THE WEST BENGAL UNIVERSITY OF HEALTH SCIENCES

REGULATION, CURRICULUM AND SYLLABUS FOR MASTER OF SCIENCE DEGREE IN MEDICAL LABORATORY TECHNOLOGY (M.Sc MLT) IN BIOCHEMISTRY

1. TITLE OF THE COURSES:

Master of Science degree in Medical Laboratory Technology courses (M.Sc. MLT) is proposing in the **M.Sc. MLT in Biochemistry**

2. GOAL/OBJECTIVES:

Post Graduate programme in Medical Laboratory Technology Gives to provide an extensive and advance technological training in the fields on Microbiology, Biochemistry, Pathology and Haematology & Blood Transfusion to the student to enable them to supervise and operate the entire laboratory.

Candidates who successfully complete M.Sc. (MLT) courses shall be able to

a. Practice as Specialized Laboratory Technologist in the concerned subject.
b. Setup and manage specialized clinical Laboratory and to deliver better health care system to the public.
c. Function as effective educators in the field of Medical Laboratory Technology.
d. Conduct independent research works and utilize the research findings in Laboratory Practice and education.
e. Establish collaborative relationship with clinicians and member of other disciplines.

3. DURATION OF THE COURSE:

The duration of the master's degree in Medical Laboratory Technology including submission of Thesis work on the topic registered shall be for a period of two years from the commencement of the academic term on full time basis

1st year - 0 – 12 Months
2nd year -13 - 24 Months

4. ELIGIBILITY FOR ADMISSION:

The minimum qualification for admission to the master's courses In Medical Laboratory Technology shall be –

a) Students who have passed in B.Sc. MLT course/BMLT course from any recognised University [with min 50% Marks].
b) Students who have passed in B.Sc. Honours in Biochemistry.
c) Students who have passed in B.Sc. in biological science along with DMLT (from State Medical Faculty or its equivalent).

1. SELECTION CRITERIA:

The selection of students for the post graduate course shall be made based strictly on merit in the qualifying entrance examination conducted by institution / University.

2. REGISTRATION / ADMISSION

A candidate on admission to the Msc. MLT shall apply to the institution/ University for registration.

- Formal application in the prescribe format
- Fill up the registration University from
- Original degree certificate/ mark sheet (3 Xerox copies)
- Migration certificate (If applicable)
- Reservation certificate (Caste Certificate) if applicable
- Physically Challenged certificate, if applicable
- NOC from employer, if applicable
- 6 copies colour passport size photo.

3. ATTENDENCE

Candidates should have 75% attendance to appear the University examination. A condition of 10% maximum of attendance shortage shall be done once during the whole post graduate programme by the Principal/ Head of the Institution.

4. MEDIUM OF INSTRUCTION:

English is the medium of instruction for the subjects of study as well as for the examination.

5. TEACHING METHODS & CURRICULUM:

(1) The 2 years curriculum includes theatrical lectures, practical, seminars, and project in addition to practical training and educational trips/tour.
(2) The students will also take co-curricular and extra-curricular activities such as NSS, Sports and Cultural etc.
(3) The students also take part in journal club for 1 Hr. (including discussion) weekly.
(4) Tutorials/group discussion/review club.

(5) M.Sc. MLT trainees present seminars under the moderation of faculty members. Each trainee presents a minimum of 6 seminars and present at least 6 journal clubs in two years.
(6) M.Sc. MLT trainee's students should regularly visit for practical training in Hospital/Diagnostic centre/College own laboratory.

10. INTAKE OF STUDENTS (GUIDE – STUDENT RATIO):

The guide student ratio shall be a maximum of 1:3 including co-guide

Experience of Guide: - Guide should have master degree in related field and minimum 3(three) years of teaching experience in the same institute or any other institute.

Experience of Co–Guide:-co-guide should have master degree in related field and minimum 1(one) year of teaching experience.

Change of Guide:-It can be changed only on unavoidable situations with prior permission on from University.

11. COMMENCE OF COURSE

The course will commence from the 1st week of October of every year.

12. DISSERTATION/THESIS EVALUATION:

1) The topic of the dissertation along with synopsis should be submitted at the end of the first 6 months and obtain the ethical clearance of the same. The candidate should also inform the name of the guide & co-guide (if any) for the dissertation.
2) If there are changes in the dissertation topic, the student has to be informed University 2 months prior to the 1st year examination.
3) The dissertation should be submitted duly signed by the Guide & Co-Guide (if any) and Head of the institution and has to be forwarded to the university through the Head of the institution 2 months prior to the University Final/2nd year Examination.
4) If the dissertation is not approved (Failed) by the majority of the examiners, the results shall be withheld fill the resubmitted dissertation is approved (passed).
5) If the candidate fails in the written/practical Examination, but his/her dissertation is approved (passed), approval of the shall be carried over to the subsequent examination.
6) The dissertation should be written under the following headings – Introduction, Aims or objectives of study, Review of literature, Material of methods, Results, Discussion, conclusion, Summary, References, Tables, Annexure.
7) The written text of dissertation shall not be less than 75 pages and shall not exceed 100 pages including introduction to annexure. It should be neatly typed in double line spacing on one side of paper (A4 size) and found properly.

13. COMPLETION OF THE COURSE OF STUDY:

The duration for completion of the course is double the duration of the course i.e. 4 years to the pass the examination, from the date of joining the course. Otherwise he/she has to be discharged from the course.

14. THEORY & PRACTICAL HOURS DISTRIBUTION

- FIRST YEAR

Subject	Theory	Practical Hours	Total Hours
1.Basic Science	100 hrs	1200 hrs	1600 hrs
2. Basic Medical Laboratory Science – I	100 hrs		
3. Basic Biochemistry	100 hrs		
4. Basic Medical Laboratory Science - II	100 hrs		

FINAL YEAR

Subject	Theory	Practical Hours	Total Hours
1.Chemistry Bio molecules & Clinical Biochemistry	100 hrs	1200 hrs	1600 hrs
2. Enzymology & Metabolism	100 hrs		
3. Pharmaceutical Chemistry & Toxicology	100 hrs		
4. Diagnostic Biochemistry & Endocrinology	100 hrs		

15. SCHEME & SCHEDULE OF EXAMINATION

There are four specialties in M.Sc. MLT course. First year shall be common to all the three specialities. In the second year the student will study subject of his/her specialization.

A) INTERNAL ASSESSMENT

1. Internal Assessment marks shall be awarded to the candidates in each paper as detailed in the Scheme of examination. The marks secured by the candidates in each subject shall be forwarded to the University 15 days before the University Examinations.
2. The marks of the internal assessment must be published on the notice board of the respective colleges.
3. If a candidate is absent from the test due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

There shall be minimum of two internal assessment examinations in 1st year & subject of specialty in 2nd year conducted by the colleges at regular intervals both in theory & practical which includes seminars. The average of best two examination Marks shall be taken into consideration by calculating marks for the internal assessment.

B) THEORY EXAMINATION

Theory main examination will be conducted yearly basis i.e. end of 1st year and 2nd year. Supplementary examination will conduct after 3 -4 months from publication of main examination.

C) PRACTICAL &VIVA

After theory examination practical & viva examination in respected subject shall be conducted by the University appointed Internal & External examiner.

D) DISSERTATION

The evaluation of the dissertation work will be on the basis of project contact, presentation, defense viva and valuation by the Internal & External examiners together, appointed by the University.

E) PATTERN OF QUESTION PAPER

Essay	4X10 = 40 Marks
Short Notes	8 X 5 = 40 Marks
	Total = 80 Marks

F) CRITERIA FOR PASS

- 40% of Marks in the University Theory Examination
- 50% of Marks in the University Practical Examination
- 40% of Marks in the Internal Assessment Marks
- 50% of the Marks in aggregate in theory, practical, IA and Oral.

G) CRITERIA FOR PROMOTION

Candidate, who fails in any subject, shall be permitted to continue the studies into the second year. However the candidate shall not be allowed to appear for the second year examination till such time that he/she passes all subjects of the first year M.Sc. MLT examination.

H) RULES FOR SUPPLEMENTARY EXAMINATION

No supplementary batch will be conducted for M.Sc. (MLT) course but supplementary examination will be conducted within six months after each regular examination. Candidate failing to secure minimum pass mark in any theory paper shall reappear for that paper only. Candidates who fail in the practical examination shall reappear for both practical and Viva voce in the supplementary examination.

I) DECLARATION OF CLASS

(1). Distinction - 75 % and above.
(2) First Class - 60 %and above, less than 75 %
(3). Second Class - 50 % and above, less than 60%.

Candidate who fail in the first attempt in any subject and pass in subsequent examination shall not be ranked in distinction or first class. Maximum number of attempts per subject is three inclusive of first attempt. The maximum period to complete the course successfully should not exceed 4 years.

