Baba Farid University of Health Sciences

Ordinances

Bachelor of Science in Medical Laboratory Technology
B.Sc.(MLT)

(Three and half years Degree Programme including six months Internship)

(Applicable w.e.f. academic session 2019-20)

Faridkot -151203

Ordinances
Bachelor of Science in Medical Laboratory Technology
B.Sc. (MLT)

1. Duration of course

Duration of course shall be three and half years including six months Internship.

2. Admission criteria and qualifications:

The students shall be admitted as per the admission criteria and qualifications prescribed in the Notification issued by the Government of Punjab or by Baba Farid University of Health Sciences, from time to time.

3. Medium of Instructions

The medium of instruction during the course and examinations shall be English.

4. Examination Schedule

4.1 The examination shall be held twice a year in the months of May/June and November/December or on such other dates as may be decided by the Board of Management on the recommendation of Faculty of Medical Sciences and Academic Council.

4.2 Normally, the University shall conduct not more than two examinations in a year, for any subject, with an interval of not less than four and not more than six months between the two examinations.

4.3 Normally, the last dates for receipt of examination form and late fee in the University Office shall be as under:-

Examination Session	Date for without late fee	Date with late fee of Rs.200/-	Date with late fee of Rs.500/-	Date with late fee of Rs.1500/-
May/June	March 1	March 15	March 31	April 15
Nov./Dec.	Sept. 15	Sept. 30	Oct. 15	Oct. 31

4.4 In the case of late declaration of result due to any reason, the last dates for receipt of examination form and fee in the University Office shall be as under:-

Up to 15 days from the date of declaration of result	Up to 30 days from the date of declaration of result	Up to 45 days from the date of declaration of result	Up to 60 days from the date of declaration of result
Without Late Fee	With a late fee of Rs.200/-	With a late fee of Rs.500/-	With a late fee of Rs.1500/-

Note: 1. Examination Fee including cost of form should be submitted in the shape of Demand Draft in favour of "The Registrar, BFUHS" payable at Faridkot.

2. The Vice chancellor may permit acceptance of admission form and fee ten days before the commencement of examination with a late fee of Rs.5000/.

5. First Year B.Sc. Medical Laboratory Technology Examination:

The First Year B.Sc. Medical Laboratory Technology Examination shall be open to a person who

a) has been enrolled for one academic year preceding the examination in a College of Health Sciences affiliated to this University.

b) has his/her name submitted to the Registrar by the Principal of the college with the following certificates:-

i) of having attended separately in theory and practical/clinical not less than 75% of the lectures delivered and practicals conducted in each of the subjects prescribed for the examination provided that deficiency in the number of lectures delivered and practicals conducted may be condoned by the Principal to the extent of 5% of the lectures delivered.

ii) of having secured at least 35% marks of the total marks fixed for internal assessment in each subject, separately, in order to be eligible to appear in all University examinations.

iii) of good moral character.

Note: If a candidate fulfils the condition laid down in clause 5(a) & (b) above for one or more subject (s) he/ she may be allowed to take the examination in such subject (s) in which he/ she fulfils the requirements.

(c) The First Year B.Sc. Medical Laboratory Technology Annual Examination shall be held in May/June and the supplementary within six months of the annual examinations.

d) The First Year B.Sc. Medical Laboratory Technology examination shall be in the following subjects and candidate shall be required to pass all the subjects:-

Sr. No.	**Subject**	**Theory**				**Practical**			**Grand Total**
		Marks	Int. Assessment	Oral/Viva	Total	Marks	Int. Assessment	Total	
1.	Basic Principles of Biochemistry	100	20	20	140	40	20	60	**200**
2.	Fundamentals of Histopathology/ Histotechnology and Cytology	100	20	20	140	40	20	60	**200**
3.	Basic Techniques in Laboratory Haematology, Blood Banking & Clinical Pathology	100	20	20	140	40	20	60	**200**
4.	General Microbiology	100	20	20	140	40	20	60	**200**
5.	English*	80	20	-	100	-	-	-	**100**

*Note: The Examination in the subject of English will be conducted at College level and minimum pass marks shall be 35% and marks will be sent to the University for final inclusion in the result.

6. Second Year B.Sc. Medical Laboratory Technology Examination:

The Second Year B.Sc. Medical Laboratory Technology Examination shall be open to a person who

a) has been enrolled for one academic year preceding the examination in a College of Health Sciences affiliated to this University.
b) has previously passed the First Year B.Sc. Medical Laboratory Technology examination of this University or an examination of any other recognized University/Institution in India considered equivalent for the purpose by the University.
c) has his/her name submitted to the Registrar by the Principal of the college with the following certificates:-

i) of having attended separately in theory and practical/clinical not less than 75% of the lectures delivered and practicals conducted in each of the subjects prescribed for the examination provided that deficiency in the number of lectures delivered and practicals conducted may be condoned by the Principal to the extent of 5% of the lectures delivered.
ii) of having secured at least 35% marks of the total marks fixed for internal assessment in each subject, separately, in order to be eligible to appear in all University examinations.
iii) of good moral character.

Note: If a candidate fulfils the condition laid down in clause 6 (a), (b) and (c) above for one or more subject (s) he/ she may be allowed to take the examination in such subject (s) in which he/ she fulfils the requirements.

(d) The Second Year B.Sc. Medical Laboratory Technology Annual Examination shall be held in May/June and the supplementary within six months of the annual examinations.

