

SRI GURU RAM DAS UNIVERSITY OF HEALTH SCIENCES, SRI AMRITSAR



Ordinance & Syllabus

B.Sc. MEDICAL LABORATORY TECHNOLOGY

(Applicable w.e.f. academic session 2017-18)

COURSE NAME: Bachelor of Science in Medical Laboratory Technology

DURATION OF COURSE: THREE & HALF YEARS

FULL-TIME/ PART – TIME: FULL-TIME

1. BACHELOR OF SCIENCE IN MEDICAL LABORATORY TECHNOLOGY (B.Sc. MLT)

A Bachelor of Sciences in Medical Laboratory Technology (B.Sc. MLT) is offered by Sri Guru Ram Das University of Health Sciences, Amritsar. This program is designed to produce workforce having efficient and balanced training in laboratory medicine. The students enrolled under this program receive a stimulating, challenging and yet supportive academic exposure. This course is designed as a comprehensive and practical oriented program with the main objective to train the technical assistants working in laboratory, hospitals as well as with private practice. It provides the opportunity to gain entry into M.Sc. MLT, M.Sc. Microbiology and M.Sc. Biochemistry courses or other equivalent programs.

The mode of teaching will be in form of regular classrooms, lectures/demonstrations supplemented by handouts, brochures, checklists, performance with supervised clinical practice.

2. Duration of Course

The Bachelor of Sciences in Medical Laboratory Technology Course is proposed to be a three and half years including six months internship.

3. Eligibility Criteria for Admission

The students shall be admitted as per the admission criteria and qualification prescribed in the Notification issued by the Board of Management of Sri Guru Ram Das University of Health Sciences from time to time.

4. Medium of Instructions

The Medium of instruction during the course and for the university examination shall be in English.

5. Examination Scheme

5.1 The examination for the first, second and third year shall ordinarily be held twice year in the months of May/June and November/ December by the Institute as per University rules.

5.2 Annual Examination shall be held in May/June and supplementary within 6 months of annual examination.

5.3 The examination in theory/practical shall be held at the end of the 1st academic year (1st Year) and the end of 2nd academic year (2nd Year) and third exam at the end of the 3rd academic year (3rd Year) with one internal and one external examiners.

5.4 Date of examination and appointment of examiner will be made by the Board of Management on recommendation of Faculty of Medical Sciences.

5.5 The examination for the first, second and third year of B.Sc. Medical Laboratory Technology Course would be held according to the prescribed syllabus.

6. Rules of Examination for Bachelor of Sciences in Medical Laboratory Technology Course:

6.1 The students shall submit his/her application for admission to the examination to Controller of Examinations SGRDUHS, Sri Amritsar through the Director Principal of the SGRDIMSAR, Sri Amritsar on the prescribed form with the required fee (the last date of which will be updated on university website after notification issued from Board of Management time to time).

- 6.2 The candidates will be given 25 marks for theory and 15 marks for practical as internal assessment in each subject on the basis of their performance during the year. That a candidate be eligible to appear in the examination provided he/she secured a minimum of 35% marks in internal assessment in theory and practical.
- 6.3 There will be fresh internal assessment and compulsory attendance for the students for the examination in which he/she has failed at the time of subsequent examination in that subject.
- 6.4 The students will not be allowed to appear in the examination unless he/she attends 75% of the total theory and practical in each subject separately.
- 6.5 Director Principal of the college is empowered to condone the shortage of attendance of lectures to the extent of 5% lectures delivered in each course of theory and practical.
- 6.6 A student will be deemed to have passed in the examination if he/she passes in each subject separately.
- 6.7 In case of students joining late owing to the late admission with the approval of the Vice-chancellor, their lecturers are to be counted from the date of joining. Deficiency in studies should be made up by attending special classes for them at the level of Head of the Department.

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

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:-

B.Sc. Part – I

Paper	Subject	Theory			Practical			Grand Total
		Marks	Internal Assessment	Total	Marks	Internal Assessment	Total	
Paper-I	Basic Principles of Biochemistry	75	25	100	35	15	50	150
Paper-II	Fundamentals of Histopathology/ Histotechnology and cytology	75	25	100	35	15	50	150
Paper-III	Basic Techniques in Laboratory and Clinical Pathology	75	25	100	35	15	50	150
Paper-IV	General Microbiology, Immunology	75	25	100	35	15	50	150
Supportive Subject	Basics of Computer	--	-----	--	--	---	--	----

Note. The Examination in the subject of Basics of Computer will be conducted at college level and Grade will be sent to University for final inclusion in the result.

