



SGRD University of Health Sciences, Sri Amritsar

ORDINANCE & SYLLABUS

MASTER OF SCIENCE IN MEDICAL LABORATORY TECHNOLOGY

(BIOCHEMISTRY, MICROBIOLOGY, AND HISTOPATHOLOGY)

(2 YEARS DEGREE COURSE)

1.0. THE ADMISSION/ EXAMINATION FOR THE DEGREE OF M.Sc. MLT SHALL BE HELD IN THE FOLLOWING SPECIALIZATION:

- a) M.Sc. MLT Biochemistry
- b) M.Sc. MLT Microbiology
- c) M.Sc. MLT Histopathology

1.1. DURATION: The duration of the course leading to the Degree of M.Sc. Medical Lab Technology (MLT) shall be of two academic years. There shall be actual teaching for a minimum of 180 days excluding admissions, preparation and examination days in each year.

2.0. ELIGIBILITY:

This course shall be open to a candidate who have passed regular MBBS, BDS, B.Sc. MLT or DMLT (With atleast 1 year work experience) examination with at least 50% marks in aggregate from a recognized University, or any other examinations recognised by the Board of Management of this University as equivalent course/examination shall be eligible to join the First year of M.Sc. MLT course.

3.0. EXAMINATION:

3.1. 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.

The amount of examination fee to be paid by a regular student shall be as prescribed by the University from time to time. A candidate who re-appears in one or more paper(s) shall pay examination fee as for the whole examination.

Note: Vice-Chancellor may permit acceptance of examination form and fee ten days before the commencement of examination with a late fee.

3.2 SUPPLEMENTARY EXAMINATION: The supplementary examinations for reappearing candidates shall be held ordinarily in the month of November/December.

4.0. FIRST YEAR M.Sc. MLT

- a) The First Year M.Sc. MLT shall be open to a student who has been enrolled for one academic year preceding the examination in a Colleges/institutions affiliated to this University.
- b) The First Year M.Sc. MLT shall be conducted by the Head of the Department in the following subjects:

| Paper code | Course Title | Course type | | Total |
|--|-----------------------|-------------|-----------|-------|
| | | Theory | Practical | |
| Paper-I | As per specialization | 50 | 50 | 100 |
| Paper-II | As per specialization | 50 | 50 | 100 |
| Choosing the subject of the Thesis work and supervisor Writing the protocol | | | | |

Note: The awards will be retained by the Heads of the Department for the purpose of calculating Internal Assessment in the Second Year.

DISTRIBUTION OF TEACHING HOURS FOR M.SC. MLT FIRST YEAR

| Paper code | Subject | Theory hour | Practical hour | Clinical Practice hour | Total hour |
|-----------------|-----------------------|-----------------|-----------------|------------------------|------------------|
| Paper-I | As per specialization | 100 hour | 100 hour | 1200 hour | 1600 hour |
| Paper-II | As per specialization | 100 hour | 100 hour | | |
| Total | First year | 200 hour | 200 hour | 1200 hour | 1600 hour |

5.0. Thesis work

- a) After the allotment of Supervisor and Co-Supervisor by the Head of the Department, Every candidate shall submit a Thesis plan (synopsis) to the University within six months from the date of admission.
- b) Every candidate shall carry out work on an approved research Thesis under the guidance of a recognized PG Teacher (First preference given to Professor only or I. Teachers holding Ph.D. qualification having at least 3 years teaching experience after Ph.D. may be appointed as supervisor, II. After MD/MS 10 years of teaching and research experience). The teachers mentioned at [I and II] should also have at least 5 research papers in indexed National and International Journals.
- c) Thesis work shall be submitted to the University six months before the commencement of the Second Year Theory Examinations i.e. by -30th November of the preceding year for May/June examinations.
- d) The Vice-Chancellor may allow a candidate to submit the Thesis work within one month after the date fixed for the purpose with the prescribed late fee.
- e) The Thesis work shall embody the results of the candidate's own research and/or experience and shall contain precise reference to the publications quoted, and 'must attain a good standard and shall be satisfactory in literary presentation and in other respects and should end with a summary embodying conclusions arrived at by the candidate.
- f) The Thesis work shall be examined by a minimum of two examiners. One internal and one external examiner. Ordinarily, this examiner will not be appointed the External Examiner for theory and Clinical/Practical examination. The candidates who have submitted the Thesis work in University will be allowed to appear in the final examination. However, the result shall be declared only on receipt of the Thesis work acceptance from both the examiners.
- g) The internal examiner shall send only report to the University after evaluation of Thesis work and the evaluated copy will be deposited in the college library for reference of the students. The external examiner shall also send copy of the Thesis work along with the report to the University. The University shall keep two copies in the University Library for reference of the students.

6.0. SECOND YEAR M.Sc. MLT

The Second year M.Sc. MLT shall be open to a student:

- A. Who has been enrolled for two academic year preceding the examination in a Colleges/institutions affiliated to this University.
- B. has submitted his/her name to the Controller of Examination/Registrar by the Principal of the Colleges/institutions with the following certificates:
 - I. of having attended separately in theory and practical/clinical not less than 75% percent 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 10% of the lectures delivered.
 - II. Of having secured at least 50% 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. Must have submitted the Thesis work.

6.1. INTERNAL ASSESSMENT:

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 weightage 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 extracurricular participation) -10%
- d. Additional mandatory requirement for Internal Assessment are as follow:
 - 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 referenced certificate of the HOD/Professor Incharge preparing the Internal Assessment.