J) SCHEME OF EXAMINATION

- FIRST YEAR

Subject	Theory	IA (Th)	Total	Practical + Oral	IA (Pr)	Total	Grand Total
1.Basic Science	80	20	100	-	-	-	100
2. Basic Medical Laboratory Science – I	80	20	100	80	20	100	200
3. Basic Biochemistry	80	20	100	80	20	100	200
4. Basic Medical Laboratory Science - II	80	20	100	80	20	100	200
Grand Total	320	80	400	240	60	300	700

BIOCHEMISTRY

Subject	Theory	IA (Th)	Total	Practical + Oral	IA (Pr)	Total	Grand Total
1.Chemistry Bio molecules & Clinical Biochemistry	80	20	100	80	20	100	200
2. Enzymology & Metabolism	80	20	100	--	--		100
3. Pharmaceutical Chemistry & Toxicology	80	20	100	--	--		100
4. Diagnostic Biochemistry & Endocrinology	80	20	100	80	20	100	200
5. Desecration	-	-	-	100	-	100	100
Grand Total	320	80	400	260	40	300	700

MINIMUM REQUIRMENT OF INFRASTRUCTURE, STAFF & FACULTY & LABORATORY FACILITIES FOR M.Sc. MLT COURSE

(Basis of 15 students each course)

6. Basic Infrastructure Applicable To All Four Specialities :-

I. Institute should have its own Hospital with full fledged Clinical Laloratory or its own diagnostic centre or own independent Clinical laboratory provided the above mentioned facilities fulfill the minimum work load criteria for each of the subject speciality mentiond here under.
II. One class room with capacity for 60 students measuring 500 sq. ft.
III. Four class room with capacity for 15 students measuring 300 sq. ft.
IV. Library:- Should be 800 sq. ft. and having more than 1000 books in related course.
V. Seminar Hall: - One seminar room measuring 500 sq. ft. with avoids – OHP, Slide Projector and computer, LCD Projector (optional).
VI. Other Infrastructure :- Principal room, Students common room, Teaching & non – teaching staff room, Office room, Store room, Boys & Girls separate toilet, Boys and Girls Hostel with canteen facilities and Playground etc.
VII.

7. Basic Laboratories :-
   Four labs with area of 500 sq. ft. each one lab for each subject infrastructure & instrument subject wise-

A. MICROBIOLOGY:-

a. Laboratory equipments

1. Auto clave
2. Hot air oven
3. Incubator
4. Centrifuge
5. Water distillation/Purification unit
6. PHmeter
7. Physical Balance
8. Digital Balance
9. Refrigerator
10. Microscope - Monocular 10
    - Binocular - 5
    - Dark field Microscope - 1
    - Fluroscent microscope - 1
12. ELISA reader
13. Anaerobic Jar
14. Micropipettes
15. Pressure cooker
16. Laminar air flow
17. Water bath
18. VDRL shaker
19. Deep freezer – 1

Apart from the above mentioned equipments necessary glassware, kits, chemicals as per the syllabus requirements should be made available in adequate quantity.

b. Minimum work load criteria for conducting M.Sc MLT course in Microbiology
100 different types of samples per day including serological tests

B. BIOCHEMISTRY:-

a. Laboratory equipments
1. Chemical Balance/single Pan Balance
2. Coloriemeter
3. Electrolyte analyser
4. pH meter
5. HPLC machine
7. Semi auto analyser
8. Auto analyser
10. Blood gas analyser
11. Refrigerator
12. Titration Appratus
13. Electrophorosis equipments

Apart from the above mentioned equipments, necessary glass ware, kits, chemicals, as per the syllabus requirements should be made available in adequate quantity.

b. Minimum work load criteria for conducting M.Sc MLT in Clinical Biochemistry.
100 different bio-chemical tests per day [Routine and special tests]

C. PATHOLOGY:-

a) Laboratory Equipments

1. Refrigerator
2. Micro oven
3. Microtome
4. Hot Air Oven
5. Water Bath
6. Coil Stone
7. Cooker – 5 lit.
8. Digital flame
9. Binocular Microscope
10. Monocular Microscope
11. Centrifuge
12. Autoclave
13. Automatic Tissue Processer
14. Ryle's tube
15. Urinometer
16. PH meter
17. Albuminometer
18. Specific gravity meter
19. FNAC Aspiration

b. Minimum work load criteria for conducting M.Sc MLT in Pathology.

100 different pathological tests per day [Routine and special tests]

D. HAEMATOLOGY & BLOOD TRANSFUSION

a. List of Equipments [Haematology]

Name of the Equipment
1. Blood cell counter - 1
2. Coagulometer 1
3. Spectrophotometer 1
4. Refrigerator - 165 lit 2
5. Hot air oven 1
6. Electronic Balance (Libror) 1
7. Water bath 1
8. Distilled water unit 1
8. Centrifuges 1
9. Hb Electrophoresis Machine 1(Tank, Scanner, monitor, Printer, CPU)
10. ELISA reader 1
11. pH meter 1
12. Autoclave 1
13. Microscope - Binocular 10
14. Haemocytometer One per student
15. Westergren pipette one per student
16. D C counters one per student
17. Calorimeter 1
18. Urinometer 1
19. Albuminometer 1
20. Blood Bank Refrigerator 2
21. Domestic Refrigerator 1
22. Centrifuge - 16 tube capacity 1
23. tube capacity 1
24. Water bath 1
25. Thawing bath 1
26. Microscope 1
27. Photoelectric Colorimeter 1
28. view box 1
29. Weighing Machine 1
30. Hot air Oven 1
31. Elisa Reader with washer 1
32. VDRL Rotator 1
33 .Donor cots with mattress and pillows 2 (ICU cots)
34. Blood collection Monitor 1
35. Spring Balance 2
36. Deep Freezer - 300C Horizontal 1
37. Deep Freezer - 700C Horizontal / Vertical 1
38. Platelet Agitator with Incubator 1
39. Refrigerated Centrifuge 1
40. Laminar Flow 1

41. Tube sealer 2
42. Cobe Spectra Cell Seperator 1
43. Couch 1 Optional
44. Automatic component extractor 1
45. Component weighing scale 1
46. Rough Balance 1
47. Oxygen cylinder

Apart from the above mentioned equipments necessary glassware, chemicals, kits, should be made available in adequate quantity.

b. Minimum work load criteria for conducting M.Sc MLT course- Haematology

100 samples per day Haematology Including Clinical Pathology samples Haematology samples should include following Special type of investigations

1. Haemolytic work up
2. Coagulation work up
3. Thrombotic work up

1st Year SYLLABUS

(Common to all streams)

1. BASIC SCIENCE (Paper – I) [Marks – 80]

A. HUMAN ANATOMY [Marks – 20]

Theory

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

1. **Skeletel System** - Development of bones, types of bones, Micro-anatomical and gross structure of bones, Osteology of human skeleton and various movement of joints.
2. **Muscular System**, Structure and type of muscles in human body, important muscles and their group action.
3. **Circulation System** - Structure of heart and blood vessels, Systemic circulation, pulmonary circulation, Portal circulation, and coronary Circulation.
4. **Lymphatic System** - orientation & origin of lymph, Lymph vessels, Lymph nodes and lymphoid organs, their structure and functions.
5. **Digestive System** - Gastrointestinal tract and associated glands (Salivary Glands, Liver, Pancreas etc).
6. **Respiratory System** - Respiratory tract,& various structure of the tract-Trachea, Lungs including other air passages.
7. **Urinary System** - Kidney, ureter and urinary bladder etc.
8. **Endocrine System** - Thyroid glands, Parathyroid glands, Adrenal glands and Pituitary glands.
9. Female and Male reproductive organs System.
10. Skin and its appendages,
11. Special sense organs: Eye, Ear, Nose Taste buds, subcutaneous sense organs.
12. Nervous system: brain, Spinal cord, Peripheral nerves.

B. HUMAN PHYSIOLOGY [Marks – 25]

Theory

1. **Blood: -** Blood volume, composition and function of blood, haemopoesis, blood coagulation, blood groups, and body fluids.

2. **Cardiovascular System :-** General plan of cirulatory system, function of heart and blood vessels (arteries, arterioles, capillaries and veins) heart sound and E.C.G. nervous control of heart and blood vessels, regular of blood pressure.

3. **Respiratory System: -** Functional anatomy of respiratory system, mechanism of breathing and exchange of gases in the lungs. Regulation of respiration, Oxygen and. carbondioxide carriage, anoxia, dysproes, cyanisis, artificial respiration and pulmonary function test.

4. **Gastrointestinal System: -** Alimentary canal and its various glands, digestion of food in mouth, stomach and small intestines, gastro-intestinal tract movements and absorption. Function of liver and metabolism.

5. **Excretory System: -** Structure and function of kidney and Urinary bladder, Structure and function of skin & lungs.

6. **Reproductive System:** Physiology of male and female reproductive System, Spermatogenesis, Sperm morphology, Menstrual cycle, ovulation,

7. Endocrine glands and their function. Regulation of endocrine secretion positive & negative feedback.

8. **Muscular System:-** Types of muscles, innervation of muscles, neuromuscular transmission, mechanism of muscular contraction.

9. **Nervous System: -** Neurone and its function, spinal cord and reflex action, sensory end organs and sensory path ways, cerebral cortex and motor path ways. Maintenance of posture and locomotion, automatic nervous system, Physiology of vision, hearing test and olfaction.