(e) The Second Year B.Sc. Medical Laboratory Technology examination shall be in the following subjects and candidate shall be required to pass all the subjects:-

Sr. No.	Subject	Theory				Practical			Grand Total
		Marks	Int. Assessment	Oral/Viva	Total	Marks	Int. Assessment	Total	
1.	Analytical Biochemistry & Metabolism	100	20	20	140	40	20	60	**200**
2.	Basic Cellular Pathology, Allied Techniques & Cytology	100	20	20	140	40	20	60	**200**
3.	Fundamentals of Haematology	100	20	20	140	40	20	60	**200**
4.	Systemic Microbiology including Mycology & Parasitology	100	20	20	140	40	20	60	**200**

7. Third Year B.Sc. Medical Laboratory Technology Examination:

The Third Year B.Sc. Medical Laboratory Technology Examination shall be open to a person who

a) has been enrolled for one academic year preceding the examination in a College of Health Sciences affiliated to this University.

b) has previously passed the Second Year B.Sc. Medical Laboratory Technology examination of this University or an examination of any other recognized University/Institution in India considered equivalent for the purpose by the University.

c) his/her name submitted to the Registrar by the Principal of the college with the following certificates:-

i) of having attended separately in theory and practical/clinical not less than 75% of the lectures delivered and practicals conducted in each of the subjects prescribed for the examination provided that deficiency in the number of lectures delivered and practicals conducted may be condoned by the Principal to the extent of 5% of the lectures delivered.

ii) of having secured at least 35% marks of the total marks fixed for internal assessment in each subject, separately, in order to be eligible to appear in all University examinations.

iii) of good moral character.

Note: If a candidate fulfils the condition laid down in clause 7 (a), (b) & (c) above for one or more subject (s) he/ she may be allowed to take the examination in such subject (s) in which he/ she fulfils the requirements.

(d) The Third Year B.Sc. Medical Laboratory Technology Annual Examination shall be held in May/June and the supplementary within six months of the annual examinations.

(e) The Third Year B.Sc. Medical Laboratory Technology examination shall be in the following subjects and candidate shall be required to pass all the subjects:-

Sr. No.	Subject	Theory				Practical			Grand Total
		Marks	Int. Assessment	Oral/Viva	Total	Marks	Int. Assessment	Total	
1.	Clinical Biochemistry Methods	100	20	20	140	40	20	60	**200**
2.	Special Histology, Histochemical Methods, Immunopathology & Cytopathology	100	20	20	140	40	20	60	**200**
3.	Applied Haematology	100	20	20	140	40	20	60	**200**
4.	Applied Microbiology	100	20	20	140	40	20	60	**200**

8. Internal Assessment

i) Internal Assessment shall be submitted to the University at least two weeks before the commencement of theory examinations or within one week from the issuance of Roll Numbers by the University. All the colleges shall adopt uniform criteria for Internal Assessment as follows:-

a) Attendance above 90% to be acknowledged with 10% extra weight-age for Internal Assessment.

b) At least two tests to be held in each year in addition to the pre-final (send up) examination. The Internal Assessment should be the average of all awards of these tests taken together.

c) Criteria for calculation of Internal Assessment

i)	House Examinations	- 80%
ii)	Attendance (above 90%)	- 10%
iii)	Subject assessment (candidate's conduct and extra curricular participation)	- 10%

d) Additional mandatory requirement for Internal Assessment to be observed by all colleges.

i) All test marks obtained by candidates will be displayed on Notice Boards of respective departments as and when they are awarded.

ii) All computations of Internal Assessment of the entire class made by the HOD of the department shall be displayed on the notice board of the department showing individual test marks, advantage of all tests, attendance advantage and subjective assessment and the total Internal Assessment thus derived for at least one week before sending the awards to the Principal's office.

iii) Professor Incharge/HOD preparing Internal Assessment shall certify that the detailed assessment of the entire class has been displayed on the department Notice Board for at least one week prior to its being submitted for onward transmission to the University and that adequate opportunity has been given to all the students to file any objections and that the same have been addressed satisfactory.

iv) The Principal forwarding the Internal Assessment to the University shall countersign the above referred certificate of the HOD/Professor Incharge preparing the Internal Assessment.

e) The re-appear/fail students may be re-assessed for improvement in the Internal Assessment and awards of Internal Assessment of all the re-appear/fail students will be submitted to the University every time.

9. Promotion and number of attempts allowed

a) A candidate who fails in all the subjects in the First Year B.Sc. Medical Laboratory Technology examination shall not be promoted to Second Year class.

b) The candidate who will absent himself/herself from the examination will be deemed to have been failed in that subject.

c) A candidate who passes in at least one subject of University level First Year B.Sc. Medical Laboratory Technology examination will be permitted to attend classes of Second Year. However, he/she will be allowed to appear in the Second Year B.Sc. Medical Laboratory Technology examination only after passing all the subjects of First Year B.Sc. Medical Laboratory Technology Examination.

d) Candidate who passes in one or more subjects of First Year B.Sc. Medical Laboratory Technology examination shall be exempted from appearing in these subject at a subsequent examination, but the candidate must pass the examination in a maximum of four attempts (including first attempt, as a regular candidate), failing which he/ she shall not be allowed to continue his studies.

e) A candidate who fails in all the subjects in the Second Year B.Sc. Medical Laboratory Technology examination shall not be promoted to Third Year class.

f) A candidate who passes in at least one subject of University level Second Year B.Sc. Medical Laboratory Technology examination will be permitted to attend classes of Third Year. However, he/she will be allowed to appear in the Third Year B.Sc. Medical Laboratory Technology examination only after passing all the subjects of Second Year B.Sc. Medical Laboratory Technology Examination.

g) Candidate who passes in one or more subjects of Second Year B.Sc. Medical Laboratory Technology examination shall be exempted from appearing in these subject at a subsequent examination, but the candidate must pass the examination in a maximum of four attempts including first attempt, as a regular candidate plus one mercy chance at the discretion of the Vice-Chancellor, failing which he/ she will have to appear in all the subjects of the examination.

h) Candidate who passes in one or more subjects of Third Year B.Sc. Medical Laboratory Technology examination shall be exempted from appearing in these subject at a subsequent examination, but the candidate must pass the examination in a maximum of four attempts (including first attempt, as a regular candidate), failing which he/ she will have to appear in all the subjects.