- e. The re-appear/fail students will be re-assessed every time for the purpose of Internal Assessment.
- If a candidate fulfils the condition laid in clause 6 above he/ she may be allowed to take the examination.
 - Every candidate before appearing in Second Year Examination must have cleared House Examination securing at least 50 percent marks in both theory as well as practical separately.
 - The Second Year M.Sc. Annual Examination shall be held in May/June and the supplementary within six months of the Annual Examination.
 - The examination shall be held according to the scheme of examination and Syllabus prescribed by the Academic Council. A candidate who fails in an examination or having been eligible fails to appear in the examination shall take the examination according to syllabus prescribed by the University for regular students provided that the syllabus for the candidate of Supplementary examination shall be the same as was in force in the last annual examination.

| Paper codes | Subject | Marks | Internal Assessment | Viva |
|----------------------------------|-----------------------|------------|---------------------|------|
| Paper-I | As per specialization | 100 | 50 | 50 |
| Paper-II | As per specialization | 100 | | |
| Paper-III | As per specialization | 100 | | |
| Paper-IV | As per specialization | 100 | | |
| Internal Assessment +Viva | | 100 | | |
| Total | | 500 | | |
| As per specialization | Practical | 200 | | |
| As per specialization | Thesis work | 100 | 50 | 50 |
| Total | | 800 | | |

- Each theory paper shall be of three hours duration.
- The minimum number of marks to pass the examination shall be 50% in theory & practical separately.
- The candidate who will absent himself/herself from the examination will be deemed to have been failed in the examination.
- The candidate who has completed his/her training of two years and has failed in the examination may appear again in a subsequent examination without further training and without submitting a new thesis work.
- The candidate must pass the examination in a maximum of three (1 +2) attempts +1 (mercy chance on the discretion of Vice-Chancellor) failing which, he/ she will not be allowed to continue his studies.

DISTRIBUTION OF TEACHING HOURS FOR M.Sc. MLT SECOND YEAR

| Paper | Subject | Theory hour | Practical hour | Clinical Practice hour | Total hour |
|------------------|-----------------------|-----------------|-----------------|------------------------|------------------|
| Paper-III | As per specialization | 100 hour | 100 hour | 1200 hour | 1600 hour |
| Paper-IV | As per specialization | 100 hour | 100 hour | | |
| Total | Second year | 200 hour | 200 hour | 1200 hour | 1600 hour |

7.0. ACADEMIC QUALIFICATIONS AND APPOINTMENT OF EXTERNAL/INTERNAL EXAMINERS

I. M.D/Ph.D/Ph.D MLT as per specialization (Anatomy/Biochemistry /Microbiology /Pathology /Physiology) with minimum one year of teaching/professional experience after Post-graduation in a teaching institution or in a laboratory.

OR

II. M.Sc. MLT /M.Sc. Medical with minimum five years of teaching/professional experience of which at least 2 years after the post-graduate qualification in a teaching Institution or laboratory approved by this University.

III. There shall be two examiners out of which one shall be external examiner recommended by Board of Studies and approved by Academic Council. The Board of Studies shall supply the panel of examiners to university for appointment of internal/external examiners by the Vice-Chancellor.

IV. Paper setting and moderation of Question Papers:

a) The University may get each paper set from External Examiner only. The moderation of question papers may be got done under the directions of the Vice-Chancellor, if necessary.

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

8.0. MAXIMUM DURATION:

A candidate must pass the whole course within **Four years** of his/her admission to First year of the course failing which he/she will be required to repeat the course de novo.

9.0. EXAMINATION FEE:

The amount of examination fee to be paid by a regular student shall be as prescribed by the University from time to time. A candidate who re-appears in one or more paper(s) shall pay examination fee as for the whole examination.

10. PASSING SCORE:

The minimum score required to pass examination shall be:

I. 50% in aggregate of Internal Assessment & Theory examination marks for each theory subject.

II. 50% in aggregate of internal assessment & Practical examination marks for the subject.

11. DECLARATION OF RESULT:

A candidate result shall be declared successful only when his/her thesis work has been accepted and the candidate has obtained a minimum of 50% in theory and practical separately.

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.

Note: There shall be no provision for grace marks

Instructions to Paper Setter

Note:

1. The question paper covering the entire course shall be divided into two sections. Each section to be attempted in a separate answer book and to be evaluated by separate examiners.
2. Part A - Question No. I and II are Compulsory and the candidate will attempt any four questions out of question No.3, 4, 5, 6 and 7.
3. Part B - Question No. I and II are Compulsory and the candidate will attempt any three questions out of question No.3, 4, 5, 6 and 7.

Section A: (Max. marks 50)

Question 1: This will of 10 marks long answer question and will be compulsory. The answer must be given in at least five pages.

Question 2: This will consist of four short answer questions. All questions will be compulsory. The questions will carry 5 marks each and total weightage being 20 marks.

Question 3 to 7: These will consist of short answer questions. Attempt any four questions. The questions will carry 3 marks and 2 marks respectively and total weightage of each question being 5 marks (20 Marks overall).

Section B: (Max. marks 50)

Question 1 : This will of 10 marks long answer question and will be compulsory. The answer must be at least five pages

Question 2: This will consist of four short answer questions. All questions will be compulsory. The questions will carry 5 marks each and total weightage being 20 marks.

Question 3 to 6: These will consist of short answer questions. Attempt any four questions. The questions will carry 3 marks and 2 marks respectively and total weightage of each question being 5 marks (20 Marks overall).