C. EPIDEMIOLOGY & PUBLIC HEALTH [Marks – 15]

1. Epidemiology - definition, concept and role in health and disease.
2. Definition of the terms used in describing disease transmission and control.
3. Modes of transmission and natural history of a disease
4. Measures for prevention and control of communicable and non-communicable disease.
5. Principal sources of epidemiological data.
6. Definition, calculation and interpretation of the measures of frequency of diseases and mortality.
7. Need and uses of screening tests.
8. Accuracy and clinical value of diagnostic and screening tests (sensitivity, specificity, & predictive values).
9. Causal Association & Various types of epidemiological study designs
10. Critical evaluation of published research.
11. Measures of Disease Frequency
12. Cross sectional studies
13. Case control studies
14. Cohort studies
15. Randomized controlled trial
16. Association and Causation
17. Bias and Confounding
18. History of Public Health
19. Organization of Health services

20. Health Care Delivery system
21. Health Economics
22. Health Planning
23. Concept of public health.
24. Principles of primary, secondary and tertiary care.
25. Planning of health services.
26. Health economics
27. Health manpower development-
    a) Basic O.T Practices
    b) Familiarity with use of Operating Microscope
28. NPCB and refractive blindness – optometrist's role as primary health care provides.
29. Health care's insurance including role of TPA.

D. BIOSTATISTICS & REASEARCH METHODOLOGY [Marks – 20]

A) RESEARCH METHODODLOGY

Theory

1. **Introduction to Research methodology:** Meaning of research, objectives of research, Motivation in research, Types of research & research approaches, Research methods vs methodology, Criteria for good research, Problems encountered by researchers in India.
2. **Research problem**: Statement of research problem. Statement of purpose and objectives of Research problem, Necessity of defining the problem
3. **Research design:** Meaning of research design, Need for research design, Features for good design, Different research designs, Basic principles of research design
4. **Sampling Design:** Criteria for selecting sampling procedure, Implications for sample design, steps in sampling design, characteristics of good sample design, Different types of sample design
5. **Measurement & scaling techniques:** Measurement in research- Measurement scales, sources of error in measurement, Technique of developing measurement tools, Meaning of scaling, its classification, Important scaling techniques.
6. **Methods of data collection:** collection of primary data, collection data through questionnaires & schedules, Difference between questionnaires & schedules.
7. **Sampling fundamentals**, need for sampling & some fundamental definitions, Important sampling distributions
8. **Processing & analysis of data:** Processing operations, problems in processing , Types of analysis, Statistics in research, Measures of central tendency, Dispersion, Asymmetry, relationship.
9. **Testing of hypothesis:** What is hypothesis? Basic concepts concerning testing of hypothesis, Procedure of hypothesis testing, measuring the power of hypothesis test, Tests of hypothesis, limitations of the tests of hypothesis.
10. **Computer technology:** Introduction to Computers, computer application in research, Computers & researcher.

BIOSTATISTICS :

Theory

1. **Introduction:** Meaning, definition, characteristics of statistics, Importance of the study of statistics, Branches of statistics, Statistics and health science including physiotherapy, Parameters and Estimates, Descriptive and inferential statistics, Variables and their types,

Measurement scales.
2. **Tabulation of Data:** Basic principles of graphical representation, Types of diagrams – histograms, frequency polygons, smooth frequency polygon, cumulative frequency curve, Normal probability curve.
3. **Measure of Central Tendency:** Need for measures of central Tendency, Definition and calculation of mean – ungrouped and grouped, Meaning, interpretation and calculation of median ungrouped and grouped., Meaning and calculation of mode, Comparison of the mean, median and mode, Guidelines for the use of various measures of central tendency.
4. **Probability and Standard Distributions:** Meaning of probability of standard distribution, The binominal distribution, The normal distribution, Divergence from normality – skew ness, kurtosis.
5. **Sampling techniques:** Need for sampling - Criteria for good samples, Application of sampling in community, Procedures of sampling and sampling designs errors, Sampling variation and tests of significance.
6. **Analysis of variance & covariance:** Analysis of variance (ANOVA), what is ANOVA? Basic principle of ANOVA, ANOVA technique, Analysis of Co variance(ANACOVA).

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2. BASIC MEDICAL LABORATORY SCIENCE - I (Paper – II)

[Marks – 80]

A. LABORATARY MANAGEMENT AND QUALITY CONTROL [Marks – 20]

THEORY

1. Quality control of product, chemical reagents, good reliable and authentic report, Total quality management framework of laboratory.
2. Essential elements of quality assurance programme, internal quality control, control of pre-analytical variable, laboratory precision, accuracy and sensitivity validation method.
3. Reference material and calibrating definitive method, source of variation in laboratory test result, systemic and random error in the laboratory.
4. Quality control chart—LJ chart, Culsum chart, Glossial curve
5. Internal and external factor for quality control assurance.
6. Standard Bio-medical Laboratory set up, management through the client, patient, physician, administrative authority,
7. Marketing, management and economics related to bio medical laboratory science, management objective, cost benefit analysis, cost effective analysis, and cost accounting input output analysis.
8. System analysis, network analysis including programme evolution and review techniques ad critical path method, planning to pro work sampling, decision monitoring, cost of conformance and non- conformance.

B. ADVANCED SERODIAGNOSTIC TECHNIQUE [Marks – 30]

Theory

1. Collection and preparation of specimen used in serological laboratory.
2. Principle of sero-diagnostic tests, precipitation, flocculation, agglutination, neutralization and coagulation.
3. Serological test for syphilis (STS) and VDRL, CRP, RPR test.

4. WIDAL test for Salmonella types.
5. Serodiagnosis test for AIDS, Rubella, Toxoplasmosis, Leishmaniasis, Trypanosonsiosis. TORCH panel test.
6. Immunological test for pregnancy.(direct and indirect)
7. Intradermal hypersensitivity test – Montouxe test.
8. ASO test.

Practical

1. Study of precipitation, agglutination and coagulation test.
2. VDRL test, WIDAL test, RPR, ASO test.
3. CRP test, RA test, AIDS test, STS test.
4. Immunological test for pregnancy.(direct and indirect)
5. Montouxe test.

C. LABORATORY ETHICS [Marks – 15]

Theory

1. Co- operation and working relationship with other health professionals
2. Principle of laboratory ethics, laboratory ethical committee, institutional ethical committee and its role, Introduction, techniques and Social ethics of pathology, ethics of pathological clinic.
3. ISO rules for laboratory medicine, NABL guidelines and its implication.
4. Confidentiality of patients information and test result and guidelines for laboratory reports, dignity and privacy of patients.
5. Responsibility from acquisition of the specimen to the production of data.
6. NACO guidelines for laboratory medicine.
7. CLSI guidelines clinical laboratory.

D. COMPUTER APPLICATION [Marks – 15]

Theory

1. Study on various components of a personal computer, hardware and software.
2. Computer Applications in pathological laboratory to recording and data presentation.
3. Basic knowledge and utility in multimedia in laboratories.
4. Application of the digital computer in patient maintaining, Basic knowledge on MS-office, Floppy recording, Storage of data in pathological laboratory.

Practical

a. Operation of personal computer.
b. Data storage, reporting, data presentation in computer.
c. Application of MS-office in pathological laboratories.

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3. BASIC BIOCHEMISTRY (Paper – III) [Marks – 80]

Theory

1. **Carbohydrate** – Definition, Source, Classification, Functions and Importance, Physiological importance of major type of carbohydrates.
2. **Protein** – Definition, Source, Classification, Function and Importance of major type of proteins.
3. **Lipids** - Definition, Source, Classification, Function of major type of lipids. Saturated and Unsaturated type of fatty acids, Essential fatty acids and their importance. Phospholipids and their importance.
4. **Nucleic acid** – Structure and function of DNA &RNA. Nucleosides and Nucleotides, Genetic code, biologically important nucleotides.
5. **Vitamins** – Fat-soluble and water-soluble vitamins, Daily requirements, Physiological functions and diseases of vitamin deficiency.
6. **Bioenergetics** – Energy rich compounds. Respiratory chain and biological oxidation.
7. **Enzymes** – Definition, Classification, Mode of action, Factors affecting enzyme action, Chemical importance of enzyme.
8. Concept of P^H and buffers, Acid-base equilibrium, Osmotic pressure and physiological importance.
9. **Electrolytes** – Sodium and potassium metabolism.
10. **Isotopes** – Isotopes and their role in treatment and diagnosis of diseases.

PRACTICAL

1. Qualitative identification of Glucose, Fructose, Lactose, Maltose, Sucrose, Starch, Peptone, Glycerol, Cholesterol, Acetone, Bile salt in sample by biochemical tests.
2. P^H determination of a solution by titration.
3. Quantification of Glucose, Lactose and Sucrose in a specific sample.
4. Preparation of different buffers used in pathological laboratory and their P^H determination.
5. Sodium and Potassium estimation in Serum.