Grading System

Marks Range	81 - 100	76 - 80	71 - 75	61 - 70	51 - 60	41 - 50	31 - 40	0 - 30
Grade	A+	A	B+	B	C+	C	D	E

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

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

B. Sc. Part – II

S. No.	Subject	Theory			Practical			Grand Total
		Marks	Internal Assessment	Total	Marks	Internal Assessment	Total	
Paper-I	Analytical Biochemistry and Metabolism	75	25	100	35	15	50	150
Paper-II	Basic Cellular Pathology, Allied Techniques, Cytology and Histopathology	75	25	100	35	15	50	150
Paper-III	Fundamentals of Hematology, clinical pathology and Blood Banking	75	25	100	35	15	50	150
Paper-IV	Systemic Microbiology including Mycology and Parasitology	75	25	100	35	15	50	150

9. Third Year

The Third Year B.Sc. Medical Laboratory Technology Examination shall be open to a person who has previously passed the Second Year B.Sc. Medical Laboratory Technology Examination of this University.

B.Sc. Part-III

S. No.	Subject	Theory			Practical			Grand Total
		Marks	Internal Assessment	Total	Marks	Internal Assessment	Total	
Paper-I	Clinical Biochemistry Methods	75	25	100	35	15	50	150
Paper-II	Special Histology, Histochemical Methods, Immunopathology and Cytopathology	75	25	100	35	15	50	150
Paper-III	Applied Haematology and clinical pathology	75	25	100	35	15	50	150
Paper-IV	Applied Microbiology	75	25	100	35	15	50	150

10. Promotion and Number of Attempts allowed

- 10.1 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.
- 10.2 A Candidate who fails in one more or more subjects will be given four attempts including first attempt as a regular candidate, plus one mercy chance at the discretion of the Vice-Chancellor, at six monthly intervals. However, he/she will have to clear all these attempts within 6 years of admission to the said course
- 10.3 The candidate who will absent himself/herself from the examination will be deemed to have been failed in that subject.
- 10.4 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, the candidate will be required to pass in all subjects of 1st Year examination at least 6 months before the final examination of 2nd Year examination.
- 10.5 A candidate who fails in all subjects in the second year B.Sc. Medical Laboratory Technology examination shall not be promoted to **Third Year** class.
- 10.6 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, the candidate will be required to pass in all subjects of 2nd Year examination at least 6 months before the final examination of **3rd Year** examination.
- 10.7 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, at six monthly intervals. However, he/she will have to clear all these attempts within 6 years of admission to the said course.
- 10.8 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), plus one mercy chance at the discretion of the Vice-Chancellor failing, at six monthly intervals. However, he/she will have to clear all these attempts within 6 years of admission to the said course.

11. Appointments of Examiners:

- 11.1 There shall be two examiners – One internal and one external.
- 11.2 Professor & head of the Department shall be Convener. The Examiner at least 3 years post PG teaching experience in that specification field will be appointed as Internal Examiner.
- 11.3 The external examiner shall be appointed from other Universities at least 3 years post PG teaching experience in that specification field.

12. Paper Setting and moderation of Question Papers

The questions papers for 1st Year, 2nd Year and 3rd Year will be set under the direction of Controller of Examinations.

Each Question Paper covering entire course consists of seven questions out of which six questions carry 10 Marks and one question carry 15 marks.

13. 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 Controller of Examinations.

14. Minimum Pass Marks

During all the three annual examinations in each subject paper the candidate shall have to obtain 50% in theory, practical & internal assessment taken together.

14.1 The successful candidates shall be classified into divisions as under:-

- a) Those who obtain 60% or more marks First Division.
- b) Those who obtain 50% or more marks but below 60% marks Second Division.
- c) A candidate who will obtain 75% or more marks of the total marks in any subject shall be declared to have obtained distinction in that subject provided he/she passed in all the subjects of the courses in all the parts in the first attempt.

A candidate is eligible to appear in the examination provided he/she secures a minimum of 35% marks in internal assessment in theory and practical separately.

15. Grace Marks

There shall be no provision for grace marks.

16. Declaration of Result

The results will be tabulated and declared by the Controller of Examination's office.

17. Award of Degree

On successfully passing the Third Year B.Sc. Medical Laboratory Technology examination the students shall be awarded the degree of Bachelor of Sciences in Medical Laboratory Technology.

SUBJECT AND HOURS OF TEACHING FOR THEORY AND PRACTICALS

The number of hours of teaching theory and practical, subject wise in first , second and third years are shown in Table-I, Table-II and Table-III.