SYLLABUS OF M.Sc. MLT BIOCHEMISTRY (ANNEXURE-I)

SYLLABUS OF M.Sc. MLT MICROBIOLOGY (ANNEXURE-II)

SYLLABUS OF M.Sc. MLT HISTOPATHOLOGY (ANNEXURE-III)

M.SC. MEDICAL LABORATORY TECHNOLOGY (BIOCHEMISTRY)**Scope and Objective**

Post Graduate programme in Medical Laboratory Technology (Biochemistry) gives opportunity for specialized study in the field of Laboratory Technology for BSc (MLT) graduates. Candidates who successfully complete MSc MLT (Biochemistry) course may obtain jobs as

- Specialized technologist in Biochemistry or supervisors of clinical laboratories in hospitals.
- Laboratory scientists in Biomedical and research institutes.
- Tutor in training institutes of Medical Laboratory Technology
- Utilize or apply the concepts, theories and principles of laboratory science.
- Demonstrate the ability to plan an effect the change in laboratory practice and health care delivery system.
- Establish collaborative relationship with members of other disciplines.
- Demonstrate Interest in continued learning and research for personal and professional advancement.

DISTRIBUTION OF MARKS & SCHEME OF EXAMINATION FOR FIRST YEAR MLT BIOCHEMISTRY

| Paper code | Course Title | Course type | | Total |
|---|---|-------------|-----------|-------|
| | | Theory | Practical | |
| MLTB.501A | General Biochemistry and metabolism of Biomolecules | 50 | 50 | 100 |
| MLTB. 502A | Enzymology, Hormones and Nutrition | 50 | 50 | 100 |
| Choosing the subject of the Thesis and supervisor | | | | |
| Writing the protocol | | | | |

Note: The awards will be retained by the Heads of the Department for the purpose of calculating Internal Assessment in the Second Year.

DISTRIBUTION OF TEACHING HOURS FOR M.SC. MLT BIOCHEMISTRY FIRST YEAR

| Paper | Subject | Theory hour | Practical hour | Clinical Practice hour | Total hour |
|-------------------|---|-----------------|-----------------|------------------------|------------------|
| MLTB.501A | General Biochemistry and metabolism of Biomolecules | 100 hour | 100 hour | 1200 hour | 1600 hour |
| MLTB. 502A | Enzymology, Hormones and Nutrition | 100 hour | 100 hour | | |
| Total | First year | 200 hour | 200 hour | 1200 hour | 1600 hour |

DISTRIBUTION OF MARKS & SCHEME OF EXAMINATION FOR SECOND YEAR MLT BIOCHEMISTRY

| Paper codes | Subject | Marks | Internal Assessment | Viva |
|--------------|--|------------|---------------------|------|
| MLTB.501A | General Biochemistry and metabolism of Biomolecules | 100 | 50 | 50 |
| MLTB. 502A | Enzymology, Hormones and Nutrition Acid-Base Balance | 100 | | |
| MLTB.503A | organ function tests, Genetics, Immunology | 100 | | |
| MLTB.504A | Analytical Biochemistry | 100 | | |
| Total | | 500 | | |
| MLTB.505A | Practical | 200 | | |
| MLTB. 600 | Thesis work | 100 | 50 | 50 |
| Total | | 800 | | |

DISTRIBUTION OF TEACHING HOURS FOR SECOND YEAR MLT BIOCHEMISTRY

| Paper | Subject | Theory hour | Practical hour | Clinical Practice hour | Total hour |
|--------------|--|-----------------|-----------------|------------------------|------------------|
| MLTB.503A | General Physiology, Acid-Base Balance and organ function tests | 100 hour | 100 hour | 1200 hour | 1600 hour |
| MLTB.504A | Genetics, Immunology and Analytical Biochemistry | 100 hour | 100 hour | | |
| Total | Second year | 200 hour | 200 hour | 1200 hour | 1600 hour |

SYLLABUS OF M.Sc. MLT BIOCHEMISTRY**I. Paper MLTB.501A General Biochemistry and metabolism of Biomolecules**

Chemistry of living things: Structure of cell, animal, bacteria and virus. Nucleus, Organelles, cell membrane, Structure and functions.

Biomolecules: Characteristics and properties.

Proteins: Classification, Digestion & Absorption, properties and chemistry of amino acids and proteins, peptides, structure of proteins and classification.

Aminoacid metabolism: Transamination, deamination, oxidative deamination, ammonia transport, urea formation, Metabolism of individual ammo acids, Biosynthesis of catecholamine, melanin formation, Nitrogen balance, Inborn errors of metabolism.

Carbohydrates: Classification, Digestion & Absorption, Chemistry and properties Glycoproteins, **Carbohydrate Metabolism:** Glycolysis, Gluconeogenesis, Uronic acid pathway, TCA cycle, I-IMP pathway, Glycogen metabolism, Galactose metabolism, Fructose metabolism, Regulation of blood glucose, Inborn errors of metabolism.

Lipids: Classification, Digestion & Absorption, Chemistry and properties & metabolism, Cholesterol structure and Metabolism, Prostaglandins.

Lipid metabolism: Fatty acid synthesis, fatty acid oxidation, ketogenesis, Metabolism of triglycerides and cholesterol. Lipoprotein metabolism, obesity, fatty liver, lipotropic factors, atherosclerosis and coronary heart disease and Inborn errors of metabolism.

II. Paper MLTB. 502A : Enzymology, Hormones and Nutrition , Acid Base Balance

Enzymes : Classification, Micheles Menten constant, Factors affecting Enzyme action, Diagnostic and therapeutic significance of enzymes. Isoenzymes.