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5. BESIC MEDICAL LABORATORY SCIENCE - II (Paper – IV)[Marks – 80]

A. MICROBIOLOGY [Marks – 20]

a) GENERAL MICROBIOLOGY

Theory

1. An introduction to microbiology, Classification of microorganisms,
2. Infection – Types, source, portals of entry, spread.
3. Prevention and control of infection, Disinfection and antiseptics Sterilization
4. Bacterial anatomy and nutrition.
5. Idea about different culture media and culture method, different staining - its procedure.
6. Introduction of Bacteriology, Virology and mycology.

b) SYSTEMIC MICROBIOLOGY

Theory

1. Diagnostic bacteriology, grouping, characteristics of common pathogen.
2. Laboratory diagnosis of mycotic infection.
3. Laboratory diagnosis of different parasitic infection of protozoa, helminth and arthropods.
4. Laboratory diagnosis of viral infection.

Practical

1. Sterilization techniques and cleaning of glassware.
2. Preparation of culture media, biochemical test for bacterial differentiation.
3. Examination of skin scapper fungi and Acid fast bacilli and examination of sputum for Acid fast bacilli.
4. Biochemical test for bacterial differentiation.
5. Gram staining: (gram positive and gram negative)
6. Collection, Presentation & Identification of different disease causing Arthopods (Housefly, Mosquito etc.)
7. Whole mount preparation of slide of different disease causing arthopods for their detailed anatomical studies.
8. Identification of different disease causing Helminth and Protozoan parasites.
9. Identification of different phases of life cycle of arthopods protozoa, helminth, having medical importance for causing disease.
10. Examination of stool for OPC (Ova parasite Cyst).

B. HEAMATOLOGY [Marks – 20]

THEORY

1. Cleaning of laboratory glassware in Haematology.
2. Blood sample collection by pricking method and brachial vein in adult and children.
3. Anticoagulants used for collection of blood samples with merits and demerits.
4. Separation of plasma and serum from blood.
5. Routine of haematological tests like Haemoglobin concentration, haematocrit, TC, DC of leukocytes, total count of Erythrocytes, determination of erythrocyte indices-MCV, MCH, MCHC, Reticulocyte count, platelets count, ESR.

6. Bleeding disorder—Determination of Clotting time, bleeding time and Prothrombin time.
7. Idea about Thalassaemia and Sickle cell anaemia, Importance of blood tests before marriage. Laboratory reports preparation and made interpretation of laboratory finding in haematology.
8. Haemostasis: Definition, types, clotting factors, Extrinsic and Intrinsic pathway, disorders.

PRACTICAL

1. Collection of blood sample from vein, Blood film preparation and it's staining.(Leishman Giemsa method)
2. Experiments on TC & DC, PCV, MCV, MCH, MCHC and ESR.(Wintrob method)
3. Determination of haemoglobin by haemoglobinometer and by colorimetric method.
4. Quantification of reticulocyte, thrombocyte and erythrocyte count.
5. Determination of Bleeding time and clotting time, PT.
6. Screening test for sickle cell anemia and slide identification of thalassaemia.

C. PATHOLOGY [Marks -20]

a)GENERAL PATHOLOGY

Theory

1. Aims and objectives of the study of pathology. Meaning of terms, etiology, pathogenesis and lesions
2. Causes of disease and cell injury – features of cell injury, mechanism of cell injury – hypoxia, free radical injury. Necrosis and gangrene
3. INFLAMMATION- definition, events of acute inflammation, chemical mediator of inflammation, morphological types of acute inflammation, chronic inflammation, difference between acute and chronic inflammation
4. REPAIR –primary healing, secondary healing, factors affecting healing and repair healing of skin, muscle and bone.
5. Fluid and hemodynamic derangements – oedema, hyperemia, Haemorrhage, shock, embolism, thrombosis, infarction
6. IMMUNITY – Classification of imunity, natural and acquired immunological mechanisms of tissue injury, hypersensitivity reactions, general features of autoimmune diseases and immunodeficiency diseases.
7. NEOPLACIA: characteristic of benign and malignant tumors, grading and staging of malignant tumors, a brief outline of the carcinogenic agents and methods of diagnosis of malignancy and general effects of malignancy on the host
8. Nutritional disorders: deficiency disorders (protein deficiency, vitamin deficiency (A,B,C,D,E,) causes , features , a brief outline of the methods of diagnosis.

b) SYSTEMIC PATHOLOGY

Theory

A brief outline of etiology, pathogenesis and general features of disease of the following systems.
(The morphology, microscopic details and details of diagnostic procedures are not required).
1. **Blood:** Disorders of RBC, WBC and platelets
2. **Blood Vessels:** Atherosclerosis, thromboangitis obliterence, vericose vein, DVT, thrombophlebitis, lymphoedema
3. **Disease of Heart:** Congestive cardiac failure, ischemic heart disease, rheumatic heart disease, infective heart disease (pericarditis, myocarditis, endocarditis)
4. **Respiratory System:** Pneumonias, Bronchiactesis, Emphysema, Chronic bronchitis, Asthma, Tuberculosis etc.
5. **Joints Disorders:** Arthritis- types and their features.
6. **Bone Disorders:** Osteoporosis, Paget's disease, Osteogenesis Imperfecta, Osteomylitis, tumors–Osteosarcoma, Chonrosarcoma, Ewings sarcoma, Multiple myeloma (a brief outline only)
7. **Muscles:** Muscular dystrophy, Myasthenia gravis
8. **Nervous System:** Meningitis, encephalitis, vascular diseases of brain, poliomyelitis, nerve injuries

c) Clinical Pathology:

1. Collection of urine and stool specimen, types of urine and stool specimen and preservation of urine and stool.
2. Routine examination of urine – physical and Microscopic examination.
3. Chemical test of urine for glucose, protein, Ketone bodies, bilirubin, urobilinogen & blood.
4. Laboratory investigation, Serous fluid and Gastric juice.
5. Collection and processing of CSF and its laboratory investigation.
6. Routine test for stool and occult blood test.
7. Examination of Sputum – routine and special test.
8. Semen Examination – routine and special test.
9. Various methods of detecting HCG level.

Practical

1. Physical and Microscopic examination of Urine.
2. Bio-chemical estimation of glucose in urine.
3. Bio-chemical estimation of protein and ketone bodies in urine, bile salt, bile pigment, urobilinogen and blood in urine.
4. Laboratory testing of CSF, Serus fluid, Gastric juice, and Synovial fluid.
5. Collection and processing of CSF and its laboratory investication.
6. Routine test and microscopical test for stool and occult blood test.
7. Examination of Sputum – routine and special test.
8. Semen Examination – routine and special test.
9. Various methods of detecting HCG level.

D. IMMUNOLOGY [Marks – 20]

Theory

1. Basic concept of Immune system. Types of immunity, cellular, humoral, active, passive, natural, and acquired immunity. Primary immune organs
2. Basic Concept of Antigen , Antibody & its components .
3. Immunity & Hypersensitivity reactions
4. Principles & practice of antigen – antibody reactions (Agglutination, Precipitation, complement , fixation , gel diffusion, toxin reaction, haemagglutination)
5. Basic Concept & techniques of studying cell mediated immune response.
6. Basic concept of immunization. Primary and secondary response of immunization. Vaccination and Booster dose.
7. Immunoglobins—type, structure and their specific importance.
8. Immunodeficiency diseases.
9. Immunosuppression - role of organ transplantation.
10. Auto immune disease: Hasimotor disease, myasthenia gravis, RA and Lupus erythromatosus.
11. Erthoblastosis foetslis

Practical

1. Determination of 'ABO' blood grouping and 'Rh' typing.
2. Antibody measurement by Radial immuno-diffusion (RID) technique.
3. Antigen-Antibody reaction testing by precipiting ring. Ouchterlony test.
4. Quantitative assay of Immunoglobins in plasma.(IgG,IgM)

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2nd YEAR (SPECIALIZATION)

1.CHEMISTRY OF BIO MOLECULE AND CLINICAL BIO CHEMISTRY (Paper – 1)

A. CHEMISTRY OF BIO MOLECULE

Theory

1. **Chemistry of living things**:

Structure of cell Plant, animal, bacteria and virus. Nucleus, organelle, cell- membrane. Structure and functions. Water-a medium for living things. Universal solvent, hydrogen bonds, colligative properties. Preparation of high quality water.

2. **Physical chemistry**:

Viscosity, surface tension, osmosis, Donnan membrane equilibrium, dialysis, diffusion, adsorption, partition coefficient- Principles and biochemical applications..

3. **Methodology:** Photometry, spectrophotometry ,fluorimetry, flamephotometry, Atomic absorption spectrophotometry, osmometrynephelometry.Chromatography, electrophoresis, electrochemistry, Biosensors, chemiluminesence, Flow cytometry. Homogenization, cell disruption, sonication, centrifugation and ultra centrifugation fractional distillation, solvent extraction ,liophilization.

General concepts regarding laboratory wares and its standardization.