Table I: Distribution of Teaching Hours in First year

S. No.	Subject	Theory No. of Hours	Practical & Training No. of Hours	Total No. of Hours
1	Basic Principles of Biochemistry	64	256	320
2	Fundamentals of Histopathology/ Histotechnology and cytology	60	250	310
3	Basic Techniques in Laboratory Haematology, Blood Banking and Clinical Pathology	60	250	310
4	General Microbiology, Immunology	64	256	320
	Total	248	1012	1260

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturdays students shall work in hospitals in the respective specialty or department chosen by them.

Subsidiary Subjects

Computer Skills 20 Hours

Table II: Distribution of Teaching Hours in Second Year

S. No.	Subject	Theory No. of Hours	Practical & Training No. of Hours	Total No. of Hours
1	Analytical Biochemistry and Metabolism	64	256	320
2	Basic Cellular Pathology, Allied Techniques and Cytology	60	250	310
3	Fundamentals of Hematology	60	250	310
4	Systemic Microbiology including Mycology and Parasitology	64	256	320
	Total	248	1012	1260

Subsidiary subjects: Patient care - 20 hours

Table III: Distribution of Teaching Hours in Third Year

S. No.	Subject	Theory No. of Hours	Practical & Training No. of Hours	Total No. of Hours
1	Clinical Biochemistry Methods	64	256	320
2	Special Histology, Histochemical Methods, Immunopathology and Cytopathology	60	250	310
3	Applied Haematology	60	250	310
4	Applied Microbiology	64	256	320
	Total	248	1012	1260

Subsidiary subjects: Medical ethics- 16 hours

INTERNSHIP

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

Sr. No.	Department	Period of Internship
1.	Biochemistry	One and Half month
2.	Microbiology	One and Half month
3.	Pathology including cytology and immunopathology	One and Half month
4.	Haematology including blood transfusion and clinical pathology	One and Half month

CURRICULUM AND SYLLABUS B.Sc. MLT

The candidate registered for B.Sc. Medical Laboratory Technology will be given basic training in theoretical and practical aspects in the field of histopathology, cytopathology, clinical pathology, haematology, blood banking, immunopathology and maintaining of museum specimens. The students will also obtain basic knowledge of morbid anatomy, physiology, histology and laboratory investigations/tests in relation to various diseases. The principles of different techniques used for such investigations will also be imparted. The student will also be given training in Laboratory management, safety measures, quality control aspects and automatic technology. The training in the subject is aimed at making the student work independently in various advanced pathology laboratories of any hospital or medical institution.

SYLLABUS FOR FIRST YEAR

Paper – I : Basic Principals 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 : (Essential fatty acids/triacylglycerol/phospholipids):- Introduction: Definition, functions, Classification, types (Simple, Complex, Derived, Miscellaneous, Neutral Lipids).

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), Acidics and basic proteins, Colour reaction of proteins, Denaturation of proteins. General properties of amino acids and proteins. General reaction of amino acids and proteins.

Heme Metabolism

Bilirubin Metabolism

Jaundice and Clinical aspects

Radioisotopes, their use in Biochemistry and Hazards of radio isotope

Biophysical chemistry:-

pH Measurement, pH indicators, Buffers solutions, pH meter

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

Porphyrias:- Definition and Types

Normal/ Reference Range:- of routine biochemical investigations

PRACTICALS

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 desiccators), 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 massage.

Preparation of: Reagents, standard solution, acid and base solution, Buffers.

Storage of chemical with example of:- non corrosive, corrosive & light sensitive chemicals.

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

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

***** 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 labeling of specimens.

Cleaning & Care

— General laboratory glassware

— Equipments (balance, colorimeter, spectrophotometers. 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

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

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
- Porphobilinogen/Urobilinogen\
- Hemoglobinuria
- Micro Albuminuria
- Bence Jones Protens

Concept of colorimeter & Spectrophotometer – Principle, working and types of filter.

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

- FBS
- Blood urea
- S Creatinine

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

Recommended Books

1. Textbook on Biochemistry for DMLT & Paramedical courses. Dr I Clements.
2. Textbook on Biochemistry D.M Vasudevan.
3. Textbook Of Biochemistry Satyanarayan
4. A Procedure Manual for Routine Diagnostic Tests Vol.I and III by KL Mukerjee; Tata McGraw Hill publishers, New Delhi
5. Biochemistry estimations by F.J. Baker

Curriculum:- Pathology

The candidates registered for B.Sc. Medical Technology (Laboratory) will be given basic training in theoretical and practical aspects in the field of histopathology, cytopathology, clinical pathology, haematology, blood banking, immune pathology and maintaining of museum specimens. The students will also contain the basic knowledge of morbid anatomy, physiology, histology and laboratory investigation/tests in relation to various disease. The principles of different techniques used for such investigations will also be imparted. The students will also be given training in Laboratory management, safety measures, quality control aspects and automatic technology. The training in the subject is aimed at making the student work independently in various advanced pathology laboratories of any hospital or medical institution.

