma), Amyloidosis.
5. Brief history of insulin, Effects of insulin on carbohydrate metabolism, Role of hormones in blood glucose homeostasis, Insulin dependent diabetes mellitus, Glucose 6-phosphate dehydrogenase deficiency. Procedure for GTT.
6. **Lipids:** classification of Lipids, Emulsification of Lipids, Function of Lipids, Fatty acids, saturated and unsaturated fatty acids, Essential fatty acids, function of phospholipids and Glycolipids.
7. **Lipoproteins:** VLDL, LDL, HDL (Clinical significance), Evaluation of patient with Hyperlipidemia, Lipid profile test: Total Lipids, Serum total cholesterol, serum HDL cholesterol, Total cholesterol/HDL Cholesterol ratio, serum triglycerides.
8. **Amino Acid:** Essential amino acids to human, Amino acids derivatives in proteins (collagen, histones, y-carboxyglutamic acid), Conceptual knowledge of Glycogenic, ketogenic and Glycogenic-ketogenic amino acids), Creatine & creatininie, clinical features of Phenyl ketonuria, Albinism, parkinson's disease, proteinuria, Micro albuminuria.
9. **Enzymes:** Emzymes as therapeutic agent: streptokinase, asperginase Diagnostic importance of enzymes: Amylase, Lipase, SGPT, SGOT Alkaline phosphatase, Creatine phosphokinase (CPK), Lactate de hydrogenase (LDH).
10. **Hormones:** Principle human hormones, Function of hormones, Hypothalamic & Pituitary hormones and their function.
11. **Vitamins:** Classification of vitamins, Fat soluble and water soluble vitamins Biochemical function of vitamins, deficiency syndrome, Dietary requirements.
12. **Minerals of the body:** Biochemical function of minerals, Dietary requirements, some disease state of minerals: Hypocalcemia, Rickets, Osteoporosis, Addison's diasease (Cushing's syndrome) Hemophilia, Wilson's disease.
13. **DNA Libraries:** Complementary DNA (cDNA) library, DNA probes Polymerase Chain Reaction (PCR), Denaturation of DNA, Annealing with primers, DNA amplification, Application of PCR.

14. **Tests to assess liver function:** Bile pigments, Bile salts, Urobilinogen, Total, Unconjugated & Conjugated bilirubin, Van-den Bergh reaction, Icterus index, Total protein, Albumin, Globulin & A/G ratio.
15. **Excertory functions of kidney:** Formation and disposal of urea, Non protein Nitrogen, Determination of urea nitrogen (DAM, Berthelot method).
16. Disposal of biohazard material.
17. Internal quality assurance.

Second Year : Practical Exercises

BIOCHEMISTRY

PRACTICAL (EXPERIMENTS):

1. Collection of blood, precautions, separation of Plasma and Serum.
2. Estimation of Total serum Protein and Albumin (Biuret)
3. Estimation of Chyle in urine (Suskowitch's test).
4. Determination of Serum Bilirubin by DMSO method & Malloy and Evelyn method.
5. Determination of Total Serum Bilirubin (Direct & Indirect), Vanden-Bergh reaction.
6. Determination of Serum Glutamate Pyruvate Transinase (SGPT or ALT) by Reifman & Frankel's method or commercial kit.
7. Determination of Serum Glutamate Oxaloacetate Transminase (SGOT or AST) (Commercial Kit).
8. Estimation of Serum Alkaline Phosphatase (Commercial Kit).
9. Determination of Serum Total Cholesterol by Watson method.
10. Determination of Serum HDL Cholesterol (Colorimetric, commercial kit).
11. Estimation of Blood sugar (Glucose oxidase methods).
12. Estimation of True sugar (Glucose) and Glucose Tolerance test (GTT).
13. Estimation of Plasma Glucose by Orthotoluidine monostep method.
14. Estimation of Serum Urea Nitrogen (DAM method)
15. Estimation of Serum Urea Nitrogen by Berthelot reaction method.
16. Estimation of Serum Creatinine by Alkaline-picrate method, Jaffe's reaction.
17. Knowledge of Automation; component steps in fully automated system.
18. Knowledge of interpretation of test result.
19. Internal quality assurance.