10. Appointment of Examiners:

The examiners shall be appointed by the University on the recommendations of the Board of Studies in Medical Sciences (Undergraduates)/Faculty of Medical Sciences.

i) There shall be four examiners – two internal and two external.

ii) Professor& Head of the Department shall be the Convener. The second Internal Examiner will be appointed by annual rotation from amongst the Professors/Associate Professors/Assistant Professor with at least 3 years post PG teaching experience. In case of non-availability of Professors/Associate Professors/Assistant Professor in the department the teacher working in another Medical College affiliated to this University, who fulfils the minimum requirements

as per MCI norms for appointment as examiner may be appointed as Internal Examiner.

iii) The examiners shall be appointed by the University from the teachers working in the Medical Colleges affiliated to it, preferably from the colleges where this course is being run, on the recommendations of the Board of Studies in Medical Sciences and Faculty of Medical Sciences.

iv) In case of non-availability of External Examiners from amongst the affiliated colleges of BFUHS, External Examiners may be appointed from the colleges which are not affiliated to BFUHS, Faridkot, in and outside the State of Punjab.

11. Paper setting and moderation of Question Papers

Each theory paper shall be of three hours duration. The paper setting and moderation of Question Papers will be got done under the direction of the Vice-Chancellor, if necessary.

The question paper covering the entire course shall be divided into two sections. **All the questions shall be compulsory.**

Section A:

Question 1: This will consist of one long answer questions with answer up to 1000 words in length. This question will carry 20 marks.

Question 2: This will consist of one long answer questions with answer up to 500 words in length. This question will carry 10 marks.

Question 3: This will consist of four short answer questions with answer to each question up to 250 words in length. All questions will be compulsory. Each question will carry 5 marks total weight-age being 20 marks.

Section B

Question 1: This will consist of one long answer questions with answer up to 1000 words in length. This question will carry 20 marks.

Question 2: This will consist of one long answer questions with answer up to 500 words in length. This question will carry 10 marks.

Question 3: This will consist of four short answer questions with answer to each question up to 250 words in length. All questions will be compulsory. Each question will carry 5 marks total weight-age being 20 marks.

12. Evaluation of Answer Books

The answer books shall be got evaluated by putting fictitious roll numbers thereon or spot evaluation (table marking) or any other method under the direction of the Vice-Chancellor.

13. Minimum pass marks:

The minimum number of marks to pass the examination shall be 50% in theory including Internal Assessment & Oral/Viva and 50% in practical including Internal Assessment in each subject separately except in the subject of English where minimum pass marks shall be 35%.

A successful candidate on the basis of theory and practical marks taken together shall be classified as under: -

Second Class : A candidate obtaining 50% or more marks but less than 60% marks
First Class : A candidate obtaining 60% or more marks
First Class with Distinction : A candidate obtaining 80% or more marks

14. Grace Marks:

That the grace marks up to 5 (five) be given to the best advantage of the students irrespective of Theory or Practical examinations.

15. Declaration of Result

The Registrar/Controller of Examinations shall publish the result after the examination. The candidates shall be issued Detailed Marks Certificate through their Principals.

12. Internship

After successfully passing Third Year B.Sc.(MLT) examination the students shall undergo six months compulsory rotatory Internship as follows:-

Sr.	Department	Period of Internship
1	Biochemistry	One & Half Month
2.	Microbiology including Bacteriology, Mycology, Parasitology and Virology.	One & Half Month
3.	Pathology including Morbid Anatomy, Histotechnology, Electrone Microscopy, Cytology and immune Pathology.	One & Half Month
4.	Haematology including blood transfusion and Clinical Pathology	One & Half Month

16. Award of Degree

On successfully completion of six months compulsory rotatory internship, duly certified by the Principal of the College, the students shall be awarded the Degree of Bachelor of Science in Medical Laboratory Technology - B.Sc.(MLT).

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Syllabus for First Year B.Sc. MLT

Theory: 60 hours
Practicals: 250 hours

Paper – I : Basic Principles of Biochemistry

THEORY

Introduction: - Introduction to medical technology, role of medical laboratory technologists, ethics, responsibilities.

Digestion and absorption: - Carbohydrates, Proteins and fats.

Introduction (in short) and Properties: Carbohydrates, Proteins and fats.

Carbohydrates: - Introduction: Definition, Functions, Classification, Types (Monosaccharide, Disaccharide, Oligosaccharide & Polysaccharide)
Isomerism (Stereoisomerism, Optical, Epimers, Anomers, Mutarotation and enantiomers), Reducing properties (Oxidation and reduction), Glycosides.
Lipids : - Introduction: Definition, Functions, Classification, Types (Simple, Complex, Derived, Miscellaneous, Neutral Lipids). Essential fatty acids/Triacylglyerol/Phospholipids.
Antioxidants, Lipid Peroxidation.
Proteins, Amino Acids & Biologically important peptides:- Introduction, Functions, classification of proteins and amino acids, Types of biologically important peptide.

Properties: Isoelectric pH (Zwitter / Dipolar ions), Solubility, Molecular weight (proteins), Shape(Proteins), Acidic and basic proteins, Colour reaction of proteins, Denaturation of proteins. General properties of amino acids and proteins. General reactions of amino acids and proteins.

Safety measures for: - Corrosive chemicals, Toxic chemicals, Carcinogens, Explosive & Inflammable chemicals, infectious material (Biological material) with special consideration for AIDS and Hepatitis B & C, Electrical apparatus (centrifuge machines, water baths, Hotplates, Spectrophotometers, Flamephotometers) etc, Glass apparatus, Dispensers, Radiation Hazards, Low pressure systems (vacuum desicators), Disposal of specimens and contaminated materials, laboratory waste etc.

First Aid and emergency treatment in: - Chemical injuries, Mechanical and thermal injuries, Electrical injuries. Obtaining held from emergency drug supply, First Aid Boxes, Special procedures common to several emergency conditions and taking care of treatment of shock, unconscious patients, Artificial respiration, Cardiac message.

Storage of chemical with example of:-**Non corrosive, corrosive, & Light sensitive chemicals.**

Units:- Unit of measurements of enzymes, mass, length and volume: S.I. units etc.