The students will be posted for practical training in the department of Pathology for a period of 20 weeks in each year. The distribution of time for the theory and practical each year will be as under:

B.Sc (MLT)- First Year

1. Histopathology/Histotechnology and Cytology

- | | | |
|--------------------------------------|---|-----------|
| I.Theory and Tutorial Demonstrations | - | 60 hours |
| II.Practical 10 weeks | - | 250 hours |

2. Haematology, Clinical Pathology and Blood Banking

- | | | |
|---------------------------------------|---|-----------|
| I. Theory and Tutorial Demonstrations | - | 60 hours |
| II. Practical 10 weeks | - | 250 hours |

B.Sc (MLT)- Second Year

1. Basic Cellular Pathology, allied techniques, Cytology and Histopathology

- | | | |
|---------------------------------------|---|-----------|
| i. Theory and Tutorial Demonstrations | - | 60 hours |
| ii. Practical 10 weeks | - | 250 hours |

2 Fundamental of Haematology

- | | | |
|---------------------------------------|---|-----------|
| i. Theory and Tutorial Demonstrations | - | 60 hours |
| ii. Practical 10 weeks | - | 250 hours |

B.Sc (MLT)- Third Year

1. Special Histological and Histochemical methods, Cytology and Immunopathology

- i. Theory and Tutorial Demonstrations - 60 hours
- ii. Practical 10 weeks - 250 hours

2. Applied Haematology

- i. Theory and Tutorial Demonstrations - 60 hours
- ii. Practical 10 weeks - 250 hours

Paper- II: Fundamentals of Histopathology, Histotechnology and Cytology

1) HISTOPATHOLOGY

a) Introduction

- i) Introduction to histopathology and laboratory organization
- ii) Laboratory equipments, 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 labeling 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 stropping)
- viii) Practical section cutting, cutting faults and remedies
- ix) Dye chemistry, theory and practice of staining- Haematoxyline and Eosin

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

2) CYTOLOGY

Collection and processing of cytological specimen. Exfoliative Cytology and FNAC

LIST OF PRACTICALS

HISTOPATHOLOGY

1. Demonstration of various parts of Microscope; its Principle, functioning and care
2. Recording and labelling of Histopathology Specimen
3. To perform FIXATION of Histopathology specimens
4. To perform EMBEDDING of Histopathology sections
5. To perform DECALCIFICATION of Histopathology specimens
6. To perform Knife Honing & Stropping
7. To perform H & E staining of Histopathology section

CYTOLOGY

1. Collection of cytological specimens, Labelling and processing

RECOMMENDED BOOKS

1. Precise Text Bok of Hematology by UshaRusia, Mira Sikka, RenuSaxena; CBS Publishing Company, New Delhi
2. Concise Text book of Medical Lab Technology and Interpretations. RamneekSood. JayPee Publishing Company, New Delhi
3. Practical Pathology. K Uma Chaturvedi, Tejinder Singh. Arya Publishing, New Delhi.

Paper-III : BASIC TECHNIQUES IN LABORATORY HAEMATOLOGY AND CLINICAL PATHOLOGY

1. Introduction to haematology and laboratory organization , lab safety and instrumentation
2. Composition and function 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 variation in Hb, PCV, TLC and platelets.
7. Normal and absolute values in haematology.
8. Quality assurance in haematology.
9. Hemoglobinometry: various methods of estimation of Hb, errors involved and standardization of instruments.
10. Haemocytometry: procedures for cell counts, visual as well as electronic, red cell, leucocytes and platelet counts. Errors involved and mean to minimize such errors.
11. Romanovsky dyes, preparation and staining procedures of blood smears.
12. Morphology of normal blood cells and their identification.
13. Erythrocyte sedimentation rate, factors influencing ESR and various procedures for its estimation with their significance.
14. Hematocrit value by macro and micro methods their merits and demerits.
15. Basic techniques in blood banking.

16. Semen analysis.

17. Examination of abnormal urine, physical, chemical and Microscopic Examination.

List of Practicals

HAEMATOLOGY

1. Collection of blood sample
2. Haemoglobin Estimation
3. To perform Total Leucocyte Count
4. To perform Differential Leucocyte Count
5. To perform Packed Cell Volume
6. To perform Absolute Eosinophil Count
7. To perform Erythrocyte Sedimentation Rate
8. To perform Blood Grouping / Cross Matching
9. To perform Leishman & Giemsa Staining of Peripheral Smear.