Quantities and units: SI units- their advantages and disadvantages

4. Specimen collection, preservation and preparation for analysis, constituent stability, documentation and specimen flow system, interferences in the collection process. Anticoagulants and preservatives.
5. Regulations and precautions regarding transport of biological specimens.
6. Electrolytes, pH and buffers- pH meter, pH measurement, buffers, biological buffers.
7. **Radioactivity:** radioisotopes, ionizing radiations, measurement of radioactivity, applications of radioisotopes in clinical biochemistry and research, Storage and disposal of radioactive materials.
8. **Biomolecules** : Characteristics and properties. Proteins: Classification, properties and chemistry of amino acids and proteins, structure of proteins amino acid sequencing of proteins. Carbohydrates: Classification, Chemistry and properties. Lipids : Classification, Chemistry and properties.
9. **Bio-membranes:** Chemistry, structure, Transport process across bio-membranes. Nucleic acids : chemistry and properties – purines, pyrimidines, nucleosides, nucleotides, nucleic acids, nucleoproteins, genes and Chromosomes.

B. CLINICAL BIO CHEMISTRY

Theory

1. **Automation in the clinical biochemistry**: Precision, reliability, reproducibility and other factors in quality control. Normal values in health and diseases, radio isotopes in diagnosis; Specimen collection and processing (blood, urine and feaces); Storage of specimens; Quality control; Pre-analytical, analytical post analytical variables in quality analysis.

2. **Kidney, liver and gastric function tests**-Renal function tests,osmolarity and free water clearances, acute and chronic renal failure,Liver function tests : clinical features and

test based on excretory functions, metabolic capacity of liver, synthetic functions of liver, serum enzymes.Gastric function tests: collection of gastric contents, examination of gastric residium, FTM, stimulation tests, tubeless gastric analysis.

3. **Disorders of metabolism**: Carbohydrate metabolism: Diabetes mellitus, insulin receptors and C-peptide, assay of insulin, proinsulin and insulin antibodies. Hemoglobin A_1C, fructosamines, insulin tolerance test, Glycogen storage diseases, galactosemia,fructosuria, pentosuria; plasma lipids and lipoprotein abnormalities: hypercholesterolemia- lipidosis and hypolipoproteinemias, Taysachs and Niemann Picks diseases. Disorders of nucleic acid metabolism-hypo and hyperuricemia, gout; Disorders of erythrocyte metabolism- hemoglobinopathies, thalassemias and anemias
4. **Inherited disorders of metabolism:** Newborn screening: PKU, tyrosinemia, aminoacidurias, organic acidurias, porphyrias. Biochemical monitoring of therapy; prenatal diagnosis of inborn errors of metabolism, amniotic fluid and fetal blood examination; Acetylcholinesterase and other tests on amniotic fluid; chromosomal abnormalities by cytogenetics

5. **Molecular diagnosis of genetic defects:** Diagnosis of genetic diseases by molecular biology techniques (cystic fibrosis,Hemachromatosis, thalassemias, sickle cell diseases) DNA probes; restriction fragment length polymorphism (RFLP); polymerase chain reaction (PCR); amplification of mRNA. AIDS,Clinical diagnosis. Oncogenic enzymology: acid phosphatase, alkaline phosphatase, lactate dehydrogenase. Body fluid constituents of use in oncology.

6. **Biochemical aspects of hormone**: Hormone receptors and intra cellular messengers, adenylate cyclase, protein kinase and phosphor di esterage.

PRACTICAL:

1. Estimation of blood glucose by Folin Wu Method, Ortho-Toluidine method & God-Pod method.
2. Estimation of protein by Biuret method, UV method
3. Estimation of Serum creatinine by jaffe's method
4. Estimation of Urea in blood sample by biuret method
5. Estimation of total cholesterol by CHOD/POD method
6. Estimation of Triglyceride by GOP/PA method.
7. Estimation of HDL cholesterol by Precipitation method.
8. Estimation of SGOT in blood sample by kinetic method
9. Estimation of SGPT in blood by kinetic method
10. Estimation of Alkaline phosphatase by Kinetic method
11. Estimation of Acid phosphatase in blood sample by Kinetic method
12. Estimation of bilirubin by Kinetic method
13. Estimation of Na^+, K^+ and Ca^{++} by flame photometer and electrode analyzer
14. Estimation of common parameters in urine through use of strips
15. Estimation of T3, T4, TSH by ELISA method
16. Isolation on DNA from blood sample
17. Protein profiling of blood sample by electrophoretic technique
18. Electrophoresis: Native, SDS-PAGE of blood sample.
19. Protein purification by : a) TCA precipitation b) Ammonium Sulphate c) ACE

B. ENZYMOLOGY AND METABOLISM (Paper – II)

A.ENZYMOLOGY

1. Historical perspectives, General Characteristics, nomenclature and IUB enzyme classification (rational, overview and specific examples) introduction to the following terms with examples - Holoenzyme, apoenzyme, cofactors, co enzyme, prosthetic group, metallo enzyme measurement and expression of enzymatic activity, Enzyme assay activity units (I.U. and metal) Enzyme specificity types and theories (Lock and key, induced fix and three points attachment) Riboenzymes and Abzymes. Isolation and purification of enzyme, criteria of homogeneity of enzymes.

2. Factor affecting enzyme activity enzyme concentration, substrate concentration, pH and temp. Derivation of michoulis maintain equation of unisubstrate reaction km and its significance, Kcat / KM and its importance, measurement of Km and Vmax line linevavarburk and other linear transformation, Bisubstrate reaction. Enzyme inhibition, types of reversible inhibition competitive, uncompetitive, derivation of equation for different types of inhibitors, determination of Ki.

3. Role of cofactor in enzyme catalysis NAD+/HADP, FMH / FAD coenzyme A, TPP, PLP, Lipic acid, Vitamin B12 and tetrahydrofalic. Factors contibutic to enzymatic catalysis proximity and orientation, acid base catalysis, covalent catalysis mechanism of action of chymotrypsin and Lysozyme.

4. Control of enzyme aciticvty feed back inhibition, allsotric control with special reference to asparate trans carbomylase. Sigmodial kinetics, concrted and sequential model for action of allostric enzyme. Reversible and irreversible modification of enzyme.

5. Protein legend interaction. Biding of protein to legend having single binding site and two binding site, cooperatively phenomena and Scatchared plot. Clinical significance of CPK, CK MB, LDH, SGOT, SGPT, Cholinestrase amylase, lipase aldolase alkaline and acid phosphate.Central of enzymatic activity feed beck inhibition.

B. METABOLISM

1. **Metabolism of Carbohydrates-**glycolysis-reactions, Metabolism of sugars other than glucose, fructose galactose and mannose-energetics and regulation(hormonal, allosteric and feed back) Gluconeogenesis-reactions and regulation.Coricycle, glyoxylate pathway, pentose phosphate pathway.Alternative oxidative pathway of glucose.Uronic acid pathway, phosphoketolase pathway.
2. **Metabolism of glycogen**Glycogen breakdown, synthesis, regulation.
3. **Citric acid cycle-**reactions, enzymes amphibolic nature of the cycle, anaplerotic reactions.Regulation.
4. **Biosynthesis of urea-** Conversion of aminoacids to histamine, polyamines, serotonin, epinephrine, and norepinephrine γ aminobutyrate.

5. **Metabolism of purine and pyrimidine nucleotides-**biosynthesis and catabolism-inter conversion - uric acid formation, regulation, Heme synthesis and degradation
6. **Hormonal regulation of metabolism-**Role of Insulin, glucagon, epinephrine-intracellular receptor and cell surface receptors signalling: Cyclic AMP-dependent protein kinase; Cyclic GMP-dependent protein kinase; Protein kinase C; Ca^{2+}-calmodulin-dependent protein kinases; AMP-dependent protein kinases. Receptor tyrosine kinases, Regulation of glycogen synthesis, degradation and glucose transport.
7. **Metabolomics-**Introduction to the origin of metabolomics, definition metabolite,metabolome, applications of metabolomics in toxicity assessment, toxicology, metagenomics.
8. **Lipid Metabolism:Fatty acid oxidation-** α, β, ω oxidation. Catabolism of unsaturated fatty acids, formation and utilization of ketone bodies.
9. Fatty acid biosynthesis-regulation,Synthesis and breakdown of traicylglycerols-regulation.Phospholipids and glycolipid metabolism-glycerophospholipids, sphingolipids, sphingoglycolipids.
10. **Cholesterol metabolism** Cholesterol biosynthesis and regulation. Transport of cholesterol-LDLreceptor pathway.Cholesterol catabolism-Synthesis of bile acid.Lipoprotein metabolism-Chemical composition, biological functions and metabolic fate of VLDL, LDL and HDL. Arachidonic acid metabolism-leukotrienes and prostaglandins.
11. **Metabolism of proteins and amino acids:** Catabolism of proteins and individual amino acids-regulation.

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3. PHARMACEUTICAL CHEMISTRY AND TOXICOLOGY

[Paper – III]

1. Drug

Classification and nomenclature, some medicinally important inorganic and organic compounds and (any four with structure)and their biological role.Chemical structure and pharmacological activity: effects of some functional group- unsaturation, chain length, isomerism, halogens, amino group, nitro and nitrite compounds, nitrite acidic groups, aldehyde and ketone group, hydroxyl group, alkyls. etc. Pharmaceutical aids: organic pharmaceutical aidspreservatives, stabilizing and suspending agents, ointment bases and related agents and solvents.