Hormones : Endocrine control of Hormones, Insulin, Glucagon, Thyroid and parathyroid hormones, Pituitary ,hypothalamic, adrenal , renal hormones., Ovarian and testicular hormones. Also their technical methods.

Nutrition.

Acid Base Balance : Buffers and Maintenance of acid base balance.

III. Paper MLTB.503A : Organ function tests, Genetics, Immunology

Nucleic acids: Chemistry and properties — purine, pyrimidine nucleosides, nucleotides, nucleic acids, nucleoproteins, genes and chromosomes.

Purine, Pyrimidine metabolism: Biosynthesis of purine and pyrimidine nucleotides, Degradation of purine and pyrimidine nucleotides.

Hemoglobin metabolism: Heme synthesis, Formation of hemoglobin, metabolism of bilirubin, urobilinogen and other bile pigments.

Liver Function Tests, Thyroid Function Tests, Renal Function Tests , Pancreatic Function Tests.

IV. Paper MLTB.504A : Analytical Biochemistry

Methodology: Photometry, spectrophotometry, fluorimetry, flame photometry, semi auto analyzer, pH meter, Homogenization, cell disruption, sonication, centrifugation and ultra-centrifugation, fractional distillation, General concepts regarding laboratory wares and its standardization. Linearity.

Units: SI units- their advantages and disadvantages.

Preparation of Reagents: Molality, Molarity and Normality, normal and molar solution.

Quality Control and quality Management systems.

Basic Concepts Of Research Methodology

Statistical methods

Ethics in Clinical Laboratory

Overview of Quality Maintenance in NABL

DISTRIBUTION OF MARKS & SCHEME OF EXAMINATION FOR FIRST YEAR MLT MICROBIOLOGY

| Paper code | Course Title | Course type | | Total |
|--|-----------------------|-------------|-----------|-------|
| | | Theory | Practical | |
| MLTM.501A | General Microbiology | 50 | 50 | 100 |
| MLTM. 502A | Systemic Bacteriology | 50 | 50 | 100 |
| Choosing the subject of the Thesis work and supervisor Writing the protocol | | | | |

Note: The awards will be retained by the Heads of the Department for the purpose of calculating Internal Assessment in the Second Year.

DISTRIBUTION OF TEACHING HOURS FOR M.SC. MLT MICROBIOLOGY FIRST YEAR

| Paper | Subject | Theory hour | Practical hour | Clinical Practice hour | Total hour |
|--------------|-----------------------|-----------------|-----------------|------------------------|------------------|
| MLTM.501A | General Microbiology | 100 hour | 100 hour | 1200 hour | 1600 hour |
| MLTM. 502A | Systemic Bacteriology | 100 hour | 100 hour | | |
| Total | First year | 200 hour | 200 hour | 1200 hour | 1600 hour |

DISTRIBUTION OF MARKS & SCHEME OF EXAMINATION FOR SECOND YEAR MLT MICROBIOLOGY

| Paper codes | Subject | Marks | Internal Assessment | Viva |
|--------------|-------------------------|------------|---------------------|------|
| MLTM.501A | General Microbiology | 100 | 50 | 50 |
| MLTM. 502A | Systemic Bacteriology | 100 | | |
| MLTM.503A | Mycology & Immunology | 100 | | |
| MLTM.504A | Parasitology & Virology | 100 | | |
| Total | | 500 | | |
| MLTM.505A | Practical | 200 | | |
| MLTM. 600 | Thesis work | 100 | 50 | 50 |
| Total | | 800 | | |

DISTRIBUTION OF TEACHING HOURS FOR SECOND YEAR MLT MICROBIOLOGY

| Paper | Subject | Theory hour | Practical hour | Clinical Practice hour | Total hour |
|--------------|-------------------------|-----------------|-----------------|------------------------|------------------|
| MLTM.503A | Mycology & Immunology | 100 hour | 100 hour | 1200 hour | 1600 hour |
| MLTM.504A | Parasitology & Virology | 100 hour | 100 hour | | |
| Total | Second year | 200 hour | 200 hour | | 1600 hour |

SYLLABUS OF M.Sc. MLT MICROBIOLOGY

Scope and Objective

The course studies the diversity of microbial types, how microorganisms can be used and manipulated to aid mankind and the detrimental effects (for example on health) of microorganisms.

The hospital lab visits and internships are arranged to allow the students to gain insight into the application of the subject in the hospital labs. The curriculum has been designed to train the students in good lab practices and encourage them to expand their knowledge base by applying for project and publishing papers.

Intensive lab works and project works are carried out to equip the students in microbiological techniques.