Clinical Pathology

1. To perform Complete Urine Examination
2. To perform Semen Analysis

RECOMMENDED BOOKS

1. Precise Text Bok of Hematology by UshaRusia, Mira Sikka, RenuSaxena; CBS Publishing Company, New Delhi
2. Concise Text book of Medical Lab Technology and Interpretations. RamneekSood. JayPee Publishing Company, New Delhi
3. Practical Pathology. K Uma Chaturvedi, Tejinder Singh. Arya Publishing, New Delhi.

Medical Microbiology

Paper – IV: General Microbiology

(Including General Bacteriology, Virology, Mycology, Parasitology & Immunocology)

Theory

1. Introduction & brief history of Microbiology- Louis Pasteur, Robert Koch, Joseph Lister, Paul Ehrlich, Edward Jenner.
2. Safety measures in Microbiology
3. Care and maintenance of laboratory equipments
4. Principals and methods of sterilization
5. Uses and modes of action of antiseptics & disinfectants
6. Handling and cleaning of glassware apparatus, Decontamination and disposal of contaminated material.
7. Preparation uses and standardization of culture media
8. Aerobic and anaerobic culture methods
9. Collection, transportation and processing of clinical samples for Microbiological investigations.
10. Principles and mode of action of antibiotics and chemotherapeutic agents for bacteria and fungi.
11. Care and handling of laboratory animals
12. Laboratory organization, management, recording of results and quality control in Microbiology.

13. Principles, functioning, care of microscopes i.e Monocular/Binocular microscope, Dark ground microscope, Phase contrast microscope, Fluorescent microscope.
14. Principles of staining methods and preparation of reagents.
15. General characteristics and classification of bacteria & fungi
16. Growth and nutrition of microbes

Immunology

1. Lymphoreticular System, T and B cells and their differences
2. Immune Response
3. Antigens, Antibodies, Complement System
4. Hypersensitivity
5. Autoimmunity

Virology

1. General properties of viruses including Size, shape, symmetry, Cultivation of viruses by various methods, inclusion body 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.

Practicals:

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

Theory:-

1. Introduction of medical parasitology and safety measures.
2. Collection, preservation and processing and samples and 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, Entamoeba coli, Giardia intestinalis, Balantidium coli, Free living amoebae, Cryptosporidium, Isospora and Microsporidium.
5. Morphology, life cycle, pathogenicity and lab. Diagnosis of haemoprotozoa:-
 - Genus, Plasmodium, Toxoplasma
 - Genus Leishmania
 - Genus Trypanosoma

Practical:-

1. Stool examination:- Methods of collection, transportation and processing of stool samples of 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.

Recommended Books

1. Textbook on Microbiology for DMLT & Paramedical courses.
1. Textbook on Microbiology Dr C P Baveja
2. Medical parasitology, D R Arora
3. Essentials of Practical Microbiology
4. Textbook on Microbiology Ananthanarayan & Panikar

BASICS OF COMPUTER

Theory : 30 hours

Practical's : 30 hours

THEORY

Introduction to computer – I/O devices – memories – RAM and ROM – Different kinds of ROM – kilobytes, MB, GB their conversions – large computer – Medium, Micro, Mini computers - Different operating system – Networking – LAN, WAN, MAN (only basic ideas)

Typing text in MS word – Manipulating text – Formatting the text – using different font sizes, bold, italics – Bullets and numbering – Pictures, file insertion – Aligning the text and justify – choosing paper size – adjusting margins – Header and footer, inserting page No's in a document – Printing a file with options – Using spell check and grammar – Find and replace – Mail merge – inserting tables in a document.

Creating table in MS-Excel – Cell editing – Using formulas and functions – Manipulating data with excel – Using sort function to sort numbers and alphabets – Drawing graphs and charts using data in excel – Auto formatting – Inserting data from other worksheets.

Preparing new slides using MS-POWERPOINT – Inserting slides – slide transition and animation – Using templates – Different text and font sizes – slides with sounds – Inserting clip arts, pictures, tables and graphs – Presentation using wizards.

Introduction to Internet – Using search engine – Google search – Exploring the next using Internet Explorer and Navigator – Uploading and Download of files and images – E- mail ID creation – Sending messages – Attaching files in E- mail.

Role of Computers in the Health care: - HIS, Medical Equipment, Pharmacy in inventory management, Patient record maintenance.