2. Drug designing and screening

Physiological properties evolved in the design and preparation of dosage forms-hydrogen ions concentration, pH and buffers-colloidal state, membrane phenomena, osmosis, adsorption, surface tension, viscosity, ionization constants, chelation-importance of chelation inmedicine, design of antibacterial and antifungal agents. Biological testing of drugs: testing drugs in-vitro enzyme inhibition, receptor studies, safety and efficacy, microbiological testing, screening and testing by NMR , testing drugs in vivo: test systems drug potency, therapeutic ratio. Use of cell lines and animal models. Placebo controlled studies. Safety evaluations, followed by efficacy studies.

3. Analytical techniques

Radio pharmacy: Label ling studies, isotopes, synthesisincorporation of D or T or C isotopes, Radio active isotopes, units of radioactivity, measurements- Gieger Muller counter, scintillation counters, radio immunoassay. Cancer chemotherapy-radioactive isotopes. X ray crystallography, comparison of physiochemical data with bioactivity. Standard operating procedures while handling radioactivematerials.

4. General and Systemic Toxicology

General toxicology: Mechanism of toxic effect, toxicokinetics-chemical carcinogens and teratogens, treatment of intoxication. Response of respiratory system, reproductive system, liver, kidney to toxic agents. Toxic effects ofmetals, solvents, environmental pollutants.

5. Pharmacokinetic analysis

Bioavailability of drugs-role of bioenhancers. Entry routes for drugs, factors that affect drug distribution, drugmetabolism, renal excretion of drug. Drug clearance: renal clearance, plasma clearance. Drug absorption and elimination.

TOXICOLOGY

Theory

1. Fundamentals of Toxicology and dose-Response Relationships: Introduction Biomarkers Criteria of Toxicity New Technologies Evaluation of Toxicity Interactions; Dose Response; Measurement of Dose-Response; Relationships Linear Dose Response Hormesis; Hazard and Risk Assessment Duration and Frequency of Exposure and Effect
2. Factors Affecting Toxic Responses: Disposition : Absorption ,Sites of absorption, distribution, Excretion; Metabolism: types of Metabolic change phase I reactions; Phase 2 reactions; control of Metabolism, Toxication vs. Detoxication
3. Toxicity testing; Test protocol, Genetic toxicity testing & Mutagenesis assay: *In vitro* test systems: bacterial mutation tests-Reversion test,Ames test, Fluctuation test, and Eukaryotic mutation test. *In vivo* test system Mammalian mutation test-Host mediated assay and Dominant Lethal test. Biochemical basis of toxicity: Mechanism of toxicity: Disturbance of excitable membrane function, Altered Calcium homeostasis, Covalent binding to cellular macromolecules&genotoxicity, Tissue specific toxicity
4. Toxic Responses to Foreign Compounds: Direct Toxic Action: Tissue Lesions; Mechanism and response in cellular toxicity, pharmacological, physiological and Biochemical effects; Developmental Toxicology-Teratogenesis; Immunotoxicity Genetic Toxicity; Chemical Carcinogenesis
5. Biochemical Mechanisms of Toxicity:Tissue Lesions: Liver Necrosis; kidney Damage; Lung Damage, Liver damage, Cardiac damage; Neurotoxicity; Exaggerated and Unwanted pharmacological effects; Physiological effects; Biochemical Effects: Lethal Synthesis and Incorporation, Interaction with specific Protein Receptors; Teratogenesis; Immunotoxicity; multi-Organ Toxicity.
6. Toxicology Analysis – Action, detection and quantification of common drugs in therapy and toxic agents. Digoxin, lithium, salicylates, paracetamol, barbiturates, alcohol, morphine derivatives, amphetamines, lead, iron, mercury, carbon monoxide, organophosphates, carbamates and cyanide.

4. DIAGONOSTIC BIOCHEMISTRY AND ENDOCRINOOGY [Paper – IV]

A.DIAGONOSTIC BIOCHEMISTRY

Theory

1. Liver diseases and diagnostic tests for liver diseases.
2. Pathophysiology of diabetes mellitus and related disorders, diagnostic tests for DM
3. Renal Diseases, tests for diagnosis of renal diseases
4. Pancreatic Function test
5. Intestinal function test
6. Gastric function test
7. Thyroid function test
8. Cardiac function test
9. Feto-Placental function test
10. Acid-base balance and diagnostic test for acid-base disorders
11. Diseases of CNS
12. Renal and pancreatic calculi.
13. Acute phase proteins:- Diagnosis and significance of C-reactive proteins, alpha feto proteins,
14. Chemiluminescence and its instrumentation types and application.
15. ECLIA, Advance ECLIA and CMIA technique.
16. Chromatography and HPLC system with application.
17. RT PCR
18. Pathophysiology of Cancer, Oncogens, Tumor suppressor genes, Apoptosis. Tumor markers their biochemical and pathological significance , use in management of benign and malignant tumors. Anti cancer drugs
19. Biochemistry of AIDS, Laboratory analysis, anti HIV drugs, prevention Biochemistry of ageing, Alzheimer‟s disease, Prions, Beta amyloid

B. ENDOCRINOLOGY

THEORY

1. Techniques followed in hormones assay and different types of standard curve used in immunoassay.
2. Different types of ELISA and steps for antibody coating, enzyme conjugate preparation, second
antibody preparation. Testing of hormone by ELISA.
3. Chemiluminescence's assay, Electrochemoluminance, Fluorescence Immunoassay (FIA).
4. Intra-assay and inter-assay co-efficient of hormones assay.
5. Sensitivity and cross-reaction specificity.
6. Standard curve plotting. Interpretation.
7. Different steps of RIA.
8. Assay of hormone by RIA.
9. Radiolabelling of hormones.
10. Recording of results. Interpretation.
11. Endocrine glands. Information on pituitary- gonadal axis, feedback system, function, pathophysiology (male

and female). Information on pituitary-thyroid axis, feedback system, function, goiter and goitrogens – its
pathophysiology. Inforamtion on pituitary-adrenocortical axis feedback system: Pathophysiology.
Information on pancreatic-hormones, regulation, function, disorders.
12. Dynamic Test on pituitary gonadal activities, thyroid activities, adrenal activities, pancreatic activities.
13. Hormonal disorders in diabetes mellitus- its types- symptoms, cause, management.
14. Diabetes insepidus- cause, symptoms and management.
15. Hypertension- Cause, symptoms and management. Obesity - Cause, symptoms and management.
16. Hypogonadism - Cause, symptoms and management. Sterility- Hypertension- Cause, symptoms and
management.
17. Goiter - Cause, symptoms and management. Adrenocortical syndromes- Cause, symptoms and
management. Growth hormone diseases

PRACTICAL

1. Instrument used in hormone assay
2. Programme in ELISA reader for hormone assay
3. Intra assay & Inter assay variation & cross reaction in hormone assay
4. Standard curve plotting
5.Assay of FSH, TSH, LH, GH, Insulin in ELISA
6.Assay of T3 andT4 in ELISA reader
7.Assay of Testosterone, E2, Progesterone in ELISA reader
8.Programming in Gamma counter for hormone
9.Standard curve in Gamma counter
10. Hormone assay in Gamma counter
11. Interpretation of results of LH, FSH, testosterone ,estradiol and PRL from same serum sample(As per sex)
12. Interpretation of results of TSH and T3 / T4from same serum sample
13. Quantification of blood iodine for the assessment of thyroid
14. Interpretation of results of insulin and C-peptide from same serum sample
15. Interpretation of results of ACTH and cortisol from same serum sample
16. Assesment of obesity by the estimation of lipid profile
17. Assesment of hypertension by the estimation of cholesterol
18. Assesment of atherosclerosis
19. Evaluation of autoimmune disorder in relation to pathophysiology of endocrine gland
20. Immuno endocrine evaluation with special reference to cytokines / growth factor.
21. LFT
22. GFR

DISSERTATION

Each candidate pursuing Msc. MLT course is required to carry out work on selected research to carry out work on selected research project/dissertation under the guidance of a recognised post graduate teacher in same field.

The dissertation/research project is aimed to train a graduate student in research methods and techniques. It includes identification of problem, formulation, formulation of hypothesis, search and review of the literature, design of the research study, collection of data, analysis of data, interpretation of results and finally frame conclusions.

The dissertation / research project should be written under following heading:

INTRODUCTION
AIMS OR OBJECTIVES OF STUDY
FORMULATION HYPOTHESIS
REVIEW OF LITERATURE
MATERIALS AND METHODS
RESULTS
DISCUSION AND INTERPRETATION
CONCLUSION
SUMMARY
REFERENCES
TABLES
ANNEXURE

SYNOPSIS

Every candidate should submit a synopsis to the registrar of the university in the prescribed format containing particulars of proposed dissertation work after obtaining ethical clearance from the Institutional Ethical Committee comprising principal and other senior faculty of the college within 6 months from the date of admission on or before the date notified by the university.