GENERAL MICROBIOLOGY

| Sr. No. | Topic of Lecture | Contents |
|---------|--|--|
| 1. | Introduction and Historical Importance of Medical Microbiology in Background | Importance of Medical Microbiology in diagnosis and prevention of infectious diseases. Contribution of Antony van Leeuwenhook, Pasteur, Lister, Robert Koch. |
| 2. | Definition | Medical Microbiology which includes the branches, Bacteriology, Virology, Mycology, Parasitology and Immunology |
| 3. | Morphology of Bacteria and classification | Morphological classification, Method of studying of bacteria, staining methods and their principles, preparation of stains and reagents preparation of smears, modification of following staining methods. Simple staining, differential staining (Gram staining, AFB staining), Negative staining, Fluorochrome staining, staining of volution granules, staining of spirochetes, spore staining, capsular staining, flagellar staining |
| 4. | Physiology of Bacteria including growth requirement and metabolism | Nutrition and growth of bacteria, growth curve Culture Media:- Definition, Classification important constituents of culture media, preparation of culture media, quality control of culture media. Inoculation & purification methods in bacteriology. Quantitation of bacterial growth. Preservation of bacteria. |
| 5. | Identification of Bacteria | Specimen collection, processing of specimens culture methods, preparation of media and reagents, interpretation quality control for biochemical reactions, and serological tests |
| 6. | Sterilization and Disinfections | Definition of sterilization, disinfection, Aspesis, antisepsis, Enmeration of physical methods of sterilization which includes principles, Detail on working and efficacy testing of autoclave, Hot air oven, Inspector and, Koch's steamer. Concept of central sterile Supply Department (CSSD), Modes Aldehydes, Acids, Alcohol, Heavy metals, Oxidizing agents. Universal Biosafet precautions, quality control. Common glassware for microbiology and its cleaning and sterilization. 13 |
| 7. | Chemotherapy | Antimicrobial susceptibility tests, disk diffusion test Kirby – Bauer's method and Stoke's method. Tube dilution test i.e. Minimum inhibitory concertration test. Briefly about antibiotic policy. |

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| 8. | Bacterial Genetics and Drug Resistance | Definition, Genotype and Phenotype, Basic structure of DNA, Mutation, Transduction, Transformation, Conjugation and R factor. Mechanisms of Drug resistance and transfer of resistance. Brief introduction to genetic engineering. |
| 9. | Normal Flora | Introduction - various sites, types and role. |
| 10. | Waste Disposal | Definition of waste, Classification, Segregation, Transport and Disposal. |

SYSTEMIC BACTERIOLOGY

| Sr. No. | Topic of Lecture | Contents |
|---------|--|---|
| 1. | Gram Positive Cocci | Staphylococcus Classification, Morphology, Pathogenesis, Laboratory diagnosis, Streptococcus/Enterococcus/Pneumococcus Classification, Morphology, Pathogenesis, Laboratory diagnosis, Rapid bed side diagnostic tests. |
| 2. | Gram Negative Cocci | Neisseria. Morphology, Pathogenesis, Laboratory diagnosis Rapid bed side diagnostic tests |
| 3. | Gram Positive Bacilli | C. diphtheriae. Morphology, Pathogenesis, Laboratory diagnosis Mycobacterium tuberculosis. Classification, Morphology, Growth on L.J. , Pathogenesis, Laboratory diagnosis, Atypical Mycobacteria. Classification, Morphology Growth on L.J., Pathogenesis, Laboratory diagnosis. M. leprae Classification, Morphology Pathogenesis Laboratory Diagnosis. |
| 4. | Cl. welchii, Cl tetani, and Cl. botulinum | Classification , Morphology, Laboratory diagnosis, |
| 5. | Anaerobic Gram Negative Bacilli (Nonspore bearing) | Classification, Morphology, Cultural characteristics, Pathogenesis, Laboratory diagnosis. |
| 6. | Enterobacteriaceae E.coli, Klebsiella, Proteus | General Characters and Classification. Morphology, Pathogenesis, Laboratory diagnosis |
| 7. | Salmonella, Shigella | Classification, Morphology, Pathogenesis, Laboratory diagnosis |
| 8. | Yersinia | Morphology, Pathogenesis, Laboratory diagnosis.. |
| 9. | Haemophilus, Bordetella Brucella | Morphology, Pathogenesis, Laboratory diagnosis.. |
| 10. | Vibrio, Campylobacter, H.Pylori | Classification, Morphology, Pathogenesis, Laboratory diagnosis, |
| 11. | Pseudomonas | Morphology, Resistance, Pathogenesis, Laboratory diagnosis, |
| 12. | Spirochaetes | Classification, Morphology, Resistance, Pathogenesis, Laboratory diagnosis. |
| 13. | Actinomycetes, Nocardia | Morphology, Pathogenesis, Laboratory diagnosis. |
| 14. | Rickettsia, Chlamydia, Mycoplasma | Classification, Morphology, Pathogenesis, Laboratory diagnosis |
| 15. | Bacteriology of Air, Water, Milk and Food | Bacterial counts. |

PRACTICAL

General Microbiology: Preparation of bacterial smear and staining – Gram’s, Acid-fast, staining of bacterial spores, flagella, capsule, spirochaetes. Preparation of media, cultivation of bacteria, Biochemical tests for identification of bacteria, preservation of stock cultures of bacteria.

Systemic Bacteriology: Transport, primary smear, Hanging drop, Selection of media, Isolation of bacteria from mixed cultures, Study of morphological, cultural and biochemical characters of common bacterial pathogens, serotyping of bacteria. Animal pathogenicity testing, Antibacterial drug Sensitivity, Serological reactions and their interpretation, Newer methods of diagnosis.

MYCOLOGY

| Sr. No. | Topic of Lecture | Contents |
|---------|--------------------------------|--|
| 1. | General Mycology | Morphological and clinical classification of fungi, Method of identification. Laboratory diagnosis of fungus, including sample collection. |
| 2. | Superficial Mycosis | Enumerate, clinical feature, morphological features. Predisposing factors, Lab diagnosis – Specimen collection, Microscopy, Cultural characteristics of important species. |
| 3. | Subcutaneous Mycosis | Enumerate, Predisposing factors, Mycetoma, Rhinosporidiosis, Pathogenesis and Lab Diagnosis. Mention briefly about Sporotrichosis and subcutaneous phycomycosis |
| 4. | Systemic Mycoses | Classification, Predisposing factors, Candida, Cryptococcus, Histoplasma capsulatum morphology, Pathogenesis, Lab Diagnosis with cultural characteristic, blastomycosis, Paracoccidiomycosis, coccidiomycosis. |
| 5. | Opportunistic fungal Infection | Classification, Predisposing factors, Morphology of Mucor, Aspergillus, Pneumocystis carinii. |