Radioisotopes, their use in Biochemistry and Hazards of radio isotope biophysical chemistry:-

***Solutions:-** Mole, Molar and normal.

*** pH measurement, pH indicators, Buffer solutions, pH meter**

* Osmosis, Dialysis, Surface tension and colloids, Donnan's membrane equilibrium

Biological specimens:- Blood (Preparation of plain vial, vials with anticoagulants like EDTA vial, Blood sugar vial, Citrate etc vial), Urine & faeces collection. Separation of serum/plasma, Preservation of biological samples (Blood, Tissues, Urine, Faeces), disposal of biological samples and labelling of specimens.

Statistics:- Mean, SD, CV, Normal distribution, Probability.

Normal/ Reference Range':- of routine biochemical investigations

Practical

Cleaning & Care

- **General laboratory glassware**
- **Equipments (**Balance, colorimeter, Spectrophotometer, water bath, hot air oven, flamephotometer, centrifuge machine).

Distilled Water:- **Preparation, storage & check the purity of single, double and triple distilled water.**

Analytical Balance:- Definition, Types Cleaning and care

Use of indicators:- Universal, paper

Calibration and Measurement:- of Volumetric apparatus (Pipettes, Flask, Cylinder)

Qualitative Analysis in Urine: Interpretation/influencing factors, Determination/Procedure, Normal Values and physical examination of normal and abnormal urine.

Qualitative estimation in urine of:-

- Sugar
- Proteins
- Bile Pigments/Bile salts
- Ketone Bodies.
- Urobilinogen
- Hemoglobinuria
- Micro albuminuria
- Albumin creatinine ratio
- Bence Jones Proteins.

Concept of colorimeter & Spectrophotometer: - Principle, laws, working and types.

Routine investigations:- Principle, procedure, calculation, normal value and interpretation of

- FBS
- Blood urea
- S Creatinine
- TSP/DSP
- S. Uric Acid
- S. Bilirubin
- S. Cholesterol
- Chloride

Stool for occult blood

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Syllabus for First Year B.Sc. MLT

Paper – II

FUNDALMENTALS OF HISTOPATHOLOGTY/HISTOTECHNOLOGY & CYTOLOGY

Theory: 60 hours
Practicals: 250 hours

THEORY

SECTION – A

A. Introduction

i) Introduction to histopathology and laboratory organization
ii) Laboratory equipment, uses and maintenance
iii) Laboratory hazards and safety precautions
iv) Compound microscope-optical system, magnification and maintenance.

B. Fundamental of Histotechnology

i) Reception, recording and labelling of tissue specimens
ii) Fixation and various simple fixatives
iii) Processing of histological tissues for paraffin embedding.
iv) Embedding and embedding media
v) Decalcification
vi) Microtomes-various types, their working principle and maintenance.
vii) Microtome knives and knife sharpening (honing and stroping)
viii) Practical section cutting, cutting faults and remedies.
ix) Dye chemistry, theory and practice of straining – Haematoxyline and Eosin

C. Cytology

Collection and Processing of cytological specimen. Exfoliative Cytology and FNAC.

SECTION – B

Anatomy and Physiology

i) The anatomic and physiological organization of human body and integrated physiology
ii) Cell organization and function
iii) Skeletal system, bones, joints and muscles.
iv) Body fluids and their significance
v) Blood morphology, chemistry and function
vi) Respiratory system
vii) Cardiovascular system
viii) Alimentary system, mechanism and physiology of digestion and absorption.
ix) Liver structure, function and Gall bladder
x) Urinary system including prostate
xi) Male and female genital system including Breast
xii) Nervous System

xiii) Spleen, Lymph node and R.E. system
xiv) Endocrine gland and their functions.
xv) Skin

PRACTICAL

1. Identification of various histopathology equipments including microscope and its parts, microtomes, automatic tissue processor, centrifugation machine and others.
2. Perform section cutting by using microtome.
3. Perform processing of tissue for paraffin embedding.
4. Perform hematoxylin and eosin stain.
5. Process the cytological specimen given (e.g. sputum) and do the staining procedure.
6. Identify various organs given.

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Syllabus for B.Sc. (MLT) First Year

Paper – III

BASIC TECHNIQUES IN LABORATORY HAEMATOLOGY, BLOOD BANKING AND CLINICAL PATHOLOGY

Theory: 60 hours
Practicals: 250 hours

SECTION – A

1) Introduction to haematology and laboratory organization, Lab safety and instrumentation
2) Composition and functions of blood.
3) Formation of blood.
4) Various anticoagulants, their uses, mode of action and their merits and demerits.
5) Collection & preservation of blood for various haematological investigations.
6) Physiological variations in Hb, PCV, TLC and platelets.
7) Normal and absolute values in haematology.
8) Quality assurance in haematology.
9) Haemocytometery: procedures for cell counts, visual as well as electronic, red cell, leucocytes and platelet counts. Errors involved and means to minimize such errors.
10) Romanovsky dyes, preparation and staining procedures of blood smears.

SECTION – B

11) Morphology of normal blood cells and their identifications.
12) Erythrocyte sedimentation rate, factors influencing ESR and various procedures for its estimation with their significance.
13) Hematocrit value by macro and micro methods their merits and demerits.
14) Hemoglobinometry: various methods of estimation of Hb, errors involved and standardization of instruments.
15) Basic techniques in blood banking.
16) Semen analysis.
17) Examination of abnormal urine. Physical, chemical and Microscopic Examination.

PRACTICAL

1. Perform blood group on the blood specimen given.
2. Identify various antisera used in blood bank.
3. Perform cross matching on the blood specimen given.
4. Identify various hematological instruments eg. Vacutainer, pipettes and others.
5. Perform ESR.
6. Perform physical, chemical & microscopic examination of urine procedure.
7. Perform Hb estimation.
8. Making and staining of peripheral blood smear & to do DLC.
9. Perform TLC on neubauer's chamber.
10. Perform semen analysis.