The synopsis shall be sent through the proper channel. Such synopsis will be reviewed and the dissertation topic will be registered by the university.

Synopsis should be written under following heading:-
Proposed research project topic
Introduction
Aim of Study
Objective of the study
Formulation hypothesis
Review of literature
Materials and methods
Statistics
References

The written text of synopsis shall not exceed 8(eight) pages including all the above mentioned topics.

DISSERTATION SUBMISSION

The candidate should submit their dissertation work at the end of 10 months of second year of the M.sc. MLT course.

The candidate should submit six (6) copies of dissertation (with hard binding) to the Principle/Head of the Institution. Institute shall be submitted four (4) copies of dissertation to the registrar on the 22nd month of the commencement of course on or before the date notified by the university.

EVALUATION OF DISSERTATION

Dissertation valuation of the candidates will be conducted by the Internal and External examiners together on the basis of work, presentation and defense viva at the time of second year M.sc. MLT practical examination.

STANDARD FORMAT OF DISSERTATION

The written text of dissertation shall not be less than 100 pages and shall not exceed 150 pages excluding references, tables, questionnaires and annexure. It should be neatly typed (font size 12 – Time New Roman or font size 123 Arial) in double line spacing on one side of the bond paper (A-4 Size) and bound properly. The Guide and the head of the Institution shall certify the dissertation.

CHANGE OF DISSERTATION TOPIC/ GUIDE

No change in the dissertation topic/guide shall be made without prior approval from the university.

ABSTRACT

Abstract provides a brief summary of the dissertation/thesis, summing up clearly the problem examined, the methods used, and the main findings. The abstract is a one-paragraph, self-contained summary of the most important elements of the paper. The abstract word limit is between 250 and 300 words. All numbers in the abstract (except those beginning a sentence) should be typed as digits rather than words. Key words (max.10) should be given, chosen from subject concerned headings. Each word should be separated by semicolon.

GENERAL PRINCIPLES

PAPER

Use only one side of high quality, plain white (unlined in any way) bond paper, minimum 20-lb weight, and "8 ½ x 11" in size. Erasable paper should not be used.

TYPE SIZE AND PRINT

The fond size should be visible to the reader, preferably Times New Roman 12 pt .No italicization.68 Size of the title should be 14 and bold; the size of sub-title should be 12 and bold. Print should be letter quality or laser (not dot matrix) printing with dark black characters that are consistently clear and dense. Use the same type of print and print size throughout the document.

PAGINATION

Number all of the pages of your document, including not only the principal text, but also all

Plates, tables, diagrams, maps and so on. Roman numerals are used on the preliminary pages (Pages up to the first page of text) and Arabic numerals are used on the text pages. The numbers themselves can be placed anywhere on the page, however they should be consistent.

SPACING

Use double spacing except for long quotations and foot notes which are single spaced.

MARGINS

Margin size; "generous"- Use plenty of room on the top, bottom, left & right (1"minimum). To allow for binding, the left hand margin must be 1.5". Other margin should be 1.0". Diagrams or photographs in any form should be a standard page size, or if larger, folded so that a free left-hand margin of 1.5" remains and the folded sheet is not larger than the standard page.

PHOTOGRAPHS

Professional quality black-and-white photographs are necessary for clear reproduction. Colors are allowed, but you should be certain the colored figure will copy clearly and will not be confusing when printed in black and white.

FILE FORMAT

Dissertation format should be in Doc (Ms Word document) or PDF (portable document Format), Image file in JPG or TIFF format and audio visual in AVI (Audio Video Interleave), GIF, MPEG (moving picture expert) files format.

LABELING ON CD

CD-ROM labeling should be standard and should contain title, Name of the candidate, degree name ,subject name, Guide name, name of the department, College, place and year.

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HAEMATOLOGY AND BLOOD TRANSFUSION

1. NEOPLASTIC AND NON- NEOPLASTIC CLINICAL HAEMATOLOGY [Paper – 1]

A. NEOPLASTIC

Theory

1. Principles of diagnosis of hematopoietic-Lymphoid neoplasm,Classification of hematopoietic neoplasm,
Classification of lymphoid neoplasm,Cancer biology
2. Molecular genetic of myeloid leukemia's, CBF translocation, RAR translocation, Molecular genetic of lymphoid leukemia's, tel gene translocation,E_2A translocation, Molecular genetic of non-Hodgkin lymphomalignancies, Complication of hematopoietic neoplasm: host defense defect, haemorrhagic, neurologic, metabolic complication, organ infiltration, ocular, renal, anemia, abdominal, musculoskeletal complications
3.Hematopoitic growth factor, their application in hematologic neoplastic conditions,Hematopoietic stem cell transplantation and its applications,Tumor antigens, Cytokines, interferon, interleukins, their role in hematologic neoplastic conditions
4.Classification of acute leukemia's--Acute lymphoblastic leukemia's, clinical features, diagnosis, classification and risk factor assessment.
5. Acute myelogenous leukemia's, epidemiology, clinical features, immunophenotypes, classification, clinicopathologic syndromes and special types,Myelodysplastic syndromes: classification, diagnosis, clinical features, pathogenesis, biologic features and lab findings
6. Chronic myeloid leukemia's: history, incidence, clinical features, diagnosis, bone marrow findings, cytogenetic findings, immunophenotypes and molecular findings, cellular and molecular pathogenesis
7.Polycythemia vera: history, epidemiology, clinical feature, blood and lab findings, bone marrow study, cytogenetic and pathogenesis
8.Myelofibrosis: History and pathogenesis, clinical features, lab finding and diagnosis
9.Chronic lymphocytic leukemia: Aetiology, clinical findings ,lab findings and staging
10.Non Hodgkin's lymphomas: aetiology, clinical features, classification and lab findings,Hodgkin Disease: Aetiology, epidemiology, clinical feature and staging and lab diagnosis,Plasma cell dyscrasis: Aetiology , cytogenetic and molecular biology, protein abnormalities, clinical features and lab diagnosis.

B. NON-NEOPLASTIC

Theory

1. Theories of Hematopoisis (origin and development of Blood cells) Normal Erythropoiesis, Role of Erythropoietin in Erythropoiesis, destruction of Erythrocytes Leucopoiesis (development and maturation of granulocytes and non-granulocytes),antigen independent and antigen dependent lymphopoiesis, Megakaryopoiesis-stages of megakaryocyte development and release of platelet, micro-megakaryocytes

2. Disorder of Red cell-Anemia-Definition, Normal Erythrocytes kinetics and pathophysiology, various classification of Anaemia and adaptive mechanism in Anaemia, Lab diagnosis of Anemia, Iron metabolism and Heme synthesis, Iron Deficiency in Anemia of chronic disorder, sideroblastic Anemia, hemochromatosis, porphyria. Hereditary disorders of Haemoglobin structures and synthesis.

3.Structural variants of haemoglobin, pathophysiology of structural haemoglobin variants, sickle cell Anemia with lab diagnosis, Thalassemia, definition, types of thalessemia including Alpha, Beta thalessemia, pathophysiology and lab diagnosis

4.Hemolytic Anemia-Classification, intrinsic and extrinsic, hemolytic Anemia, hereditary spherocytosis, hereditary elliptocytosis, PNH, G6PD and Pyruvate kinase deficiency, HUS, TTP, IDC,Immune hemolytic Anemia: classification ,pathophysiology and lab diagnosis,Megaloblastic Anemia, Pathophysiology and lab diagnosis.

5. Disorder of White Blood Cells: Neutriophilia, Luekemoid reaction, neutropenia, morphologic abnormalities of neutrophils, functional abnormalities of neutrophils, reactive eosinophilic and hyper eosinophilic syndrome, lymphocytosis, infectious mono neucleosis, lymphocytopenia

6. Hemostatic mechanisms, Disorder and Lab Diagnosis: Role of platelet in hemostasis, lab investigation of primary hemostasis,Secondary hemostasis, coagulation factors, coagulation pathways-intrinsic and extrinsic, fibrinolytic system, screening test for coagulation and fibrinolysis.

7. Platelet disorders in primary hemostasis, Von-Wille Brand disorder, factor VIII & IX deficiency, fibrinogen deficiency, lupus like anticoagulant, thrombosis and conditions pre-disposing to thrombosis, heparin anticoagulants.

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1. IMMUNO HAEMATOLOGY AND BLOOD BANKING

[Paper – II]

Theory

1. Basic Immunohematology: Blood group antigens, red cells membrane structure. Blood group antibody and complements Erythrocytes antigen and antibody, ABO and Rh system and other red blood cells and antigen and anti body, Immuno hematology test and procedures, factors affecting haemagglutination, compatibility testing, anti human globulin test, New techniques and automation.

2. Blood collection, donor registration, donor selection, medical history, phlebotomy and donor reactions, Blood processing test: guideline for blood transfusion and testing, Pre transfusion testing, Artificial blood and blood substitute

3. Component preparation and uses, Organization, planning and management of blood bank, Licensing of blood bank, Quality control in blood banking, Special situations hemapheresis, plasmapheresis and leucopheresis.