Note : *Awareness: Laboratory manner, utility of the test, requirements for the test, test principle, storage and stability of reagents, procedure, precautions, sources of error, calculation, advantages and disadvantages of the test. Logical explanation of the application of steps in an experiment, normal values, abnormal values, conditions causing disease and additional clinical significance of the test result.*

20. Biosafety & proper disposal of waste by applying Biomedical Waste Rules of India.

Second Year : Theory & Practical Contents

PAPER III (Section A) : HISTOPATHOLOGY

1. Responsibilities of Laboratory Worker.
2. Study of abnormal and normal cells & tissues of our body, collection of specimen, storage and transportation.
3. **Tissue fixation:** Fixatives and fixation, uses of microanatomical fixatives: Formal saline, Bouin's fluid, Helly's fluid. Zenker's fluid. Lillie's buffered formalin, Cytological fixatives: Carnoy's, Fleming's & Zenker's fluid.
4. **Methods of decalcification:** Collection of tissue, thickness of tissue, Aqueous solutions for decalcification, Removal of decalcifying fluid, Detection of end point of decalcification.
5. **Reagents used for dehydrating tissue:** Methods of dehydration, dehydration of tissue for paraffin/celloidin embedding method.
6. **Clearing:** mention clearing agents and their advantages & disadvantages.
7. Instruments use for **paraffin wax infiltration & Impregnation,** various embedding media, mention moulds used for blocking preparation of paraffin blocks for cutting section, thickness of section for routine purpose.
8. **Section cutting:** Floating out technique, Microtomy, Sharpening of microtype Knives, steps for final cutting of sections.
9. Rapid manual method for processing larger and denser piece of tissue.
10. Steps for Rapid manual processing of small piece tissue.
11. **Frozen Section:** Preparation of frozen sections, common fixatives used for frozen sectioning, thickness of tissue for preparation of frozen sections.
12. **Staining:** Hæmatoxylin & Eosin stain, Ripening of hæmatoxylin by natural method & chemical method, Mordant, solvent and acidification, steps for H & E staining, uses of some important stains: Masson's trichrome, Von Gieson's, Periodic acid schiff's, oil red O, sudan, Perl's Prussian blue stain, Vonkosa, ZN Stain.
13. **Exfoliative cytology:** Study of exfoliated cells, Body fluids (Pleural, Ascitic, Peritoneal, Pericardial, CSF, Synovial), Clytology of Pleural fluid, fixation, smearing, staining and microscopy, PAP smear staining Papanicolaou staining procedure.
14. **Fine Needle Aspiration cytology (FNAC):** Size of needle used for FNAC, needle requires for Bone Marrow aspiration, common sites for FNAC, smearing, fixation & staining.
15. **Mounting:** Mounting media (Aqueous & non-aqueous) and their refractive Index. Mounting by synthetic media.
16. **Museum technique:** Reception of specimen, fixation (Kaiserling's fluid I) Restoration of colour of speciment (Kaiserling's Fluid II), Preservation (Kaiserling's fluid III), presentation in glass jar.

Second Year : Theory Contents

PAPER III (Section B) : CLINICAL PATHOLOGY

1. Collection of Blood, Sputum, Urine and various Body fluids, precautions, stability & storage of specimens.
2. **Hæmorrhagic diseases:** causes of Anaphylactoid (allergic) purpura, scurvy, cushing's syndrome, Macroglobulinemia, vascular purpura, pathogenesis of hæmorrhagic purpura due to infection and mocroglobulinæmia, Von-wille Brand's disease.
3. **Coagulation disorders:** Mechanism of blood coagulation, coagulation factors, Formation of fibrin form fibrinogen, Extrinsic, Intrinsic and common pathway Prothrombin time (PT), Factor causing abnormal PT, Determination of Thrombin, CT and Prothrombin time, Common congenital deficiency disease, Hemophilia A Cristmas disease (Hemophilia B). Vitamin K dependent factors, Fibrinolytic defects and DIC (Disseminated intravascular coagulation), Clotting factors present in serum and absent in serum.
4. Physical and chemical analysis of Urine and clinical significance of the tests.
5. **Sputum:** Method of collection, Criteria for rejection, Gross analysis of sputum, Pathgenic bacteria found in sputum, concentration technique for detection of AFB, Petroff's method, ZN and Kinyoun method of AFB staining Detection of crystals in sputum: Charcot-Leydon crystals, Fatty acid crystals. Fibrinous casts, Curschman's spirals.
6. **CSF:** composition of Cerebrospinal fluid, Lunber Puncture, significance of cloudy appearance, raised protein and glucose, decreased chloride content and clot formation, Examination of CSF: Protein, sugar & chloride, Pandy's test CSF findings in different meningitis.
7. **Synovial fluid:** Collection, gross analysis of synovial fluid, characteristics of inflammatory synovial fluid, significance of the crystals found in synovial fluid.
8. **Study of Stool:** method of collection, precautions before collection, use of preservatives. Clinical significance of chemical examinations of stool (acidity/basicity, fats, nitrogen, stercobilinogen, coproporphyoin), occult blood and clinical significance, occult blood test, Direct smear preparation of stool with saline and iodine.
9. **Protozoa & helminthes:** Association of parasites and host classification of Parasites, Diseases and diagnostics features, Laboratory diagnosis, Localisation or habitat and pathogenic effects: Balantidium coli, Entamœba histolytica, Entamœba coli. Giardia intestinalis. Ascaris lumbricoides, schistosoma mansoni, Taenia saginata, Aolium, Hymenoleps nana, Ancylostoma