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Syllabus for First Year B.Sc. MLT

Paper – IV : GENERAL MICROBIOLOGY

Theory: 60 hours
Practicals : 250 hours

THEORY

SECTION – A

1. General Bacteriology

1. Introduction & brief history of Microbiology- Louis Pasteur, Robert Koch, Joseph Lister, Paul Ehrlich, Edward Jenner
2. Safety measures in Microbiology
3. Principles and methods of sterilization
4. Uses and modes of action of antiseptics & disinfectants
5. Decontamination and disposal of contaminated material.
6. Biomedical Waste Management
7. General characteristics and classification of bacteria & fungi
8. Growth and nutrition of microbes.
9. Preparation uses and standardization of culture media
10. Aerobic and anaerobic culture methods
11. Collection, transportation and processing of clinical samples for Microbiological investigations.
12. Principles, functioning, care of microscopes i.e. Monocular/Binocular microscope, Dark ground microscope, Phase contrast microscope, Fluorescent microscope.
13. Principles of staining methods and preparation of reagents.
14. Laboratory organization, management, recording of results and quality control in Microbiology.

2. Immunology

1. Antigens
2. Antibodies
3. Antigen-Antibody reactions (Agglutination, Precipitation, ELISA etc)
4. Hypersensitivity

SECTION – B

1. Virology

1. General properties of viruses including Size, shape, symmetry. Cultivation of viruses by various methods, inclusion body formation and antiviral agents.
2. Classification of viruses by various methods
3. Lab diagnosis of viral infections, including collection, transportation processing and storage of various samples.

2. Parasitology

1. Introduction to Medical parasitology and safety measures.
2. Collection, preservation and processing of samples for parasites:- stool, blood, fluids.
3. General characters, classification of protozoa of medical importance.
4. Morphology, lifecycle, pathogenicity and lab, diagnosis of intestinal protozoa:- Entamoeba histolytica, Ent. coli, Giardia intestinalis, Balantidium coli, free living amoebae, Cryptosporidium, Isospora and Microsporidium.
5. Morphology, life cycle, pathogeniciy and lab. Diagnosis of haemoprotozoa:-

    - Genus, Plasmodium, Toxoplasma gondi.
    - Genus Leishmania
    - Genus Trypanosoma

PRACTICALS

General Microbiology

1. Safety measures in Microbiology
2. Care & maintenance of laboratory equipment
3. Methods of Sterilization
4. Handling & cleaning of glassware apparatus
5. Decontamination & Disposal of contaminated material.
6. Biomedical Waste Management
7. Preparation, uses & standardisation of culture media
8. Culture techniques
9. Anaerobic culture methods
10. Collection of various samples for microbiological investigations
11. Transport media
12. Staining methods- Simple staining, Gram's staining, Z.N staining

Virology

1. Collection, handling, storage of samples for viral diagnosis.
2. Washing, cleaning and sterilization of Media and glassware in virology
3. Use and sterilization of pipettes, syringes and other viruses contaminated instruments in the laboratory.
4. Demonstration of preservation of viruses, viral antigens and infected biological materials.
5. Usage of Laboratory animals

Parasitology

1. Stool examination:- Methods of collection, transportation and processing of stool samples for intestinal protozoa.
2. Examination of vaginal secretions for T. vaginalis.
3. Preparation of blood films for demonstration of haemoprotozoa.
4. Staining techniques and examination of cysts of Cryptosporidium parvum.

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Syllabus for B.Sc. (MLT) First Year

PAPER - V

ENGLISH

Theory : 35 hours

Communication:-

Role of communication Defining Communication Classification of communication Purpose of communication
Major difficulties in communication Barriers to communication
Characteristics of successful communication – The seven Cs Communication at the work place
Human needs and communication "Mind mapping" Information communication

Comprehension passage:-

Reading purposefully
Understanding what is read
Drawing conclusion
Finding and analysis

Explaining:-

How to explain clearly
Defining and giving reasons
Explaining differences
Explaining procedures
Giving directions

Writing business letters:-

How to construct correctly
Formal language
Address
Salutation
Body
Conclusion

Report writing:-

Reporting an accident
Reporting what happened at a session
Reporting what happened at a meeting

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Syllabus for Second Year B.Sc. MLT

Theory: 60 hours
Practicals: 250 hours

PAPER – I : ANALYTICAL, BIOCHEMISTRY AND METABOLISM

Theory

Simple metabolism:- Important aspects so that they can understand clinical tests and their interpretations.

All outlines are without formula

Carbohydrates: - Outline of Glycolysis, outline of TCA, outline of Gluconeogenesis, outline of Glycogen metabolism (Glycogenesis, Glycogenolysis- Glycogenstorage disease, Hormonal regulation), Outline of HMP (Biomedical importance and metabolic disorder and regulation), GTT. (4 hrs.)

Lipids: - Outline of β fatty acid oxidation along with inborn errors, Outline of fatty acids synthesis, Outline of Cholesterol: Synthesis, Catabolism, Regulation, Inborn errors and atherosclerosis, Outline of Lipoproteins, Ketosis, Lipid Peroxidation and role of antioxidants. (4 hrs.)

Proteins and Aminoacids:- Oxidative and nonoxidative deamination, Transamination and decarboxylation, Transamidation, Transport and function of ammonia, Urea cycle with inborn errors of metabolism;, Specialised products and inborn errors of glycine, Phenylalanine, Tyrosine, Tryptophan, Methionine, Cysteine, Cystine and Histidine, Branch chain amino acids, Creatine metabolism (6 hrs.)

Bioenergetics : High energy compounds, ETC, Oxidative phosphoylation

Nucleosides and Nucleotides: Definition.