PRACTICAL

- Typing a text and aligning the text with different formats using MS-Word
- Inserting a table with proper alignment and using MS-Word - Create mail merge document using MS-word to prepare greetings for 10 friends
- Preparing a slide show with transition, animation and sound effect using MSPowerpoint
- Customizing the slide show and inserting pictures and tables in the slides using MSpowerpoint
- Creating a worksheet using MS-Excel with data and sue of functions Using MSExcel prepare a worksheet with text, date time and data Preparing a chart and pie diagrams using MS-Excel
- Using Internet for searching, uploading files, downloading files creating e-mail ID

Syllabus for Second Year

B.Sc. MLT

BIOCHEMISTRY

Paper-I : ANALYTICAL, BIOCHEMISTRY and METABOLISM

Theory

Carbohydrate : 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).

Lipids :-Outline of B 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.

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

Nucleic acids , Nucleosides and Nucleotides : Definition, Types and Functions.

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 disease (MI, liver diseases, Muscle diseases, Cancer).

Vitamins & Co-enzymes :- Concept of water soluble & fat-soluble vitamins

Chromatography:- Define, Types (Absorption, Ion exchange, Partition, Thinlayer, Paper, Gaschromatography). (1 hrs.)

Electrophoresis :- Define, Types (paper, Cellulose acetate, Starch gel, Agar gel)

PRACTICAL

Colorimetry:-Definition, Principle/working, Types, Lambert and beer law, photoelectric colorimetry, standard calibration curve.

Spectrophotometer :- Definition, Principle.Working, Types (UV etc.)

Flamephotometer :- Definition, Principle/Working, types

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

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

Flamephotometric estimation of Na⁺, K⁺, Ca⁺⁺ and Li⁺:- Estimation of Na⁺, K⁺, Ca⁺⁺ & Li⁺ levels in body fluids and their interpretation

Chromatography :-Definition, Types (Thinlayer, paperchromatography)

Electrophoresis :-Define, Type (Paper)

Demonstration of :-Semiautoanalyser, Elisa Reader

Recommended Books

1. Textbook on Biochemistry for DMLT & Paramedical courses. Dr I Clements.
2. Textbook on Biochemistry D.M Vasudevan.
3. Textbook Of Biochemistry Satyanarayan
4. A Procedure Manual for Routine Diagnostic Tests Vol.I and III by KL Mukerjee; Tata McGraw Hill publishers, New Delhi
5. Biochemistry estimations by F.J. Baker

Paper-II : BASIC CELLULAR PATHOLGY, ALLIED TECHNIQUES, CYTOLOGY& HISTOPATHOLOGY

HUMAN HISTORY

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 endocrine.

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 (males/female)including Breast.
- h) The Nervous system and organs of special senses.
- i) The skin & skin appendages structures.

FUNDAMENTAL OF APPLIED HISTOLOGY:-

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

- Dark ground microscope
- Polarizing microscope
- Phase contrast microscope
- Interference microscope

— U.V Light microscope

— Micrometry

II. Metachromasia and metachromatic dyes.

III. Haematoxylin stain. Its importance in histology.

IV. Amyloid-special stains

V. Connective tissues and muscles stains, Trichome staining, Van Gieson staining, Reticulin stain, Verhoeff stain, PTAH stain.

VI. Demonstration and identification of minerals and pigments.

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.

List of Practicals

HISTOPATHOLOGY

1. To perform H & E Staining of Tissue Section
2. To perform Amyloid Staining of Tissue Section
3. To perform PAS Staining of Tissue Section
4. To perform Trichrome Staining of Tissue Section
5. To perform Von Kossa Staining of Tissue Section
6. To perform Reticulin Staining of Tissue Section
7. To perform Verhoeff Staining of Tissue Section
8. To perform PTAH Staining of Tissue Section

CYTOLOGY

1. To perform PAP Staining of Cytological Smear
2. To perform MGG Staining of Cytological Smear
3. To perform PAS Staining of Cytological Smear
4. To perform Mucicarmine Staining of Cytological Smear
5. To perform Alcian Blue Staining of Cytological Smear
6. To perform PAP Staining of Cytological Smear
7. Screening of Cytology Smear

RECOMMENDED BOOKS

1. Precise Text Book of Hematology by Usha Rusia, Mira Sikka, Renu Saxena; CBS Publishing Company, New Delhi
2. Concise Text book of Medical Lab Technology and Interpretations. Ramneek Sood. Jaypee Publishing Company, New Delhi
3. Practical Pathology. K Uma Chaturvedi, Tejinder Singh. Arya Publishing, New Delhi.

HEMATOLOGY

Paper- III : FUNDAMENTAL OF HAEMATOLOGY

1. Definition and classification of Anemias, general features and morphological changes in Iron deficiency, megaloblastic and hypoplastic anemias.
2. Haemoglobin disorders-various hemoglobinopathies-like sickle cell anemia, Thalassemia, spherocytosis, G6PD deficiency etc.
3. Definition & classification of leukemias, General features and morphological changes in various leukemias.
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.