duodenale Trichuris trichiura, Enterobius vermicularis, salt floatation method for helminthic ova, mention bile stained eggs in stool, helminthic eggs float in saturated salt solution.

10. **Seminal fluid:** Collection of semen, macroscopic appearance of a normal semen, Microscopic examination : count of sperm, motility, abnormal morphology, significance of fructose content of semen, method for detection of fructose content; test for presence of semen for medicolegal purpose, concept of abnormility, oligo-agoospemia. IVF (In Vitro Fertilization) and GIFT (gamete intra fallopian transfer).
11. Proper Disposal of Lab. Waste and specimens.

Second Year : Practical Exercises

CLINICAL PATHOLOGY

PRACTICAL (EXPERIMENTS):

1. Method of collection of Blood, Urine, Sputum, Body fluid etc. best chosen anticoagulant, Preservation, use of preservatives, storage, stability and transport of specimen, changes on keeping urine at room temperature (RT).
2. **Physical Examination of Urine:** Volume, Colour, appearance, odour, reaction specific gravity causes of high & low specific gravity. Causes of fixed specific gravity, condition associated with acid and alkaline urine, the term oliguria, Anuria, Polyuria.
3. Chemical Examination of Urine:
    i. **Tests for proteins in Urine:** Sulphosalicylic acid test (cold test), Nitric acid test. Nitrate in urine (modified Griess test), utility of nitrate test. Test for Chyle in urine.
    ii. Estimation of Proteins in Urine by Heat and acetic acid test.
    iii. Quantitative estimation of proteins in urine with **Esbach's albuminometer.**
    iv. Screening test for **Benee Jones Protein** (BJ) in urine and Hydrocloric acid test for BJ proteins, conditions of Bence Jones proteinuria.
    v. Qualitative & Quantitave tests for sugar in urine, Benedict's test, explain sugar and non-sugar substances found in urine.
    vi. Detection of **Ketone bodies** in urine (Rothera's test).

vii. Detection of Ketone bodies **(Gerhardt's test)**, significance of presence of ketone bodies in urine.

viii. Detection of Beta-hydroxybutyric acid in urine.

ix. Test for **Bile Pigments** in urine **(Fouchet's method)**, Gmelin's test, Iodine ring test.

x. Detection of **Bile Salts** (Hay's test) and **Urobilonogen** (Ehrlich's reagent)

4. Detection of blood in urine, Benzidine test or orthotoluidine test or Aminophenazone reagent test, conditions, causing haemoglobilinuria, haematuria, porphyria, Urinary forms of porphyrins, **Occult blood test** in urine.

5. Determination of **Urine Urea Nitrogen** (DAM method), clinical significance.

6. **Microscopic examination of Urinary deposit:** Detection of Red cells, epithelial cells, Pus cells, crystals, casts, parasites, spermatozoa etc. clinical features and interpretation of diseases.

7. **Examination of Stool:** Normal constituents of stool, normal amount of an adult stool per day, best chosen preservative, chemical test for occult blood in stool with Aminophenazane crystals.

8. **Microscopic examination of stool:** Preparation of smear (Saline & Iodine) Entamoeba histolytica, Ancylostoma duodenale, Enterobias vermicularis, Tænia solium, T.Saginata, Trichuris trichuria, Ascaris Lumbrecoides, Hymenolepis nana, Echinococcus granulosus, Giardia intestinalis, Trichomonas hominis, Trichomonas vaginalis.