Nucleic acids: Definition, Types, Function. (3 hrs)

Enzymes:- Definition, Properties of enzymes, Factors affecting enzyme activity in vitro units of Enzyme activity, application of enzymes (Therapeutic, Analytical, Diagnostic enzymes), Isoenzymes (Definition and Types), Enzyme pattern in diseases (MI, liver diseases, Muscle diseases, Cancer). (4-5 hrs)

Vitamins & Co-enzymes: - Concept of water soluble & fat-soluble vitamins (2-3 hrs)

Minerals : Biochemical role of minerals

Practical

Preparation of: Reagents, standard solutions, acid and base solutions, Buffers

Volumetric Analysis: - Preparation of reagents, standard solutions. Acid and base solutions preparation and titration for normality

Concept of standard (external and internal) and concept of blank, Drawing of standard curve

Principle ,working and types of Semiautoanalyser

Principle and working of Flame photometer

Definition , Types and Uses of ELISA

Glucose Tolerance Test

G6PD

Special investigations lipid profile:- Cholesterol, Triglycerides, HDL ,VLDL, LDL, Total Lipid,

Estimation of Serum and urine levels of electrolyte and mineral – Calcium (serum and urine) , Phosphorus, Mg, Cu, ceruoplasmin and Iron

Flamephotometeric estimation of Na+, K+, Ca++ and Li+: - Estimation of Na+, K+, Ca++ & Li+ levels in body fluids and their interpretation (Hypo and Hyper conditions)

Stone Analysis: - Gallbladder, Kidney/Ureteric/ Urinary Bladder stones and their interpretation

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Syllabus for B.Sc. (MLT) Second Year

PAPER – II: BASIC CELLULAR PATHOLOGY AND ALLIED TECHNIQUES

Theory: 60 hours
Practicals: 250 hours

SECTION – A

HUMAN HISTOLOGY

I. **Study of various body tissues:-**

a) Epithelial tissue
b) Connective tissue including bone and cartilage and adipose tissue.
c) Muscular tissue
d) Nervous tissue
e) Glands, epithelial and endoerine.

II. Histological study of various systems of the body:-

a) The circulatory system
b) The alimentary system.
c) The digestive system including liver, pancreas and gall bladder.
d) The respiratory system.
e) The Urinary system including prostate.
f) The system of endocrine glands
g) The reproductive system (male & female) including Breast.
h) The Nervous system and organs of special senses.
i) The skin & skinodenexal structures.

CYTOLOGY

THREE LECTURES ON THE FOLLOWING SUBJECTS:-

I) Routine cytology stain - PAP stain & MGG stain.
II) Special stains like PAS, Mucicarmine, Alcian blue.
III) Cytologic screening and quality control in cytology laboratory.

SECTION – B

FUNDAMENTAL OF APPLIED HISTOLOGY:-

I. Mircoscopy, working principle, maintenance and applications of various types microscopes:-

- Dark ground microscope
- Polarizing microscope
- Phase contrast microscope
- Interference microscope
- U.V. Light microscope
- Micrometry

2. Metachromasia and metachromatic dyes.
3. Haematoxylin stain. Its importance in histology.
4. Amyloid-special stains
5. Connective tissues and muscle stains, Trichome staining, Van Gison staining, Reticulin stain, Verhoeff stain, PTAH stain.
6. Demonstration and identification of minerals and pigments.

PRACTICAL

1. Identify the gross specimens.
2. Identify the organ from given slide using microscopy.
3. Perform the cytology stains on given cytology specimen.
4. Section cutting followed by H & E stain.
5. Special staining – PAS, giemsa, PAP.
6. Bony decalcification procedure.

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Syllabus for B.Sc. (MLT) Second Year

PAPER – III : FUNDAMENTALS OF HAEMATOLOGY

Theory: 60 hours
Practicals: 250 hours

SECTION – A

1. Definition and classification of Anemias, General features and morphological changes in Iron deficiency, megaloblastic, haemolytic and hypoplastic amenia's.
2. Haemoglobin disorders – various hemoglobinpathies- like sickle cell anemia, Thalassemia, spherocytosis, G6PD deficiency etc.
3. Definition & classification of leukemias, General features and morphological changes in various leukemias.

SECTION – B

4. Normal haemostasis : coagulation factors, platelets, vascular components, inhibitors & fibrinolytic system.
5. Haemostatic disorders: deficiency of various coagulation Factors, quantitative and qualitative abnormality of platelets, abnormal vascular component & other factors.

PRACTICAL

1. Perform Hb estimation.
2. Perform sickling test.
3. Perform G6PD deficiency test.
4. Perform physical, chemical & microscopic examination of urine procedure.
5. Perform Hb estimation.
6. Making and staining of peripheral blood smear & to do DLC.
7. Perform TLC on neubauer's chamber.
8. Perform blood grouping by both slide & test-tube method on the blood specimen given.
9. Identify various antisera used in blood bank & name all precautions while using it.
10. Perform cross matching by various methods on the blood specimen given.
11. Make PBF, do the giemsa stain from blood sample given and screen for all hemoparasites.

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Syllabus for Second Year B.Sc. MLT

PAPER – IV : SYSTEMIC MICROBIOLOGY INCLUDING MYCOLOGY & PARASITOLOGY

Theory: 60 hours
Practicals: 250 hours

THEORY

SECTION – A

1. Systemic Bacteriology

To study Morphology, culture characters, biochemical reactions, pathogenicity, lab diagnosis and anti microbial sensitivity testing of the following organisms:-

1. Staphylococci including Micrococci
2. Genus – Streptococcus.
3. Genus – Neisseria.
4. Genus- Corynebacterium, Mycobacterium
5. Family Enterobacteriaceae
6. Pseudomonas, Vibrio, Hemophilus, Brucella, Bordetella.
7. Aerobic and anaerobic spore forming organisms i.e. Genus Bacillus & Clostridium
8. Non sporing anaerobes.
9. Spirochaetes, Mycoplasma, Helicobater, Campylobacter, Legionella.
10. Rickettsia and Chlamydiae.
11. Actinomycosis

2. Mycology

Brief study of :-

1. Pathogenic and non-pathogenic fungi, Identification, pathogenicity, Lab. Diag & drug sensitivity of fungi.
2. Superficial mycosis including –dermatophytes.
3. S/C mycosis:- Sporothrix shenkii, Mycetoma, Chromoblastomycosis, Rhinosporidiosis.
4. Deep mycosis:- Histoplasmosis, Coccidioidomycosis, Blastomycosis, Paracoccidioidomycoses.
5. Candida
6. Nocardia
7. Cryptococcus
8. Lab. Contaminants.
9. Myotic Poisoning

SECTION – B

Virology

1. Different staining techniques used in virology
2. Brief knowledge about :-
   Rabies virus, Polio virus, Hepatitis Viruses, HIV, Arbo viruses

Parasitology:

1. Study of intestinal and tissue nematodes

- Ascaris lumbricoides
- Ancylostoma duodenale/Necator americanus
- Trichinella spiralis
- Trichiuris trichura
- Dracunculus medinensis
- W. bancrofti, B. malayi, Loa Loa, Oncocerca volvulus.
- Strongyloides stercoralis.
- Enterobius vermicularis.