List of Practicals

HAEMATOLOGY

1. To perform Foetal Haemoglobin
2. To perform Osmotic Fragility Test
3. To perform Glucose 6 Phosphate Dehydrogenase Test
4. To perform Sickle Cell Test
5. To Perform PTI
6. To Perform APTT

RECOMMENDED BOOKS

1. Precise Text Book of Hematology by Usha Rusia, Mira Sikka, Renu Saxena; CBS Publishing Company, New Delhi
2. Concise Text book of Medical Lab Technology and Interpretations. Ramneek Sood. JayPee Publishing Company, New Delhi
3. Practical Pathology. K Uma Chaturvedi, Tejinder Singh. Arya Publishing, New Delhi

MEDICAL MICROBIOLOGY

Paper- IV: Systemic Microbiology Including Systemic Bacteriology/ Virology/ Mycology/ Parasitology

Systemic Bacteriology

Theory:

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, Helicobacter, Campylobacter, Legionella
10. Rickettsia and chlamydiae

Practicals

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

Mycology

Theory:

Brief Study of:-

1. Pathogenic and non-pathogenic fungi, identification, pathogenicity, lab diagnosis & drug sensitivity of fungi.
2. Superficial mycosis including – dermatophytes.
3. S/C mycosis:- Sporotrichum shenckii, Mycetozoa, Chromoblastomycosis, Rhinosporidiosis
4. Deep mycosis:- Histoplasmosis, Coccidioidomycosis, Blastomycosis. Paracoccidioidomycoses
5. Candida
6. Nocardia
7. Cryptococcus
8. Actinomycosis
9. Lab. Contaminants.
10. Myotic Poisoning

Practicals:

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.
5. Hair bait and paraffin bait technique for isolation of geophilic fungi and Nocardia respectively.

Virology

Theory:

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

Practicals:

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.

Parastilology:

Theory:

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

Recommended Books

6. Textbook on Microbiology for DMLT & Paramedical courses.
7. Textbook on Microbiology Dr C P Baveja
8. Medical parasitology, D R Arora
9. Essentials of Practical Microbiology
10. Textbook on Microbiology Ananthanarayan & Panikar

Syllabus for Third Year

B.Sc. MLT

BIOCHEMISTRY

Paper- I : CLINICAL BIOCHEMISTRY METHODS

THEORY

Carbohydrate : Diabetes mellitus , Glucose Tolerance Test, Glucose Challenge Test

Lipids :- Lipoprotein Metabolism, Lipid Peroxidation and Atherosclerosis

Proteins and Aminoacids :- Inborn errors of protein metabolism. Ammonia Toxicity, Errors of urea cycle.

Quality control of Clinical investigation(external & internal quality control)

Automation in clinical biochemistry

Laboratory organization management maintenance of records

Gastric function tests:- collection of sample & tests for blood, lactic acid and pH etc.

Pancreatic function tests

Liver function tests

Thyroid function tests

Kidney function tests

Mineral Metabolism

PRACTICAL:-

1. **Estimations**:-Principle, Procedure, Normal value, Interpretation of :

- Urinary proteins 24 hours
- 24 hrs Urinary urea
- 24 hrs Urinary creatinine
- 24 hrs uric acid
- Creatinine clearance test
- Urea clearance test

2. Electrolyte and Mineral estimation : Serum and Urinary Calcium, Inorganic Phosphates

3. **Special Investigation**

A. **Hormonal assay**

- Thyroid estimation (T3,T4, TSH)
 - Infertility profile (LH, FSH, Estradiol, Prolactin) – Female sex hormones (Testosterone)- Male sex hormones
- B. Special tests for diabetes :- Insulin, Glycosylated Haemoglobin .
- C. Cardiac maker :- CPK (MB), Troponin I/T
- D. Serum iron, TIBC and serum magnesium
5. **Clearance test for renal function**
6. **Enzymes :-** Amylase, Lipase, LDH, CPK
7. **Clinical significance Of following special investigations :-**
- A. 17-Keto steroids in urine
 - B. VMA in urine
 - C. Serum Copper
 - D. Urinary Copper

Analysis of CSF :- Estimation of Proteins, Glucose, Chloride

Analysis of Ascitic fluid, Pleural fluid and Stool examination for fat & occult blood

Recommended Books

1. Textbook on Biochemistry for DMLT & Paramedical courses. Dr I Clements.
2. Textbook on Biochemistry D.M Vasudevan.
3. Textbook Of Biochemistry Satyanarayan
4. A Procedure Manual for Routine Diagnostic Tests Vol.I and III by KL Mukerjee; Tata McGraw Hill publishers, New Delhi
5. Biochemistry estimations by F.J. Baker

Paper- II : SPECIAL HISTOLOGY AND HISTOCHEMICAL METHODS

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 phosphates, dehydrogenases.
10. Oxidases and peroxidases etc.
11. Museum techniques. Mounting of museum specimens.