9. Examination of Sputum: Routine examination of sputum, physical examination, minute macroscopic examination, Microscopic examination: Pus Cells, Red Blood Cells, Fatty acid, Curschmana's spirals, Elastic fibres, Charcot Leyden Crystals, Clinical conditions associated with sputum examination.

Note:- *Awareness: Requirements for the tests, care of instruments, test principle, stability of specimens and reagents, storage, procedure, sources of error, a method of writing test report, significance of the tests, conditions causing disease and additional clinical significance of the tests result.*

10. Internal quality assurance and biosafety measures.

Second Year : Theory Contents

PAPER IV (Section A) : HÆMATOLOGY

1. Definition: Hæmoglobin, Hæm, Globin, Globulin, Hæmatin.
2. Precautions of blood samples after collection from a patient, conditions of refrigerated blood for various tests, Biochemical changes occur in blood on keeping at room temperature.
3. Choice of Anticoagulants for various tests and their effects on blood cell morphology.
4. **Stains:** Components of Romanowsky's group of stains and Principle, Preparation of Leishman's, Giemsa and Field's stain and staining technique.
5. Estimation of **Hemoglobin** concentration of blood by Sahli's and Cyanmethaemoglobin method, principle, Preparatin of Drabkin's solution, clinical significance of Hb values and high Hb values. Advantages and disadvantages of the tests, Mention various hæmoglobins, Hæmoglobin molecules, Hæmoglobin variants.
6. **Red cell Indices:** Mean corpuscular volume (MCV), Mean corpuscular hæmoglobin concentration (MCHC), Mean corpuscular Hæmoglobin (MCH), Changes in RBC indices in iron deficiency and megaloblastic anemia, Evaluation of PCV and calculation of absolute values of MCV, MCH, MCHC, Absolute values in macrocytic, microcytic and dimorphic anemia, PCV estimation by multichannel Coulter Automated cell counter.
7. **Morphology of Blood cells:** Evaluation of peripheral blood smear, significance changes in size, shape of RBCs and their variations: Normal red blood cells, Microcytes, Macrocytes, Hypochromia, Spherocyte, Target Cells, Anisocytosis, Poikilocytosis, Spherocytosia, Sickle cells, Schistocytes, Acathocytes, Burr cells, Basophilic stippling. Howell-Jolly body, Cabot ring, Siderocyte, Crenated cells and their clinical significance.
8. **Abnormalities of White Blood Cells:** Toxic granules, Vacuoles, Dhole bodies, Hypersegmentation, Hyposegmentation, Auer bodies, Smudge cell and their clinical features.
9. **Alterations in Differential Leucocyte Count:** Clinical featues of Neutrophila, Neutropenia, Eosinophilia, Basophilia, Lymphocytosis, Monocytosis and their common causes and clinical causes. LE cell test, Principle, method and significance.
10. **Red Cell Mass:** Red cell count, diluting fluids, preparation of Hayem's and Dacie's fluid, Procedure, Calculation, Importance of red cell count, significance of increased & decreased red cell count.

11. **Anemias:** Definition and classification of Anemias, Cut off points for anemia by WHO and normal Limits for Hb level (WHO), morphology of Macrocytic, Microcytic hypochromic (Iron deficiency, Thalassemia major) anemia, Sickle cell anemia, G-6-PD deficiency, Megaloblastic anemia, Pernicious anemia, Aplastic anemia, clinical features.

12. Screening test for G-6-PD deficiency, Alkali denaturation test for HbF, Thalassemia trait, Hb electrophoresis, Schilling test, Serum iron test, Test for folate deficiency (FIGLU).

13. **Leukemias:** Causes of Leukemia, classification of Leukemia, Microscopic appearance of Acute Blastic Leukemia, Chronic Myeloid Leukemia (CLL).

14. **Blood examination for parasites:** Plasmodium, habitat, Microfilariae, Microscopical examination, Preparation of thin & thick blood films, Method of staining, Giemsa's and Fields staining, clinical picture of MP & MF, Pathogenesis of Plasmodium.

15. **Leishmania Donovani:** Habitat, Morphology, Mode of transmission, Clinical picture & Diagnosis.