IMMUNOLOGY

| Sr. No. | Topic of Lecture | Contents |
|---------|------------------------|--|
| 1. | Introduction | Definition of immunity, types of immunity, factors responsible, active and passive-immunity, local immunity |
| 2. | Antigens | Definition, types, antigen determinants, properties of antigen.. |
| 3. | Antibodies | Definition, nature, structure of immunoglobulin – immunoglobulin classes, Physical and biological properties of immunoglobulin. |
| 4. | Serological Reactions | application of precipitation, Gel diffusion, Agglutination, Complement fixation, ELISA, RIA, immune-fluorescence test, neutralization and opsonization. |
| 5. | Structure and function | Primary lymphoid organs – thymus, bursa of fabricus, of Immune System Bone marrow. Secondary lymphoid organs lymph nodes , spleen, mucosa – associated lymphoid tissue, gut associated lymphoid tissue (MALT and GALT). Cells of immune system – lymphocytes, T cell, B cells, Null cells, Antigen presenting cells (APC). |
| 6. | Immune Response | Humoral – Primary and Secondary immune responses, principle and uses of monoclonal antibodies, factors affecting immune response. CMI – Definition, types, role of T cells and macrophages. Immune tolerance – Definition and mechanism of tolerance. |
| 7. | Complement | Definition, components, synthesis, pathways of activation, role and biological functions, measurement |
| 8. | Hypersensitivity | Definition, Classification, Difference between immediate and delayed reactions, mechanism and manifestation of anaphylaxis, |

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|-----|--------------|---|
| | | types and tests for anaphylaxis. |
| 9. | Autoimmunity | Autoimmunity Definition, Mechanism, Classification and Pathogenesis. |
| 10. | Vaccination | Nature if vaccines, rationale and dosage. Principles of Immunization. Future Vaccines |

PARASITOLOGY

| Sr. No. | Topic of Lecture | Contents |
|---------|-----------------------------------|--|
| 1. | Introduction to Parasitology | Parasite:- Their nature, classification, explanation of terminology, emerging parasitic infections |
| 2. | <i>E. histolytica</i> | Geographical distribution, habitat, morphology, life cycle, Pathogenesis, laboratory diagnosis. |
| 3. | Flagellates & Free living amoebae | Giardia, Trichomonas, Free living amoebae - Negleria, Acanthamoeba, Balamuthia., Morphology, lifecycle, Pathogenesis, laboratory diagnosis. |
| 4. | Haemoflogellates | Leishmania donovani – Geographical distribution habitat Morphology, Life Cycle, Pathogenesis, Laboratory diagnosis, Brief account of Trypanosomes |
| 5. | Malaria | Malaria parasites:- Geographical distribution, habitat, Morphology, Life cycle, Pathogenesis, Laboratory Diagnosis |
| 6. | Miscellaneous Pathogenic Protozoa | Toxoplasma. Brief account on Cryptosporidium, Protozoa Isospora, Balantium Coli. |
| 7. | Cestodes | Taenia saginata and solium, Echinococcus granulosus Life cycle, Morphology, Pathogenesis, Laboratory diagnosis. Brief account of H.nana, D.latum. |
| 8. | Trematodes | Schistosomiasis – Geographical distribution, habitat, Morphology, Life cycle, Pathogenesis, Laboratory Diagnosis. Brief account of Fasciola hepatica. |
| 9. | Intestinal Nematodes | Geographical distribution, hapitat, Morphology, Life cycle, Pathogenesis, Laboratory diagnosis, of E. vermicularis, T. Trichura. Brief account on S. stercoralis Life cycle, Morphology, Laboratory diagnosis. |
| 10. | Tissue Nematodes | Geographical distribution, habitat, Morphology, Life cycle, Morphology, Pathogenesis, Laboratory diagnosis, D. medinensis, in brief – T.spiralis. |

VIROLOGY

| Sr. No. | Topic of Lecture | Contents |
|---------|------------------|---|
| 1. | General Virology | Basic structure, Shape, Size, Symmetry, resistance ,multiplication, classification of viruses, pathogenesis Laboratory diagnosis of viral infections, Collection of samples, Transport, Cultivation and method of diagnosis., |
| 2. | Herpes Viruses | List of viruses included, Lesions produced, pathogenesis and latency, laboratory diagnosis |
| 3 | Hepatitis | Viruses Immunity, Resistance, Laboratory Diagnosis |

| | | |
|----|---------------------------|--|
| 4. | Orthomyxo Viruses | Morphology, Pathogenesis, Classification, antigenic variation in influenza virus. |
| 5 | Arboviruses | List of arboviruses prevalent in India, Dengue, Definition, Classification, Pathogenesis, Laboratory diagnosis |
| 6 | Retroviruses HIV/AIDS, | Morphology, Pathogenesis , Immunity, Lab diagnosis, Laboratory tests and their interpretation, Universal precautions, Specific precautions, Recent trends in diagnosis |

PRACTICAL

Immunology

Tests based on agglutination, latex agglutination, precipitation, Immunodiffusion-RID, Double ID, Immuno-electrophoresis, Counter current immuno-electrophoresis, Haemagglutination, Haemagglutination inhibition, ELISA, Delayed Hypersensitivity tests, Western blot demonstration, Immunofluorescent technique.

Parasitology

Collection & transport of specimens Examination of stool for parasites. Examination of blood & bone marrow for parasites.