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 test.
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, Rheumatoid arthritis, glomerulonephritis etc.
5. Infections and the immune system.
6. Immunology in Cancer and AIDS.

List of Practicals

HISTOPATHOLOGY

1. Demonstration of various parts of Freezing Microtome; its Principle, functioning and care
2. To Perform various stains for Frozen Section
3. Museum Techniques – Handling & Mounting of Museum Specimens.

CYTOLOGY

1. To Perform Screening of Pap Smear
2. To Demonstrate Barr body.

RECOMMENDED BOOKS

1. Precise Text Book of Hematology by Usha Rusia, Mira Sikka, Renu Saxena; CBS Publishing Company, New Delhi
2. Concise Text book of Medical Lab Technology and Interpretations. Ramneek Sood. Jaypee Publishing Company, New Delhi
3. Practical Pathology. K Uma Chaturvedi, Tejinder Singh. Arya Publishing, New Delhi

Paper- III : APPLIED HAEMATOLOGY

1. Laboratory investigations for iron deficiency anaemia.
2. Laboratory investigations for megaloblastic anaemia.
3. Laboratory investigations for haemolytic anaemia including sickling test, red cell osmotic fragility test, Heins body detection, G-6-PD deficiency, Coombs test & HB-electrophoresis.
4. Leukemia and lab investigation.
5. Cytochemical staining procedures in various hemopoietic disorders.
6. Laboratory tests for assessing bleeding disorders. Prothrombin Time and Index.
7. Laboratory investigations for disseminated intravascular coagulation (DIC).
8. Mechanism of fibrinolysis: tests for fibrinolysis.
9. Platelet function tests and their interpretation.
10. Use of Radioisotopes in haematology
11. Safety measures for handling radioisotopes.
12. B.M. aspiration study & B.M. biopsy-handling & processing the material.
13. Foetal haemoglobin.
14. L.E. Cell Phenomenon.
15. Plasma Haemoglobin.

List of Practicals

HAEMATOLOGY

1. To Perform Coombs Test
2. To Demonstrate Heinz Body
3. To perform Hb Electrophoresis
4. To perform MPO Stain
5. To perform PAS Stain
6. To perform Sudan Black Stain

7. To perform PTI
8. To perform APTT
9. To perform D – Dimer
10. To perform LE Cell
11. To perform Plasma Haemoglobin
12. Handling of Bone Marrow Aspiration & Biopsy

RECOMMENDED BOOKS

1. Precise Text Book of Hematology by Usha Rusia, Mira Sikka, Renu Saxena; CBS Publishing Company, New Delhi
2. Concise Text book of Medical Lab Technology and Interpretations. Ramneek Sood. JayPee Publishing Company, New Delhi
3. Practical Pathology. K Uma Chaturvedi, Tejinder Singh. Arya Publishing, New Delhi

Paper – IV: Applied Microbiology

Theory

1. Preservation of microbes and lyophilization methods.
2. Total and viable counts of bacteria
3. Testing of disinfectants- Rideal- Walker, Chich- 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.

VIROLOGY

Theory:

1. Lab. Diagnosis of viral infections by various serological tests.
2. Mode of transmission of viral agents.
3. Prevention of viral diseases.

Practicals

1. Demonstration of 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

2. Harvesting of the materials from eggs inoculated by the method.
3. Demonstration of antiviral antibodies by ELISA test and other rapid tests.
4. Preparation of tissue culture media- 1. Hank's Balanced Salt Solution
5. Minimum Essential Medium
6. Earle's Balanced Salt Solution

PARASITOLOGY

Theory:

To study Morphology, Life cycle, Pathogenicity and Lab. Diagnosis of Cestodes- *Diphyllobothrium latum*, *Taenia solium/saginata*, *E. granulosus*, *H.nan*, *T.multiceps*, *E.multilocularis*, Trematodes:- Schistosomes: Intestinal, blood and liver flukes.

Practicals:-

1. Stool examination for segments and ova of cestodes.
2. Casoni's test.

Introduction to Entomology:

Identification and role in various diseases of :-

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

Recommended Books

1. Textbook on Microbiology for DMLT & Paramedical courses.
2. Textbook on Microbiology Dr C P Baveja
3. Medical parasitology, D R Arora
4. Essentials of Practical Microbiology
5. Textbook on Microbiology Ananthanarayan & Panikar