Second Year : Practical Exercises

HÆMATOLOGY

PRACTICAL (EXPERIMENTS):

1. Collection of blood from Veins & capillary, adaptation of precautions, purpose of blood collection. Choice of anticoagulants for various hæmatological tests.

2. Preparation of Leishman's and Giema Stain, Preparation of Peripheral smear, utility of **Peripheral smear,** fixation of smear, Leishman's staining, assessment of Red cell morphology and their variations in size and shape.

3. Estimation of **Hæmoglobin** concentration of blood (sahli's method).

4. Estimation of Hæmoglobin by cyanmethæmoglobin (colorimetric method).

5. Estimation of Fetal hemoglobin, clinical significance.

6. Estimation of **Red cell count,** direct method and dilution method using sahli's Hb meter pipette and significance of the test, clinical significance.

7. Evaluation of **Peripheral smear** for Differential Leucocyte Count (DLC), method normal range of DLC and Alterations in DLC, clinical significance common causes of diseases.

8. Determination of **Platelet count**, preparation of Dacie's fluid and Rees-Ecker fluid, Method, sources of errors, normal values, clinical features of increased & decreased platelet count.

9. Determination of **Packed cell volume** (Hæmatocrit) and **Erythrocyte Indices** (Wintrobe's Constant), MCV, MCH, MCHC, significance of increae & decrease values.

10. Determination of **Absolute Eosinophil count** (AEC), preparation of **Dunger's fluid** normal range, significance of high AEC.

11. Preparation of **Lupus Erythromatosus** (LE Cell), principle, wintrobe's and Glass bead method, staining, demonstration of LE bodies, clinical significance.

12. Preparation of **Heinz bodies,** principle, procedure, calculation (%) of Heinz bodies and significance.

13. **Haemoparasites:** Detection of **Malerial** parasites and **Microfilariae,** Blood alternation in malaria, collection of blood, preparation of thin & thick smear, unstained wet preparation for microfilaria, peripheral smear, staining (Giemsa's & Field's) Morphology of **Plasmodium,** concentration method for the detection of **microfilariae (W.bancrofti)**, clinical manifestations of plasmodium and microfilaria.

14. Laboratory diagnosis of **Kala-Azar,** causative agent of Kala-Agar, (gamma Globulin estimation, aldehyde test, antimony test).

Note : *Awareness: Laboratory manners and ethics, Biosafety, Requirements for the diagnosis, Logical explanation of test principle, storage & stability of the reagents and blood samples, standard procedure, precautions, sources of error, interpretation of result, advantages and disadvantages of the tests normal and abnormal values, clinical significance of altered values and conditions causing diseases.*

15. Internal quality assurance.

16. Proper disposal of waste as per Biomedical waste management rules of India.

PAPER IV (Section B) : BLOOD BANKING & TRANSFUSION MEDICINE

1. Discovery of Human blood group.
2. Role of training and personal proficiency testing.
3. **Preparation and use** of ACD (Acid Citrate-Dextrose), EDTA, Heparin, CPD-A1, CPD-A2 (Citrate Phosphate Dextrose) & their storage & stability.
4. **Preservation, storage and transportation of blood.** Physical & Biochemical effects of storage of Blood, Preservation of blood components.
5. **Inheritance of blood groups:** Phenotypes & Genotypes, ABO and Rh blood group (Karl Landsteiner and Weiner's Principle).
6. **Concept of various blood groups** (Natural antigens & Immune antibodies).
7. **Subgroups of ABO system** & Bombay group. Blood grouping technique sources of error & their elimination.
8. **Rh grouping** (slide and tube technique), Rh(D) grouping in Hæmolytic disease of new born (HDN).
9. **Compatibility testing** (cross matching), Clinical significance, Major cross matching, Minor cross matching, Cross matching by Liss (Low ionic strength solution).
10. **Antihuman globulin test (AHG):** Direct Coombs' test, Indirect Coombs' test.
11. **Routine investigations:** AIDS
12. **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.
13. **Adverse reaction to blood transfusion:** Type of transfusion reactions (Hæmolytic reaction, Immediate Hæmolytic reaction, Acute Extravascular Hæmolytic reaction, Allergic reaction).
14. **Biosafety and infection control** in blood bank and medicolegal aspects.