4. Flow cytometry: principle, instrumentation and application of flow cytometry, Advance monoclonal antibody testing and procedures, Advance cytogenetic method and their hematologic application, Molecular genetic and its application in hematology, PCR, hybridization, stem cell therapy and gene therapy.

5. Antibody screening & identification, blood tranfution reaction, quality assurance in transfusion service, special investigation in transfusion technology.

6. Transplantation immunology, immune-response to infectious disease, vaccines.

7. Immuno deficiencies – B cell, T cell, combined, phagocytic & compliment.

8. Cancer & the immune system

9. Auto immune blood diseases.

10. Separation of different cells in the blood.

Practical

1. Reagent Preparation of Blood Bank.
2. Determination of Blood groups.(forward grouping and reverse grouping). Idea about grading system. Detection of sub group of ABO system.
3. Determination of cross matching by blood group testing techniques, Coomb's test.(direct and indirect)
4. Fraction collection from Blood and it's storage.
5. Pre-transfusion blood screening.
6. Preparation of blood component.
7. Aphaeresis
8. Compatibility testing with its advanced techniques.
9. Hemapheresis, and plasmapheresis techniques.
10. Platelepheresis and its application
11. pH meter and its application
12. ABO antibody titration, Cold antibody titration & Anti-D Titration.
13. Preparation of antigen and standardising them.
14. Antiglobulin test
15. Du test.

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2. ADVANCED HAEMATOLOGY AND BLOOD TRANSFUSION (Paper – III)

1. Flow cytometry: principle ,instrumentation and application of flow cytometry

2. Advance monoclonal antibody testing and procedures
3. Advance cytogenetic method and their hematologic application
4. Molecular genetics and its application in hematology, PCR, hybridization, stem cell therapy and gene therapy.
5. Automation in blood coagulation techniques like coagulometer.
6. Transfusionology : - blood bank management and planning the receiving and recording the blood samples; indexing; maintaining the blood bank record; legal aspect in starting and running a blood bank; knowledge of maintenance and working of blood bank refrigerators, welkin coolers, refrigerated centrifuge incubators, ovens, autoclaves etc.
7. Transfusion reactions-recognition and investigations, action to take when transfusition reaction occurs; criteria used while selecting a blood donor; Special investigation in transfusion technology. Blood donation , Donor registration, Donor selection, Blood collection. Adverse donor reaction
5. Anticoagulants used to store blood
Changes occuring in the stored blood
6. Blood group systems - antigen - antibody reaction , ABO system- Forward grouping reverse group
7. Rh system Inheritence& nomenclature R h grouping - Rh antigen and antibodies DuVariant Anti D
Type of reagents and their application
8. Coomb's test - Application - DCT, ICT Rh antibody titre
9. Compatibility testing – Major Minor Coomb's cross match
10. Blood components - Indications preparation of blood components
11 Autologous transfusion
12. Transfusion transmitted disease
13. Haemolytic disease of the new born and exchange transfusion
14. Transfusion Therapy
15. Transfusion in Special Situations-Auto immune haemolytic anaemia
16. Transfusion reactions a nd Investigation of transfusion reaction
17.Transfusion transmitted Infections
18. Immunomodulation and Graft versus host reactions .
19. Haemapheresis-Definition, Types of pheresis ,Machines and Techniques.
20. Tissue banking
21. Cord blood banking
22. Stem Cell processing, Storage and Transplantation
23. Disposal of wastes and biologically hazardous substance in the blood bank
24. Medico legal aspects of blood transfusion
25. Technical advances and future trends in blood banking
26. Paternity Testing
27. Orientation of a routine blood bank
28. Quality Assurance - General condition, Equipment, Reagents, Donor processing
29. Drugs control regulation and Blood Bank.

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4. CLINICAL HAEMATOLOGY AND HAEMATOGENETICS (Paper – IV)

1. General aspects of blood cell formation, Sites of haemopoiesis. Blood coagulation and its pathway, Development of blood cells. Morphology and Regulation of heaemopoiesis.
2. Red cells - Basic aspects of anaemia definition, patho phsiology ,classification and clinical features. Investigation of a case of anaemia in general.
3. Microcytic hypochromic anaemias, Iron deficiency anemia, Sideroblastic anemia, Anaemia of chronic infection,Thalassaemia. Iron deiciency anaemia - Iron metabolism ,causes of iron deficiency, clinical features, laboratory investigations.
4. Macrocytic Anaemias Megaloblastic, Non megaloblastic, Megaloblastic anaemia - Etiology, clinical featurees, laboratory investigation. Pernicious naemia.
5. Normocytic normochronic anaemia, Anaemia in systemic disorders, Acute blood loss, Renal failure Liver disorders etc.
6. Disorders of Haemoglobin, Structure of Hb and Synthesis, Normal and Abnormal haemoglobins Hamoglobinspathies
7. Haemolytic anaemia, Definition, pathogenesis, classification, clinical features. Laboratory investigations to establish a case of haemolytic anaemia. Peripheral smear - spceific morphologic abnormalities
8. Aplastic anaemia, Pancytopenia.
9. Polycythaemia - classification, Clinical features, laboratory investigation
10. Leucocyte disorders, Leukaemoid reaction - type of leukaemoid and diagnosis. Myelodysplastic syndrome [MDS] Definition, Clinical features, peripheral smear and Bone marrow findings.
11. Leukaemias: Definition, classification -French- American-British [FAB],WHO-classification of acute leukaemias ,Diagnostic criteria , Cytochemical staining and Immunophenotyping, Chronic Leukaemias: classification, Diagnostic criteria, Myeloproliferative disorders - classification ,Clinical features, laboratory investigations. Chronic myeloid leukaemia in detail.
12. Lymphoproliferative disorders - Chronic lymphocytic leukaemia in detail.
13. Plasma cell disorders - classification. Plasma cell myeloma - definition. Clinical features, laboratory investigations.
14. Haemorrhagic disorders: Definition: Pathogenesis, clinical features, Classification: Vascular disorders, platelet disorders,Coagulation diorders Fibrinolysis.
15. Platelet disorders: Quantitative - Thrombocytopenia - Idiopathic thromobcytopenic purpura (ITP)Classification, clinical featrues, diagnosis and B.M findings in ITP. Qualitative platelet disorders.
Thromobcytosis - Definition, Etiology, Lab Investigations.
16. Coagulation disorders - Inherited -Haemoplulia Aand B von Willebrand's disease Acquired: Vit. K deficiency, Liver disease, DIC,
17. Investigation of Haemorrhagic disorders. Tests of vascular and platelet function - Bleeding time, Clot retraction ,Patelet count. Platelet aggregation studies. Bone marrow examination.
18. Tests for coagulation disorders: Screening tests- First line tests -Prothrombin time (PT) Activated partial thromboplastin time(APTT) Thrombin time (TT),Second line tests - Mixing experiments.Coagulation factory assay. Urea solubility tests for Factor XIII. Factor VIII inhibitor study.Fibrinogen assay.
19.Disseminated intravascular coagulation- Definition, Pathogenesis, laboratory investigations Thrombotic disorders: Classification - Inherited and Acquired. Clinical features, Investigation of thrombotic disorders:Tests: i. Protein C ii. Protein S,
20.Antiphospholipid antibody syndrome: Defintion clinical feature laboratory investigation.
21.B.M.Examination- Aspiration and Trephin biopsy staining
22. Automation in haematology Organisation and quality control in the laboratory Preparation of Reagents, Diluting fluids,Stains - Leishman's stain,Geimsa stain

M. G. G. stain
- LE cell phenomenon and various methods of its demonstration , clinical importance
- Haemostatic mechanisms and theories of blood coagulation
- Physiochemical properties of coagulation factors
- Screening coagulation procedures
- Quantative essay of coagulation factors

Basic principles and clinical aspects of cell counter,Electrode analyzer, Artial blood gas analyzer

23. Immunogenetics; pre-natal diagnosis – chorionic villus sampling, amniocentesis.
Pre-implantation diagnosis.
Genetic diagnosis.
Genetic counseling.
Gene therapy-concept, vectors, gene targeting and tissue specific expression.
Ethics and human genetics.

PRACTICAL

1. Osmotic fragility test
2. Sickling test
3. Kleihaure acid elution test
4. Alkali denaturation test
5. Ham's test ,Sucrose lysis test
6. Coomb's test
7. Electrophoresis - HbF, HbA2 estimation
8. Tests for G6PD deficeiency
9. Preparation of Reagents, Diluting fluids,Stains - Leishman's stain, Geimsa stain, M. G. G. stain
10. Blood coagulation factor assay.
11. Determinaton of thalassaemia.
12. Automation in haematology. (backman coulter counter and electrical impedance).
13. ESR estimation.
14. Prothrombin time (PT), Activated partial thromboplastin time (APTT), Thrombin time (TT).
15. Hb electrophoresis and HPLC assay.
16. Screening test for anemia, slide identification of sickle cell anemia.