PRACTICALS

1. Systemic Bacteriology

Identification of various bacteria by studying colony characters, Gram's staining, Biochemical reactions, special tests for particular isolate.

2. Mycology

1. Methods of collection and processing of hair, nail, skin, pus, sputum samples.
2. Identification of fungi by KOH preparation, Gram's staining.
3. Growth identification on SDA medium by LCB mount
4. Germ tube and chlamydospore formation of Candida albicans.

3. Virology

1. Demonstration of staining technique to demonstrate inclusion bodies by Giemsa method.
2. Test to identify HBV, HCV, HIV, Dengue fever virus e.g. ELISA Test, TRIDOT test, COMBAIDS, Latex agglutination, other rapid chromatogenic tests.

4. Parasitology

1. Collection, Preparation by direct and conc. Methods for eggs of nematodes.
2. Blood films examination for microfilaria.
3. Egg counting techniques.

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Syllabus for Third Year B.Sc. MLT

PAPER – I : CLINICAL BIOCHEMISTRY METHODS

Theory: 60 hours
Practicals: 250 hours

Theory: -

1. Quality control of Clinical investigation (external & internal quality control)
2. Automation in clinical biochemistry
3. Laboratory organization management maintenance of records
4. Pancreatic function tests
5. Liver function tests
6. Thyroid function tests
7. Kidney function tests
8. Clinical Enzymology
9. Hormones : Classification, mechanism of action.
10. Chromatography:- Define, Types (Absorption, Ion exchange, Partition, Thinlayer, Paper, Gas chromatography).
11. Electrophoresis:- Define, Types (paper, Cellulose acetate, Starch gel, Agar gel)

Practical:-

Estimations:-

1) Principle, Procedure, Normal value, Interpretation of following organ function tests

- Pancreatic function tests
- Liver function tests
- Thyroid function tests
- Kidney function tests
- Cardiac markers

2) Clinical Enzymology

i. AST
ii. ALT
iii. ALP
iv. Amylase
v. LDH
vi. CPK MB,CPK NAC
vii. Lipase
viii. GGT

3) Biochemical Tests in Diabetes Mellitus

4). Hormonal assay

- Thyroid estimation (T3, T4, TSH)
- Infertility profile (LH, FSH, Estradiol, Prolactin)- Female sex hormones (Testosterone) –Male sex hormones)

5) Tissue Transglutaminase (tTG)

6) Analysis of Fluids

CSF:- Estimation of Proteins, Glucose, Chloride, ADA (in cases of viral meningitis, Bacterial meningitis, Tubercular meningitis)

Ascitic and Pleural fluid.

6) Chromatography:-

7) Electrophoresis

8) ABG analysis

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Syllabus for Third Year B.Sc. MLT

PAPER – II : SPECIAL HISTOLOGY AND HISTOCHEMICAL METHODS

Theory: 60 hours
Practicals: 250 hours

SECTION – A

APPLIED HISTOLOGY

Lectures:
1. Fixatives including compound fixatives
2. Frozen section
3. Lipids, identification and demonstrations.
4. Special stains for carbohydrates, PAS, Mucicarmine, stain for fats, Mucin – Alacian Blue, Silver stains.
5. Micro-organisms in the tissues: various staining techniques for their demonstration and identification.
6. Nucleic acids, DNA and RNA –special stains and procedures.
7. Cytoplasmic constituents and their demonstration.
8. Tissues requiring special treatment i.e. eye ball, B.M. biopsy, under calcified & calcified bones.
9. Enzyme histochemistry- demonstration of phosphatases, dehydrogenases.
10. Oxidases and peroxidases etc.
11. Museum techniques. Mounting of museum specimens.

SECTION – B

CYTOPATHOLOGY

Lectures:
1. Cervical cytology: basis of detection of malignant and premalignant lesions.
2. Hormonal assessment with cytological techniques as well as sex chromatic and pregnancy tests.
3. Aspiration cytology: principles, indications and utility of the techniques with special emphasis on the role of cyto-technician in FNAC clinics.

IMMUNOPATHOLOGY

Lectures:
1. Cells and the organs of the immune system.
2. Humoral and cellular immune response.
3. Allergy
4. Immunological disorders and their investigations including SLE, Rhematoid arthritis, glomerulonephritis etc.
5. Infections and the immune system.
6. Immunology in Cancer and AIDS.

PRACTICAL

1. Perform PAP stain on a slide.
2. Demonstrate processing and staining of a fresh histology and cytological specimen's.
3. Perform nucleic acid stains like methylgreen and pyronine.
4. Demonstrate processing of body fluids.
5. Show steps to process bony tissue.
6. Perform MPO stain.
7. Perform Haemtoxylin and eosin stain in a laboratory.
8. Perform special stains: PAS, Alacian blue, Mucicarnine, Reticulin, GMS, PTAH, Congo red, Trichrome stain, Verhoeff's stain
9. Mount brain and eye ball specimen.
10. Prepare FNAC slide and stain with MGG, H & E, PAP.
11. Do the immunohistochemical stain on the section provide.

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Syllabus for Third Year B.Sc. MLT

PAPER – III: APPLIED HAEMATOLOGY

Theory: 60 hours
Practicals: 250 hours

SECTION – A

1. Laboratory investigations for iron deficiency anaemia.
2. Laboratory investigations for megaloblastic anaemia.
3. Laboratory investigation for haemolytic anaemia including sickling test, red cell osmotic fragility test, Hein'z body detection, G-6-FD deficiency, Coombs test & Hb-electrophoresis.
4. Leukemia and lab investigation
5. Cytochemical staining procedures in various hemopoietic disorders.
6. Foetal haemoglobin
7. L.E. Cell phenomenon.
8. Plasma Haemoglobin.