Second Year : Theory Contents

PAPER V (Section A) : MICROBIOLOGY

1. Safety precautions in clinical Microbiology Laboratory.
2. Collection of samples, suitable containers for collection, suitability of the sampling method and transport, the appropriate transit time and transport media.
3. **Protista:** Classification of Protista, Higher (eukaryotic) & Lower (prokaryotic) protist, Difference between prokaryotic & eukaryotic cells, Bacteria, Size of bacteria, the resolution power of unaided eye, the resolution power of ordinary light microscope, the measurement of medically important bacteria.
4. Optical methods for bacterial study, **Microscope,** types of microscope and their uses. Microscopical study of bacteria: Preparations of wet films, stained film.
5. Stained film; common **staining technique** (Simple stains, negative staining. Impregnation methods, Differential stains and indicator stains), usefulness of staining technique, Gram's stain, method, observation, mechanism of Gram's stain (permeability differences & integrity of cell wall, Acid-Fast stain, (Ziehl-Neelson stain), principle, method, observation, Albert's stain, preparation of Alber's stain and staining technique.
6. **True bacteria, Free living nature of bacteria,** structure of cell wall of Gram positive and Gram negative bacteria, bacteria with defective cell wall, Capsulated bacteria and their functions, Demonstration (negative staining, immunological method, Quelling phenomenon), Slime layer, spore forming bacteria (Gram positive, obligatory anaerobes, other bacteria).
7. **Flagella,** Flagellin, types of Flagella, parts (filament, hook and basal body), Detection of motility by Hanging drop preparation, Fimbriæ and their functions.
8. **Toxins,** Exotoxins, Endotoxins, Exotoxins production by Gram positive and Gram negative bacteria, Endotoxins produced by Gram negative bacteria, properties of bacterial toxins, Extracellular enzymes.
9. **Normal bacterial flora** (commensals), Distribution of normal flora in the body, Beneficial functions of normal flora, Harmful effects of normal flora.
10. Definition of **pathogens,** opportunistic pathogens, infection, mode of transmission. route of entry, Mention bacterial agents in UTI, Respiratory tract infection. Wound infection (sepsis), Burns, Diarrhoeal diseases, Enteric fever, Meningitis, STD and Tuberculosis.

11. **Methods of growing bacteria in culture** (Liquid and solid medium, enriched & enrichment media, Selective media), special elective media, special selective media, Identification of bacteria: staining, single enzyme test (catalase, oxidase, urease, coagulase), Biochemical tests: sugar fermentation, VP, MR, Phenyl alanine deaminase test, citrate utilisation, Indole production. H2S production, Triple sugar iron (TSI) test, Bilesolubility test, motility test.

12. **Viruses** (definition), General properties of viruses, Viruses differ from bacteria, Distinguishing features of Bacteria, Mycoplasma, Rickettsiae and Chlamydiae viruses, Common characteristics of Poxvirus. Togavirus, Filovirus, Flaviviruses, corona virus, Retrovirus, Paramyxo virus, Picorna virus, Hepatitis B virus, Bacteriophage.

13. **Medically important Fungi:** Introduction, Disease diagnosis of candidiasis, Histoplasmosis, Aspergillosis, Crytococcosis and Dermatomycosis.

14. **Water pollution,** Role of microorganisms in water pollution, causes of water pollution, Methods of total count and viable count in water sample (Dilution & plating method).

15. Disc diffusion technique of **antimicrobial sensitivity testing** (NCCLS) microbial Antimicrobial drugs; Penicillins. Cephalosporins, tetracyclines, Macrolides, Fluoroquinolones, concentration of disc. Procedure, Interpretation of result, zone of inhibition, significant zone of inhibition.

Second Year : Practical Exercise

MICROBIOLOGY

PRACTICAL (EXPERIMENTS):

1. **Preparation of Media:** Peptone water, Nutrient agar, MacConkey's agar and carbohydrates media.

2. **Culture of Specimens for the isolation of pathogenic bacteria:** Urine, Throat swab, Sputum, Wound swab, Genital tract culture (vaginal discharge, High vaginal swab), 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-Neelsan staining (Hot and Cold), Negative staining (India ink preparation), morphology of the organism and their reaction to the chemical agents present in the stain.

5. **Colonial & Microscopical Morphology of Bacteria:** Shape, Size, Group pattern of bacteria, Gram negative and Gram positive cocci and bacilli, Capsules, spores, swarming, pigments, slimelayer etc.

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

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

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

9. **Cultivation of Fungi:** KOH preparation, lactophenol cotton Blue preparation.