Examination of other body fluids & biopsy specimens for parasites.

Culture techniques for parasites. Serological diagnostic methods, skin tests.

Mycology

Media & Strains preparation for Mycology, Diagnostic Methods in Mycotic Infections, Identification test in Mycology, Serological tests in Mycology Skin tests.

Recommended Books:

1. Practical Medical Microbiology – Mackie and McCartney – latest Ed
2. Text book of Medical Microbiology – CP Baveja Theory
3. Text book of Medical Microbiology – CP Baveja Practical
4. Medical Lab Manual – Vol I – Monica Cheesbrough - ELBS
5. Medical Lab Manual – Vol II – Monica Cheesbrough - ELBS

M.Sc. MLT IN HISTOPATHOLOGY**Scope and Objective**

HistoPathology is the demanding and evergreen field of medicine and diagnosis. Demand of pathologist is never ended. Medical pathology is categorized as clinical pathology and anatomic pathology. Clinical pathology is the study of disciplines of microbiology, immunology, clinical chemistry and Haematology. Anatomic pathology comprises the study of cellular and tissue. Histopathologists study organs, tissues, cells and genetics to help provide a diagnosis.

- Students will study patients' organs and tissues by eye and look at cellular samples under a microscope.
- Students undertake studies to provide diagnostic and prognostic information or determine the cause of death.
- Histopathologist play a important role in a hospital, alongside many other doctors, nurses, laboratory staff, biomedical scientists, secretaries and mortuary staff. Most histopathologists don't have direct contact with patients, but their work plays a vital role in patient care.

DISTRIBUTION OF MARKS & SCHEME OF EXAMINATION FOR FIRST YEAR MLT HISTOPATHOLOGY

| Paper code | Course Title | Course type | | Total |
|---|---------------------------------|-------------|-----------|-------|
| | | Theory | Practical | |
| MLTH.501A | Basic Histological Techniques | 50 | 50 | 100 |
| MLTH. 502A | Special Histological Techniques | 50 | 50 | 100 |
| Choosing the subject of the Thesis and supervisor Writing the protocol | | | | |

Note: The awards will be retained by the Heads of the Department for the purpose of calculating Internal Assessment in the Second Year.

DISTRIBUTION OF TEACHING HOURS FOR M.SC. MLT BIOCHEMISTRY FIRST YEAR MLT HISTOPATHOLOGY

| Paper code | Course Title | Theory hour | Practical hour | Clinical Practice hour | Total hour |
|--------------|---------------------------------|-----------------|-----------------|------------------------|------------------|
| MLTH.501A | Basic Histological Techniques | 100 hour | 100 hour | 1200 hour | 1600 hour |
| MLTH. 502A | Special Histological Techniques | 100 hour | 100 hour | | |
| Total | First year | 200 hour | 200 hour | 1200 hour | 1600 hour |

DISTRIBUTION OF MARKS & SCHEME OF EXAMINATION FOR SECOND YEAR MLT HISTOPATHOLOGY

| Paper codes | Subject | Marks | Internal Assessment | Viva |
|--------------|--|------------|---------------------|------|
| MLTH.501A | Basic Histological Techniques | 100 | 50 | 50 |
| MLTH. 502A | Special Histological Techniques | 100 | | |
| MLTH.503A | Basic Advanced Histological Techniques | 100 | | |
| MLTH.504A | Immunohistochemistry and Molecular Pathology | 100 | | |
| Total | | 500 | | |
| MLTH.505A | Practical | 200 | | |

| | | | | |
|------------------|-------------|------------|----|----|
| MLTH. 600 | Thesis work | 100 | 50 | 50 |
| Total | | 800 | | |

DISTRIBUTION OF TEACHING HOURS FOR SECOND YEAR MLT BIOCHEMISTRY

| Paper | Subject | Theory hour | Practical hour | Clinical Practice hour | Total hour |
|------------------|---|-----------------|-----------------|------------------------|------------------|
| MLTH.503A | Basic Advanced Histological Techniques | 100 hour | 100 hour | 1200 hour | 1600 hour |
| MLTH.504A | Immunohistochemistry and Molecular Pathology | 100 hour | 100 hour | | |
| Total | Second year | 200 hour | 200 hour | 1200 hour | 1601 hour |

Paper-I

I. Laboratory management

- a) Collection, handling and storage of specimen
- b) Utilisation and maintenance of general laboratory equipment including minor repairs
- c) Sterilisation of apparatus and reagents
- d) Safety precautions including those of radioactive material

2. Laboratory application of Microscopy:

- a) Principle, application and maintenance of light microscope with knowledge of various types of lenses (simple and compensated)
- b) Principle of dark-ground illumination
- c) Principle of phase contrast microscope
- d) Principle of polarizing microscope
- e) Principle of fluorescent microscope
- f) Principle of electron —microscope .

3. Histology of normal tissue

Recognition of normal human tissue in sections.

4. Fixation

- a) Methods of fixation for biopsies and gross specimens i.e. immersion, injection etc,
- b) Secondary fixation and post-mordanting.
- c) Post-chromation.
- d) Effects of fixation on subsequent staining.

5. Processing of tissues

- a) Manual processing
- b) Automatic processing
- c) Different embedding media and their particular use i.e. paraffin wax, celloidin, gelatin, water soluble waxes, ralwax etc,
- d) Dehydrating and clearing agents.
- e) Rapid celloidin processing.
- f) Different methods of decalcification and their effect on staining. .
- g) Double embedding.
- h) Vacuum impregnation.