SECTION – B

1. Laboratory tests for assessing bleeding disorders. Prothrombin Time and Index.
2. Laboratory investigations for disseminated intravascular coagulation (DIC)
3. Mechanism of fibrinolysis: tests for fibrinolysis.
4. Platelet function tests and their interpretation.
5. Use of Radioisotopes in haematology.
6. Safety measures for handling radioisotopes.
7. B.M. aspiration study & B.M. biopsy- handling & processing the material.

PRACTICAL

1. Perform foetal haemoglobin and discuss its interpretation.
2. Demonstrate the test for detecting Heinz's body.
3. Prepare and stain a peripheral blood film.
4. Perform indirect coomb's test.
5. Make LE cell preparation.
6. Plasma hemoglobin in a given sample – Procedure and interpretation
7. Osmotic fragility test.
8. Perform test for coagulation i.e. P.T, APTT.
9. Perform Hb electrophoresis.
10. G6PD deficiency test.
11. Perform physical, chemical & microscopic examination of urine procedure.
12. Perform Hb estimation.
13. Making and staining of peripheral blood smear & to do DLC.
14. Perform TLC on neubauer's chamber.
15. Preparation and staining of bone marrow slides.
16. Perform ABO & Rh typing on the blood specimen given. Name blood transfusion complications.
17. Identify various antisera used in blood bank. Name all blood components prepared in blood bank.
18. Perform cross matching by agglutination & antiglobulin methods on the blood specimen given.
19. Make PBF & check for agglutination. Write hazards of massive blood transfusion & name transfusion associated diseases.

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Books Recommended

MORBID ANATOMY & HISTOPATHOLOGY

1. Theory and practice of histopathological techniques, Bancroft and Stevens, Butterworths, London
2. Cellular Pathology techniques, C.F.A culling, Butterworths London
3. Histopathology techniques and its management, Ramdas Nayak

ANATOMY AND PHYSIOLOGY

1. Rosh and Wilson anatomy and physiology in health and illness, Kathleen J.W. et. al Churehill Livingston
2. Principles of anatomy and physiology, G.J. Tartora, B. Derrickson, John wiley and sons

HAEMATOLOGY AND CLINICAL PATHOLOGY

1. An introduction to medical laboratory technology, F.J. Baked et. Al., Butterworths and Co. London
2. Practical Haematology, J.V. Dacie and Churehill Livingston Edinburgh
3. Haematology for medical technologists, Charles F. Seiverd
4. Technical Haematology, Arthur Simmons, J.B Lippinport
5. Clinical diagnosis and management by Laboratory methods, Todd & Sanford, W.B Saunders
6. Medical laboratory technology, Lynch, W.B. Saunders
7. Blood coagulation, Thomson J. Churchill Livingston
8. Medical laboratory technology methods and interpretation, Ramnik Sood

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Syllabus for Third Year B.Sc. MLT

PAPER – IV : APPLIED MICROBIOLOGY

Theory: 60 hours
Practicals: 250 hours

THEORY

SECTION – A

1. Applied Microbiology

1. Preservation of microbes and lyophilization methods.
2. Total and viable counts of bacteria
3. Testing of disinfectants –Rideal- Walker, Chick- Martin and in-use tests
4. Artificial active immunity by various types of vaccines.
5. Bacteriological examination of water, milk , food and air.
6. Nosocomial infection and sterility testing of I/V fluids and processing of various samples for hospital infections.
7. Epidemiological markers of micro-organisms- Serotyping, Bacteriophage and Bacteriocin typing methods.
8. Lab. Diagnosis of common bacterial infections viz. Pyogenic infection, respiratory tract infections, Meningitis, Diphtheria, Whooping cough, Gas gangrene, Food Poisoning, Enteric fever, acute diarrhoeal diseases, cholera, Urinary tract infection, Tuberculosis, Leprosy, Plague, Anthrax, Typhus fever, Syphilis, Gonorrhoea and other STD's
9. Serological tests:-
   Widal, ASO, CRP, Rosewaller, Brucella agglutination , RA, H Bs Ag, HCV, VDRL, TPHA, FTA- ABS, RPR.
10. Lab. Diagnosis of fungal infections in various fungal infections.
11. Serological tests for infections and skin tests.
12. Advanced techniques in microbiology –ELISA, CCIEP, PCR, Western blot, Co-agglutination, Branched DNA Technique
13. Rapid diagnostic methods and automation in Microbiology.

SECTION – B

1. VIROLOGY

1. Lab. Diagnosis of viral infections by various serological tests.
2. Mode of transmission of viral agents.
3. Prevention of viral diseases.
4. Anatomical structures in fertile hen's egg.

- Inoculation of fertile eggs.
- Egg inoculation techniques into
    a) Chorioallantoic membrane
    b) Amniotic cavity
    c) Allantoic cavity
    d) Yolksac
    e) Harvesting of the materials from eggs inoculated by the method.

2. PARASITOLOGY

To study Morphology, Life cycle, Pathogenicity and Lab. Diagnosis of Cestodes- Diphyllobothrium latum, Taenia solium/saginata, E. granulosus, H.nana, T.multiceps, E. multilocularis, Trematodes:- Schistosomes: Intestinal, blood and liver flukes, Casoni's test

3. INTRODUCTION TO ENTOMOLOGY

Identification and role in various diseases of:-

a) Mosquitos
b) Flies
c) Ticks
d) Fleas

PRACTICALS:

1. VIROLOGY

1. Demonstration of antiviral antibodies by ELISA test and other rapid tests.
2. Preparation of tissue culture media – 1. Hank's Balanced Salt Solution
   2. Minimum Essential Medium
   3. Earle's Balanced Salt Solution

2. BACTERIOLOGY

1. Stool examination for segments and ova of cestodes.

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