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

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

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

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

12. Preservation of microorgamisms in semi-solid artificial media.

13. Proper disposal of waste, Biohazard waste management by applying Biomedical Waste Rules of India.

Second Year : Theory Contents

PAPER V (Section B) : IMMUNOLOGY & SEROLOGY

1. Biosafety in serology Laboratory, Preventive measures against Laboratory infection.
2. **Immunity:** Innate immunity, Acquired immunity (Active and Passive) Active natural and Artificial immunity, comparison of active and passive immunity, Important cells of innate immune system (macrophages, dendritic cells, NK-T cells, neutrophils, eosinophils, mast cell, basophils, epithelial cell), components of Acquired (adapive) immune system (T-cells, B-cells, antibodies and plasma cells), cell-mediated immunity (T-Lymphocytes) Humoral immunity mediated by B-Lymphocytes and antibodies, Local immunity, Herd immunity.
3. **Anaphylactic reaction:** factors influencing anaphylaxis, Mechanism of anaphylaxis, Feature of anaphylaxis, Relation of IgE with infection, skin test and conjunctival test for anaphylaxis.
4. Distinguishing features of immediate and delayed types of hypersensitivity, Type IV delayed reaction, Tubberculin test technique.
5. Antigens, Types of antigen (complete or immunogen), Hapten (incomplete antigen), Carrier molecules of Hapten, Heterophile antigen (Forssman antigen, cross reacting microbial antigens, weil-felix reaction), Antigenic determinant (Epitope), Paratope.
6. **Antibodies:** Definition structure of immunoglobulins, Immunoglobulin classes, properties of immunoglobulins (Multiple Myeloma, Bence Jones protein, Cryoglobulinæmia), Types of antibody (Ig) in various conditions.
7. **Antigen- Antibody reactions,** characteristic of Antigen-Antibody reactions, Antigen-Antibody interaction (Primary stage, secondary stage, Tertiary stage), main zones of antigen-antibody in precipitation reaction.
8. **Agglutination reaction:** Slide agglutination test, Tube agglutination test (widal), Cold agglutination test, Measurement of agglutination in patient's Serum (titre), Prozone phenomenon, Heterophil agglutination test (Weil-Felix reaction, Paul-Bunnel test), Haemagglutination test (Rose-Waaler and TPHA), complement fixation test (Wasserman reaction).
9. **Neutralisation reaction:** Agar gel precipitation test, streptolysin neutraliastion.
10. **Enzyme-**Linked Immunosorbent assay (ELISA), ELISA for diagnosis of microbial and virus infections, Method and interpretation of result.
11. **Immune deficiency syndrome:** Acquired immune deficiency styndrome (AIDS) auto immune diseases.
12. **Serological tests:** VDRL slide floculaiton test & dilution technique, Rapid plasma Reagin (RPR) test (Qualitative & Quantitative), TPI, TPHA test for diagnosis of syphilis, Widal test for diagnosis of enteric fever (Qualitative & Quantitative).

13. **Quality control of materials:** Internal quality assurance.
14. Disposal of biohazard materials.

Second Year : Practical Exercises

SEROLOGY

PRACTICAL (EXPERIMENTS):

1. 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, Factor 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 Reagain** (RPR) test for syphilis (commercial kit).
4. **Heterophil Agglutination Test:** Paul-Bunnel test for infectious mononucleosis, Concept of disease status.
5. **Detection of HIV-1 & HIV-2** by a screening method based on ELISA (commercial kit).
6. **Antistreptolysin O** (ASO) for the investigation of post streptococcal diseases. (Qualitative slide test & tube method).
7. **Rheumatoid Arthritis** test (RA) to detect the presence of rheumatoid factor. (Latex-RF reagent, commercial kit).
8. **C-Reactive Protein** test (Latex CRP kit).
9. Detection of Hepatitis-B surface antigen (HbsAg) by rapid Latex slide test.
10. Detection of DNA antibodies associated with systemic **Lupus Erythromatosus** (SLE)– by Diagnostic kit.

Curriculum & Syllabus

for

Two Years Diploma Course

in

Medical Laboratory Technology (DMLT)

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Yours faithfully,

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Date

Signature of the Applicant

Name (in CAPITAL LETTERS)

Permanent Home Address

Father Name

Mother Name

Date of Birth (Not age)

Sex

Qualification (Academic)

(Technical)

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