6. Microtomy

- a) Working principle and use of various types of microtomes.
- b) Use and maintenance of various types of microtomy knives including automatic knife sharpener and types of aglhesives
- c) Preparation of thin section, step section and serial section.

- d) Practical difficulties in section cutting and their remedy.

PAPER – II

Staining

- a) Theory and practice of staining
- b) Principal and application of different staining methods i.e. direct staining, indirect staining, progressive and regressive staining, metallic impregnation, metachromasia etc.

Recognition of artifacts in sections

- a) Cutting artifacts.
- b) Processing artifacts.
- c) Staining artifacts.

Museum techniques

- a) Fixation and staining for individual tissue
- b) Preparation of specimens including specimen castings
- c) Colour and transparency maintenance
- d) Mounting of specimen
- e) Labelling
- f) Specimen storage

Photography

- a. Practical approach for gross and microphotography —
 - I. Exposure
 - II. Developing and fixing
 - III. Printing
 - IV. Glazing
- a. Digital gross and photo micrograph and the use of computers.

Storage of tissue blocks and sections.

Autopsies and mortuary maintenance .

PAPER- III

I. Application of various microscopes in the field of morbid anatomy and Histopathology.

- a) Fluorescence microscopy
 - i. Principle and different components
 - ii. Fluorescent antigen antibody reaction
 - iii. Primary fluorescence
 - iv. Secondary fluorescence and use of various fluorochromes.
- b) Polarised microscopy
 - I. Isotropic and anisotropic substances
 - II. Identification of lipids, pigments, crystals and amyloid
- c) Dark ground illumination
 - I. Principle
 - II. Identification of T. Pallidum and minerals after micro-incineration.
- d) Phase contrast microscopy
 - i) Study of unstained cells and tissue structures.
- e) Electron microscopy
 - i) Working principle and application.

II. Use of sliding and sledge-microtomes to prepare large sections of:

- I. Brain
- II. Lung
- III. Whole kidney etc

III. Special techniques for

- I. Bone marrow processing
- II. Un-decalcified bone sections

III. Processing and embedding of eyeball.

IV. Electron Microscopy Techniques —

Preparation Of material for electron microscopy.

- a. Fixation. post ossification. dehydration, clearing, upon and araldite embedding, preparation and curing Of Epon / araldite blocks, trimming of blocks.
- b. Ultra—Microtomy
 - i. Working principle and use of ultra-microtome.
 - ii. Cutting and ultra-thin sections.
 - iii. Staining Of and ultrathin sections with Toludine blue and metal salts respectively.
- c. Utilization and maintenance of an Electron Microscope
 - i. Alignment of electron beam.
 - ii. Screening Of grids.
 - iii. Taking photographs.
- d. Photographic techniques for electron micrograph
 - i. Developing Of films.
 - ii. Printing and make enlargement.

V. Study Of pathological tissues and identification of various lesions and tumours in sections.

VI. Autoradiography

- a) Principle
- b) Various isotopes used and their precautions.
- c) Techniques — emphasizing upon Dipping and Stripping techniques
- d) Exposure ,
- e) Staining Of autoradiographs.

VII. Micro—Incineration

- a) Principle
- b) Technique
- c) Method Of section examination

VIII. Microphotography:

- a) Exposure
- b) Developing & fixing
- c) Printing
- d) Glazing

IX. Microwave technology and its application to histology

PAPER- IV

1. Special techniques for Histochemical studies

- I. Freeze drying
- II. Vapor fixation,

2. Principles of Histochemical and advanced special staining techniques

| | |
|------------------------------|----------------------|
| a) Carbohydrates | b) Amyloid |
| c) Proteins | d) Lipids |
| e) Pigments | f) Minerals |
| g) Cytoplasmic organelles | h) Pancreatic islets |
| i) Pituitary cells | j) Fibrin |
| k) Hemoglobin | l) Bile pigment |
| m) Melanin | n) Adrenal medulla |
| o) Argentaffin cell granules | p) Peneth cells |
| q) Bacteria | r) Fungus |

| | |
|--------------------|---------------------|
| s) Spirochetes | t) Inclusion bodies |
| u) Mucin | v) Astrocytes |
| w) Nissl granules | x) Glial fibres |
| y) Microglia | z) Oligodendrocytes |
| aa) Axons | bb) Neurofibrills |
| cc) Purkinje cells | dd) Nerve endings. |

3. Enzyme Histochemistry

- a) Preparation of post-fixed and prefixed cryostat sections
- b) Demonstration of the following enzymes
 - I. Phosphatases — Acid ph-ase, alkaline ph-ase and ATP-ases.
 - II. Dehydrogenases
 - III. Oxidases.
 - IV. Esterases.
 - V. Tyrosinase.

4. Immunohistochemistry

- I. Principle — direct, indirect and other special techniques
- II. FJC and FITC techniques
- III. Techniques of unmasking of antigen sites
- IV. Enhancement and amplification of binding sites
- V. Double or multiple labeling technique
- VI. Preparation of conjugates
- VII. Blocking of endogenous enzyme and background
- VIII. Methods for frozen and paraffin sections.
- IX. Controls, internal & external quality assessment.

5. Molecular Pathology

- A. In-situ-hybridisation
 - I. Principle
 - II. Technique and application
 - III. Probes
 - IV. Application in fixed tissue sample
- B. Polymerase chain reaction- principle, types and utilisation
- C. Electrophoresis — principle, types and application

6. Image Analysis-

Overview. technique, specimen preparation and analysis, and software.

7. Flow Cytometry:

Principle, technique, specimen collection and preparation, application.